



**Grant Number:** 1R01AI110964-01  
**FAIN:** R01AI110964

**Principal Investigator(s):**  
PETER DASZAK, PHD

**Project Title:** Understanding the Risk of Bat Coronavirus Emergence

Aleksei  
President  
460 West 34th Street  
17th Floor  
New York, NY 100012317

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 06/01/2014 – 05/31/2015

**Project Period:** 06/01/2014 – 05/31/2019

Dear Business Official:

The National Institutes of Health hereby awards a grant in the amount of \$666,442 (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to ECOHEALTH ALLIANCE, INC. in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release, or other document about research supported by an NIH award must include an acknowledgment of NIH award support and a disclaimer such as "Research reported in this publication was supported by the National Institute Of Allergy And Infectious Diseases of the National Institutes of Health under Award Number R01AI110964. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health." Prior to issuing a press release concerning the outcome of this research, please notify the NIH awarding IC in advance to allow for coordination.

Award recipients must promote objectivity in research by establishing standards that provide a reasonable expectation that the design, conduct and reporting of research funded under NIH awards will be free from bias resulting from an Investigator's Financial Conflict of Interest (FCOI), in accordance with the 2011 revised regulation at 42 CFR Part 50 Subpart F. The Institution shall submit all FCOI reports to the NIH through the eRA Commons FCOI Module. The regulation does not apply to Phase I Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) awards. Consult the NIH website <http://grants.nih.gov/grants/policy/coi/> for a link to the regulation and additional important information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Laura A. Pone  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

---

**SECTION I – AWARD DATA – 1R01AI110964-01****Award Calculation (U.S. Dollars)**

Salaries and Wages	\$167,708
Fringe Benefits	\$54,168
Supplies	\$21,400
Travel Costs	\$35,918
Other Costs	\$10,000
Consortium/Contractual Cost	\$227,663

Federal Direct Costs	\$516,857
Federal F&A Costs	\$149,585
Approved Budget	\$666,442
Federal Share	\$666,442
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$666,442</b>

**AMOUNT OF THIS ACTION (FEDERAL SHARE)** \$666,442

SUMMARY TOTALS FOR ALL YEARS			
YR	THIS AWARD		CUMULATIVE TOTALS
1		\$666,442	\$666,442
2		\$630,445	\$630,445
3		\$611,090	\$611,090
4		\$597,112	\$597,112
5		\$581,646	\$581,646

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

**CFDA Number:** 93.855  
**EIN:** 1311726494A1  
**Document Number:** RAI110964A

**PMS Account Type:** P (Subaccount)  
**Fiscal Year:** 2014

IC	CAN	2014	2015	2016	2017	2018
AI	8472350	\$666,442	\$630,445	\$611,090	\$597,112	\$581,646

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

**PCC:** M51C / **OC:** 414A / **Released:** (b) (6) 05/20/2014

**Award Processed:** 05/08/2014 01:52:21 PM

---

**SECTION II – PAYMENT/HOTLINE INFORMATION – 1R01AI110964-01**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

---

**SECTION III – TERMS AND CONDITIONS – 1R01AI110964-01**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- a. The grant program legislation and program regulation cited in this Notice of Award.

- b. Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- c. 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- d. The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- e. This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm> for certain references cited above.)

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

This award is subject to the requirements of 2 CFR Part 25 for institutions to receive a Dun & Bradstreet Universal Numbering System (DUNS) number and maintain an active registration in the Central Contractor Registration. Should a consortium/subaward be issued under this award, a DUNS requirement must be included. See <http://grants.nih.gov/grants/policy/awardconditions.htm> for the full NIH award term implementing this requirement and other additional information.

This award has been assigned the Federal Award Identification Number (FAIN) R01AI110964. Recipients must document the assigned FAIN on each consortium/subaward issued under this award.

Based on the project period start date of this project, this award is likely subject to the Transparency Act subaward and executive compensation reporting requirement of 2 CFR Part 170. There are conditions that may exclude this award; see <http://grants.nih.gov/grants/policy/awardconditions.htm> for additional award applicability information.

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

**Treatment of Program Income:**  
Additional Costs

---

**SECTION IV – AI Special Terms and Conditions – 1R01AI110964-01**

THIS AWARD CONTAINS GRANT SPECIFIC RESTRICTIONS. THESE RESTRICTIONS MAY ONLY BE LIFTED BY A REVISED NOTICE OF AWARD.

RESTRICTION: This award is issued with the knowledge that subjects may be involved within the period of support, but definite plans were not set forth in the application as per 45 CFR 46.118. No human subjects may be involved in any project supported by this award until all requirements for Human Subjects research as identified in the PHS398/SF424 Instructions have been provided to and approved by NIH.

RESTRICTION: The present award is being made without a currently valid certification of IRB approval for this project with the following restriction: Only activities that are clearly severable and independent from activities that involve human subjects may be conducted pending the NIAID's acceptance of the certification of IRB review and approval.

No funds may be drawn down from the payment system and no obligations may be made against Federal funds for any research involving human subjects prior to the NIAID's notification to the grantee that the identified issues have been resolved and this restriction removed.

~~~~~  
This award includes funds for subcontract/consortium activity with Wuhan Institute of Virology, CHINA and is budgeted as follows:

|                      | -Yr 1     | -Yr 2     | -Yr 3     | -Yr 4     | -Yr 5     |
|----------------------|-----------|-----------|-----------|-----------|-----------|
| Total Direct Costs   | \$123,699 | \$128,718 | \$147,335 | \$147,335 | \$147,335 |
| F&A Costs @ 8%(MTDC) | \$9,896   | \$10,297  | \$11,787  | \$11,787  | \$11,787  |
| TOTAL COSTS          | \$133,595 | \$139,015 | \$159,122 | \$159,122 | \$159,122 |

Consortiums are to be established and administered as described in the NIH Grants Policy Statement. This written agreement with the consortium must address the negotiated arrangements for meeting the scientific, administrative, financial, and reporting requirements for this grant.

~~~~~  
This award includes funds for subcontract/consortium activity with East China Normal University, CHINA and is budgeted as follows:

	-Yr 1	-Yr 2	-Yr 3	-Yr 4	-Yr 5
Total Direct Costs	\$87,100	\$67,300	\$50,108	\$39,167	\$14,850
F&A Costs @ 8%(MTDC)	\$6,968	\$5,384	\$4,009	\$3,133	\$2,404
TOTAL COSTS	\$94,068	\$72,684	\$54,117	\$42,300	\$32,454

