

BIOGRAPHICAL SKETCH

NAME Alice Latinne	POSITION TITLE Research Scientist
eRA COMMONS USER NAME (b) (6)	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
University of Namur, Namur, Belgium	BSC	06/2004	Biology
University of Liege, Liege, Belgium	MSC	06/2006	Animal Biology
University of Liege, Liege, Belgium	PHD	12/2012	Molecular Biology

A. Personal Statement

My research focuses on understanding the dynamics of pathogens within and among wildlife populations, livestock, and humans. I have conducted fieldwork in Asia for the past 6 years, focused on the evolutionary dynamics of host-pathogen (rodent-virus; bat-virus) interactions, the phylogenetics of co-evolution, and analysis of phylogeographic scale. My main interest is to analyze the risk of zoonotic pathogen emergence at high-risk human-wildlife interfaces. My published work analyzes patterns and likelihood of pathogen sharing among species, and to determine how the host phylogenetic and phylogeographic structure affects pathogen distribution and cross-species transmission. Prior to my current position at EcoHealth Alliance, I was a Marie Curie COFUND fellow conducting postdoctoral research at the Institut des Sciences de l'Evolution in Montpellier (ISEM, France) and at the Kasetsart University in Thailand.

B. Positions and Honors

Positions and Employment

2013-2013 Research Assistant, University of Liege, Liege, Belgium
 2014- Research Associate, University of Liege, Liege, Belgium
 2015- Research Scientist, EcoHealth Alliance, New York

Honors

2007 Belgian Government graduate scholarship, Belgian Fund for Research in Industry and Agriculture, Belgium
 2008 Belgian Government graduate scholarship, Belgian Fund for Scientific Research, Belgium
 2013 Award "VOCATIO" (Vocation grant) from the Belgian Foundation of Vocation (VOCATIO)
 2013 Marie Curie COFUND fellowship from European Union

C. Contribution to Science: Selected peer-reviewed publications most relevant to the current application

1. Latinne A, Bezé F, Delhaes L, Pottier M, Gantois N, Nguyen J, Blasdel K, Dei-Cas E, Morand S, Chabé M (2017). Genetic diversity and evolution of *Pneumocystis* fungi infecting wild Southeast Asian murid rodents. **Parasitology**, 145(7): 885-900. PMID: 29117878

2. Olival KJ, Latinne A, Islam A, Engstrand R, Hersch R, Amato G, Epstein JH, Daszak P (2016). Using bat population genetics to understand Nipah virus dynamics and cross-species transmission in south and southeast Asia. **International Bat Research Conference**, Durban.
3. Morand S, Bordes F, Chen H, Claude J, Cosson J, Galan M, Czirjak GA, Greenwood A D, Latinne A, Michaux J, Ribas A (2015) Global parasite and *Rattus* rodent invasions: the consequences for rodent-borne diseases. **Integrative Zoology**, 10(5), 409-423. PMID: 26037785
4. Latinne A, Meynard CN, Herbreteau V, Waengsothorn S, Morand S, Michaux J (2015). Influence of past and future climate changes on the distribution of three Southeast Asian murine rodents. **Journal of Biogeography**, 42(9), 1714-1726. doi.org/10.1111/jbi.12528
5. Blasdell K, Bordes F, Chaval Y, Claude J, Cosson J, Latinne A, Michaux J, Morand S, Pagès M, Tran A (2015). Progress on research on rodents and rodent-borne zoonoses in South-east Asia. **Wildlife Research**, 42(2), 98-107. doi.org/10.1071/WR14201

Additional recent publications

1. Mouton A, Mortelliti A, Grill A, Sara M, Kryštufek B, Juškaitis R, Latinne A, Amori G, Randi E, Büchner S, Schulz B, Ehlers S, Lang J, Adamik P, Verbeylen G, Dorenbosch M, Trout R, Elmeros M, Aloise G, Mazzoti S, Matur F, Poitevin F, Michaux JR (2017). Evolutionary history and species delimitations: a case study of the hazel dormouse, *Muscardinus avellanarius*. **Conservation Genetics**, 18(1): 181-196. doi.org/10.1007/s10592-016-0892-8
2. Smits N, Cornélis D, Chardonnet P, Caron A, de Garine-Wichatitsky M, Jori F, Mouton A, Latinne A, Pigneur L, Melletti M, Kanapeckas KL, Marescaux J, Lopes-Pereira C, Michaux J (2014). Genetic structure of fragmented southern populations of African Cape buffalo (*Syncerus caffer caffer*). **BMC Evolutionary Biology**, 14: 203. doi.org/10.1186/s12862-014-0203-2
3. Latinne A, Galan M, Waengsothorn S, Rojanadilok P, Eiamampai K, Sribuarod K, Michaux J (2014). Diet analysis of *Leopoldamys neilli*, a cave-dwelling rodent in Southeast Asia, using Next-Generation Sequencing from feces. **Journal of Cave and Karst Studies**, 76(2): 139-145. doi.org/10.4311/2013LSC0100
4. Latinne A, Chaval Y, Waengsothorn S, Rojanadilok P, Eiamampai K, Sribuarod K, Herbreteau V, Morand S, Michaux J (2013). Is *Leopoldamys neilli* (Rodentia, Muridae) a synonym of *Leopoldamys herberti*? A reply to Balakirev *et al.* (2013). **Zootaxa**, 3731(4): 589-598. doi.org/10.11646/zootaxa.3731.4.10
5. Latinne A, Waengsothorn S, Rojanadilok P, Eiamampai K, Sribuarod K, Michaux J (2013). Diversity and endemism of Murinae rodents in Thai limestone karsts. **Systematics and Biodiversity**, 11(3): 323-344. doi.org/10.1080/14772000.2013.818587
6. Pauwels OSG, Sumontha M, Latinne A, Grismer LL (2013). *Cyrtodactylus sanook* (Squamata: Gekkonidae), a new cave-dwelling gecko from Chumphon Province, southern Thailand. **Zootaxa**, 3635(3): 275-285. PMID: 26097949
7. Latinne A, Waengsothorn S, Rojanadilok P, Eiamampai K, Sribuarod K, Michaux J (2012). Combined Mitochondrial and Nuclear Markers Revealed a Deep Vicariant History for *Leopoldamys neilli*, a Cave-Dwelling Rodent of Thailand. **PLOS One**, 7(10), e47670. PMID: 23118888

BIOGRAPHICAL SKETCH

NAME Hongying Li	POSITION TITLE Research Scientist		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
School of Life Sciences, Sun Yat-Sen University, China	BS	06/2012	Biosciences
School of Public Health, Emory University	MPH	05/2015	Health Policy
School of Life Sciences, Kingston University, UK	Ph.D Candidate	2018-	Infectious Diseases

A. Personal Statement

I have an interdisciplinary background in ecology, public health, and human behavior, coupled with extensive on-the-ground experience working with communities, governmental and academic partners in China. For the past 3 years I have worked as China Programs Coordinator at EcoHealth Alliance, acting as the key point-of-contact among EcoHealth staff and our partners in China. I have coordinated fieldwork to conduct bat sampling, and human behavioral risk assessments across 5 provinces in southern China. I have also liaised directly with all key partners on this proposal. Additionally, I coordinate EcoHealth Alliance's wildlife trade research in China and SE Asia focusing on analyzing incentives to trade and consume wildlife. I work closely with Chinese Health and Forestry governmental departments, research institutes, and local organizations to foster collaboration and communication as part of my PhD research on "*Policy and Human Behavioral Strategies to Mitigate Zoonotic Disease Emergence in Southern China*".

B. Positions and Honors.**Positions and Employment**

2011 - 12 Research Assistant of HIV Prevention Program, Yunnan Maternity and Children's Hospital, China
 2013 - 14 Program Assistant of School HIV/AIDS & School Education, UNESCO Beijing, China
 2015 - China Programs Coordinator & Research Scientist, EcoHealth Alliance, USA
 2017 - Coordinator of the Initiative of National Virome Project in China

Other Experience and Professional Memberships

2018- Member, IUCN SSC Pangolin Specialist Group
 2018- Member, Society for Applied Microbiology
 2017- Member, China Health Policy and Management Society
 2016- Member, International Association for Ecology & Health
 2016- Columnist, *China Environment*
 2016- Asian Representative, Conservation Leadership Programme

Honors

2010 National Scholarship, Ministry of Education, the People's Republic of China.
 2012 Outstanding Graduate Award, Sun Yat-sen University, China
 2016 Invited speaker, China Conservation Network workshop. "Impacts of wildlife trade on public health"
 2017 Invited Speaker, International Association for Ecology & Health. "Understanding the wildlife trade in China"

C. Selected peer-reviewed publications most relevant to the current application

Liang X, Zhang L, Wan Y, Yu X, Guo Y, Chen X, Li H (2012). Changes in the diurnal rhythms during a 45-day head-down bed rest. **PLOS One**, 7(10), e47984.

Wu Z, Lu L, Du J, Yang L, Ren X, Liu B, Li H, Zhu Y (2018). Comparative analysis of rodent and small mammal viromes to better understand the wildlife origin of emerging infectious diseases. **Microbiome**, 6(1), 178.

Additional recent publications of importance to the field (in chronological order)

Li H, Zhu G, Zhang Y, Daszak P (2018). Qualitative Approach to Developing a One Health Intervention Strategy for Zoonosis Risk Mitigation in Southern China. Poster Presentation at **One Health Congress 2018**.

Li H, Chmura AA, Ma C, Gabriel G, Daszak P (2018). Attitudes Towards Wildlife Trade and Disease Risk in China. Poster presentation at **One Health Congress 2018**.

Li H, Zhu G, Zhang Y, Daszak P (2018). Viral Pathogen Discovery in China: Understanding the Risks of Bat Coronaviruses. Poster presentation at **USAID EPT-2 PREDICT Meeting**.

D. Research Support**Ongoing Research Support**

R01 AI110964 Daszak (PI) 06/01/14-05/31/19

Understanding Risk of Bat Coronaviruses

The goal of this study is to analyze the risk of coronavirus spillover from bats to humans in Southern China

Role: Project Coordinator & Human Research Lead

Emerging Pandemic Threat Program, USAID Mazet (PI) 10/01/14-09/30/19
PREDICT 2

The goal of this project is to create and implement a global virus surveillance system in animals and humans and analyze spillover risk.

Role: Country Coordinator for China

Completed Research Support

(b) (4)

Zhang (PI) 01/01/16-12/31/17

The goal of this study is to understand the current population and distribution of the critically endangered Chinese pangolin (*Manis pentadactyle*) in mainland China

Role: Community Research Lead

BIOGRAPHICAL SKETCH

NAME Leilani V. Francisco	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
University of Maryland, College Park, Maryland	BA	05/1995	Anthropology (Sociocultural)
University of South Florida, Tampa, Florida	MA	05/2002	Applied Anthropology (Medical)
Johns Hopkins University, Baltimore, Maryland	Ph.D	05/2010	Public Health (Int'l Health)
Project Management Institute, Pennsylvania	PMP	Current	Project Management

A. Personal Statement

I have a Bachelors and Masters degree in anthropology and applied anthropology, and over 20 years of professional experience managing human behavioral research projects in public health, the majority of which has been in developing countries. I have extensive experience in the private sector, managing research projects and evaluating public health interventions for infectious diseases. I have worked extensively on: quantitative, qualitative, and mixed-methods study design, data collection, and analysis; management of behavioral intervention projects, public health assessments, and behavioral research study design. My work has focused on HIV/AIDS and other zoonotic infectious diseases, and sociocultural behavior change interventions. Previously, I managed a portfolio of global health contracts valued at over \$20 million in service to the U.S. Agency for International Development (USAID), (b) (4), (b) (4), and the Centers for Disease Control and Prevention (CDC). While my private sector career meant that I was not able to publish much of my work, I generated over 80 high-profile technical reports for federal and international health agencies. At EcoHealth Alliance I lead a behavioral risk team for USAID/EPT PREDICT (project ending 2019) characterizing behavioral risk in 28 countries with high-risk human-animal disease transmission interfaces. I have been

B. Positions and Honors**Positions and Employment**

2017-Present Senior Scientist, EcoHealth Alliance, NY
 2017-Present USAID PREDICT-2 Global Director for Behavioral Risk Surveillance, NY
 2017-Present USAID PREDICT-2 Partner Lead for Ecological and Biological Human Surveillance, NY
 2013-2017 Lead Associate / Senior Lead Scientist, Booz Allen Hamilton, Washington, DC
 2010-2012 Associate / Lead Scientist, Booz Allen Hamilton, Washington, DC
 2010 Research Consultant, Johns Hopkins Bloomberg School of Public Health, Center for Communication Programs, Baltimore, MD
 2010 Research Consultant, Academy for Educational Development, Washington, DC
 2007-2008 Research Fellow in Social Epidemiology, London School of Hygiene and Tropical Medicine, London, UK and Kampala, Uganda
 2007-2008 SASA! Study Baseline Project Leader, London School of Hygiene and Tropical Medicine, London, UK and Kampala, Uganda
 2005-2007 Senior Research Analyst, American Institutes for Research, Washington, DC
 2004-2005 Research Analyst, American Institute for Research, Washington, DC
 2003 Research Consultant, International Center for Research on Women, Washington, DC
 2002-2004 Health Research Scientist, Battelle Memorial Institute, Arlington, VA

1999-2001 Health Researcher, Battelle Memorial Institute, Arlington, VA
1998-1999 Graduate RA, Center for Urban Transportation Research, Tampa, FL
1998 Graduate RA, H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL
1997-1998 Graduate RA, University of South Florida, Department of Anthropology, Tampa, FL
1996-1997 Project Manager, Cultural Systems Analysis Group, Univ Maryland, College Park, Maryland
1995-1996 RA, Cultural Systems Analysis Group, University of Maryland, College Park, Maryland

Other Experience and Professional Memberships

Member, American Public Health Association (APHA)
Member, American Evaluation Association (AEA)
Member, Global Health Council (GHC)
Member, American Anthropological Association (AAA)
Member, Society for Applied Anthropology (SfAA)

Honors

2007-2010 Johns Hopkins University Tuition Scholarship
2003 Distinguished Service Award, Latin American Youth Center
1999 Center for Urban Transportation Research Graduate Assistantship
1999 Latin American and Caribbean Studies Passport Scholarship
1998 Latin American and Caribbean Studies Research Grant
1997-1998 Department of Anthropology Graduate Assistantship