Consortiums are to be established and administered as described in the NIH Grants Policy Statement. This written agreement with the consortium must address the negotiated arrangements for meeting the scientific, administrative, financial, and reporting requirements for this grant.

~~~~~  
**Select Agents:**

Awardee of a project that at any time involves a restricted experiment with a select agent, is responsible for notifying and receiving prior approval from the NIAID. Please be advised that changes in the use of a Select Agent will be considered a change in scope and require NIH awarding office prior approval. The approval is necessary for new select agent experiments as well as changes in on-going experiments that would require change in the biosafety plan and/or biosafety containment level. An approval to conduct a restricted experiment granted to an individual cannot be assumed an approval to other individuals who conduct the same restricted experiment as defined in the Select Agents Regulation 42 CFR Part 73, Section 13.b (<http://www.selectagents.gov/Regulations.html>).

**Highly Pathogenic Agent:**

NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmb15/bmb15toc.htm>). Research funded under this grant must adhere to the BMBL, including using the BMBL-recommended biocontainment level at a minimum. If your Institutional Biosafety Committee (or equivalent body) or designated institutional biosafety official recommend a higher biocontainment level, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If your IBC or equivalent body or official has determined, for example, by conducting a risk assessment, that the work being planned or performed under this grant may be conducted at a biocontainment safety level that is lower than BSL3.

If the work involves Select Agents and/or Highly Pathogenic Agents, also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) including its restricted experiments that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s), and whether or not the work is a restricted experiment;
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

**STAFF CONTACTS**

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Laura A. Pone  
**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Erik J. Stemmy  
**Email:** (b) (6) **Phone:** (b) (6)

**SPREADSHEET SUMMARY**

**GRANT NUMBER:** 1R01AI110964-01

**INSTITUTION:** ECOHEALTH ALLIANCE, INC.

| Budget                      | Year 1    | Year 2    | Year 3    | Year 4    | Year 5    |
|-----------------------------|-----------|-----------|-----------|-----------|-----------|
| Salaries and Wages          | \$167,708 | \$167,708 | \$167,708 | \$167,708 | \$167,708 |
| Fringe Benefits             | \$54,168  | \$54,168  | \$54,168  | \$54,168  | \$54,168  |
| Supplies                    | \$21,400  | \$19,250  | \$7,250   | \$7,000   | \$3,500   |
| Travel Costs                | \$35,918  | \$35,918  | \$35,918  | \$35,918  | \$35,918  |
| Other Costs                 | \$10,000  | \$13,550  | \$11,050  | \$9,800   | \$9,400   |
| Consortium/Contractual Cost | \$227,663 | \$211,699 | \$213,239 | \$201,422 | \$191,576 |
| TOTAL FEDERAL DC            | \$516,857 | \$502,293 | \$489,333 | \$476,016 | \$462,270 |
| TOTAL FEDERAL F&A           | \$149,585 | \$128,152 | \$121,757 | \$121,096 | \$119,376 |
| TOTAL COST                  | \$666,442 | \$630,445 | \$611,090 | \$597,112 | \$581,646 |

| Facilities and Administrative Costs | Year 1    | Year 2    | Year 3    | Year 4    | Year 5    |
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|
| F&A Cost Rate 1                     | 44.1%     | 44.1%     | 44.1%     | 44.1%     | 44.1%     |
| F&A Cost Base 1                     | \$339,194 | \$290,594 | \$276,094 | \$274,594 | \$270,694 |
| F&A Costs 1                         | \$149,585 | \$128,152 | \$121,757 | \$121,096 | \$119,376 |

|                                                                                                                                                   |                                                                                     |                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------|
| PI: <b>DASZAK, PETER</b>                                                                                                                          | Title: Understanding the Risk of Bat Coronavirus Emergence                          |                                                    |
| Received: 06/05/2013                                                                                                                              | FOA: PA11-260                                                                       | Council: 01/2014                                   |
| Competition ID: ADOBE-FORMS-B2                                                                                                                    | FOA Title: RESEARCH PROJECT GRANT (PARENT R01)                                      |                                                    |
| <b>1 R01 AI110964-01</b>                                                                                                                          | Dual:                                                                               | Accession Number: 3595101                          |
| IPF: 4415701                                                                                                                                      | Organization: ECOHEALTH ALLIANCE, INC.                                              |                                                    |
| Former Number:                                                                                                                                    | Department:                                                                         |                                                    |
| IRG/SRG: CRFS                                                                                                                                     | AIDS: N                                                                             | Expedited: N                                       |
| Subtotal Direct Costs<br>(excludes consortium F&A)<br>Year 1: 499,993<br>Year 2: 499,469<br>Year 3: 499,978<br>Year 4: 499,953<br>Year 5: 499,974 | Animals: Y<br>Humans: Y<br>Clinical Trial: N<br>Current HS Code: (b) (4)<br>HESC: N | New Investigator: N<br>Early Stage Investigator: N |
| <i>Senior/Key Personnel: Organization: Role Category:</i>                                                                                         |                                                                                     |                                                    |
| Peter Daszak                                                                                                                                      | EcoHealth Alliance, Inc.                                                            | PD/PI                                              |
| ZhengLi Shi                                                                                                                                       | Wuhan Institute of Virology                                                         | Co-Investigator                                    |
| ShuYi Zhang                                                                                                                                       | East China Normal University                                                        | Co-Investigator                                    |
| Changwen Ke                                                                                                                                       | CDC and Prevention of Guangdong Province                                            | Co-Investigator                                    |
| Jonathan Epstein                                                                                                                                  | EcoHealth Alliance                                                                  | Co-Investigator                                    |
| Kevin Olival                                                                                                                                      | EcoHealth Alliance                                                                  | Co-Investigator                                    |
| Parviez Hosseini                                                                                                                                  | EcoHealth Alliance                                                                  | Co-Investigator                                    |
| XingYi Ge                                                                                                                                         | Wuhan Institute of Virology                                                         | Co-Investigator                                    |
| Guanjin Zhu                                                                                                                                       | Guangdong Entomological Institute                                                   | Co-Investigator                                    |
| Yun-Zhi Zhang                                                                                                                                     | Yunnan Center for Disease Control                                                   | Co-Investigator                                    |

*Additions for Review*

Accepted Publication

News of manuscripts  
acceptance

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

|                                  |                                     |
|----------------------------------|-------------------------------------|
| <b>3. DATE RECEIVED BY STATE</b> | <b>State Application Identifier</b> |
|                                  |                                     |

|                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. * TYPE OF SUBMISSION</b>                                                                                                                  |
| <input type="checkbox"/> Pre-application <input type="checkbox"/> Application <input checked="" type="checkbox"/> Changed/Corrected Application |

|                                     |               |
|-------------------------------------|---------------|
| <b>4. a. Federal Identifier</b>     | GRANT11418218 |
| <b>b. Agency Routing Identifier</b> |               |

|                          |                             |
|--------------------------|-----------------------------|
| <b>2. DATE SUBMITTED</b> | <b>Applicant Identifier</b> |
| 06/05/2013               |                             |

|                                 |                                             |
|---------------------------------|---------------------------------------------|
| <b>5. APPLICANT INFORMATION</b> | <b>* Organizational DUNS:</b> 0770900660000 |
|---------------------------------|---------------------------------------------|

\* Legal Name: EcoHealth Alliance, Inc.

Department: \_\_\_\_\_ Division: \_\_\_\_\_

\* Street1: 460 West 34th Street

Street2: 17th Floor

\* City: New York County / Parish: \_\_\_\_\_

\* State: NY: New York Province: \_\_\_\_\_

\* Country: USA: UNITED STATES \* ZIP / Postal Code: 10001-2317

Person to be contacted on matters involving this application

Prefix: Dr. \* First Name: Peter Middle Name: \_\_\_\_\_

\* Last Name: Daszak Suffix: \_\_\_\_\_

\* Phone Number: (b) (6) Fax Number: +1.212.380.4465

Email: (b) (6)

|                                                               |
|---------------------------------------------------------------|
| <b>6. * EMPLOYER IDENTIFICATION (EIN) or (TIN):</b> 311726494 |
|---------------------------------------------------------------|

|                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>7. * TYPE OF APPLICANT:</b> M: Nonprofit with 501C3 IRS Status (Other than Institution of Higher Education)                                |
| Other (Specify): _____                                                                                                                        |
| <b>Small Business Organization Type</b> <input type="checkbox"/> Women Owned <input type="checkbox"/> Socially and Economically Disadvantaged |

|                                                                                                          |                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>8. * TYPE OF APPLICATION:</b>                                                                         | If Revision, mark appropriate box(es).                                                                                                                                            |
| <input checked="" type="checkbox"/> New <input type="checkbox"/> Resubmission                            | <input type="checkbox"/> A. Increase Award <input type="checkbox"/> B. Decrease Award <input type="checkbox"/> C. Increase Duration <input type="checkbox"/> D. Decrease Duration |
| <input type="checkbox"/> Renewal <input type="checkbox"/> Continuation <input type="checkbox"/> Revision | <input type="checkbox"/> E. Other (specify): _____                                                                                                                                |

\* Is this application being submitted to other agencies? Yes  No  What other Agencies? \_\_\_\_\_

|                                                                   |                                                           |
|-------------------------------------------------------------------|-----------------------------------------------------------|
| <b>9. * NAME OF FEDERAL AGENCY:</b> National Institutes of Health | <b>10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:</b> |
|                                                                   | TITLE: _____                                              |

|                                                                                                            |