C. Contribution to Science

1. **Ethical and Robust Human Subjects Research:** My advanced training and experience in designing, carrying out, and evaluating mixed-methods research projects with vulnerable human populations, has allowed me to contribute to the body of literature and recommended practices around balancing robust study design with the ethical treatment of human subjects. With public health research and evaluation experience spanning Africa, Asia, Central America, the Caribbean, and North America, my contributions within this subject area have added to the discourse of building, implementing, and measuring scientific exploration in the name of human health improvements without compromising human privacy, dignity, and respect.
 - a. Francisco LV, Abramsky T, Kiss L Michau L, Musuya T, Kerrigan D, Kaye D, Watts C (2013). Violence against Women and HIV Risk Behaviours in Kampala, Uganda: Baseline Findings from the SASA! Study. **Violence Against Women**, 19(7): 814-832.
 - b. Wagman J, Francisco LV, Glass N, Sharps PW, Campbell JC (2008). Ethical challenges of research on and care for victims of intimate partner violence. **Journal of Clinical Ethics**,19(4):371-80.
 - c. Campbell JC, Baty ML, Ghandour RM, Stockman JK, Francisco LV, Wagman J (2008). The intersection of intimate partner violence against women and HIV/AIDS: a review. **International Journal of Injury Control and Safety Promotion**, 15(4), 221-31.
 - d. Campbell, JC, Baty ML, Ghandour RM, Stockman JK, Francisco LV, Wagman J (2008). The Intersection of Violence against Women and HIV/AIDS. In Scott KA (Rapporteur) **Violence Prevention in Low- and Middle- Income Countries: Finding a Place on the Global Agenda**, pp.149-166. Washington, DC: Institute of Medicine, National Academies Press.
2. **Scientific approaches to behavioral intervention:** Through the example of my work as a scientist with subject matter expertise in behavior change, I have built a strong case that scientific evidence can and should make its way into the hands of decision-makers and the community. This evidence-action gap is one that is often recognized, but regularly left unaddressed. My work in Kampala Uganda using a cluster randomized controlled trial to understand the impact of an intervention in preventing violence against

women and reducing their HIV risk was recognized by Harvard University as a program that closes gender gaps in economic opportunity, politics, health, and education. It was also added to the Women and Public Policy Program's Gender Action Portal, a hub of scientific evidence providing insights on the impact of policies, strategies and practices aimed at closing gender gaps, and taking promising interventions to scale. Additionally, I led the development of a behavioral intervention resource in the form of a moderated picture book, "Living Safely with Bats," based upon feedback from communities living in countries and in areas of regular bat-human contact in their homes. This resource became a key component in ministerial and community outreach by the USAID PREDICT consortium following the announcement of the discovery of the Bombali ebolavirus in 2018, and reflects my continued efforts to translate research to practice.

- a. Abramsky T, Devries K, Kiss L, Nakuti J, Kyegombe N, Starmann E, Cundill B, Francisco LV, Kaye D, Musuya T, Michau L, Watts C (2014). Findings from the SASA! Study: a cluster randomised controlled trial to assess the impact of a community mobilisation intervention to prevent violence against women and reduce HIV risk in Kampala, Uganda. **BMC Medicine**, 12:122.
 - b. Francisco LV, Sullivan A, Goley J, Martinez S, Saylor K, Euren J, Epstein JH, Bird B, Goldstein T, Wolking D, Johnson C, Hagan E, Olival KJ, Karesh WB, Daszak P, Mazet JK (2018). Living Safely with Bats: a risk-reduction resource to help communities in developing countries change behavior to minimize zoonotic spillover from bats. **USAID** Washington, DC.
 - c. Campbell JC, Baty ML, Ghandour RM, Stockman JK, Francisco LV, Wagman J (2008). The Intersection of Violence against Women and HIV/AIDS. In Scott KA (Rapporteur). **Violence Prevention in Low- and Middle- Income Countries: Finding a Place on the Global Agenda**, pp.149-166. Washington, DC: Institute of Medicine, The National Academies Press.
3. **Applied behavioral research:** Through my advanced training and experience in quantitative, qualitative, and mixed-methods research methodology I have focused on promoting the application of behavioral research to on-the-ground problems. My authorship of over 80 technical reports and publications reinforces my track record of commitment to making robustly-generated methodologies available and accessible to those who affect policy and programming.
- a. Francisco LV, *et al.* (2015). DTRA CBEP Country Assessment Manual: Guidance for Implementation of CBEP Assessments of Country Capabilities in Biosurveillance, Biosafety, and Biosecurity. **Booz Allen Hamilton**, Lorton, VA.
 - b. Francisco LV, *et al.* (2011). Resilience and Prevention Study: Program Evaluation Framework for the Never Leave a Marine Behind (NLMB) Program. For the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, US Department of Defense. **Booz Allen Hamilton**, Rockville, MD.
 - c. Francisco LV (2010). Operational Plan for Ethnographic and Network Assessment Research Project. For Centers for Disease Control and Prevention HIV prevention project in Côte d'Ivoire and Zambia. **Academy for Educational Development**, Washington, DC.

Complete List of Published Work in MyBibliography:

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

R01 AI110964	Daszak (PI)	06/01/14-05/31/19
NIAID: Understanding the Risk of Bat Coronavirus Emergence		
Bat ecological, human risk behavioral and virological studies to understand the risk of bat coronavirus emergence		
Role: Research Scientist		
USAID EPT PREDICT-2	Mazet (PI)	10/01/14 – 09/30/19

Conducting surveillance for novel pathogens in wildlife, livestock and people; characterizing human risk behavior; modeling risk of novel disease emergence; identifying mitigation strategies

The goal of this project is to assist focal countries in monitoring viruses with pandemic potential, as well as the behaviors, practices, and conditions that are associated with viral evolution, spillover, amplification, and spread.

Role: Research Scientist

Completed Research Support

CDC CGH DGHT Zambia ART Bell (Project Director) 03/28/16 – 01/15/17

Centers for Disease Control and Prevention (CDC), Center for Global Health (CGH), Division of Global HIV/AIDS and Tuberculosis (DGHT), ART Readiness in HIV-infected Pregnant Women: From Formative Qualitative Research to Individual Randomized Trial – Zambia

Trial monitoring visits to evaluate accuracy of screening instrument and effectiveness of enhanced adherence package through early data on virologic response, mother to child transmission (MTCT) rates of HIV, and renal function.

Role: Project Manager

PFSCM Projects McLaughlin (Officer in Charge) 06/01/2014 – 01/15/17

Partnership for Supply Chain Management (PFSCM) Projects: USAID Supply Chain Management System (SCMS); Global Fund Pooled Procurement Mechanism (PPM); 3MDG Regional Supply Chain Strengthening (RSCS)

Led and oversaw all company-wide team members and activities associated with these three projects, as part of a 16-member consortium, known as the Partnership for Supply Chain Management (PFSCM). All projects focused on increasing regular and consistent HIV/AIDS treatment through health systems strengthening, performance management, country strategic planning, and technical assistance provision.

Role: Program Manager

BIOGRAPHICAL SKETCH

NAME Amy Catherine Sims	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (4)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
University of Alabama at Birmingham	BS	05/1995	Molecular Biology
Vanderbilt University, Nashville, TN	PhD	05/2001	Microbiology & Immuno
Duke University, Durham, NC	Postdoctoral	08/2002	RNA/Protein Interaction
University of North Carolina at Chapel Hill (US)	Postdoctoral	10/2005	Virology

A. Personal Statement

The identification of highly pathogenic human coronaviruses (SARS-CoV and MERS-CoV) underscored the importance of understanding how viruses emerge from zoonotic reservoirs and how these emergent viruses replicate and cause pathogenesis in the new host. My research has focused on several key aspects of these questions by working to understand the cellular tropism of SARS-CoV and MERS-CoV in primary human lung cells, how host genetic pathways and gene networks affect virus replication and pathogenesis and how manipulating the coronavirus genome changes the host innate immune response to virus infection. Dr. Sims created the humanized transgenic mice that facilitate bat coronavirus replication in coronavirus small animal models and has significant expertise using the coronavirus reverse genetics platform established at UNC. She pioneered the use of primary human lung cell cultures for understanding coronavirus cellular permissivity, in vitro replication kinetics, and therapeutic treatment options within the Baric laboratory.

Relevant publications: My most relevant work to date focuses on using primary human lung cells as culture models for human and human-like bat coronavirus strains.

1. Menachery VD, Yount BL, Sims AC, Agnihothram S, Gralinski LE, Plante JA, Graham RL, Scobey T, Royal S, Pickles RJ, Randell SH, Lanzavecchia A, Marasco WA, Shi Z, Baric RS (2016). SARS-like WIV1-CoV poised for human emergence. **Proceedings of the National Academy of the Sciences** 15:113(11): 3048-53. PMC4801244
2. Becker MM, Graham RL, Donaldson EF, Rockx B, Sims AC, Timothy Sheahan, Raymond Pickles, Davide Corti, Robert E. Johnston, Ralph S. Baric, Mark R. Denison (2008). Platforms for the Synthetic Reconstitution of Noncultivable Zoonotic Viruses. **Proceedings of the National Academy of the Sciences** PMC2588415
3. Sims AC, Baric RS, Yount B, Burkett SE, Jeffers L, Pickles RJ (2005). SARS-CoV infection of human ciliated airway epithelium: the role of the ciliated cell in viral spread in the conducting airways of the lung. **Journal of Virology** 79(24):15511-15524, 2005. PMC1316022
4. Scobey T, Yount BL, Sims AC, Donaldson EF, Agnihothram SS, Menachery VD, Graham RL, Swanstrom J, Bove PF, Kim JD, Grego S, Randell SH, Baric RS. Reverse genetics with a full-length infectious cDNA of the Middle East respiratory syndrome coronavirus. **Proceedings of the National Academy of the Sciences U S A**. 2013 Oct 1;110(40):16157- 62. PMID: 24043791. PMC3791741
5. Sims AC, Sheahan TP, Graham RL, Menachery VD, Gralinski LE, Case JB, Leist SR, Pirc K, Feng JY, Trantcheva I, Bannister R, Park Y, Babusis D, Clarke MO, Mackman RL, Siegel D, Ray AS, Cihlar T, Jordan R, Denison MR, Baric RS (2017). Broad-spectrum antiviral GS-5734 inhibits both epidemic and zoonotic coronaviruses. **Science Translational Medicine** 28;9(396). PMC5567817

B. Positions and Honors

- 1993 American Society of Microbiology Undergraduate Research Award, University of Alabama
 1994 Albert Einstein College of Medicine Summer Student Award
 1996 - 01 Graduate Student, Laboratory of Mark Denison, Vanderbilt University, Nashville, TN
 1999 Dissertation Enhancement Award, Vanderbilt University
 2001 - 02 Postdoctoral Fellow, Laboratory of Jack Keene, Duke University, Durham, NC
 2002 - 05 Postdoctoral Fellow, Laboratory of Ralph Baric, UNC at Chapel Hill
 2002 - 04 Infectious Disease Pathogenesis Training Grant Fellow (NIH/NIAID 5T32AI07151-27)
 2005 - 17 Research Assistant Professor, Department of Epidemiology, UNC, Chapel Hill, NC
 2017 - Research Associate Professor, Department of Epidemiology, UNC, Chapel Hill, NC

C. Contributions to Science

1. *In vitro* models for viral infection. Finding suitable *in vitro* models for studying newly identified or emerged human respiratory viruses can be a challenge. Primary cells isolated from the human conducting airway can be cultured at an air liquid interface and following maturation recapitulate the morphology of the airway epithelium. These cultures provide a unique *in vitro* model and for one human coronavirus, HKU1, provide the only *in vitro* model for studying this virus.

- a) Sims AC, Pyrc K, Dijkman R, Jebbink M, Long C, Deming D, Donaldson E, Vabret A, Baric RS, van der Hoek L, Pickles R (2010). Culturing the unculturable: human coronavirus HKU1 infects, replicates, and produces progeny virions in human ciliated airway epithelial cell cultures. **Journal of Virology**, 84(21): 11255-63. PMC2953148
- b) Sims AC, Baric RS, Yount B, Burkett SE, Jeffers L, Pickles RJ (2005). SARS-CoV infection of human ciliated airway epithelium: the role of the ciliated cell in viral spread in the conducting airways of the lung. **Journal of Virology**, 79(24): 15511-15524. PMC1316022

2. Gene pathways to regulate viral replication. In collaboration with researchers at the University of Wisconsin Madison and Pacific Northwest National Laboratories, I have been working to identify specific host gene networks and pathways that regulate lethal human respiratory virus replication and pathogenesis. Specifically, I was interested in determining genes that regulate SARS-CoV and MERS-CoV replication in human cell lines, models of the human conducting airway and mouse models.

- a) Sims AC, Tilton SC, Menachery VD, Gralinski LE, Schäfer A, Matzke MM, Webb-Robertson BM, Chang J, Luna ML, Long CE, Shukla AK, Bankhead AR, Burkett SE, Zornetzer G, Tseng CK, Metz TO, Pickles R, McWeeney S, Smith RD, Katze MG, Waters KM, and Baric RS (2013). Release of SARS-CoV Nuclear Import Block Enhances Host Transcription in Human Lung Cells. **Journal of Virology**, 87(7): 3885-902. PMC3624188
- b) Mitchell HD, Einfeld AJ, Sims AC, Waters KM. A Network Integration Approach to Identify Highly Conserved Regulatory Targets Related to Pathogenicity for Influenza and SARS-CoV Respiratory Viruses. **PLoS ONE** 8(7): e69374. PMC3723910
- c) Menachery VD, Einfeld AJ, Josset L, Sims AC, Schaefer A, Proll S, Fan S, Li C, Neumann G, Tilton SC, Chang J, Gralinski LE, Long C, Green R, Matzke MM, Webb-Robertson BJ, Shukula AK, Burkett S, Metz TO, Pickles R, Smith RD, Waters KM, Katze M, Kawaoka Y, Baric RS (2014) Pathogenic influenza and coronaviruses utilize similar and contrasting approaches to control global ISG responses. **mBio**, 5(3). PMC4030454
- d) Aebermann BD, Pickett BE, Kumar S, Sims AC, Sova P, Tam VC, Tchitchek N, Thomas PG, Tilton SC, Totura A, Wang J, Webb-Robertson B, Wen J, Weiss J, Yang J, Yount B, Zhang Q, McWeeney S, Smith RD, Waters KM, Kawaoka Y, Baric RS, Aderem A, Katze MM, Scheuermann R (2014). A Comprehensive Collection of Systems Biology Data Characterizing the Host Response to Viral Infection. **Nature's Scientific Data**, 1(10). 1038/sdata.2014.33. PMC4410982

Complete List of Published Work in NCBI MyBibliography:

<http://www.ncbi.nlm.nih.gov/myncbi/collections/bibliography/49189460/>

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

U19-AI106772-01 (PI: Kawaoka) 06/01/13-05/31/19 Univ. of Wisconsin/NIH

MERS-CoV Supplement for OMICs Proposal

The proposed studies will provide a more detailed look at the intracellular environment by taking “snapshots” of the lipids, metabolites, and proteins present during viral infection time courses. These assays will allow us to determine the innate immune response occurring immediately following virus infection and to determine how the virus and cell interact over a 72 hour window.

Role: Project PI

U19 AI 109680 CETR (PI: Whitley) 03/01/14-02/28/19 UAB/NIH/NIAID

Antiviral Drug Discovery and Development Center

The specific aims of the proposal will identify small molecule inhibitors of CoV fidelity and RNA capping, define their mechanism of action, and determine their efficacy against SARS-CoV and across CoV families using in vivo mouse models of acute and persistent CoV disease.

Role: Investigator

U19 AI109761 CETR (PI: Lipkin) 03/01/14-02/28/19 Columbia/NIH/NIAID

Diagnostic and Prognostic Biomarkers for Viral Severe Lung Disease

The overall goal of this program is to develop new platform technologies that use functional genomics as diagnostic and prognostic indicators of severe end stage lung disease following virus infection of the lung.

Role: Investigator

R01 AI110700 (PI: Baric) 04/01/15-03/31/20 NIH

Mechanisms of MERS-CoV Entry, Cross-species Transmission and Pathogenesis

The overall goal is to build a comprehensive understanding of the molecular mechanisms guiding group 2c CoV receptor recognition, entry and pathogenesis.

Role: Investigator

1R01 AI132178-01 (MPI:Sheahan/Baric) 08/06/17-07/31/22 NIH

Broad-spectrum antiviral GS-5734 to treat MERS-CoV and related emerging CoV

In partnership with Gilead Sciences, we aim to accelerate the preclinical development of GS-5734 and promote IND licensure. We define the pharmacokinetics, pharmacodynamics, resistance profile, efficacy breadth and mechanism of action of GS-5734 against MERS-CoV and related emerging CoV.

Role: Investigator

Completed Research Support

Contract 576652 (PI:Katze) 09/26/08-09/25/13 University of Washington/NIAID

Systems Biology of Lethal and Attenuated SARS-CoV Infection

The overall hypothesis is that highly pathogenic respiratory viruses use common and unique strategies to mechanistically remodel the intracellular environment to enhance virus replication, regulate disease severity and promote virus transmission. Using SARS-CoV and H1N1 2009 and a comparative systems biology approach with H5N1 avian influenza virus we will identify unique and common signaling circuitry that is essential for promoting severe disease profiles in the lung.

Role: Co-Investigator

Supplement to OMIC Pilot Award (PI: Kawaoka) 6/1/14-5/31/16 Univ. of Wisconsin/NIH/NIAID

Epigenetic Regulation of Interferon-Stimulated Genes Following MERS-CoV Infection

The overriding hypothesis of this supplemental application is that MERS-CoV and H5N1 manipulate host epigenetic programs to specifically down-regulate certain classes of ISGs, which likely antagonize virus replication efficiency in vitro. The goal is to develop systems biology datasets and unbiased modeling algorithms to deconvolute the complex pathogen-host interactions that regulate severe disease outcomes following infection and identify common host pathways/genes that can be exploited for therapeutic control.

Role: Project PI

U19-AI100625 (PI: Baric) 8/05/12-07/31/17 NIH/NIAID

Systems Immunogenetics of Biodefense Pathogens in the Collaborative Cross

Specific Aims: In this proposal, we are utilizing the Collaborative Cross (CC), a novel panel of reproducible, recombinant inbred (RI) mouse lines to identify genes and gene interactions, which regulate the induction, kinetics, and magnitude of the innate, inflammatory and adaptive arms of the immune response following virus infection. Specifically, we will develop novel modeling algorithms to predict and validate the causal relationships between natural genetic variation and host signaling networks, immune cell recruitment, and immune function.

Role: Investigator and Co-Education Director

Supplement to OMIC (PI: Kawaoka) 6/1/16-5/31/17 Univ. of Wisconsin/NIH/NIAID

Systems Virology for MERS-CoV in vivo

The goal is to develop systems biology datasets and unbiased modeling algorithms to deconvolute the complex pathogen-host interactions that regulate severe disease outcomes following infection and identify common host pathways/genes that can be exploited for therapeutic control. These studies will build on our current data set by collecting data sets for MERS-CoV in vivo.

Role: Project PI

(b) (4)

The overall goal of this project is to test (b) (4) protease inhibitor/interferon cocktails in comparison to and with nucleoside analog compounds to determine the best course of treatment for patients infected with highly pathogenic human coronaviruses.

Not Assigned (PI: Baric) 08/01/17-06/30/18 Emory/NIH

Elucidating the potential of nucleoside analog, EIDD-1931, as a broad-spectrum antiviral against highly pathogenic human coronavirus strains

To define the activity, potency and mechanism of action of EIDD-1931 against highly pathogenic human coronaviruses for development as potential therapeutic.

Role: Investigator

BIOGRAPHICAL SKETCH

NAME Emily Ann Hagan		POSITION TITLE Research Scientist	
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YYYY	FIELD OF STUDY
Hiram College	BA	05/2008	Biol. Biomed. Humanities
Columbia Univ. Mailman Sch. Public Health	MPH	05/2013	Epidemiology
Columbia Univ. Mailman Sch. Public Health	CPH	08/2013	Public Health

A. Personal Statement

I have a background in laboratory science, veterinary science, epidemiology, and human behavioral health. My main focus in the current proposed R01 work is on the human behavioral work in Aim 2. My experience in understanding the implications of laboratory testing, in conducting and analyzing quantitative and qualitative human behavioral risk assessment and mixed-methods data analysis are exactly the tools required to conduct this work. As assistant to the Senior Behavioral Risk Scientist on the USAID-EPT-PREDICT project I have regularly applied behavioral analytical skills to research data from 28 countries. I have also conducted my own focused work in Bangladesh, analyzing the results of 2 years of survey work on zoonotic viral spillover risk – directly applicable to the current proposal.

B. Positions and Honors**Positions and Employment**

2006-2007 Researcher, Hiram College, Hiram College, Cellular and Molecular Lab, Hiram, OH
 2007 NSF REU Research Intern, University of Akron, Polymer Department, Akron, OH
 2007-2008 Teaching Assistant, Hiram College, Organic Chemistry Department, Hiram, OH
 2008-2012 RA, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA
 2011-2012 Team Manager, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, MA
 2013-2015 RA, EcoHealth Alliance, New York, NY
 2015-2016 Research Coordinator, EcoHealth Alliance, New York, NY
 2016-2018 Research Scientist and PREDICT Bangladesh Country Liaison, EcoHealth Alliance, NY

Other Experience and Professional Memberships

2013- *EcoHealth*, reviewer
 2016- WHO Bulletin, reviewer
 2018- *PLOS Neglected Tropical Diseases*, reviewer

Honors

2008 Biology Departmental Honors, Hiram College

C. Contribution to Science

- Human behavioral risk analysis.** I have helped design, coordinate training for, and conduct on-the-ground human behavioral work for the USAID-EPT-PREDICT project. This work focuses on the risk of zoonotic spillover of novel viruses from wildlife to people at high-risk interfaces in developing countries, and is therefore directly applicable to the research proposed for this R01. I have conducted field survey work in

Program Director/Principal Investigator: Daszak, Peter

This project preceded PREDICT-2, described above. \$75 million award to identify hotspots of emerging diseases of pandemic potential and to help guide surveillance activities and disease control and prevention strategies across several countries.

Role: Research Scientist

BIOGRAPHICAL SKETCH

NAME Guangjian Zhu	POSITION TITLE Co-Investigator
eRA COMMONS USER NAME (b) (6)	

EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
East China Normal University, Shanghai, China	BS	07/03	Biology Science
Hainan Normal University, Haikou, China	MS	07/03	Ecology
East China Normal University, Shanghai, China	PHD	6/12	Biochemistry/Mol. Biol.

A. Personal Statement

Throughout my graduate studies and work with East China Normal University, I have carried out molecular biology and field ecological research focused on bat genetics and viral diversity. I have co-authored multiple publications in the field of viral genetics and bat ecology under the mentorship of Drs. Daszak (EcoHealth Alliance) and Shi (Wuhan Inst. Virol.). For the past 9 years I have been the in-country coordinator for all EcoHealth Alliance work in China on USAID- EPT-PREDICT, as well as for the previous NIAID R01 on bat CoVs. During this time I have been responsible for the identification of high-risk interfaces between wildlife and people, where close contact might allow for zoonotic pathogen spillover. I have also led wildlife surveys which involved bat and rodent capture and sampling for viral discovery. Through this work I have led site-selection and wild and domestic animal sampling in Guangxi, Yunnan, Guangdong and Shanghai, and have compiled archived and current samples from birds in Shanghai Chongming Reserve for H7N9 avian influenza analyses. Under the USAID PREDICT program I collected over 1,000 bat samples which have been tested for coronaviruses and other viral families at the Wuhan Institute of Virology. Under our previous NIAID award (R01AI110964), I am responsible for developing and leading a wildlife team to sample bats, rodents, and other small mammals in the live animal markets of southern China. I will continue these efforts in our renewal proposal as we focus our efforts on centers of CoV diversity in southern China. Through my graduate and professional work I have developed expertise in collecting high-quality, non-destructive samples from wildlife as well as expertise in molecular diagnostics.

B. Positions and Honors**Positions and Employment**

2007- Assistant Researcher, Guangdong Entomological Institute, China

Other Experience and Professional Memberships**Honors**

2009 Biology Prize of the 2009 Ig Nobel Prize (Tan *et al.* 2009, PLoS One)

C. Selected peer-reviewed publications most relevant to the current application

Ge XY, Li JL, Yang X-L, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang YJ, Luo CM, Tan B, Wang N, Zhu Y, Cramer G, Zhang SY, Wang LF, Daszak P, Shi Z (2013). Isolation and characterization of a bat SARS-like Coronavirus that uses the ACE2 receptor. **Nature** 503: 535-538.

Zhu G, Han N, Hong T, Tan M, Yu D, Zhang L (2008). Echolocation Call, Roost and ND 1 Sequence Analysis of New Record of *Nyctalus plancyi* (Chiroptera: Vespertilionidae) on Hainan Island. **Zoological Research**, 29(4): 447-451.

Zhu G, Li D, Ye J, Hong T, Zhang L (2008). New Record of *la io* in Hainan Island, its Echolocation Pulses and ND1 Analysis. **Chinese Journal of Zoology**, 43(5): 69-75.

Sun Y, Yu D, Zhu G, Liu X, Zhang SY, Chen J (2009). Isolation and characterization of 11 microsatellite loci in *Scotophilus kuhlii* (Lesser Asiatic Yellow House Bat). **Conservation Genetics**, 10: 1857-1859.

Mao X, Zhu G, Zhang SY, Rossiter SJ (2010). Pleistocene climatic cycling drives intra-specific diversification in the intermediate horseshoe bat (*Rhinolophus affinis*) in Southern China. **Molecular Ecology**, 19(13): 2754-2769.

Hua P, Zhang L, Zhu G, Jones G, Zhang SY, Rossiter SJ (2011). Hierarchical polygyny in multiparous lesser flat-headed bats. **Molecular Ecology**, 20(17): 3669-3680.

Additional recent publications of importance to the field (in chronological order)

Mazet JAK, Wei Q, Zhao G, Cummings DAT, Desmond JS, Rosenthal J, King CH, Cao W, Chmura AA, Hagan EA, Zhang S, Xiao X, Xu J, Shi Z, Feng F, Liu X, Pan W, Zhu G, Zuo G, Daszak P (2015). Joint China-U.S. Call for Employing a Transdisciplinary Approach to Emerging Infectious Diseases. **EcoHealth** 12(4): 555-559.

Hu B, Chmura AA, Li J, Zhu G, Desmond JS, Zhang YJ, Zhang JS, Epstein JH, Daszak P, Shi Z (2014). Detection of Diverse Novel Astroviruses from Small Mammals in China. **Journal of General Virology** 95: 2442-2449.

Zhu G, Wang R, Xuan F, Daszak P, Anthony SJ, Zhang SY, Zhang L, He G (2013). Characterization of Recombinant H9N2 Influenza Viruses Isolated from Wild Ducks in China. **Veterinary Microbiology** 166(4): 327-336.

Zhu G, Chmura AA, Zhang L (2011). Morphology, echolocation calls and diet of *Scotophilus kuhlii* (Chiroptera: Vespertilionidae) on Hainan Island, south China. **Acta Chiropterologica**, 14(1): 175-181.

Ma J, Jones G, Zhu G, Metzner W (2010). Echolocation behaviours of the Japanese pipistrelle bat *Pipistrellus abramus* during foraging flight. **Acta Theriologica**, 55(4): 315-332.

Tan M, Jones G, Zhu G, Ye J, Hong T, Zhou S, Zhang S, Zhang L (2009). Fellatio by fruit bats prolongs copulation time. **PLOS One**, 4(10), e7595.

Zhang L, Zhu G, Jones G, Zhang SY (2009). Conservation of bats in China: problems and recommendations. **ORYX**, 43(2): 179-182.

Zhu G, Tang Z, Liang B, Zhang X (2007). Diet and Roost Site of *Cynopterus sphinx* in Winter in Haikou. **Chinese Journal of Zoology**, 42(4): 22-27.