|------------------------------------------------------------------------------------------------------------|
| <b>11. * DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:</b> Understanding the Risk of Bat Coronavirus Emergence |
|------------------------------------------------------------------------------------------------------------|

|                                                    |                                                  |
|----------------------------------------------------|--------------------------------------------------|
| <b>12. PROPOSED PROJECT:</b>                       | <b>* 13. CONGRESSIONAL DISTRICT OF APPLICANT</b> |
| * Start Date: 10/01/2013 * Ending Date: 09/30/2018 | NY-010                                           |

|                                                                        |  |
|------------------------------------------------------------------------|--|
| <b>14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION</b> |  |
| Prefix: Dr. * First Name: Peter Middle Name: _____                     |  |
| * Last Name: Daszak Suffix: _____                                      |  |
| Position/Title: President                                              |  |
| * Organization Name: EcoHealth Alliance, Inc.                          |  |
| Department: _____ Division: _____                                      |  |
| * Street1: 460 West 34th Street                                        |  |
| Street2: 17th Floor                                                    |  |
| * City: New York County / Parish: _____                                |  |
| * State: NY: New York Province: _____                                  |  |
| * Country: USA: UNITED STATES * ZIP / Postal Code: 10001-2317          |  |
| * Phone Number: (b) (6) Fax Number: +1.212.380.4465                    |  |
| * Email: (b) (6)                                                       |  |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>15. ESTIMATED PROJECT FUNDING</b></p> <p>a. Total Federal Funds Requested <input style="width:150px;" type="text" value="3,362,338.00"/></p> <p>b. Total Non-Federal Funds <input style="width:150px;" type="text" value="0.00"/></p> <p>c. Total Federal &amp; Non-Federal Funds <input style="width:150px;" type="text" value="3,362,338.00"/></p> <p>d. Estimated Program Income <input style="width:150px;" type="text" value="0.00"/></p> | <p><b>16. * IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?</b></p> <p>a. YES <input type="checkbox"/> THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:<br/>DATE: <input style="width:100px;" type="text"/></p> <p>b. NO <input type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372; OR<br/><input checked="" type="checkbox"/> PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**17. By signing this application, I certify (1) to the statements contained in the list of certifications\* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances \* and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)**

\* I agree

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

**18. SFLLL or other Explanatory Documentation**

Add Attachment
Delete Attachment
View Attachment

**19. Authorized Representative**

Prefix:  \* First Name:  Middle Name:

\* Last Name:  Suffix:

\* Position/Title:

\* Organization:

Department:  Division:

\* Street1:

Street2:

\* City:  County / Parish:

\* State:  Province:

\* Country:  \* ZIP / Postal Code:

\* Phone Number:  Fax Number:

\* Email:

**\* Signature of Authorized Representative**

Winifred Zubin

**\* Date Signed**

06/05/2013

**20. Pre-application**

Add Attachment
Delete Attachment
View Attachment

## 424 R&R and PHS-398 Specific Table Of Contents

Page Numbers

|                                                                 |     |
|-----------------------------------------------------------------|-----|
| SF 424 R&R Face Page-----                                       | 1   |
| Table of Contents-----                                          | 3   |
| Performance Sites-----                                          | 4   |
| Research & Related Other Project Information-----               | 6   |
| Project Summary/Abstract (Description)-----                     | 7   |
| Public Health Relevance Statement (Narrative attachment)-----   | 8   |
| Facilities & Other Resources-----                               | 9   |
| Research & Related Senior/Key Person-----                       | 12  |
| Biographical Sketches for each listed Senior/Key Person-----    | 17  |
| Research & Related Budget - Year 1-----                         | 48  |
| Research & Related Budget - Year 2-----                         | 51  |
| Research & Related Budget - Year 3-----                         | 54  |
| Research & Related Budget - Year 4-----                         | 57  |
| Research & Related Budget - Year 5-----                         | 60  |
| Budget Justification-----                                       | 63  |
| Research & Related Budget - Cumulative Budget-----              | 67  |
| Research & Related Budget - Consortium Budget (Subaward 1)----- | 68  |
| Research & Related Budget - Consortium Budget (Subaward 2)----- | 86  |
| PHS 398 Specific Cover Page Supplement-----                     | 104 |
| PHS 398 Specific Research Plan-----                             | 106 |
| Specific Aims-----                                              | 107 |
| Research Strategy-----                                          | 108 |
| Human Subjects Sections-----                                    | 120 |
| Protection of Human Subjects-----                               | 120 |
| Women & Minorities-----                                         | 121 |
| Planned Enrollment Table-----                                   | 122 |
| Children-----                                                   | 123 |
| Vertebrate Animals-----                                         | 124 |
| Select Agent Research-----                                      | 127 |
| Bibliography & References Cited-----                            | 128 |
| Consortium/Contractual-----                                     | 135 |
| Letters of Support-----                                         | 136 |
| Resource Sharing Plan-----                                      | 143 |
| PHS 398 Checklist-----                                          | 144 |

**Project/Performance Site Location(s)****Project/Performance Site Primary Location**  I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

\* Street1:

Street2:

\* City:  County:

\* State:

Province:

\* Country:

\* ZIP / Postal Code:  \* Project/ Performance Site Congressional District:

**Project/Performance Site Location 1**  I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

\* Street1:

Street2:

\* City:  County:

\* State:

Province:

\* Country:

\* ZIP / Postal Code:  \* Project/ Performance Site Congressional District:

**Project/Performance Site Location a**  I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

\* Street1:

Street2:

\* City:  County:

\* State:

Province:

\* Country:

\* ZIP / Postal Code:  \* Project/ Performance Site Congressional District:

### Project/Performance Site Location(s)

**Project/Performance Site Location 3**

I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

\* Street1:

Street2:

\* City:  County:

\* State:

Province:

\* Country:

\* ZIP / Postal Code:  \* Project/ Performance Site Congressional District:

**Project/Performance Site Location a**

I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

\* Street1:

Street2:

\* City:  County:

\* State:

Province:

\* Country:

\* ZIP / Postal Code:  \* Project/ Performance Site Congressional District:

Additional Location(s)

## RESEARCH & RELATED Other Project Information

1. \* Are Human Subjects Involved?  Yes  No

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations?  Yes  No

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

If no, is the IRB review Pending?  Yes  No

IRB Approval Date:

Human Subject Assurance Number:

2. \* Are Vertebrate Animals Used?  Yes  No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending?  Yes  No

IACUC Approval Date:

Animal Welfare Assurance Number

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

4.a. \* Does this project have an actual or potential impact on the environment?  Yes  No

4.b. If yes, please explain:

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

4.d. If yes, please explain:

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

5.a. If yes, please explain:

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

6.a. If yes, identify countries:

6.b. Optional Explanation:

7. \* Project Summary/Abstract

8. \* Project Narrative

9. Bibliography & References Cited

10. Facilities & Other Resources

11. Equipment

12. Other Attachments

## Project Summary

This project will examine the risk of future coronavirus (CoV) emergence from wildlife using in-depth field investigations across the human-wildlife interface in China, molecular characterization of novel CoVs and host receptor binding domain genes, mathematical models of transmission and evolution, and *in vitro* and *in vivo* laboratory studies of host range. Zoonotic CoVs are a significant threat to global health, as demonstrated with the emergence of pandemic severe acute respiratory syndrome coronavirus (SARS-CoV) in China in 2002, and the recent and ongoing emergence of Middle East Respiratory Syndrome (MERS-CoV). Bats appear to be the natural reservoir of these viruses, and hundreds of novel bat-CoVs have been discovered in the last two decades. Bats, and other wildlife species, are hunted, traded, butchered and consumed across Asia, creating a largescale human-wildlife interface, and high risk of future emergence of novel CoVs. This project aims to understand what factors increase the risk of the next CoV emerging in people by studying CoV diversity in a critical zoonotic reservoir (bats), at sites of high risk for emergence (wildlife markets) in an emerging disease hotspot (China). The three specific aims of this project are to:

- 1. Assess CoV spillover potential at high risk human-wildlife interfaces in China.** This will include quantifying the nature and frequency of contact people have with bats and other wildlife; serological and molecular screening of people working in wet markets and highly exposed to wildlife; screening wild-caught and market sampled bats from 30+ species for CoVs using molecular assays; and genomic characterization and isolation of novel CoVs.
- 2. Develop predictive models of bat CoV emergence risk and host range.** A combined modeling approach will include phylogenetic analyses of host receptors and novel CoV genes (including functional receptor binding domains); a fused ecological and evolutionary model to predict host-range and viral sharing; and mathematical matrix models to examine evolutionary and transmission dynamics.
- 3. Test predictions of CoV inter-species transmission.** Predictive models of host range (i.e. emergence potential) will be tested experimentally using reverse genetics, pseudovirus and receptor binding assays, and virus infection experiments across a range of cell cultures from different species and humanized mice.

## **PROJECT NARRATIVE**

Most emerging human viruses come from wildlife, and these represent a significant threat to global public health and biosecurity - as demonstrated by the SARS coronavirus pandemic of 2002-03 and an ongoing SARS-like epidemic in the Middle East. This project seeks to understand what factors allow animal Coronaviruses to evolve and jump into the human population by studying virus diversity in a critical group of animals (bats), at sites of high risk for emergence (wildlife markets) in an emerging disease hotspot (China).

## FACILITIES AND OTHER RESOURCES

**EcoHealth Alliance, New York, USA** (Peter Daszak, Jon Epstein, Parvizeh Hosseini, and Kevin Olival)

EcoHealth Alliance is a 40-year old scientific research NGO that specializes in multidisciplinary research on the causes, origins and spread of zoonotic emerging diseases. EcoHealth Alliance scientists have been working on the emergence of Nipah & Hendra virus, SARS CoV, surveillance for zoonotic agents in wildlife, and spatial modeling for over 15 years, and on modeling of infectious disease emergence and spread for over a decade. EcoHealth Alliance is based in New York City with (b) (4) square feet of office space including a meeting room and basic laboratory – freezer storage and light microscopy. The scientific staff (25 core scientists, 100+ field staff) is supported by a core admin staff of 11 which is available for work on this project and is funded through core funds.

EcoHealth Alliance is equipped with 35 networked PCs including an NIH ARRA-funded International LifeSize Video Conferencing facility. High-speed video conferencing facilities have been installed with key international collaborators in 2011. EcoHealth Alliance has access to a 24-7 server, server support, and all required software including ArcGIS ArcINFO, MatLab, SPSS, R, Microsoft Office, and Adobe CS5 running on both Apple and Windows Operating Systems. Additionally we have a four-processor, public IP addressed Linux and an eight-processor Mac Pro Server - each with 4TB hard drives, which in combination can be used for intensive computational modeling and database processing by all the grantees. Access to the cloud (Amazon) is provided by core funding to EHA.

EcoHealth Alliance is the headquarters of a series of global networks that provide exceptional leverage for the core scientists: 1) The USAID EPT PREDICT consortium. This group conducts human and wildlife surveillance for high-risk pathogens in 24 countries including China. Partners include Dr Ian Lipkin's Center for Infection and Immunity at Columbia University (pathogen discovery), UC Davis, The Smithsonian, GVFI and WCS; 2) The One Health Alliance of South Asia. This is a Rockefeller Foundation funded transboundary disease surveillance program; 3) The EcoHealth Alliance Partners: A global partnership of leading wildlife and global health researchers in tropical and subtropical countries. This gives us unique access to working on-the-ground in countries where surveillance is difficult, such as China, where our group has proven capacity to export samples from; 4) The Consortium for Conservation Medicine: A unique collaborative institution linking Johns Hopkins Bloomberg School of Public Health, Tufts University School of Veterinary Medicine, The University of Pittsburgh Graduate School of Public Health, The University of Wisconsin-Madison Nelson Institute for Environmental Studies, The USGS National Wildlife Health Center, and EcoHealth Alliance. The CCM provides access to hundreds of high caliber scientists, their facilities,



and their students at 6 leading institutes of public health, veterinary medicine, and environmental science in the USA.

**East China Normal University, Shanghai, China** (Shuyi Zhang and Guangjian Zhu)  
Dr. Zhang is Dean of the Institutes for Advanced Interdisciplinary Research at East China Normal University. Over (b) (4) square metres is allocated to his research group at ECNU. The lab is fully capable of carrying out molecular, protein, epidemic disease and evolution research. Experimental equipment includes: Roche 454 (GS FLX Titanium System), Bioinformatics Computer Server, Multi-Channel Neurophysiology Workstation TDT, PCR Amplifier, Real time PCR Amplifier, Electrophoresis, Ultra-low Temperature Freezer, Centrifuge, UV-Visible Spectrophotometer, Two-dimensional Electrophoresis, Vertical Electrophoresis System, Incubator, Clean Bench, and Class II-Biosafety Cabinet, Hybridization Oven, Water Purification System, and Shaker.

**Wuhan Institute of Virology, Wuhan, China** (Zhengli Shi and Xingyi Ge)  
The Shi laboratory includes 4 rooms totaling (b) (4), one equipped with two CO<sub>2</sub> incubators for tissue culture, one equipped facilities including with high speed centrifuge, 2 -20°C, 3 -80°C freezers, 2 PCR machines, 1 ELISA plate reader, one for molecule diagnosis equipped with two biosafety cabinets, and one normal laboratory equipped various small equipment items (mini-centrifuges, gel electrophoresis units, circulating adjustable water baths, and heat blocks). Also available to Dr. Shi's group is a fully equipped biosafety level 3 laboratory, a newly opened BLS-4 laboratory (the first in China) and Institute-supported facility center, which houses full-time staff and equipment for electronic microscopy, ultracentrifugation, confocal microcopy, and sequencing machine.

The Wuhan Institute of Virology is China's premier institute for virological research. It consists of three research departments and one center: Department of Molecular Virology, Department of Bio-control, Department of Analytical Biochemistry and Biotechnology, and the Virus Resource and Bioinformation Center of China. It also has the Key Laboratory of Molecular Virology of CAS, the Joint-laboratory of Invertebrate Virology, a HIV Pre-screening Lab and Hubei Engineering and Technology Research Center for Viral Diseases. The institute is further divided into 14 research groups, one of which is run by Dr Zhengli Shi. The supporting system of the institute consists of an Analytical Equipment Center, an Experimental Animal Center, an Editorial Office of "Virologica Sinica" and an Computer Network Center. The virus resource and bio-information center of China contains the largest virus bank in Asia, curating around 800 viral strains.

The Institute collaborates with the World Health Organization (WHO), universities and research institutes in more than 30 counties and regions including EcoHealth Alliance in the USA. There are 14 professors, 36 associated professors, 47 assistant professors conducting research on virology and five of these have been awarded honors in the "Hundred Talents Project". The institute has built a BSL-3 lab and a 600 m<sup>2</sup> experimental animal center. In 2013, the first BSL-4 lab in China was opened at this

Daszak, Peter

Institute in a purpose-built facility which has been designed with the assistance of the US Centers for Disease Control and the Pasteur Institute.

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

## PROFILE - Project Director/Principal Investigator

|                                  |                               |                              |                   |                 |  |
|----------------------------------|-------------------------------|------------------------------|-------------------|-----------------|--|
| Prefix:                          | Dr.                           | * First Name:                | Peter             | Middle Name:    |  |
| * Last Name:                     | Daszak                        | Suffix:                      |                   |                 |  |
| Position/Title:                  | President                     | Department:                  |                   |                 |  |
| Organization Name:               | EcoHealth Alliance, Inc.      | Division:                    |                   |                 |  |
| * Street1:                       | 460 West 34th Street          |                              |                   |                 |  |
| Street2:                         | 17th Floor                    |                              |                   |                 |  |
| * City:                          | New York                      | County/ Parish:              |                   |                 |  |
| * State:                         | NY: New York                  | Province:                    |                   |                 |  |
| * Country:                       | USA: UNITED STATES            | * Zip / Postal Code:         | 10001-2317        |                 |  |
| * Phone Number:                  | (b) (6)                       | Fax Number:                  | +1.212.380.4465   |                 |  |
| * E-Mail:                        | (b) (6)                       |                              |                   |                 |  |
| Credential, e.g., agency login:  | (b) (6)                       |                              |                   |                 |  |
| * Project Role:                  | PD/PI                         | Other Project Role Category: |                   |                 |  |
| Degree Type:                     | Ph.D.                         |                              |                   |                 |  |
| Degree Year:                     | 1994                          |                              |                   |                 |  |
| * Attach Biographical Sketch     | 1244-Peter_Daszak_NIH_biosket | Add Attachment               | Delete Attachment | View Attachment |  |
| Attach Current & Pending Support |                               | Add Attachment               | Delete Attachment | View Attachment |  |

## PROFILE - Senior/Key Person 1

|                                  |                               |                              |                   |                 |  |
|----------------------------------|-------------------------------|------------------------------|-------------------|-----------------|--|
| Prefix:                          | Dr.                           | * First Name:                | ZhengLi           | Middle Name:    |  |
| * Last Name:                     | Shi                           | Suffix:                      |                   |                 |  |
| Position/Title:                  | Senior Scientist              | Department:                  |                   |                 |  |
| Organization Name:               | Wuhan Institute of Virology   | Division:                    |                   |                 |  |
| * Street1:                       | Xiao Hong Shan, no. 44        |                              |                   |                 |  |
| Street2:                         | Wuchang District              |                              |                   |                 |  |
| * City:                          | Wuhan                         | County/ Parish:              |                   |                 |  |
| * State:                         |                               | Province:                    | Hubei             |                 |  |
| * Country:                       | CHN: CHINA                    | * Zip / Postal Code:         | 430071            |                 |  |
| * Phone Number:                  | (b) (6)                       | Fax Number:                  | +86-27-87198072   |                 |  |
| * E-Mail:                        | (b) (6)                       |                              |                   |                 |  |
| Credential, e.g., agency login:  |                               |                              |                   |                 |  |
| * Project Role:                  | Co-Investigator               | Other Project Role Category: |                   |                 |  |
| Degree Type:                     | Ph.D.                         |                              |                   |                 |  |
| Degree Year:                     | 2000                          |                              |                   |                 |  |
| * Attach Biographical Sketch     | 1245-SHI_Zhengli_Biosketch_20 | Add Attachment               | Delete Attachment | View Attachment |  |
| Attach Current & Pending Support |                               | Add Attachment               | Delete Attachment | View Attachment |  |

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

## PROFILE - Senior/Key Person 2

|                                  |                                |                              |                   |                 |  |
|----------------------------------|--------------------------------|------------------------------|-------------------|-----------------|--|
| Prefix:                          | Dr.                            | * First Name:                | ShuYi             | Middle Name:    |  |
| * Last Name:                     | Zhang                          | Suffix:                      |                   |                 |  |
| Position/Title:                  | Dean                           | Department:                  |                   |                 |  |
| Organization Name:               | East China Normal University   |                              |                   | Division:       |  |
| * Street1:                       | B319, Science Building 3663    |                              |                   |                 |  |
| Street2:                         | North Zhongshan Road           |                              |                   |                 |  |
| * City:                          | Shanghai                       | County/ Parish:              |                   |                 |  |
| * State:                         |                                | Province:                    | Shanghai          |                 |  |
| * Country:                       | CHN: CHINA                     | * Zip / Postal Code:         | 200062            |                 |  |
| * Phone Number:                  | (b) (6)                        | Fax Number:                  |                   |                 |  |
| * E-Mail:                        | (b) (6)                        |                              |                   |                 |  |
| Credential, e.g., agency login:  |                                |                              |                   |                 |  |
| * Project Role:                  | Co-Investigator                | Other Project Role Category: |                   |                 |  |
| Degree Type:                     | Ph.D.                          |                              |                   |                 |  |
| Degree Year:                     | 1994                           |                              |                   |                 |  |
| * Attach Biographical Sketch     | 1246-Zhang_Shuyi_Biosketch_K\$ | Add Attachment               | Delete Attachment | View Attachment |  |
| Attach Current & Pending Support |                                | Add Attachment               | Delete Attachment | View Attachment |  |

## PROFILE - Senior/Key Person 3

|                                  |                                          |                              |                   |                 |  |
|----------------------------------|------------------------------------------|------------------------------|-------------------|-----------------|--|
| Prefix:                          | Dr.                                      | * First Name:                | Changwen          | Middle Name:    |  |
| * Last Name:                     | Ke                                       | Suffix:                      |                   |                 |  |
| Position/Title:                  | Director                                 | Department:                  |                   |                 |  |
| Organization Name:               | CDC and Prevention of Guangdong Province |                              |                   | Division:       |  |
| * Street1:                       | Xing Gang West Road, no. 176             |                              |                   |                 |  |
| Street2:                         |                                          |                              |                   |                 |  |
| * City:                          | Guangzhou                                | County/ Parish:              |                   |                 |  |
| * State:                         |                                          | Province:                    | Guangdong         |                 |  |
| * Country:                       | CHN: CHINA                               | * Zip / Postal Code:         | 510300            |                 |  |
| * Phone Number:                  | (b) (6)                                  | Fax Number:                  |                   |                 |  |