D. Research Support

Ongoing Research Support

USAID

EPT PREDICT-1

Mazet (PI)

10/01/09 – 09/30/14

Modeling hotspots for disease emergence and conducting surveillance in wildlife in hotspots for new emerging zoonoses

Amount: \$18 million subcontract on a \$75 million award

Role: Lead Field Scientist

1R01AI110964

Daszak (PI)

06/01/14 – 05/31/19

NIAID: Understanding the Risk of Bat Coronavirus Emergence

Bat ecological, human risk behavioral and virological studies to understand the risk of bat coronavirus emergence

Amount: \$2.5 million

Role: Lead Field Scientist

Completed Research Support

USAID

EPT PREDICT-1

Mazet (PI)

10/01/09 – 09/30/14

Modeling hotspots for disease emergence and conducting surveillance in wildlife in hotspots for new emerging zoonoses

Amount: \$18 million subcontract on a \$75 million award

Role: Lead Field Scientist

1 R01AI079231

Daszak (PI)

09/18/08 – 08/31/13

NIAID Non-Biodefense Emerging Infectious Diseases

Risk of viral emergence from bats.

To model hotspots for bat viral diversity, identify & characterize new bat viruses & understand their pathology

Role: Research Scientist

BIOGRAPHICAL SKETCH

NAME Linfa Wang	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
East China Normal University, Shanghai	BS	01/1982	Biology
University of California, Davis	PHD	07/2086	Biochemistry

A. PERSONAL STATEMENT

My 20+ years of research focused on designing and applying novel testing platforms to discover zoonotic pathogens has direct applicability to the current proposal. I am trained as a biochemist and molecular biologist, and have been working in the field of virology and infectious diseases for more than 20 years, playing a key role in identification of animal links with several high profile zoonotic agents, including Hendra virus in Australia, Nipah virus in Malaysia and SARS virus in China. During this time, I've directed largescale laboratory diagnostic studies based on serological and PCR surveys of wildlife, domestic animals and people; and worked with multidisciplinary lab, field and modeling teams, including those at EcoHealth Alliance, to interpret the results. In my current role as director of the Program in Emerging Infectious Diseases at Duke-NUS Graduate Medical School, I have initiated major projects to continue this work, and to analyze bat genomics and basic bat biology to better understand bat-unique biological features such as longevity and co-existence with pathogens with no or minimal clinical disease. This work has led to a number of patented techniques, as well as novel reagents that I have made available to collaborators and the greater scientific community. Over the years, I have established an extensive collaborative network with scientists all around the world, covering research and surveillance work into infections of human, animal and wildlife in a truly One Health approach, including many of the collaborators on the current proposal.

Li W, Shi Z, Yu M, Ren W, Smith C, Epstein JH, Wang H, Crameri G, Hu Z, Zhang H, Zhang J, McEachern J, Field H, Daszak P, Eaton BT, Zhang S, Wang LF (2005) Bats are natural reservoir of SARS-like coronaviruses. **Science** 310: 676-679.

Ge XY, Li JL, Yang X-L, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang YJ, Luo CM, Tan B, Wang N, Zhu Y, Crameri G, Zhang SY, Wang LF, Daszak P, Shi Z (2013). Isolation and characterization of a bat SARS-like Coronavirus that uses the ACE2 receptor. **Nature** 503: 535-538.

Zhang G, Cowled C, Shi Z, Huang Z, Bishop-Lilly KA, Fang X, Wynne JW, Xiong Z, Baker ML, Zhao W, Tachedjian M, Zhu Y, Zhou P, Jiang X, Ng J, Yang L, Wu L, Xiao J, Feng Y, Chen Y, Sun X, Zhang Y, Marsh GA, Crameri G, Broder CC, Frey KG, Wang LF Wang J (2013) Comparative Analysis of Bat Genomes Provides Insight into the Evolution of Flight and Immunity. **Science** 339: 456-60.

Zhou P, Fan H, Lan T, Yang XL, Shi WF, Zhang W, Zhu Y, Zhang YW, Xie QM, Mani S, Zheng XS, Li B, Li JM, Guo H, Pei GQ, An XP, Chen JW, Zhou L, Mai KJ, Wu ZX, Li D, Anderson DE, Zhang LB, Li SY, Mi ZQ, He TT, Cong F, Guo PJ, Huang R, Luo Y, Liu XL, Chen J, Huang Y, Sun Q, Zhang XL, Wang YY, Xing SZ, Chen YS, Sun Y, Li J, Daszak P, Wang LF, Shi ZL, Tong YG, Ma JY (2018). Fatal swine acute diarrhoea syndrome caused by an HKU2-related coronavirus of bat origin. **Nature** 556: 255–258

Patents: A protease deficient *Bacillus subtilis* mutant strain US patent No. 5,585,253; *Bacillus subtilis* expression and secretion system. US patent No. 7,238,560; Footrot antigens, vaccines and diagnostic assays.

Australian Patent No. 38377/93; A novel epitope tagging system for protein surveillance and purification.
 Australian Patent No. PM7419/94; Assay for the Parallel Detection of Biological Material Based on PCR.
 PCT/SG2013/000455; A Chimeric Animal Comprising Stably Transplanted Bat Cells. IMC/P/10031/00/SG

B. POSITIONS AND HONORS

Positions and Employment

1986 - 89 Post-doctoral Fellow, Department of Biochemistry, University of California, Davis, USA
 1990 Senior Research Officer, Centre for Molecular Biology and Medicine, Monash University, Australia
 1990 - 92 Research Scientist, CSIRO Australian Animal Health Laboratory (AAHL), Geelong, Australia
 1992 - 96 Senior Research Scientist, CSIRO AAHL, Geelong, Australia
 1996 - 04 Principal Research Scientist, CSIRO AAHL, Geelong, Australia
 2004 - 08 Senior Principal Research Scientist, CSIRO AAHL, Geelong, Australia
 2008 - 15 OCE Science Leader, CSIRO AAHL, Geelong, Australia
 2012 - Professor & Director, Programme in Emerging Infectious Diseases, Duke-NUS Medical School, Singapore

Other Experience and Professional Memberships

1996 - Editorial Board, *Asia Pacific J. Mol. Biol. Biotech.*
 2003 WHO SARS Scientific Research Advisory Committee
 2005 - Honorary Professor, Wuhan Institute of Virology, Chinese Academy of Sciences
 2006 - Editorial Board, *Chinese J. Virol.; Zoonoses & Publ. Hlth.*
 2006 - 7 NH & MRC Grant Review Panel
 2008 - Chair, ICTV Study Group, Paramyxoviridae
 2009 - Honorary Professor, University of Melbourne, Australia
 2010 - Editorial Board, *Frontiers Virol.*
 2012 - Editor-in-Chief, *Viol. J.*
 2012 - Board of Directors, Singapore Eye Research Institute
 2012 - Executive Committee, Australasian Society of Virology
 2013 - WHO International Health Regulations, Roster of Experts
 2017 - World Economic Forum, Global Health Threat Advisory Board

Selected Awards/Honors:

2006 CSIRO Award for Excellence in Partnership
 2007 Finalist, Eureka Prize for Scientific Research
 2008 CSIRO CEO Science Leader Award
 2010 Elected fellow of the Australian Academy of Technological Sciences and Engineering
 2011 Gardner Lecture Award, European Society of Clinical Virologist
 2013 CSIRO Chairman's Medal for Research
 2014 Winner, Eureka Prize for Infectious Disease Research
 2014 Finalist, Prime Minister's Science Award, Australia

C. CONTRIBUTION TO SCIENCE

1. Application of both molecular and serological platforms to pathogen discovery

My work at CSIRO AAHL, and now at Duke-NUS has focused on the development and use of PCR and serological assays to identify novel pathogens in wildlife, livestock and people, often under outbreak conditions. This includes the discovery of bats as a reservoir for SARS-CoV, using novel serological assays and PCR techniques I developed.

- a. Bossart KN, McEacherna JA, Hickey AC, Choudhry V, Dimitrov DS, Eaton BT, Wang LF (2007) Neutralization assays for differential henipavirus serology using Bio-Plex Protein Array Systems. **Journal of Virological Methods**, 142: 29-40.
- b. Thalmann CM, Cummins DM, Yu M, Lunt R, Pritchard LI, Hansson E, Crameri S, Hyatt A, Wang LF (2010) Broome virus, a new fusogenic Orthoreovirus species isolated from an Australian fruit bat. **Virology** 402:26-40.
- c. Cui J, Tachedjian G, Tachedjian M, Holmes EC, Zhang SY, Wang LF (2012) Identification of diverse groups of endogenous gammaretroviruses in mega- and microbats. **Journal of General Virology** 93:2037-2045.
- d. Wang J, Selleck P, Yu M, Ha W, Rootes C, Gales R, Wise T, Crameri S, Chen H, Broz I, Hyatt A, Woods R, Meehan B, McCullough S, Wang LF (2014) Novel Phlebovirus with Zoonotic Potential Isolated from Ticks, Australia. **Emerging Infectious Diseases** 20:1040-1043.

2. Identification of bats as major reservoir of emerging zoonotic viruses

I have used surveillance in wildlife, livestock and humans, coupled with experimental infections under BSL-2, -3, and -4, and laboratory assays to identify evidence that bats are the reservoir for a series of emerging viruses in people, including Hendra virus, Nipah virus, SARS-CoV, and others. This work has been one of the foundations for current interest in bats in emerging infectious disease research.

- a. Eaton BT, Broder CC, Middleton D, and Wang LF, (2006). Hendra and Nipah viruses: different and dangerous. **Nature Reviews Microbiology**, 4: 23-35.
- b. Chua KB, Crameri C, Hyatt A, Yu M, Tompang MR, Rosli J, McEachern J, Crameri S, Kumarasamy V, Eaton BT, Wang LF (2007). A previously unknown reovirus of bat origin is associated with an acute respiratory disease in humans. **Proceedings of the National Academy of Sciences**, 27: 11424-11429.
- c. Mahalingam S, Herrero LJ, Playford G, Spann K, Herring B, Rolph R, Middleton D, McCall B, Field H, Wang LF (2012) Hendra virus: an emerging paramyxovirus in Australia. **Lancet Infectious Diseases** 12: 799-807.
- d. Clayton BA, Middleton D, Arkinstall R, Frazer L, Wang LF, Marsh GA (2016) The Nature of Exposure Drives Transmission of Nipah Viruses from Malaysia and Bangladesh in Ferrets. **PLOS Neglected Tropical Diseases**, 10(6): e0004775.

3. Establishment of bats as a new mammalian model system to study virus-host interaction and evolutionary biology

Working with collaborators around the world, my lab has amassed an unprecedented collection of serological, tissue and other samples from bat surveillance programs. I have used these to develop and disseminate primary and immortalized bat cell lines, and a host of reagents which my team and collaborators are using to test hypotheses about why bats are able to host so many distinct viruses. Current projects include bat genomics and proteomics; examining the bat MHC, using gene knockout technology to identify links between flight, viral resistance, and longevity.

- a. Wynne JW, Shiell BJ, Marsh G, Boyd V, Monaghan P, Zhou P, Klein R, Todd S, Mok L, Green D, Tachedjian M, Baker M, Matthews D, Wang LF (2014). Proteomics informed by transcriptomics reveals Hendra virus sensitizes bat cells to TRAIL mediated apoptosis. **Genome Biology** 15: 532.
- b. Zhou P, Tachedjian M, Wynne JW, Boyd V, Cui J, Smith I, Cowled C, Ng JH, Mok L, Michalski WP, Mendenhall IH, Tachedjian G, Wang LF, Baker ML (2016). Contraction of the type I IFN locus and unusual constitutive expression of IFN- α in bats. **Proceedings of the National Academy of Sciences**, 113: 2696-2701.

- c. Xie J, Li Y, Shen X, Goh G, Zhu Y, Cui J, Wang LF, Shi Z, Zhou P (2018). Dampened STING-Dependent Interferon Activation in Bats. **Cell Host and Microbe**, 23(3):297-301.
- d. Yong KSM, Ng JHJ, Her Z, Hey YY, Tan SY, Tan WWS, Irac SE, Liu M, Chan XY, Gunawan M, Foo RJH, Low DHW, Mendenhall IH, Chionh YT, Duterte CA, Chen Q, Wang LF (2018). Bat-mouse bone marrow chimera: a novel animal model for dissecting the uniqueness of the bat immune system. **Science Reports**, 8(1):4726.

D. RESEARCH SUPPORT

Ongoing research support

NRF2012NRF-CRP001-056 Wang (PI) 01/11/13-31/10/18
National Research Foundation (NRF, Singapore)
Learning from bats: from genomics to controlling viral infection and combating cancer
Using bats as model to study immunology, inflammation and other cellular/molecular mechanisms which are responsible for the unique biological features of bats, such as longevity and infection with no or less diseases.
Role: Leading PI

AI212961 Crump (PI) 01/02/16-31/01/21
NIH
Investigating Febrile Deaths in Tanzania (INDITe)
To identify actionable patient management and health system interventions that could avert fatal outcomes among patients with severe febrile illness in low-resource areas.
Role: Co-PI

(b) (4)

Development of multiple serological platforms for differentiation of Zika and dengue virus infections

Using multiple multiplex serological platforms to develop antibody tests which can differentiate infections of Zika virus from Dengue virus and other closely related flaviviruses.
Role: PI

Completed

(b) (4)

Establishment of serological diagnostic capability for highly virulent zoonotic viral infections in Singapore

Using most advanced technological platforms to enhance the capability in diagnosing and responding to future zoonotic disease outbreaks in Singapore.
Role: PI

(b) (4)

Understanding the host pathogen relationships of Hendra Virus in bats, horses and humans
Examines why bats can be infected with Hendra Virus with no apparent symptoms, yet the virus causes severe disease in other mammals including humans. We hope this information can be used to design new drugs or vaccines to Hendra Virus.
Role: Co-PI

(b) (4)

Improving the management of an emerging viral disease In Australia: determination of the mechanisms of neuroinvasion by Hendra Virus and their control, leading to optimization of post-exposure therapy following contact with Hendra Virus

Using a recently established mouse infection model, this study aims to elucidate the mechanism of Hendra Virus neuroinvasion and to optimize the post-exposure therapy strategies.