| * E-Mail:                        | (b) (6)                                  |                              |                   |                 |  |
| Credential, e.g., agency login:  |                                          |                              |                   |                 |  |
| * Project Role:                  | Co-Investigator                          | Other Project Role Category: |                   |                 |  |
| Degree Type:                     | Ph.D.                                    |                              |                   |                 |  |
| Degree Year:                     | 2001                                     |                              |                   |                 |  |
| * Attach Biographical Sketch     | 1247-Biosketch_ChangWenKe_COV            | Add Attachment               | Delete Attachment | View Attachment |  |
| Attach Current & Pending Support |                                          | Add Attachment               | Delete Attachment | View Attachment |  |

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

| PROFILE - Senior/Key Person 4    |                             |                              |                                   |
|----------------------------------|-----------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                         | * First Name:                | Jonathan                          |
|                                  |                             | Middle Name:                 | H                                 |
| * Last Name:                     | Epstein                     | Suffix:                      |                                   |
| Position/Title:                  | Associate Vice President    | Department:                  | Conservation Medicine             |
| Organization Name:               | EcoHealth Alliance          | Division:                    |                                   |
| * Street1:                       | 460 W34th Street            |                              |                                   |
| Street2:                         | 17th Floor                  |                              |                                   |
| * City:                          | New York                    | County/ Parish:              |                                   |
| * State:                         | NY: New York                | Province:                    |                                   |
| * Country:                       | USA: UNITED STATES          | * Zip / Postal Code:         | 10001-2317                        |
| * Phone Number:                  | (b) (6)                     | Fax Number:                  | +1.212.380.4465                   |
| * E-Mail:                        | (b) (6)                     |                              |                                   |
| Credential, e.g., agency login:  |                             |                              |                                   |
| * Project Role:                  | Co-Investigator             | Other Project Role Category: |                                   |
| Degree Type:                     | DVM                         |                              |                                   |
| Degree Year:                     | 2002                        |                              |                                   |
| * Attach Biographical Sketch     | 1248-Epstein_BioSketch_NIH_ | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                             | Add Attachment               | Delete Attachment View Attachment |

| PROFILE - Senior/Key Person 5    |                              |                              |                                   |
|----------------------------------|------------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                          | * First Name:                | Kevin                             |
|                                  |                              | Middle Name:                 |                                   |
| * Last Name:                     | Olival                       | Suffix:                      |                                   |
| Position/Title:                  | Senior Research Scientist    | Department:                  |                                   |
| Organization Name:               | EcoHealth Alliance           | Division:                    |                                   |
| * Street1:                       | 460 W34th Street             |                              |                                   |
| Street2:                         | 17th Floor                   |                              |                                   |
| * City:                          | New York                     | County/ Parish:              |                                   |
| * State:                         | NY: New York                 | Province:                    |                                   |
| * Country:                       | USA: UNITED STATES           | * Zip / Postal Code:         | 10001-2317                        |
| * Phone Number:                  | (b) (6)                      | Fax Number:                  | +1.212.380.4465                   |
| * E-Mail:                        | (b) (6)                      |                              |                                   |
| Credential, e.g., agency login:  |                              |                              |                                   |
| * Project Role:                  | Co-Investigator              | Other Project Role Category: |                                   |
| Degree Type:                     | Ph.D.                        |                              |                                   |
| Degree Year:                     | 2008                         |                              |                                   |
| * Attach Biographical Sketch     | 1249-Olival_biosketch_NIAID_ | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                              | Add Attachment               | Delete Attachment View Attachment |

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

| PROFILE - Senior/Key Person 6    |                               |                              |                                   |
|----------------------------------|-------------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                           | * First Name:                | Parvaz                            |
| Middle Name:                     |                               |                              |                                   |
| * Last Name:                     | Hosseini                      | Suffix:                      |                                   |
| Position/Title:                  | Senior Research Scientist     | Department:                  |                                   |
| Organization Name:               | EcoHealth Alliance            | Division:                    |                                   |
| * Street1:                       | 460 W 34th Street             |                              |                                   |
| Street2:                         | 17th Floor                    |                              |                                   |
| * City:                          | New York                      | County/ Parish:              |                                   |
| * State:                         | NY: New York                  | Province:                    |                                   |
| * Country:                       | USA: UNITED STATES            | * Zip / Postal Code:         | 10001-2317                        |
| * Phone Number:                  | (b) (6)                       | Fax Number:                  | +1.212.380.4165                   |
| * E-Mail:                        | (b) (6)                       |                              |                                   |
| Credential, e.g., agency login:  |                               |                              |                                   |
| * Project Role:                  | Co-Investigator               | Other Project Role Category: |                                   |
| Degree Type:                     | Ph.D.                         |                              |                                   |
| Degree Year:                     | 2002                          |                              |                                   |
| * Attach Biographical Sketch     | 1250-HOSSEINI_Biosketch_COV20 | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                               | Add Attachment               | Delete Attachment View Attachment |

| PROFILE - Senior/Key Person 7    |                               |                              |                                   |
|----------------------------------|-------------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                           | * First Name:                | XingYi                            |
| Middle Name:                     |                               |                              |                                   |
| * Last Name:                     | Ge                            | Suffix:                      |                                   |
| Position/Title:                  | Assistant Researcher          | Department:                  | Department of Emerging Viruses    |
| Organization Name:               | Wuhan Institute of Virology   | Division:                    |                                   |
| * Street1:                       | Xiao Hong Shan, no. 44        |                              |                                   |
| Street2:                         | Wuchang District              |                              |                                   |
| * City:                          | Wuhan                         | County/ Parish:              |                                   |
| * State:                         |                               | Province:                    | Hubei                             |
| * Country:                       | CHN: CHINA                    | * Zip / Postal Code:         | 430071                            |
| * Phone Number:                  | (b) (6)                       | Fax Number:                  |                                   |
| * E-Mail:                        | (b) (6)                       |                              |                                   |
| Credential, e.g., agency login:  |                               |                              |                                   |
| * Project Role:                  | Co-Investigator               | Other Project Role Category: |                                   |
| Degree Type:                     | Ph.D.                         |                              |                                   |
| Degree Year:                     | 2011                          |                              |                                   |
| * Attach Biographical Sketch     | 1251-GE_XingYi_Biosketch_2013 | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                               | Add Attachment               | Delete Attachment View Attachment |

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

| PROFILE - Senior/Key Person 8    |                                                |                              |                                   |
|----------------------------------|------------------------------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                                            | * First Name:                | Guanjin                           |
| Middle Name:                     |                                                |                              |                                   |
| * Last Name:                     | Zhu                                            | Suffix:                      |                                   |
| Position/Title:                  | Assistant Researcher                           | Department:                  |                                   |
| Organization Name:               | Guangdong Entomological Institute              | Division:                    |                                   |
| * Street1:                       | Room 1707, Building 622, 3663 Zhongshanbei Rd. |                              |                                   |
| Street2:                         | Putuo District                                 |                              |                                   |
| * City:                          | Shanghai                                       | County/ Parish:              |                                   |
| * State:                         |                                                | Province:                    |                                   |
| * Country:                       | CHN: CHINA                                     | * Zip / Postal Code:         | 200026                            |
| * Phone Number:                  | (b) (6)                                        | Fax Number:                  |                                   |
| * E-Mail:                        | (b) (6)                                        |                              |                                   |
| Credential, e.g., agency login:  |                                                |                              |                                   |
| * Project Role:                  | Co-Investigator                                | Other Project Role Category: |                                   |
| Degree Type:                     | Ph.D.                                          |                              |                                   |
| Degree Year:                     | 2012                                           |                              |                                   |