Role: Chief Investigaor

(b) (4)

New targets in antiviral therapies

Development of novel antiviral strategies based on the interruption of nuclear localization process of key virus proteins in the families of *Paramyxoviridae* and *Rhabdoviridae*.

Role: Co-PI

AI077995

Broder (PI)

01/06/07-31/05/13

NIH/NIAID

Vaccines and therapeutics for Nipah and Hendra Virus

Establish virus infection, lethal dose, and detection parameters of Nipah virus in a ferret model. 2. Evaluate the protective efficacy of recombinant sG as a subunit vaccine for Nipah virus in the ferret. 3. Determine the passive protective efficacy of neutralizing, anti-G, fully-human monoclonal antibody therapy for Nipah virus infection in the cat and ferret. 4. Determine the solution structure of Nipah sG and in complex with its receptor ephrinB2.

Role: Co-PI

BIOGRAPHICAL SKETCH

NAME Lili Ren	POSITION TITLE Co-Investigator
eRA COMMONS USER NAME (credential, e.g., agency login) (b) (6)	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
Norman Bethune Univ. Med. Sci., China	BS	07/1998	Clinical medicine
Medical College, Jilin university	MS	07/2002	Pathology, pathophysiol.
Ctr. Disease Control & Prevention, China	Ph.D	07/2005	Immunology

A. Personal Statement

I have expertise in the pathogenesis and evolution of respiratory viruses. Using systems biological concepts and technical systems, my group has identified several new emerging respiratory virus epidemics in China, clarifying new causative viral agents of severe pneumonia, providing insights into the pathogenic mechanisms of viruses, and improving clinical pathogen diagnostics. My group has also conducted a longitudinal study to analyze evolution of known common respiratory viruses since 2005 – the largest and the longest continuous study of its type in China. My multiple pathogen detection system approach has been transferred to more than 300 national sentinel sites. In addition, my group has established several platforms to identify the serological epidemiology of common respiratory viruses including human CoVs. This will be a critical reference for the proposed R01 work, and have implications on the design of our serological screening platform. I have also established a collaborative group with clinicians in China to study the ecology of emerging viral pathogens. My extensive experience in this type of study will greatly assist in my role overseeing clinical sample collection, and screening by PCR and serological methods in southern China.

B. Positions and Honors.

Positions and Employment

2005-2010	Research assistant, Institute of Pathogen Biology, Chinese Academy of Medical Sciences/Peking Union Medical College, China
2010-2016,	Research scientist, Institute of Pathogen Biology, Chinese Academy of Medical Sciences/Peking Union Medical College, China
2016-	Senior Scientist, Institute of Pathogen Biology, Chinese Academy of Medical Sciences/Peking Union Medical College, China

Other Experience and Professional Memberships

2016-2019	Member, Expert Committee on Biosafety Assessment of the National Health and Family Planning Commission
2014-2020	Member, Youth Committee of the Chinese Medical Association Medical Virology Branch
2016-2021	Member, China Research Hospital, Space Microbiology and Infection Committee Branch
2017-	Editorial board, <i>Chinese Journal of Experimental & Clinical Virology</i>

Honors

- 2008 - 10 Outstanding Young Talents of New Century (NCET-07-0506), granted by Ministry of Education, China. Principal Investigator.
- 2015 2nd prize of the advanced science and technology progress award, second author, granted by Ministry of Education, China.
- 2016 1st prize of the advanced science and technology progress award, second author, granted by Ministry of Education, China.
- 2017 Excellent teacher of Peking Union Medical College (PUMC), China

C. Selected peer-reviewed publications most relevant to the current application

* = Co-corresponding or first authors

Ren L*, Richard G*, Wang Z*, Xiang Z*, Wang Y*, Zhou H, Li J, Xiao Y, Yang Q, Zhang J, Chen L, Wang W, Li Y, Li T, Meng X, Zhang Y, Guy V, Chen J, Jin Q, Wang J (2009) Prevalence of human respiratory viruses in adults with acute respiratory tract infections in Beijing, 2005–2007. **Clinical Microbiology and Infection**, 15(12): 1146-1153.

Ren L, Gonzalez R, Xu X, Li J, Zhang J, Vernet G, Paranhos-Baccalà G, Jin Q, Wang J (2009) WU polyomavirus in fecal specimens of children with acute gastroenteritis, China. **Emerging Infectious Diseases**, 15(1): 134-135.

Ren L, Gonzalez R, Xiao Y, Xu X, Chen L, Vernet G, Paranhos-Baccalà G, Jin Q, Wang J (2009) Saffold cardiovirus in children with acute gastroenteritis, Beijing, China. **Emerging Infectious Diseases** 15(9): 1509-1511.

Ren L, Gonzalez R, Xu J, Xiao Y, Li Y, Zhou H, Li J, Yang Q, Zhang J, Chen L, Wang W, Vernet G, Paranhos-Baccalà G, Wang Z, Wang J (2011). Prevalence of human coronaviruses in adults with acute respiratory tract infections in Beijing, China. **Journal of Medical Virology** 83(2): 291-297.

Yang J*, Yang F*, Ren L*, Xiong Z, Wu Z, Dong J, Sun L, Zhang T, Hu Y, Du J, Wang J, Jin Q (2011). Unbiased parallel detection of viral pathogens in clinical samples by use of a metagenomic approach. **Journal of Clinical Microbiology**, 49(10): 3463-3469.

Guo L*, Zhang X*, Ren L*, Yu X*, Chen L*, Zhou H, Gao X, Teng Z, Li J, Hu J, Wu C, Xiao X, Zhu Y, Wang Q, Pang X, Jin Q, Wu F, Wang J (2014). Human antibody responses to avian influenza A(H7N9) virus, 2013. **Emerging Infectious Diseases**, 20(2): 192-200.

Ren L*, Yu X*, Zhao B*, Wu F, Jin Q, Zhang X, Wang J (2014). Infection with possible precursor of avian influenza A(H7N9) virus in a Child, China, 2013, **Emerging Infectious Diseases**, 20(8): 1362-1365.

Ren L*, Zhang Y*, Li J, Xiao Y, Zhang J, Wang Y, Chen L, Paranhos-Baccalà G, Wang J (2015). Genetic drift of human coronavirus OC43 spike gene during adaptive evolution. **Scientific Reports**, 5:11451. doi.org/10.1038/srep11451

Zhang Y, Li J, Xiao Y, Zhang J, Wang Y, Chen L, Paranhos-Baccalà G, Ren L*, Wang J* (2015). Genotype shift in human coronavirus OC43 and emergence of a novel genotype by natural recombination. **Journal of Infection**, 70(6): 641-650.

Yan F, Xiao Y, Li M, Zhang H, Zhang R, Zhou H, Shen H, Wang J, Li W*, Ren L* (2017). Metagenomic analysis identified human rhinovirus B91 infection in an adult suffering from severe pneumonia. **American Journal of Respiratory and Critical Care Medicine**, 195(11):1535-1536.

Ren L*, Yang D*, Ren X*, Li M, Mu X, Wang Q, Cao J, Hu K, Yan C, Fan H, Li X, Chen Y, Wang R, An F, An S, Luo M, Wang Y, Xiao Y, Xiang Z, Xiao Y, Li L, Huang F, Jin Q, Gao Z, Wang J (2017). Genotyping of human rhinovirus in adult patients with acute respiratory virus infections identified predominant infections of genotype A21. **Scientific Reports**, 7:41601.

Ren L*, Zhang R*, Rao J, Xiao Y, Zhang Z, Yang B, Cao D, Zhong H, Ning P, Shang H, Li M, Gao Z, Wang J (2018). Transcriptionally Active Lung Microbiome and Its Association with Bacterial Biomass and Host Inflammatory Status. **mSystems**, 3:e00199-18.

D. Research Support

Ongoing Research Support

1. 2017ZX10103004, Key project of infectious diseases 01/01/2017-12/31/2020
Viral etiology and spectrum of respiratory tract infections and the mutations characteristics
The goal of this project is to identify the etiology of community acquired pneumonia in China and the epidemic and mutations of the important respiratory viruses.
Role: PI

Completed Research Support

1. 2012ZX10004-206 Key project of infectious diseases 01/01/2012-12/31/2015
Viral etiology and spectrum of respiratory tract infections and the mutations characteristics
The goal of this project is to investigate the etiology of acute respiratory tract infections in China and the sero-epidemiological of important respiratory viruses.
Role: PI
2. 2009ZX10004-206 Key project of infectious diseases 01/01/2009-12/31/2010
Viral etiology and spectrum of respiratory tract infections and the mutations characteristics
The goal of this project is to establish the surveillance network and to investigate the etiology of acute respiratory tract infections in China.
Role: PI

BIOGRAPHICAL SKETCH

NAME Li Guo	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
Bengbu Medical College, China	B.S.	07/1997	Clinical Medicine
Anhui Medical University, China	M.S.	07/2002	Microbiology
Chinese Center for Disease Control & Prevention	M.D.	07/2006	Immunology

A. Personal Statement

I have direct expertise in the proposed work described in this R01. I have been working on the etiology and immunology of respiratory viruses since 2003. I have evaluated cross-reactivity of NP among HCoV and developed a competitive ELISA (cELISA) for detecting anti-N IgG antibodies against HCoV -229E, -OC43, -NL63, and -HKU1. These data indicate differential transmission of HCoVs in the Chinese population and that anti-N IgG may serve as an index for susceptibility to HCoV infections. In addition, I have evaluated human antibody responses to A(H7N9) influenza virus, differential seroprevalence of human bocavirus species 1-4 in China, and found bocavirus in children with respiratory tract infections.

B. Positions and Honors.**Positions and Employment**

1997 - 99 Teaching Assistant, Bengbu Medical College
 2002 - 09 Assistant Professor, Chinese Center for Disease Control and Prevention
 2009 - 15 Associate Professor, Institute of Pathogen Biology (IPB), Chinese Academy of Medical Science (CAMS) /Peking Union Medical College.
 2015 - Professor, Institute of Pathogen Biology (IPB), Chinese Academy of Medical Science (CAMS) /Peking Union Medical College

C. Selected peer-reviewed publications

* = Co-corresponding or first author

Guo L, Wang D, Zhou H, Wu C, Gao X, Xiao Y, Ren L, Paranhos-Baccalà G, Shu Y, Jin Q, Wang J (2016). Cross-reactivity between avian influenza A (H7N9) virus and divergent H7 subtypic and heterosubtypic influenza A viruses. **Scientific Reports**, 6, 22045.

Gao X, Zhou H, Wu C, Xiao Y, Ren L, Paranhos-Baccalà G, Guo L*, Wang J* (2015). Antibody against nucleocapsid protein predicts susceptibility to human coronavirus infection. **Journal of Infection** 71(5): 599-602.

Chen Z*, Wang J*, Bao L*, Guo L*, Zhang W, Xue Y, Zhou H, Xiao Y, Wang J, Wu F, Deng Y, Qin C, Jin Q (2015). Human monoclonal antibodies targeting the haemagglutinin glycoprotein can neutralize H7N9 influenza virus. **Nature Communications**, 6:6714.

Yang J*, Zhang T*, Guo L*, Hu YF, Li JL, Su HX, Xiao Y, Ren XW, Dong J, Sun LL, Xiao Y, Li Li, Yang F, Wang JW, Yuan H, Jin Q (2014). Mutations of Novel Influenza A(H10N8) Virus in Chicken Eggs and MDCK Cells. **Emerging Infectious Diseases**, 20(9):1541-1543.

Zhou Z, Gao X, Wang Y, Zhou H, Wu C, Paranhos-Baccalà G, Vernet G, Guo L*, Wang J* (2014). Conserved B-Cell Epitopes among Human Bocavirus Species Indicate Potential Diagnostic Targets. **PLOS One**, 9(1): e86960.

Guo L, Zhang X, Ren L, Yu X, Chen L, Zhou H, Gao X, Teng Z, Li J, Hu J, Wu C, Xiao X, Zhu Y, Wang Q, Pang X, Jin Q, Wu F, Wang J (2014). Human antibody responses to avian influenza A(H7N9) virus. **Emerging Infectious Diseases**, 20(2): 192-200.

Guo L, Wu C, Zhou H, Wu C, Paranhos-Baccalà G, Vernet G, Jin Q, Wang J, Hung T (2013). Identification of a nonstructural DNA-binding protein (DBP) as an antigen with diagnostic potential for human adenovirus. **PLOS One**, 8(3): e56708.

Guo L, Wang Y, Zhou H, Wu C, Song J, Li J, Paranhos-Baccalà G, Vernet G, Wang J, Hung T (2012). Differential seroprevalence of human bocavirus species 1-4 in Beijing, China. **PLOS One**, 7(6): e39644.

Guo L, Gonzalez R, Zhou H, Wu C, Vernet G, Wang Z, Wang J (2012). Detection of three human adenovirus species in adults with acute respiratory infection in China. **European Journal of Clinical Microbiology and Infectious Disease**, 31(6): 1051-1058.

Guo L, Gonzalez R, Xie Z, Zhou H, Liu C, Wu C, Paranhos-Baccalà G, Vernet G, Shen K, Jin Q, Wang J (2011). Bocavirus in children with respiratory tract infections. **Emerging Infectious Diseases**, 17(9): 1775-1777.

Wang Y, Gonzalez R, Zhou H, Li J, Li Y, Paranhos-Baccalà G, Vernet G, Guo L*, Wang J* (2011). Detection of human bocavirus 3 in China. **European Journal of Clinical Microbiology and Infectious Disease**, 30(6): 799-805.

Guo L, Gonzalez R, Wang W, Vernet G, Paranhos-Baccalà G, Wang J (2010). Complete genome sequence of human astrovirus genotype 6. **Virology Journal**, 7: 29.

Guo L, Xu X, Song J, Wang W, Wang J, Hung T (2010). Molecular Characterization of Astrovirus Infection in Children with Diarrhea in Beijing, 2005-2007. **Journal of Medical Virology**, 82(3): 415-423.

Guo L, Zhou H, Wang M, Song J, Han B, Shu Y, Ren L, Si H, Qu J, Zhao Z, Wang J, Hung T (2009). A recombinant adenovirus prime-virus-like particle boost regimen elicits effective and specific immunities against norovirus in mice. **Vaccine**, 27(38): 5233-5238.

Guo L, Song J, Xu X, Ren L, Li J, Zhou H, Wang M, Qu J, Wang J, Hung T (2009). Genetic analysis of norovirus in children affected by acute gastroenteritis in Beijing, 2004-2007. **Journal of Clinical Virology** 44(1): 94-98.

Guo L, Wang J, Zhou H, Si H, Wang M, Song J, Han B, Shu Y, Ren L, Qu J, Hung T (2008) Intranasal administration of a recombinant adenovirus expressing the norovirus capsid protein stimulates specific humoral, mucosal, and cellular immune responses in mice. **Vaccine**, 26(4): 460-468.

D. Research Support **Ongoing Research Support**

2018ZX10734404-006

01/01/2018-12/31/2020

Key technologies for the identification and identification of important respiratory viruses and establishment of reference libraries

Role: Co-PI

Completed Research Support

(b) (4)

(b) (4)

Study on the immunoprotection of recombinant adenovirus vaccine against Norovirus by using virus-like particles as a control

Role: PI

BIOGRAPHICAL SKETCH

NAME Peng Zhou	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
College of Life Science, Henan University, China	BS	07/04	Bioengineering
Wuhan Inst. Virol., Chinese Acad. Sci., China	PHD	01/11	Virology
Australian Animal Health Laboratory, CSIRO	Postdoc	07/14	Viral Immunology
Singapore Duke-NUS Medical School, Singapore	Postdoc	02/16	Viral Immunology

A. Personal Statement

My virological expertise is directly related to the proposed work in this R01 renewal, including next generation diagnostic tool development for monitoring bat virus spillover, bat pathogen discovery and bat viral immunology. I have worked on bat virology since 2004, and participated in the work that led to the discovery of SARS-like coronaviruses in Mainland China. I worked on bat viral immunology to explore reasons why bats can coexist with high viral diversity and viral loads. My findings show that in bats, a constitutively expressed interferon and a dampened STING-dependent interferon production pathway exists, which may explain why bats can control viral replication and tolerate viral diseases. My most recent work on Swine Acute Diarrhea Syndrome (SADS) characterized the spillover of CoV from bats to swine causing a large-scale pandemic. I have worked closely with Dr. Linfa Wang from Singapore Duke-NUS medical school, on developing next-generation viral nucleotide, serological and isolation tools for coronavirus from bats and other animals. I have also collaborated with, and published papers with Dr. Daszak and other staff at EcoHealth Alliance. I will be in charge of diagnostics, genomics, and virus isolation in this project.

B. Positions and Honors.**Positions and Employment**

2016- Principle Investigator, Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, China

Other Experience and Professional Memberships

2009 - 10 Joint PhD study in Australia Animal Health Laboratory, CSIRO

Honors

2009 Scholarship for China-Australia Joint PhD study, China Scholarship Council.

2017 Natural Science Award (the first rank) of Hubei province, China.

2018 National Science Fund for Excellent Young Scholars, China.

C. Selected peer-reviewed most relevant to the current application

^ = Co-corresponding or first authors

1. Zhou P, Fan H, Lan T, Yang XL, Shi WF, Zhang W, Zhu Y, Zhang YW, Xie QM, Mani S, Zheng XS, Li B, Li JM, Guo H, Pei GQ, An XP, Chen JW, Zhou L, Mai KJ, Wu ZX, Li D, Anderson D, Zhang LB, Li SY, Mi ZQ, He TT, Cong F, Guo PJ, Huang R, Luo Y, Liu XL, Chen J, Huang Y, Sun Q, Zhang XLL, Wang YY, Xing SZ, Chen YS, Sun Y, Li J, Daszak P, Wang LF, Shi ZL, Tong YG, Ma JY (2018) Fatal swine acute diarrhea syndrome

caused by an HKU-2 related coronavirus of bat origin. **Nature**, 556: 255-258.

doi.org/10.1038/s41586-018-0010-9

2. Xie J, Li Y, She X, Goh G, Zhu Y, Cui J, Wang LF, Shi Z, Zhou P (2018) Dampened STING-dependent interferon activation in bats. **Cell Host and Microbes** 23(3): 297-301. doi.org/10.1016/j.chom.2018.01.006
3. Zhou P, Tachedjian M, Wynne JW, Boyd V, Cui J, Smith I, Cowled C, Ng JH, Mok L, Michalski WP, Mendenhall IH, Tachedjian G, Wang LF, Baker ML (2016). Contraction of the type I IFN locus and unusual constitutive expression of IFN- α in bats. **Proceedings of the National Academy of Sciences**, 113(10): 2696-701. doi.org/10.1073/pnas.1518240113
4. Wu L*, Zhou P*, Ge XY, Wang LF, Baker ML, Shi Z (2013). Deep RNA Sequencing Reveals Complex Transcriptional Landscape of a Bat Adenovirus. **Journal of Virology**, 87(1): 503-511. doi.org/10.1128/JVI.02332-12
5. Zhou P, Li H, Wang H, Wang LF, Shi Z (2012). Bat severe acute respiratory syndrome-like coronavirus ORF3b homologues display different interferon antagonist activities. **Journal of General Virology**, 93: 275-281. doi.org/10.1099/vir.0.033589-0
6. Zhou P, Cowled C, Todd S, Cramer G, Virtue ER, Marsh GA, Shi ZL, Wang LF, and Baker ML (2011). Type III Interferons in pteropid bats: differential expression patterns provide evidence for distinct roles in antiviral immunity. **Journal of Immunology**, 186(5): 3138-3147. doi.org/ 10.4049/jimmunol.1003115
7. Zhou P, Han Z, Wang LF, Shi Z (2009). Immunogenicity difference between the SARS coronavirus and the bat SARS-like coronavirus spike (S) proteins. **Biochemical Biophysical Research Communications**, 387(2): 326-329. doi.org/10.1016/j.bbrc.2009.07.025

D. Research Support

Ongoing Research Support

(b) (4)

Combating the next SARS- or MERS-like emerging infectious disease outbreak by improving active surveillance

Role: PI

(b) (4)

Interferon responses in SARS-Like Coronavirus infected

Bat cells

Role: PI

(b) (4)

Bat virology

Role: PI

Completed Research Support

(b) (4)

Immune responses and transcriptome analysis of bat adenovirus infected bat cells

Role: Co-PI

BIOGRAPHICAL SKETCH

NAME Ben Hu	POSITION TITLE Co-Investigator		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
Huazhong Agricultural University, China	BS	2007	Veterinary medicine
Huazhong Agricultural University, China	MS	2010	Preventive vet. med.
Wuhan Inst. Virology, Chinese Acad. Sci.	PHD	2015	Microbiology

A. Personal Statement

I obtained my PhD degree in 2015 and have been working as a Research Assistant in Dr. Zhengli Shi's laboratory for over 3 years. My research is focused on the discovery and characterization of viruses in small mammals, especially in bats and rodents. My work forms the basis for some of the key findings built on in the current R01 proposal, in particular: 1) the identification of diverse bat SARSr-CoVs at cave sites in Yunnan, China; 2) the potential recombination origin of SARS-CoV; and 3) characterization of spillover risk for bat SARSr-CoVs. I have also reported genetically diverse novel astroviruses in bats, rodents, and shrews in China. I have collaborated with EcoHealth Alliance scientists on multiple research projects for the past 3 years.

B. Positions and Honors.

Positions and Employment

2015- Assistant Researcher, Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, China

Honors

C. Selected peer-reviewed publications most relevant to the current application

Note: * = Corresponding Author

1. Ge X, Li J, Yang X, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang YJ, Luo CM, Tan B, Wang N, Zhu Y, Cramer G, Zhang SY, Wang LF, Daszak P*, Shi Z (2013). Isolation and characterization of a bat SARS-like coronavirus that uses the ACE2 receptor. **Nature**, 503: 535-538. doi.org/10.1038/nature12711
2. Hu B, Chmura AA, Li J, Zhu G, Desmond JS, Zhang Y, Zhang W, Epstein JH, Daszak P, Shi Z (2014). Detection of diverse novel astroviruses from small mammals in China. **Journal of General Virology** 95, 2442-2449. doi.org/10.1099/vir.0.067686-0
3. Hu B, Ge X, Wang LF, Shi Z (2015). Bat origin of human coronaviruses. **Virology Journal**, 12(1): 221. doi.org/10.1186/s12985-015-0422-1
4. Ge XY, Wang N, Zhang W, Hu B, Li B, Zhang YZ, Zhou JH, Luo CM, Yang XL, Wu LJ, Wang B, Zhang Y, Li ZX, Shi Z (2016). Coexistence of multiple coronaviruses in several bat colonies in an abandoned mineshaft. **Virologica Sinica**, 31(1): 31-40. doi.org/10.1007/s12250-016-3713-9

5. Wang MN, Zhang W, Gao YT, Hu B, Ge XY, Yang XL, Zhang YZ, Shi Z (2016). Longitudinal surveillance of SARS-like coronaviruses in bats by quantitative real-time PCR. **Virologica Sinica**, 31(1): 78-80. doi.org/10.1007/s12250-015-3703-3
6. Yang XL, Hu B, Wang B, Wang MN, Zhang Q, Zhang W, Wu LJ, Ge XY, Zhang YZ, Daszak P, Wang LF, Shi Z (2016). Isolation and Characterization of a Novel Bat Coronavirus Closely Related to the Direct Progenitor of Severe Acute Respiratory Syndrome Coronavirus. **Journal of Virology**, 90(6): 3253-3256. doi.org/10.1128/JVI.02582-15
7. Waruhiu C, Ommeh S, Obanda V, Agwanda B, Gakuya F, Ge XY, Yang XL, Wu LJ, Zohaib A, Hu B, Shi Z (2017). Molecular detection of viruses in Kenyan bats and discovery of novel astroviruses, caliciviruses, and rotaviruses. **Virologica Sinica**, 32(2):101-114. doi.org/10.1007/s12250-016-3930-2
8. Hu B, Zeng LP, Yang XL, Ge XY, Zhang W, Li B, Xie JZ, Shen XR, Zhang YZ, Wang N, Luo DS, Zheng XS, Wang MN, Daszak P, Wang LF, Cui J, Shi Z (2017). Discovery of A Rich Gene Pool of Bat SARS-related Coronaviruses Provides New Insights into the Origin of SARS Coronavirus. **PLOS Pathogens**, 13(11): e1006698.
9. Luo CM, Wang N, Yang XL, Liu HZ, Zhang W, Li B, Hu B, Peng C, Geng QB, Zhu GJ, Li F, Shi Z (2018). Discovery of Novel Bat Coronaviruses in South China That Use the Same Receptor as Middle East Respiratory Syndrome Coronavirus. **Journal of Virology**, 92(13): e00116-18.
10. Luo Y, Li B, Jiang RD, Hu BJ, Luo DS, Zhu GJ, Hu B, Liu HZ, Zhang YZ, Yang XL, Shi ZL (2018). Longitudinal Surveillance of Betacoronaviruses in Fruit Bats in Yunnan Province, China during 2009-2016. **Virologica Sinica**, 33(1):87-95. doi.org/10.1007/s12250-018-0017-2

D. Research Support

Ongoing Research Support

31800142 Hu (PI) 01/01/2019-12/31/2021
 National Natural Science Foundation of China
 Pathogenicity studies of two novel bat SARSr-CoVs on transgenic mice expressing human ACE2
 Role: PI

R01 AI110964 Daszak (PI) 06/01/14-05/31/19
 Understanding Risk of Bat Coronaviruses
 The goal of this study is to analyze the risk of coronavirus spillover from bats to humans in Southern China
 Role: Research Scientist

Emerging Pandemic Threat Program, USAID Mazet (PI) 10/01/14-09/30/19
 PREDICT 2
 The goal of this project is to create and implement a global virus surveillance system in animals and humans and analyze spillover risk.
 Role: Laboratory Scientist

Completed Research Support

USAID EPT PREDICT-1 Mazet (PI) 10/01/09 – 09/30/14
 Modeling hotspots for disease emergence and conducting surveillance in wildlife in hotspots for new emerging zoonoses
 Amount: \$18 million subcontract on a \$75 million award
 Role: Laboratory Scientist

BIOGRAPHICAL SKETCH

NAME Aleksi A. Chmura	POSITION TITLE Research Scientist		
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE	MM/YY	FIELD OF STUDY
Columbia University	BS	06/2004	Biology
School of Life Sciences, Kingston University (UK)	PhD	08/2018	Biology

A. Personal Statement

Dr. Chmura has an interdisciplinary background in ecology, wildlife biology, virology, and extensive on-the-ground experience conducting wildlife sampling in China. Fluent in spoken and written Mandarin, for the past decade, Dr. Chmura has acted as a key coordinator among EcoHealth Alliance headquarters staff, and laboratory and field teams in China. Dr. Chmura's personal research involves the wildlife origins of SARS-CoV, wildlife paramyxovirus diversity and evolution, and human-wildlife contact behavior in southern China. His work has been funded by USAID EPT/PREDICT since 2009. As part of his doctoral work, he spent over a year in the Wuhan Institute of Virology laboratory in China under the direction of Dr. Zhengli Shi and Dr. Peter Daszak.

B. Positions and Honors.**Positions and Employment**

2001-2004, Volunteer Curator, Dept. of Mammalogy, American Museum of Natural History, USA
 2001-2005, Program Assistant, Ctr. Environmental Research and Conservation, Columbia University, USA
 2002-2005, Instructor, Columbia University Tropical Field Ecology Programs, USA/Dominican Republic/Brazil
 2005-Present, Program Coordinator, EcoHealth Alliance, USA
 2006-Present, Managing Editor, *EcoHealth*, New York, USA

Other Experience and Professional Memberships

2000-2005 The Explorers Club
 2002-present American Museum of Natural History
 2005-present International Association for Ecology and Health
 2009-present Society for Applied Microbiology

C. Selected peer-reviewed publications most relevant to the current application

Monagin C, Ning L, Schneider B, Chmura AA, Epstein JH, Wu D, Paccha B, Ke C, Daszak P, Rabinowitz P (2018) Serologic and behavioral risk survey of workers with wildlife contact in China. **PLOS ONE**, 13(4): e0194647.