| * Attach Biographical Sketch     | 1252-Zhu_Guanqian_Biosketch                    | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                                                | Add Attachment               | Delete Attachment View Attachment |

| PROFILE - Senior/Key Person 9    |                                         |                              |                                   |
|----------------------------------|-----------------------------------------|------------------------------|-----------------------------------|
| Prefix:                          | Dr.                                     | * First Name:                | Yun-Zhi                           |
| Middle Name:                     |                                         |                              |                                   |
| * Last Name:                     | Zhang                                   | Suffix:                      |                                   |
| Position/Title:                  | Head of Infectious Disease Surveillance | Department:                  |                                   |
| Organization Name:               | Yunnan Center for Disease Control       | Division:                    |                                   |
| * Street1:                       | 33 Wenhua Road                          |                              |                                   |
| Street2:                         |                                         |                              |                                   |
| * City:                          | Dali City                               | County/ Parish:              |                                   |
| * State:                         |                                         | Province:                    | Yunnan                            |
| * Country:                       | CHN: CHINA                              | * Zip / Postal Code:         | 671000                            |
| * Phone Number:                  | (b) (6)                                 | Fax Number:                  |                                   |
| * E-Mail:                        | (b) (6)                                 |                              |                                   |
| Credential, e.g., agency login:  |                                         |                              |                                   |
| * Project Role:                  | Co-Investigator                         | Other Project Role Category: |                                   |
| Degree Type:                     | Ph.D.                                   |                              |                                   |
| Degree Year:                     | 2010                                    |                              |                                   |
| * Attach Biographical Sketch     | 1253-Biosketch_YunZhiZhang_CO           | Add Attachment               | Delete Attachment View Attachment |
| Attach Current & Pending Support |                                         | Add Attachment               | Delete Attachment View Attachment |

Program Director/Principal Investigator (Last, First, Middle): Daszak, P.

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

|                                                                                                                                                                             |                           |                                               |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------|---------------------|
| NAME<br>Peter Daszak                                                                                                                                                        |                           | POSITION TITLE<br>President & Chief Scientist |                     |
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>(b) (6)                                                                                                           |                           |                                               |                     |
| EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.) |                           |                                               |                     |
| INSTITUTION AND LOCATION                                                                                                                                                    | DEGREE<br>(if applicable) | MM/YY                                         | FIELD OF STUDY      |
| Bangor University (UK)                                                                                                                                                      | BSc. (hons)               | 07/86                                         | Zoology             |
| University of East London (UK)                                                                                                                                              | Ph.D                      | 03/93                                         | Infectious Diseases |

**A. Personal Statement**

The goal of the proposed research is to investigate the ecology, evolutionary biology and transmission dynamics of bat coronaviruses at the human-wildlife interface. Specifically, we will conduct field studies in China to obtain high quality samples from bats, and identify, characterize and isolate known and novel coronaviruses. We will analyze the patterns of coronavirus transmission among bats and other wildlife, and the risk of spillover to humans. I have been working on the dynamics of emerging viral diseases from wildlife for over 15 years, and have the proven scientific vision, leadership and capacity to lead this team and test the hypotheses laid out here. Since working at the CDC Pathology Activity in 1998 during the Nipah virus outbreak, I have specialized in the ecology of viruses emerging from bats. Under my first Nipah virus R01, I developed a multidisciplinary approach combining fieldwork, phylogenetics, virology, and mathematical modeling to isolate and characterize NiV from bats, analyze transmission dynamics, and identify the cause of its emergence. In 2001, I became director of a research program at a New York-based scientific research NGO. This allowed me to expand my research globally, and in 2005, working with current co-investigators Drs Zhang and Zhengli, we were the first team to identify and characterize SARS-like coronaviruses in bats. I have consolidated this work as PI of: 1) a NIAID R01 to conduct pathogen discovery in bats, and map bat viral diversity; 2) a renewal to my Nipah virus R01 focused on the emergence of NiV in Bangladesh; and 3) a large USAID project (PREDICT) to identify new pathogens in wildlife from emerging disease 'hotspot' regions. The current application builds on this work and leverages my group's unique partnership in China, where we have proven capacity to conduct disease surveillance in humans and wildlife in the markets where SARS emerged, and where we have collaborated at a high level for 12 years. I have a proven record of leading multidisciplinary research teams on emerging viral pathogens from wildlife and have the leadership skills, institutional capacity and network to deliver successful outcomes in the current proposed work.

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

1993-8 Senior Faculty Research Scientist, Kingston University  
 1998 Guest Researcher, Centers for Disease Control and Prevention (CDC)  
 1999-2001 Faculty Research Scientist, University of Georgia  
 2001- Adjunct Faculty, Tufts Univ. Sch. Veterinary Med.; Univ. Georgia; Columbia Univ.  
 2001-9 Executive Director, Consortium for Conservation Medicine, EcoHealth Alliance, New York  
 2009- President & Chief Scientist, EcoHealth Alliance New York.



Program Director/Principal Investigator (Last, First, Middle): Daszak, P.

**Other Experience and Professional Membership**

Keynote speaker Merieux Foundation Conference on Emerging paramyxoviruses, France (2000); UN Millenium Ecosystem Assessment: Lead Author, human infectious diseases (2006); NIH: ad hoc member, ZRG1 IDM-G 90 study section: Virology, Biodefense & Emerg. Diseases (2003-5); Editorial Board, Conservation Biology (Blackwell); Founding Co-Editor *EcoHealth* (Springer) (2004-10); NAS – Committee Member, Future Needs in Veterinary Research (2004-5); DIVERSITAS (UNESCO-ICSU): Member of Scientific Committee (2004-11; Treasurer 2007-11); NIAID: Steering Committee, workshop on virus-host shifts & emergence of new pathogens (2005); Australian Biosecurity Cooperative Research Center: International Standing Advisory Committee (2005-10); NIH: ad hoc member, ZRG1 IRAP-Q study section (infectious diseases, epidemiology) (2005-7); International EcoHealth Association: Founding board of directors, Treasurer (2006-11); CDC: ad hoc member, ZCD1 SGI, 09PAR07-231, R36 Research Dissertation Awards (2007); European CDC: Keynote speaker, future infectious disease threats (2008); NAS-IOM Committee Member, Global capacity for EID surveillance (2008-9); Scientific Advisory Board, NIAID Center of Excellence, avian influenza (CRISAR), UCLA (2008-9); Reviewer IOM report on Infectious Disease Movements in a Borderless World (2009); NIAID: Steering Committee, workshop on viruses from bats (2009); NAS-IOM Participant, workshop on H1N1, Committee on Emerging Microbial Threats (2009); NIH: ZRG1 IRAP-Q Review panel ARRA Challenge grants (2009); Organizing Committee, 1<sup>st</sup> International One Health Symposium, Australia (2010); Member, Council of Advisors One Health Commission (2010-); Editor-in-Chief, *EcoHealth* (2010-); Scientific Advisory Board, Oxford Univ. Clinical Research Unit, Vietnam (2010-); Member of IOM Forum on Microbial Threats 2010-; Steering Committee, NIAID Workshop on Arboviruses 2011; Organizer IOM Forum on Microbial Threats briefing on MERS-CoV 2013.

**Honors**

Meritorious service award, CDC (1999); CSIRO silver medal for collaborative research (2000); Honored by the naming of a new species of centipede, *Cryptops daszaki* (*J Nat Hist* 2002; 36: 76-106) (2002); ISI Fast-breaking paper (2002); CBS 60 Minutes documentary on Nipah virus research; 6<sup>th</sup> Annual Lecturer, Medicine & Humanities, Texas A&M (2003); Editor's choice, *Science* (2006); Zayed International Prize for the Environment (2<sup>nd</sup>) (2006); Finalist, Director's Pioneer Award (2007); Discovery Channel documentary on Nipah virus research, Bangladesh (2008); Presidential Lecturer, University of Montana (2008); Elected member of the Cosmos Club 2012; Honored by the naming of a new species of parasite, *Isospora daszaki* (*Parasitol. Res.* 2013; 111:1463-1466) (2012); Awarded the Hsu-Li Distinguished Lectureship in Epidemiology (2013).

**C. Peer-reviewed publications** (selected from over 190+); \* = Corresponding author**Most relevant to the current application**

1. **Daszak P**, Cunningham AA, Hyatt AD (2000). Emerging infectious diseases of wildlife - threats to biodiversity and human health. *Science* 287: 443-449
2. 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 L-F (2005). Bats are natural reservoirs of SARS-like coronaviruses. *Science* 310: 676-679.
3. Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, and **Daszak P\*** (**Corresponding Author**). (2008). Global trends in emerging infectious diseases. *Nature* 451:990-993
4. Keesing F, Belden LK, **Daszak P**, Dobson A, Harvell CD, Holt RD, Hudson P, Jolles A, Jones KE, Mitchell CE, Myers SS, Bogich T & Ostfeld RS. (2010). Impacts of biodiversity on the emergence and transmission of infectious diseases. *Nature* 468:647-652.
5. Morse SS, Mazet JAK, Woolhouse M, Parrish CR, Carroll D, Karesh WB, Zambrana-Torrel C, Lipkin WI, **Daszak P\*** (**Corresponding Author**) (2012). Prediction and prevention of the next pandemic zoonosis. *Lancet* 380:1956-1965.
6. **Daszak P** (2012). Anatomy of a pandemic *Lancet* 380: 1883-1884.

Program Director/Principal Investigator (Last, First, Middle): Daszak, P.

7. Quan P-L, Firth C, Conte JM, Williams SH, Zambrana-Torrel C, Anthony SJ, Ellison JA, Gilbert AT, Kuzmin IV, Niezgodna M, Osinubi MOV, Recuenco S, Markotter W, Breiman R, Kalemba L, Malekani J, Lindblade KA, Rostal MK, Ojeda-Flores R, Suzan G, Davis LB, Blau DM, Ogunkoya AB, Castillo DAA, Moran D, Ngam S, Akaibe D, Agwanda B, Briese T, Epstein JH, **Daszak P**, Rupprecht CE, Holmes EC, Lipkin WI. (2013). Bats are a major natural reservoir for hepaciviruses and pegiviruses. *PNAS* Published ahead of print April 2013.
8. Anthony SJ, Ojeda-Flores R, Rico-Chávez O, Navarrete-Macias I, Zambrana-Torrel CM, Rostal MK, Epstein JH, Tipps T, Liang E, Sanchez-Leon M, Sotomayor-Bonilla J, Ávila R, Medellín RA, Goldstein T, Suzán G, Daszak P, Lipkin WI. (2013). Coronaviruses in bats from Mexico **Journal of General Virology** Online First.
9. Anthony SJ, Epstein JH, Murray KA, Navarrete-Macias I, Zambrana-Torrel CM, Solovyov A, Ojeda-Flores R, Arrigo NC, Islam A, Ali Khan S, Hosseini P, Bogich TL, Olival KJ, Sanchez-Leon MD, Karesh W, Goldstein T, Luby SP, Morse SS, Mazet JAK, **Daszak P\*(Co-corresponding Author)**, Lipkin WI, Estimating viral diversity in Bats. *PNAS* in review.

10. (b) (6)**Additional recent publications of importance to the field (from 190+ total)**

1. Cui J, Han N, Streicker D, Li G, Tang X, Shi Z, Hu Z, Zhao G, Fontanet A, Yi G, Wang L, Jones G, Field HE, **Daszak P\* (Corresponding Author)** & Zhang, S. (2007) Evolutionary relationships between bat coronaviruses and their hosts. *Emerg. Infect. Dis.* 13: 1526-1533
2. Epstein JH, Prakash V, Smith CS, **Daszak P**, McLaughlin AB, Meehan G, Field HE, Cunningham AA (2008). Henipavirus infection in fruit bats (*Pteropus giganteus*), India. *Emerg. Infect. Dis.* 14: 1309-1311.
3. Smith KF, Behrens M, Schloegel LM, Marano N, Burgiel S, **Daszak P\* (Corresponding Author)**. (2009). Reducing the risks of the wildlife trade. *Science* 324:594-595.
4. Epstein J H, Quan PL, Briese T, Street C, Jabado O, Conlan S, Khan SA, Verdugo D, Hossain MJ, Hutchison SK, Egholm M, Luby SP, **Daszak P\* (Co-corresponding Author)**, Lipkin WI. (2010). Identification of GBV-D, a Novel GB-like Flavivirus from Old World Frugivorous Bats (*Pteropus giganteus*) in Bangladesh. *PLoS Pathogens* 6 (7): e1000972.