Wang N, Li, S, Yang X, Huang H, Zhang Y, Guo H, Luo C, Miller M, Zhu G, Chmura AA, Hagan E, Zhou J, Zhang Y, Wang L, Daszak P, Shi Z (2018) Serological evidence of bat SARS-related coronavirus infection in humans, China. **Virologica Sinica**, 33(1): 104-107.

Zeng L, Ge X, Peng C, Yang X, Tan B, Gao Y, Chen J, Chmura AA, Daszak P, Shi Z (2016) Bat Severe Acute Respiratory Syndrome-Like Coronavirus WIV1 Encodes an Extra Accessory Protein, ORFX, Involved in Modulation of the Host Immune Response. **Journal of Virology**, 90(14): 6573-6582.

Mazet JAK, Wei Q, Zhao G, Cummings DAT, Desmond JS, Rosenthal J, King CH, Cao W, Chmura AA, Hagan EA, Zhang S, Xiao X, Xu J, Shi Z, Feng F, Liu X, Pan W, Zhu G, Zuo G, Daszak P (2015). Joint China-US Call for Employing a Transdisciplinary Approach to Emerging Infectious Diseases. **EcoHealth** 12(4): 555-559.

Hu B, Chmura AA, Li J, Zhu G, Desmond JS, Zhang YJ, Zhang JS, Epstein JH, Daszak P, Shi Z (2014). Detection of Diverse Novel Astroviruses from Small Mammals in China. **Journal of General Virology** 95: 2442-2449.

Ge XY, Li JL, Yang X-L, Chmura AA, Zhu G, Epstein JH, Mazet JK, Hu B, Zhang W, Peng C, Zhang YJ, Luo CM, Tan B, Wang N, Zhu Y, Cramer G, Zhang SY, Wang LF, Daszak P, Shi Z (2013). Isolation and characterization of a bat SARS-like Coronavirus that uses the ACE2 receptor. **Nature** 503: 535-538.

Zhu G, Chmura AA, Zhang L (2011). Morphology, echolocation calls and diet of *Scotophilus kuhlii* (Chiroptera: Vespertilionidae) on Hainan Island, south China. **Acta Chiropterologica**, 14(1): 175-181.

Kilpatrick AM, Chmura AA, Gibbons DW, Fleischer RC, Marra PP, Daszak P (2006). Predicting the global spread of H5N1 avian influenza. **PNAS** 103: 19368-19373.

D. Research Support

Ongoing Research Support

R01 AI110964
Understanding Risk of Bat Coronaviruses
The goal of this study is to analyze the risk of coronavirus spillover from bats to humans in Southern China
Role: Research Scientist
Daszak (PI) 06/01/14-05/31/19

Emerging Pandemic Threat Program, USAID
PREDICT 2
The goal of this project is to create and implement a global virus surveillance system in animals and humans and analyze spillover risk.
Role: Program Coordinator
Mazet (PI) 10/01/14-09/30/19

Completed Research Support

USAID EPT PREDICT-1
Modeling hotspots for disease emergence and conducting surveillance in wildlife in hotspots for new emerging zoonoses
Role: Program Coordinator
Mazet (PI) 10/01/09 – 09/30/14

2 R01TW005869
NIH Ecology of Infectious Diseases (Fogarty International Center)
The Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh
To conduct mathematical modeling and fieldwork to understand the dynamics of Nipah virus in Bangladesh
Role: Research Scientist
Daszak (PI) 09/01/08 – 08/31/13

NSF DEB-1257513
US-China Ecology and Evolution of Infectious Diseases Collaborative Workshop; Kunming, China 2012
Role: Program Coordinator
Daszak (PI) 08/15/12-07/31/13

1 R01AI079231
NIAID Non-Biodefense Emerging Infectious Diseases
Risk of viral emergence from bats.
To model hotspots for bat viral diversity, identify & characterize new bat viruses & understand their pathology
Role: Research Scientist
Daszak (PI) 09/18/08 – 08/31/13

RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 1

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Enter name of Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2019

End Date*: 05-31-2020

Budget Period: 1

A. Senior/Key Person													
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*	
1 . Dr.	PETER		DASZAK		PD/PI							(b) (4), (b) (6)	
2 . Dr.	Kevin	J	Olival		Co-Investigator								
3 . Dr.	Leilani	V	Francisco		Co-Investigator								
4 . Dr.	Noam		Ross		Co-Investigator								
5 . Ms.	Hongying		Li		Research Scientist								
6 . Dr.	Alice		Latinne		Research Scientist								
7 . Ms.	Emily	A	Hagan		Research Scientist								
8 . Dr.	Aleksei	A	Chmura		Research Scientist								
Total Funds Requested for all Senior Key Persons in the attached file													
Additional Senior Key Persons:											File Name:		
											Total Senior/Key Person	223,713.00	

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
0	Total Number Other Personnel					Total Other Personnel	0.00
						Total Salary, Wages and Fringe Benefits (A+B)	223,713.00

RESEARCH & RELATED Budget (A-B) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 1

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2019

End Date*: 05-31-2020

Budget Period: 1

C. Equipment Description		Funds Requested (\$)*
List items and dollar amount for each item exceeding \$5,000		
Equipment Item		
Total funds requested for all equipment listed in the attached file		
Total Equipment		0.00
Additional Equipment: File Name:		

D. Travel		Funds Requested (\$)*
1. Domestic Travel Costs (Incl. Canada, Mexico, and U.S. Possessions)		9,440.00
2. Foreign Travel Costs		29,958.00
Total Travel Cost		39,398.00

E. Participant/Trainee Support Costs		Funds Requested (\$)*
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
Number of Participants/Trainees		0.00
Total Participant Trainee Support Costs		0.00

RESEARCH & RELATED Budget (C-E) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 1

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2019

End Date*: 05-31-2020

Budget Period: 1

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	20,850.00
2. Publication Costs	
3. Consultant Services	79,750.00
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	190,649.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
Total Other Direct Costs	291,249.00

G. Direct Costs	Funds Requested (\$)*
Total Direct Costs (A thru F)	554,360.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1 . EcoHealth Alliance Indirect Cost	32.74	363,710.00	119,079.00
2 . EcoHealth Alliance Indirect Cost on 3 Subawards (IPB, UNC, WIV)	32.74	75,000.00	24,555.00
3 . University of North Carolina at Chapel Hill Indirect Cost	55.5	50,000.00	27,750.00
4 . IPB and WIV Subawards (2) Indirect Costs	8.0	140,649.00	11,252.00
		Total Indirect Costs	182,636.00
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)	736,996.00

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	736,996.00

L. Budget Justification*
File Name: EHA_NIAID_COV_BUDGET_JUSTIFICATION_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget {F-K} (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 2

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Enter name of Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2020

End Date*: 05-31-2021

Budget Period: 2

A. Senior/Key Person													
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*	
1 . Dr.	PETER		DASZAK		PD/PI							(b) (4), (b) (6)	
2 . Dr.	Kevin	J	Olival		Co-Investigator								
3 . Dr.	Leilani	V	Francisco		Co-Investigator								
4 . Dr.	Noam		Ross		Co-Investigator								
5 . Ms.	Hongying		Li		Research Scientist								
6 . Dr.	Alice		Latinne		Research Scientist								
7 . Ms.	Emily	A	Hagan		Research Scientist								
8 . Dr.	Aleksei	A	Chmura		Research Scientist								
Total Funds Requested for all Senior Key Persons in the attached file													
Additional Senior Key Persons:											File Name:		
											Total Senior/Key Person	223,713.00	

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
0	Total Number Other Personnel					Total Other Personnel	0.00
						Total Salary, Wages and Fringe Benefits (A+B)	223,713.00

RESEARCH & RELATED Budget (A-B) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 2

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2020

End Date*: 05-31-2021

Budget Period: 2

C. Equipment Description		Funds Requested (\$)*
List items and dollar amount for each item exceeding \$5,000		
Equipment Item		
Total funds requested for all equipment listed in the attached file		
Total Equipment		0.00
Additional Equipment: File Name:		

D. Travel		Funds Requested (\$)*
1. Domestic Travel Costs (Incl. Canada, Mexico, and U.S. Possessions)		9,440.00
2. Foreign Travel Costs		29,958.00
Total Travel Cost		39,398.00

E. Participant/Trainee Support Costs		Funds Requested (\$)*
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
Number of Participants/Trainees		0.00
Total Participant Trainee Support Costs		0.00

RESEARCH & RELATED Budget (C-E) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 2

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2020

End Date*: 05-31-2021

Budget Period: 2

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	14,850.00
2. Publication Costs	6,000.00
3. Consultant Services	79,750.00
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	190,649.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
Total Other Direct Costs	291,249.00

G. Direct Costs	Funds Requested (\$)*
Total Direct Costs (A thru F)	554,360.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. EcoHealth Alliance Indirect Cost	32.74	363,710.00	119,079.00
2. University of North Carolina at Chapel Hill Indirect Cost	55.5	50,000.00	27,750.00
3. IPB and WIV Subawards (2) Indirect Costs	8.0	140,649.00	11,252.00
		Total Indirect Costs	158,081.00
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)	712,441.00

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	712,441.00

L. Budget Justification*
File Name: EHA_NIAID_COV_BUDGET_JUSTIFICATION_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget (F-K) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 3

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Enter name of Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2021

End Date*: 05-31-2022

Budget Period: 3

A. Senior/Key Person												
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*
1 . Dr.	PETER		DASZAK		PD/PI							(b) (4), (b) (6)
2 . Dr.	Kevin	J	Olival		Co-Investigator							
3 . Dr.	Leilani	V	Francisco		Co-Investigator							
4 . Dr.	Noam		Ross		Co-Investigator							
5 . Ms.	Hongying		Li		Research Scientist							
6 . Dr.	Alice		Latinne		Research Scientist							
7 . Ms.	Emily	A	Hagan		Research Scientist							
8 . Dr.	Aleksei	A	Chmura		Research Scientist							
Total Funds Requested for all Senior Key Persons in the attached file												
Additional Senior Key Persons:											File Name:	
											Total Senior/Key Person	223,713.00

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
0	Total Number Other Personnel					Total Other Personnel	0.00
						Total Salary, Wages and Fringe Benefits (A+B)	223,713.00

RESEARCH & RELATED Budget (A-B) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 3

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2021

End Date*: 05-31-2022

Budget Period: 3

C. Equipment Description		Funds Requested (\$)*
List items and dollar amount for each item exceeding \$5,000		
Equipment Item		
Total funds requested for all equipment listed in the attached file		
Total Equipment		0.00
Additional Equipment: File Name:		

D. Travel		Funds Requested (\$)*
1. Domestic Travel Costs (Incl. Canada, Mexico, and U.S. Possessions)		9,440.00
2. Foreign Travel Costs		29,958.00
Total Travel Cost		39,398.00

E. Participant/Trainee Support Costs		Funds Requested (\$)*
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
Number of Participants/Trainees		0.00
Total Participant Trainee Support Costs		0.00

RESEARCH & RELATED Budget (C-E) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 3

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2021

End Date*: 05-31-2022

Budget Period: 3

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	14,850.00
2. Publication Costs	6,000.00
3. Consultant Services	79,750.00
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	190,649.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
Total Other Direct Costs	291,249.00

G. Direct Costs	Funds Requested (\$)*
Total Direct Costs (A thru F)	554,360.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. EcoHealth Alliance Indirect Cost	32.74	363,710.00	119,079.00
2. University of North Carolina at Chapel Hill Indirect Cost	55.5	50,000.00	27,750.00
3. IPB and WIV Subawards (2) Indirect Costs	8.0	140,649.00	11,252.00
		Total Indirect Costs	158,081.00
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)	712,441.00

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	712,441.00

L. Budget Justification*
File Name: EHA_NIAID_COV_BUDGET_JUSTIFICATION_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget (F-K) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 4

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Enter name of Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2022

End Date*: 05-31-2023

Budget Period: 4

A. Senior/Key Person													
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*	
1 . Dr.	PETER		DASZAK		PD/PI							(b) (4), (b) (6)	
2 . Dr.	Kevin	J	Olival		Co-Investigator								
3 . Dr.	Leilani	V	Francisco		Co-Investigator								
4 . Dr.	Noam		Ross		Co-Investigator								
5 . Ms.	Hongying		Li		Research Scientist								
6 . Dr.	Alice		Latinne		Research Scientist								
7 . Ms.	Emily	A	Hagan		Research Scientist								
8 . Dr.	Aleksei	A	Chmura		Research Scientist								
Total Funds Requested for all Senior Key Persons in the attached file													
Additional Senior Key Persons:											File Name:		
											Total Senior/Key Person	223,713.00	

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
0	Total Number Other Personnel					Total Other Personnel	0.00
						Total Salary, Wages and Fringe Benefits (A+B)	223,713.00

RESEARCH & RELATED Budget (A-B) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 4

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2022

End Date*: 05-31-2023

Budget Period: 4

C. Equipment Description		Funds Requested (\$)*
List items and dollar amount for each item exceeding \$5,000		
Equipment Item		
Total funds requested for all equipment listed in the attached file		
Total Equipment		0.00
Additional Equipment: File Name:		

D. Travel		Funds Requested (\$)*
1. Domestic Travel Costs (Incl. Canada, Mexico, and U.S. Possessions)		9,440.00
2. Foreign Travel Costs		29,958.00
Total Travel Cost		39,398.00

E. Participant/Trainee Support Costs		Funds Requested (\$)*
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
Number of Participants/Trainees		0.00
Total Participant Trainee Support Costs		0.00

RESEARCH & RELATED Budget (C-E) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 4

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2022

End Date*: 05-31-2023

Budget Period: 4

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	14,850.00
2. Publication Costs	6,000.00
3. Consultant Services	79,750.00
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	190,649.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
Total Other Direct Costs	291,249.00

G. Direct Costs	Funds Requested (\$)*
Total Direct Costs (A thru F)	554,360.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. EcoHealth Alliance Indirect Cost	32.74	363,710.00	119,079.00
2. University of North Carolina at Chapel Hill Indirect Cost	55.5	50,000.00	27,750.00
3. IPB and WIV Subawards (2) Indirect Costs	8.0	140,649.00	11,252.00
		Total Indirect Costs	158,081.00
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)	712,441.00

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	712,441.00

L. Budget Justification*
File Name: EHA_NIAID_COV_BUDGET_JUSTIFICATION_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget (F-K) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 5

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Enter name of Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2023

End Date*: 05-31-2024

Budget Period: 5

A. Senior/Key Person												
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*
1 . Dr.	PETER		DASZAK		PD/PI							(b) (4), (b) (6)
2 . Dr.	Kevin	J	Olival		Co-Investigator							
3 . Dr.	Leilani	V	Francisco		Co-Investigator							
4 . Dr.	Noam		Ross		Co-Investigator							
5 . Ms.	Hongying		Li		Research Scientist							
6 . Dr.	Alice		Latinne		Research Scientist							
7 . Ms.	Emily	A	Hagan		Research Scientist							
8 . Dr.	Aleksei	A	Chmura		Research Scientist							
Total Funds Requested for all Senior Key Persons in the attached file												
Additional Senior Key Persons: File Name:											Total Senior/Key Person	223,713.00

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
0	Total Number Other Personnel					Total Other Personnel	0.00
						Total Salary, Wages and Fringe Benefits (A+B)	223,713.00

RESEARCH & RELATED Budget (A-B) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 5

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2023

End Date*: 05-31-2024

Budget Period: 5

C. Equipment Description		Funds Requested (\$)*
List items and dollar amount for each item exceeding \$5,000		
Equipment Item		
Total funds requested for all equipment listed in the attached file		
Total Equipment		0.00
Additional Equipment: File Name:		

D. Travel		Funds Requested (\$)*
1. Domestic Travel Costs (Incl. Canada, Mexico, and U.S. Possessions)		9,440.00
2. Foreign Travel Costs		29,958.00
Total Travel Cost		39,398.00

E. Participant/Trainee Support Costs		Funds Requested (\$)*
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
Number of Participants/Trainees		0.00
Total Participant Trainee Support Costs		0.00

RESEARCH & RELATED Budget (C-E) (Funds Requested)

RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 5

ORGANIZATIONAL DUNS*: 0770900660000

Budget Type*: Project Subaward/Consortium

Organization: ECOHEALTH ALLIANCE, INC.