5. Homaira N, Rahman M, Hossain MJ, Epstein JH, Sultana R, Khan MSU, Podder G, Nahar K, Ahmed B, Gurley ES, **Daszak P**, Lipkin WI, Rollin PE, Comer JA, Ksiazek TG & Luby SP. (2010). Nipah virus outbreak with person-to-person transmission in Thakurgaon, Bangladesh 2007. *Epidemiol & Infection* 138: 1630-1636.
6. Olival KJ, Islam A, Yu M, Anthony SJ, Epstein JH, Khan SA, Khan SU, Cramer G, Wang L-F, Lipkin WI, Luby SP, **Daszak P** (2013). Filovirus antibodies in fruit bats, Bangladesh. *Emerg. Infect. Dis.* 19: 270-273.
7. Sazzad HMS, Hossain MJ, Gurley ES, Ameen KMH, Parveen S, Islam MS, Faruque LI, Podder G, Banu SS, Lo MK, Rollin PE, Rota PA, **Daszak P**, Rahman M, Luby SP. (2013). Nipah virus infection outbreak with nosocomial and corpse-to-human transmission, Bangladesh. *Emerg. Infect. Dis.* 19: 210-217.

**D. Research Support****Ongoing Research Support**

|                                                                                                           |               |                   |
|-----------------------------------------------------------------------------------------------------------|---------------|-------------------|
| NSF                                                                                                       | Daszak (PI)   | 07/01/10-06/30/15 |
| EcoHealthNet - a Research Coordination Network                                                            |               |                   |
| Funding for student exchange and workshops to fuse veterinary science, ecology and human medical sciences |               |                   |
| Role: PI                                                                                                  |               |                   |
| 5R01GM100471                                                                                              | Perrings (PI) | 09/15/11-06/30/15 |
| NIGMS                                                                                                     |               |                   |
| Modeling Anthropogenic Effects in the Spread of Infectious Disease                                        |               |                   |
| Role: Co-Investigator                                                                                     |               |                   |
| 1R56TW009502                                                                                              | Daszak (PI)   | 09/17/12-08/31/14 |
| NIH Fogarty International Center                                                                          |               |                   |
| Comparative Spillover Dynamics of Avian Influenza in Endemic Countries                                    |               |                   |
| Role: PI                                                                                                  |               |                   |

Program Director/Principal Investigator (Last, First, Middle): Daszak, P.

USAID EPT PREDICT Daszak (PI) 10/01/09 – 09/30/14  
 Modeling hotspots for disease emergence and conducting surveillance in wildlife in hotspots for new emerging zoonoses  
 Role: PI on Subcontract

2 R01TW005869 Daszak (PI) 09/01/08 – 08/31/13  
 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: PI

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

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: PI

HDTRA1-13-C-0029 Preston(PI) 01/11/13-01/10/14  
 Office of Naval Research, Defense Threat Reduction Agency  
 Global Rapid Identification Tool (GRIT) for Undiagnosed Emerging Infectious Diseases (EID) Events  
 Role: Co-Investigator

**Completed Research Support**

NSF BCS 0826779 Daszak (PI) 10/01/08 – 03/31/12  
 NSF Human and Social Dynamics  
 AOC - HSD – Collaborative Research: Human-related factors affecting emerging infectious diseases  
 To analyze how socio-economic and environmental drivers predict risk of EIDs  
 Role: PI on lead proposal

R01TW005869 - supplemental Daszak (PI) 09/01/08 – 08/31/11  
 NIH EID (Fogarty International Center)  
 Supplemental funding: Predicting the risk of global H5N1 spread  
 This project will involve mathematical modeling and fieldwork in Bangladesh and China to understand risk of H5N1 spread.  
 Role: PI

NSF EF-062239 Kilpatrick (PI) 09/01/06 - 08/30/11  
 NSF/NIH: Ecology & Evolution of Infectious Diseases  
 Predicting spatial variation in West Nile virus transmission  
 Study interaction among WNV vector, reservoir host populations across an urban-to-rural gradient.  
 Role: Co-PI

R01 TW05869 Daszak (PI) 08/01/02 - 05/31/07  
 NIH/Fogarty International Center  
 Anthropogenic change & emerging zoonotic paramyxoviruses  
 To identify the cause of emergence of Nipah and Hendra viruses in Malaysia and Australia.  
 Role: PI

HSD 0525216 Daszak (PI) 10/15/05 - 10/14/06  
 National Science Foundation: Human and Social Dynamics  
 Collaborative Research: Socio-Economic and Environmental Drivers of Emerging Diseases  
 To analyze patterns of disease emergence globally and produce a broad risk assessment.  
 Role: PI

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

| NAME<br>Zhengli Shi                                                                                                                                                         | POSITION TITLE<br>Senior scientist |       |                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------|----------------|
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>(b) (6)                                                                                                           |                                    |       |                |
| EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.) |                                    |       |                |
| INSTITUTION AND LOCATION                                                                                                                                                    | DEGREE<br>(if applicable)          | MM/YY | FIELD OF STUDY |
| Department of Biology, Wuhan University, China                                                                                                                              | B.S.                               | 1987  | GENETICS       |
| Wuhan Institute of Virology, Chinese Academy of Sciences, China                                                                                                             | M.S.                               | 1990  | VIROLOGY       |
| University Montpellier II, Montpellier, France                                                                                                                              | Ph.D.                              | 2000  | VIROLOGY       |

**A. Personal Statement**

The focus of this project is to understand the risk of coronavirus spillover from bats to people in China, using ecological analyses, fieldwork, receptor binding assays, and modeling approaches. I have worked in lab-based virology for 23 years, specializing in SARS-CoV and SARS-like CoVs since 2002. This includes the discovery of a wide-array of SARS-like coronaviruses in mainland China, including two isolates able to bind to the ACE2 receptor. My lab has established several bat primary cell lines and immortalized cell lines, capacity for pseudovirus generation and SARS-specific binding assays and we have expertise in every laboratory technique in this proposal. I have collaborated with the PI for over 10 years, and have spent time in laboratories in the USA and Europe. My lab will be responsible for diagnosis, genomics and isolation of coronavirus from wild and domestic animals in Southern China and for analyzing their receptor binding domains.

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

1990-1993 Research assistant, Wuhan Institute of Virology, Chinese Academy of Sciences, China  
1993-1995 Research scientist, Wuhan Institute of Virology, Chinese Academy of Sciences, China  
2000- Senior Scientist, Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, China

**Other Experience and Professional Memberships**

2008- Member, American Society of Microbiology  
2001- Member, Chinese Society of Microbiology  
2001- Member, Chinese Society of Biochemistry and Molecular Biology  
2004- Editor board, Chinese Journal of Virology  
2004-2009 Editor board, Virologica Sinica  
2010- Associate Editor, Virologica Sinica

**Honors**

1996 Chinese Government Graduate Scholarship, the Ministry of Education, PR China.  
2003 Natural Science Award (the second rank) of Hubei province, China.  
2004 Outstanding supervisor of graduate student of Hubei province, China.  
2005 Visitor scholarship from the Chinese Academy of Sciences.  
2006 Outstanding scientist of the Chinese Academy of Sciences.

**C. Selected peer-reviewed publications (Selected from 82 peer-reviewed)****Most relevant to the current application**

1. Li, W., Shi Z., Yu M., Ren W., Smith C., Epstein H. J., Zhang S., Wang H., Cramer G., Hu Z., Zhang H., Zhang J., Mceachern J., Field H., Daszak P., Eaton T.B. and Wang L. F. (2005). Bats are natural reservoirs of SARS-like coronaviruses. *Science*, 310(5748), 676-679.
2. Hon, C. C., Lam, T. Y., Shi, Z., Drummond, A. J., Yip, C. W., Zeng, F., Lam, P. Y. and Leung, F. C.. (2008). Evidence of the recombinant origin of a bat severe acute respiratory syndrome (SARS)-like coronavirus and its implications on the direct ancestor of SARS coronavirus. *Journal of Virology*, 82(4), 1819-1826.
3. Yuan, J., Hon, C. C., Li, Y., Wang, D., Xu, G., Zhang, H., Zhou, P., Poon, L. M., Lam, T. T. Leung, F. C. and Shi, Z. (2010). Intra-species Diversity of SARS-Like Coronaviruses (CoVs) in *Rhinolophus sinicus* and Its Implications on the Origin of SARS-CoVs in human. *Journal of General Virology*, 91(4), 1058-1062.
4. Hou, Y., Peng, C., Yu, M., Li, Y., Han, Z., Wang, L-F., Li, F., Shi, Z. (2010). Bat Angiotensin Converting Enzyme-2 Displays Different Receptor Activity to Severe Acute Respiratory Syndrome Coronavirus Entry. *Archives of Virology*, 155(10), 1563-1569.
5. Wang, J., Wang, L-F. and Shi, Z. (2008). Construction of a non-infectious SARS coronavirus replicon for application in drug screening and analysis of viral protein function. *Biochemical and Biophysical Research Communications*, 374(1), 138-142.

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

1. Ren, W., Li, W., Yu, M., Hao, P., Zhang, Y., Zhou, P., Zhang, S., Zhao, G., Zhong, Y., Wang, S., Wang, L. F. and Shi, Z. (2006). Full genome sequences of two SARS-like coronaviruses in horseshoe bats and genetic variation analysis. *Journal of General Virology*, 87(11), 3355-3359.
2. Li, Y., Wang, J., Hickey, A. C., Zhang, Y., Li, Y., Wu, Y., Zhang, H., Yuan, J., Han, Z., McEachern, J., Broder, C. C., Wang, L. F. and Shi, Z. (2008). Potential nipah virus infection in Chinese bats. *Emerging Infectious Diseases*, 14(12), 1974-1976.
3. Ren, W., Qu, X., Li, W., Han, Z., Yu, M., Zhang, S., Wang, L. F., Deng, H., Shi, Z. (2008). Difference in receptor usage between SARS coronavirus and SARS-like coronavirus of bat origin. *Journal of Virology*, 82(4), 1899-1907.
4. Zhou, P., Han, Z., Wang, L.F. and Shi, Z. (2009). Immunogenicity difference between the SARS coronavirus and the bat SARS-like coronavirus spike (S) proteins. *Biochemical and Biophysical Research Communications*, 387(2), 326-329.
5. Li, Y., Ge X., Hon C. C., Zhang H., Zhou P., Zhang Y., Wang L. F. and Shi Z. (2010). Prevalence and Genetic Diversity of Adeno-Associated Viruses in Bats, China. *Journal of General Virology*, 91(10), 2601-2609.
6. Zhang Y., Zhang H., Dong X., Yuan J., Zhang H., Yang X., Zhou Peng., Ge X., Li Y., Wang L-F, and Shi Z (2010). Hantavirus Outbreak Associated with Laboratory Rats in Yunnan, China. *Infection, Genetics and Evolution*, 10(5): 638-644.
7. Li, Y., Ge X., Zhang H., Zhou P., Zhu Y., Zhang Y., Yuan J., Wang L-F., Shi Z. (2010). Host Range, Prevalence and Genetic Diversity of Adenoviruses in Bats. *Journal of Virology*, 84(8), 3889-3897.
8. Yu, M., Tachedjian, M., Cramer, G., Shi, Z. and Wang, L.F. (2010). Identification of key amino acid residues required for horseshoe bat angiotensin-I converting enzyme 2 to function as a receptor for severe acute respiratory syndrome coronavirus. *Journal General Virology*, 91(7), 1708-1712.
9. Ge, X., Li, Y., Yang, X., Zhang, H., Zhou, P., Zhang, Y. & Shi, Z. (2012). Metagenomic analysis of viruses from bat fecal samples reveals many novel viruses in insectivorous bats in china. *Journal of Virology*, 86, 4620-4630.
10. Zhou, P., Li, H., Wang, H., Wang, L. F., Shi, Z. (2012). Bat severe acute respiratory syndrome-like coronavirus ORF3b homologues display different interferon antagonist activities. *Journal General Virology*, 93, 275-281.

#### **D. Research Support**

##### **Ongoing Research Support**

30970137 National Natural Science Foundation of China Shi (PI) 01/01/2010-12/31/2012  
Metagenomic analysis of bat intestinal viruses  
Role: PI

2011CB504700 National Basic Research program of China Shi (PI) 01/01/2011-12/31/2015

Mechanism of interspecies transmission of zoonotic viruses

Role: PI

81290341 National Natural Science Foundation of China Shi (PI) 01/01/2013-12/31/2017

Genetic diversity, identification and pathogenesis of bat viruses

Role: PI

**Completed Research Support**

2005CB523004 National Basic Research program of China Shi (PI) 01/01/2006-12/31/2010

Interspecies transmission mechanism of zoonotic viruses

Role: PI

2009ZX10004-109 Key project of infectious diseases Shi (PI) 01/01/2009-12/31/2010

Rapid and high throughput diagnostic methods for emerging infectious viral pathogens

Role: PI

## BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

|                                                                                                                                                                             |                           |       |                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------|-------------------------------|