Start Date*: 06-01-2023

End Date*: 05-31-2024

Budget Period: 5

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	14,850.00
2. Publication Costs	6,000.00
3. Consultant Services	79,750.00
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	190,649.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
Total Other Direct Costs	291,249.00

G. Direct Costs	Funds Requested (\$)*
Total Direct Costs (A thru F)	554,360.00

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. EcoHealth Alliance Indirect Cost	32.74	363,710.00	119,079.00
2. University of North Carolina at Chapel Hill Indirect Cost	55.5	50,000.00	27,750.00
3. IPB and WIV Subawards (2) Indirect Costs	8.0	140,649.00	11,252.00
		Total Indirect Costs	158,081.00
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)	712,441.00

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	712,441.00

L. Budget Justification*
File Name: EHA_NIAID_COV_BUDGET_JUSTIFICATION_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget (F-K) (Funds Requested)

ECOHEALTH ALLIANCE BUDGET JUSTIFICATION

A. Senior/Key personnel:

The PD/PI, Dr. Peter Daszak, will commit (b) (4), (b) (6) per year in each year of this budget. He will be primarily responsible for overseeing the project, general management, communication and collaboration with subaward partners, as well as contributing to data analysis and manuscript writing.

Co-Investigator, Dr. Kevin Olival, will commit (b) (4), (b) (6) per year in each year of this budget. Dr. Olival will lead the design and implementation of the bat sampling fieldwork (Aim 1); facilitate overall project management; and train and oversee field teams. Dr. Olival will also oversee modeling and analyses under Aims 1 & 3, participate in regular conference calls, and help write manuscripts and reports.

Co-Investigator, Dr. Leilani Francisco, will commit (b) (4), (b) (6) per year in each year of this budget. Dr. Francisco will lead the implementation of the community and clinic-based surveillance (Aim 2), including adherence to study design, sampling methodology, and ethics in human subjects research; data collection instrument development; data management, cleaning, and analysis; and, findings dissemination.

Co-Investigator, Dr. Noam Ross, will commit (b) (4), (b) (6) per year in each year of this budget. Dr. Ross will lead modeling work and assist in with data analyses and manuscript writing. He will also advise on data management, statistical approaches, and computational work.

B. Other Personnel

Research Scientist, Ms. Hongying Li, will commit (b) (4), (b) (6) per year in each year of this budget. Ms. Li will coordinate the field and laboratory activities in China, maintaining the financial administration, results reporting, and data management, as well as work closely with Dr. Lili Ren at the Institute of Pathogen Biology to refine protocols, oversee field data collection, and perform data analysis for human study.

Research Scientist, Dr. Alice Latinne, will commit (b) (4), (b) (6) per year in each year of this budget. Dr. Latinne will assist in with phylogenetic and phylogeographic analyses and manuscript writing. She will also advise on data management and field activities.

Research Scientist, Dr. Aleksei Chmura, will commit (b) (4), (b) (6) per year in each year of this budget. Dr. Chmura will coordinate regular calls, reports, maintain EcoHealth Alliance and subaward budgets and both project and financial reporting, draft subcontracts, and set-up project databases, advise field activities, assist with statistical analysis, and manuscript writing.

Research Scientist, Ms. Emily Hagan, will commit (b) (4), (b) (6) per year in each year of this budget. Ms. Hagan will assist with the development of human data collection instruments, testing, and implementation; advise on data storage, data analyses, and manuscript writing. She will also provide training for field teams conducting human subjects research.

Fringe benefits for Year 1 are calculated for EcoHealth Alliance's federally approved rate of 31.5% of base salary and is included in all subsequent years.

C. Equipment

No Equipment costing more than \$5,000 will be purchased

D. Travel

Domestic Travel

\$9,440 is requested annually for Years 1 through 5 for the PD/PI, 3 Co-Investigators, and 1 Research Scientist to attend and present on research results at the annual American Society for Tropical Medicine and Hygiene and the American Public Health Association meetings. 2 night and 3 day travel to Washington, DC is

calculated as follows: \$205 for hotels ($\$251 \times 2 \text{ nights} \times 5 \text{ people} \times 2 \text{ trips} = \$5,020$); \$76 for meals and incidentals ($\$76 \times 2.5 \text{ days} \times 5 \text{ people} \times 2 \text{ trips} = \$1,900$); and \$252 for round-trip train ($\$252 \times 5 \times 2 = \$2,520$).

International Travel

\$11,998 is requested annually in Years 1 to 5. This will support round-trip flights from New York to Beijing and Wuhan for the field annual meetings for 3 Senior/Key Personnel and 1 for the PD/PI (Daszak) at \$1,055 each. Five nights and six days of hotels, meals, and incidentals for 3 Senior/Key Personal and 1 PD/PI are calculated at \$1,944.50 per year: hotels at \$258 per night ($\times 5 \text{ nights and } 4 \text{ personnel} = \$5,160$) and meals and incidentals at \$119 per day ($\times 5.5 \text{ days and } 4 \text{ personnel} = \$2,856$).

\$17,960 is requested annually in Years 1 to 5 for EHA Research Scientists (Ms. Li and Ms. Hagan) who will travel to China for two field training and supervising visits per year for duration of 21 days each. Support for this request, annually, is \$17,960 and is calculated as follows: 2 round trip flights = \$4,400; hotel $\$258 \times 20 \text{ nights} \times \text{twice a year} = \$4,732$; meals and incidentals at \$119 per day $\times 20.5 \text{ days} \times \text{twice a year} = \$3,570$

E. Participant/Trainee Support Costs

There are no participant/trainee support costs.

F. Other Direct Costs

Materials & Supplies

We request \$7,000 in Year 1 for sample collection materials to be shipped to China including bat catching equipment (\$1,000); PPE (\$2,000); and 1 liquid nitrogen dry shipper (\$1,000) for Wuhan Institute of Virology in China to be used by Dr. Guanjian Zhu for field work.

In Years 2 through 5, field and human sampling will be completely underway; we request support for PPE (\$2,000) and other sample collection materials (\$2,000) in each of these years.

Publication Costs

We request \$6,000 per year for only Years 2 to 5 for publication fees required to publish research findings in peer-reviewed journals such as *Nature*, *Public Library of Science*, and other journals

Subawards/Consortium/Contractual Costs

We are requesting consortium/contractual support for our three partners: Wuhan Institute of Virology (WIV), Institute of Pathogen Biology (IPB), and University of North Carolina (UNC). We have fully detailed these direct and indirect costs in their respective sub-award budgets.

Computers, Software, Reference Materials and Dataset Acquisition

We request support of \$6,000 to permit two Research Scientists to purchase 1 laptop each (2 x \$3,000 including insurance and software). We also request \$1,000 per year in each year to cover software and reference materials, and an additional \$1,000 per year in each year for acquisition of datasets.

Shipping

We will be shipping the materials and supplies detailed above to our subaward institutions in China (IPB and WIV). Shipping box and all taxes are estimated at \$1,667 per shipment. We estimate 3 shipments of supplies and materials will be sent every year through the duration of this project.

Consultants

Dr. Linfa Wang, Co-Investigator/Consultant We request (b) (4), (b) (5) per year for each year of the project for a consultancy for Dr. Linfa Wang who will focus on PCR development, serological testing strategy and virus characterization, and will also participate in regular meetings with collaborators. Dr. Wang has more than 20 years of research experience in designing and applying novel testing platforms to discover zoonotic pathogens.

Dr. Guangjian Zhu, Co-Investigator/Consultant In total, we request \$368,000 for the consultancy of Dr. Guangjian Zhu from Year 1 to Year 5 of the project including: \$204,390 for field personnel, \$124,750 for field travel; \$33,548 for field supplies and materials, and \$5,255 for other costs. Detailed expenses are calculated as the follows:

Personnel (\$204,390)

Dr. Guangjian Zhu Co-Investigator/Consultant will oversee all field sampling activities in China by coordinating with local partners and stakeholders to lead the specimen collection and bats population monitoring at selected surveillance sites. Dr. Zhu is a zoologist and ecologist specializing in bats surveillance in southern and western China and has been leading EcoHealth Alliance's field surveillance work in China for more than 15 years. We request (b) (4), (b) (6) annual stipend for Zhu, who will commit (b) (4), (b) (6) per year to this project in years 1-3 and increase time to (b) (4), (b) (6) per year for in years 4-5, since he will allocate more time to collaborating on peer-reviewed publications in the last two years of the project.

Research Assistant (TBD) will assist the Co-PI and Field Coordinator (Zhu) for project data management, reporting, and administration. We request (b) (4), (b) (6) p.a. salary for this Research Assistant who will dedicate 2 months p.a. on this project from Years 1-5.

Field Assistants (2 in each province, TBD) will assist all field surveillance activities including specimen collection and data entry and management. The assistants will commit a total of 50 days per year to this project from years 1-5. We request (b) (4), (b) (6) per year to support each assistant for the field surveillance work.

Travel (\$124,750)

Inter-Province Travel. We request 1) \$1,200 per year for all five years of this project to cover 3-per-year round-trip flights/trains each from Shanghai, to Yunnan, Guangdong, Guizhou, and Guangxi for Dr. Zhu to meet with collaborating institutions, train field teams, and ensure sample collection, storage, and shipments. Each round-trip flight is estimated at \$400, in total \$6,000 for 5 years; 2) \$2,400 per year for all five years of this project to cover 2-per-year round-trip flights/trains for 2 field assists traveling to the field sites in Yunnan, Guangdong, Guizhou, and Guangxi for sampling work. Each round-trip flight is estimated at \$400, in total \$12,000 for 5 years.

Field Transportation. Field work will take place for 50 days per year for 5 years, the expenses of local transportation include 1) car rental at the rate of \$79/car/day, with 1 car for 50 days, in total of \$3,950 per year, and \$19,750 for 5 years; 2) Gas and toll fee at the rate of \$32/car/day, with 1 car for 50 days, in total of \$1,600 per year, and \$8,000 for 5 years.

Meal and Lodging. We request 1) \$6,400 to cover the expense of meals for 4 field team members in the field for 50 days per year, at the rate of \$32/person/day, totaling \$32,000 in 5 years; 2) \$9,400 for lodging expenses of 4 field team members in the field for 50 days at the rate of \$47/person/night, totaling \$247,000 in 5 years.

Supplies and Materials (\$33,548)

Biological sampling supplies (\$25,165) We request \$25,165 to purchase supplies for biological sampling during the 5 years of the project, including 1) puritan calcium alginate swabs \$8,800 (5,000 IND); 2) viral sample collection tubes \$6,875 (15,000 IND); 3) heparinized glass hematocrit tubes \$190 (~4,000IND); 4) mist nets for bats trapping \$2,200 (~500IND); 5) cloth bags for bats trapping \$2,400 (~1,000IND); 6) Viral Transport Media \$4,700 (~7,000 mL).

Personal Protection Equipment (\$4,336): We request 1) \$3,440 for 3M N95 respirators (~1,600IND) for field work across Year 1-5; 2) \$470 for eye protection glasses (~100 IND) for

the use in field across Year 1-5; 3) \$426 for nitrile gloves (~3,000IND) for sampling work for Year 1-5.

Cold Chain Maintenance (\$4,047): We request \$4,047 to purchase 3 liquid nitrogen dry shippers for preserve biological samples in the field before transported an ultra-low temperature freezer. The expense is calculated at the rate of \$1,349 each, with 1 purchased per year from Year 1-3, totaling \$4,047.

Equipment (\$0)

No equipment over \$5,000 will be purchased.

Other Costs (\$6,399)

We request 1) a total of \$1,275 for specimen transportation or delivery from the field to partners' labs from Year 1-5, at the rate of \$85/delivery with 1,000 tubes, with three times per year; and 2) a total of \$3,980 for rabies and tetanus vaccination 4 field team members from Year 1-5, at the rate of \$199/year/person.

H. Indirect Costs

We are requesting the EcoHealth Alliance federally approved indirect cost rate of 32.74% on all applicable direct costs. Indirect is taken only on the first \$25,000 for each consortium/contractual agreement in each year. As there are 3 (Wuhan Institute of Virology, Institute of Pathogen Biology, and University of North Carolina), a total of \$24,555 (\$8,185 x 3) is requested as indirect costs on consortium/contractual/subaward agreements. This is not included as part of direct cost calculations and is only requested for year 1. In years 2-5 no indirect will be taken on consortium/contractual agreement subcontracts.