| NAME<br>Zhang, Shuyi                                                                                                                                                        | POSITION TITLE<br>Dean    |       |                               |
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>(b) (6)                                                                                                           |                           |       |                               |
| EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.) |                           |       |                               |
| INSTITUTION AND LOCATION                                                                                                                                                    | DEGREE<br>(if applicable) | MM/YY | FIELD OF STUDY                |
| Northeast Normal University, China                                                                                                                                          | B.Sc                      | 07/87 | Biology                       |
| University of Paris XIII, France                                                                                                                                            | D.E.A.                    | 10/90 | Ethology                      |
| University Pierre & Marie Curie, France                                                                                                                                     | Ph.D.                     | 12/94 | Primatology, Tropical Ecology |

### A. Personal Statement

The goal of the current proposal is to work on the ecology and evolutionary biology of a coronaviruses from wildlife, with special emphasis on China. My background is ideally suited to this work because I am originally trained as a wildlife biologist, but have been working on the ecology and evolutionary biology of zoonoses in wildlife for the past decade. My career as a wildlife biologist began with a Ph.D in France on the behavioral ecology of capuchin monkeys (*Cebus apella*) in primary forest of French Guiana. In 1995, I returned to China, working on golden monkeys (*Rhinopithecus*) at the Institute of Zoology, Chinese Academy of Sciences. At the same time, I began to work on the behavioral ecology of bats and rapidly became the leading bat researcher in China, building a large, well-funded group working on the phylogeny, genetics and ecology of bats. In 2003, during the early outbreak of SARS epidemic, I was one of the few Chinese researchers hypothesizing that SARS must have originated from wild birds or mammals, and I became closely involved in the work of the WHO veterinary team investigating potential wildlife reservoirs for SARS. I continued this work with Drs Zhengli Shi, Peter Daszak and Jon Epstein after the WHO team had left, and discovered that bats are the natural reservoir of SARS-like CoVs. After we published our results in *Science* in 2005, I continued to work on bat CoVs, bat genetics, molecular biology and immunology. I have worked actively with the EcoHealth Alliance and with the Wuhan Institute of Virology, and am involved in most of the preliminary data that is listed in the current application. I also act as the main, on-the-ground contact for EcoHealth Alliance research in China, and am Country Coordinator for the USAID-EPT PREDICT program. During the past decade, I have demonstrated my capacity to provide access to some of the most sensitive fieldwork sites in China and collaborate with US institutions in this work. This includes: collaborative work at Xinghai Lake, where we successfully isolated the first H5N1 from wild birds; work on hunter-trader cohorts in the wet markets of Guangzhou, where we are collaborating with EcoHealth Alliance to identify novel pathogens spilling over from wildlife to people; and the work we conducted on bat SARS-like CoVs in 2003/4, which involved the export of samples from wildlife into foreign collaborators labs for sequencing and pathogen discovery. In my current capacity as Dean of a 3-institute collaboration at ECNU, I have unique capability to mobilize resources, and work within my large network of collaborators to facilitate the current project.

### B. Positions and Honors

#### Positions and Employment

|           |                                                                                               |
|-----------|-----------------------------------------------------------------------------------------------|
| 2011-     | Dean, Institutes for Advanced Interdisciplinary Research, East China Normal University, China |
| 2010-     | Country Coordinator, USAID-EPT PREDICT                                                        |
| 2006-2008 | Professor, School of Life Science, East China Normal University, China                        |
| 1997-2006 | Research Professor, Institute of Zoology, Chinese Academy of Sciences, China                  |
| 1995-1997 | Associate Research Professor, Institute of Zoology, Chinese Academy of Sciences, China        |
| 1995      | Assistant Research Professor, Institute of Zoology, Chinese Academy of Sciences, China        |

#### Other Experience and Professional Memberships

|       |                                                                                  |
|-------|----------------------------------------------------------------------------------|
| 1997- | Chairman of China's Primate Specialist Group, Species Survival Commission, World |
|-------|----------------------------------------------------------------------------------|

- Conservation Union (IUCN-SSC)  
1999- Secretary General of Bat Specialists Group of China's Mammalogical Society  
2000- Member of Chinese National Committee for International Union of Biological Sciences

### **Honors**

- 1989 Fellowship from the China's Education Ministry for students abroad  
1991 Fellowship from the French Government for Chinese students  
1995 Research grant under the "100 Talent Programme" sponsored by the Chinese Academy of Sciences  
1998 Allowance of the State Department for research and technology  
1999 Research grant under the "Young Scientist" sponsored by the Chinese Academy of Sciences  
2000 "Excellent Young Researcher Grant" of the National Natural Science Foundation of China  
2001 "Young Scientist" award of the Chinese Academy of Sciences  
2006 Nation Award (class II) for Science and Technology

### **C. Peer-reviewed publications** (selected from over 180 peer-reviewed publications)

#### **Most relevant to the current application**

1. He, J.F., Peng, G.W., Min, J., Yu, D.W., Liang, W.J., Zhang, S.Y., Xu, R.H., Zheng, H.Y., Wu, X.W., Xu, J., Fang, L., Zhang, X., Li, H., Yan, X.G., Lu, J.H., Hu, Z.H., Huang, J.C., Wan, Z.Y., Lin, J.Y., Song, H.D., Wang, S.Y., Zhou, X.J., Zhang, G.W., Guo, B.W., Zheng, H.J., Zhang, X.L., Zheng, K., Wang, B.F., Fu, G., Hou, J.L., Wang, X.N., Chen, S.J., Hao, P., Tang, H., Ren, S.X., Zhong, Y., Guo, Z.M., Liu, Q., Miao, Y.G., Kong, X.Y., He, W.Z., Li, Y.X., Chen, Z., Wu, C-I, Zhao, G.P., Chiu, R.W.K., Chim, S.S.C., Tong, Y.K., Chan, P.K.S., Tan, J.S., Lo, Y.M.D. (2004). Molecular evolution of the SARS-coronavirus during the course of the SARS epidemic in China. *Science*, 303, 1666-1669.
2. Li, W.D., Shi, Z.L., Yu, M., Ren, W.Z., Smith, C., Epstein, J., Wang, H.Z., Cramer, G., Hu, Z.H., Zhang, H.J., Zhang, J.H., McEachern, J., Field, H., Daszak, P., Eaton, B.T., Zhang, S.Y., Wang, L.F. (2005). Bats are natural reservoirs of SARS-like coronaviruses. *Science*, 310, 676-679.
3. Tang, X.C., Zhang, J.X., Zhang, S.Y., Wang, P., Fan, X.H., Li, L.F., Li, G., Dong, B.Q., Liu, W., Cheung, C.L., Xu, K.M., Song, W.J., Vijaykrishna, D., Poon, L.L.M., Peiris, J.S.M., Smith, G.J.D., Chen, H., Guan, Y. (2006). Prevalence and genetic diversity of coronaviruses in bats from China. *Journal of Virology*, 80, 7481-7490.
4. Ren, W.Z., Qu, X.X., Li, W.D., Han, Z.G., Yu, M., Zhou, P., Zhang, S.Y., Wang, L.F., Deng, H.K., Shi, Z.L. (2008). Difference in receptor usage between SARS coronavirus and SARS-like coronavirus of bat origin. *Journal of Virology*, 82, 1899-1907.
5. Tang, X.C., Li, G., Vasilakis, N., Zhang, Y., Shi, Z.L., Zhong, Y., Wang, L.F., Zhang, S.Y. (2009). Differential stepwise evolution of SARS Coronavirus functional proteins in different host species. *BMC Evolutionary Biology* 9, 52, doi:10.1186/1471-2148-9-52.

#### **Additional recent publications of importance to the field**

1. Wang, L.F., Shi, Z.L., Zhang, S.Y., Field, H., Daszak, P., Eaton, B.T. (2006). Review of Bats and SARS. *Emerging and Infectious Disease*, 12, 1834-1840.
2. Li, G., Jones, G., Rossiter, S., Chen, S.F., Parsons, S., Zhang, S.Y. (2006). Phylogenetics of small horseshoe bats from East Asia based on mitochondrial DNA sequence variation. *Journal of Mammalogy*, 87, 1234-1240.
3. Ren, W.Z., Li, W.D., Yu, M., Hao, P., Zhou, P., Zhang, S.Y., Zhao, G.P., Zhong, Y., Wang, S.Y., Wang, L.F., Shi, Z.L. (2006). Full-length genome sequences of two SARS-like coronaviruses in 4 horseshoe bats and genetic variation analysis. *Journal of General Virology*, 87, 3355-3359.
4. Cui, J., Han, N.J., Streicker, D., Li, G., Tang, X.C., Shi, Z.L., Hu, Z.H., Zhao, G.P., Guan, Y., Wang, L.F., Field, H., Jones, G., Daszak, P., Zhang, S.Y. (2007). Evolutionary relationships between bat coronaviruses and their hosts. *Emerging and Infectious Disease*, 13, 1526-1532.
5. Rossiter, S.J., Benda, P., Dietz, C., Zhang, S.Y., Jones, G. (2007). Rangewide phylogeography in the greater horseshoe bat inferred from microsatellites: implications for population history, taxonomy and conservation. *Molecular Ecology*, 16, 4699-4714.
6. Cui, J., Counor, D., Shen, D., Sun, G.Y., Deubel, V., Zhang, S.Y. (2008). Detection of Japanese



encephalitis virus antibodies in bats, Southern China. American Journal of Tropical Medicine and Hygiene, 78, 1007-1011.

7. Zhang, J.S., Jones, G., Zhang, L.B., Zhu, G.J., Zhang, S.Y. (2010). Recent surveys of bats (*Mammalia: Chiroptera*) from China II. Pteropodidae. Acta Chiropterologica, 12, 103-116.
8. Liu, Y., Cotton, J.A., Shen, B., Han, X.Q., Rossiter, S.J., Zhang, S.Y. (2010). Convergent sequence evolution between echolocating bats and dolphins. Current Biology, 20, R53-54.
9. Zhang, L.B., Parson, S., Daszak, P., Wei, L., Zhu, G.J., Zhang, S.Y. (2010). Variation in the abundance of ectoparasite mites in relation to the reproduction status, age, sex and size of flat-headed bats. Journal of Mammalogy, 91, 136-143.
10. Shen, B., Han, X.Q., Jones, G., Rossiter, S.J., Zhang, S.Y. (2013). Adaptive evolution of Myo6 Gene in Old World Fruit Bats (Family: Pteropodidae). PLOS ONE, 8(4), doi: 10.1371/journal.pone.0062307

#### D. Research Support

##### Ongoing Research Support

(b) (4) Morse (PI) 10/01/09-09/30/14  
PREDICT-Wildlife SMART Surveillance/PREDICT Project to pre-empt at the earlier stages possible, zoonotic diseases that impose significant threat to public health.  
Role: Collaborator

(b) (4) Zhang (PI) 01/01/11-12/30/13  
(b) (4): Surveillance Emerging Infectious Diseases This project is to conduct surveillance in wildlife in hotspots for new emerging zoonoses.  
Role: PI

(b) (4) Zhang (PI) 01/01/11-12/30/13  
(b) (4): Study of the Evolution of SARS Coronavirus This project is to study the evolutionary relationships between bat coronaviruses and their hosts.  
Role: PI

##### Completed Research Support

(b) (4) Zhang (PI) 01/01/09-12/30/12  
(b) (4)  
(b) (4): Research on biological characteristics of Bats.  
Role: PI

(b) (4) Zhang (PI) 01/01/10-12/30/12  
Changjiang Scholars and Innovative Research Team in University in China: Studying and Monitoring Wildlife and Zoonosis in Eastern China This project is to identify new viruses from wildlife in Eastern China, and to examine the pathogenicity and infectiousness for these novel pathogens.  
Role: PI

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

| NAME<br>Ke, ChangWen                                                                                                                                                               |                                  | POSITION TITLE<br>Director, Institute of Pathogenic Microbiology<br>Guangdong Center for Disease Control and<br>Prevention |                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| eRA COMMONS USER NAME (credential, e.g., agency login)                                                                                                                             |                                  |                                                                                                                            |                                       |
| EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)</i> |                                  |                                                                                                                            |                                       |
| INSTITUTION AND LOCATION                                                                                                                                                           | DEGREE<br><i>(if applicable)</i> | MM/YY                                                                                                                      | FIELD OF STUDY                        |
| West China Medical University                                                                                                                                                      | M.P.H.                           | 1984                                                                                                                       | Public Health                         |
| West China Medical University                                                                                                                                                      | B.S.                             | 1989                                                                                                                       | Medicine                              |
| Sun Yensen University                                                                                                                                                              | M.D.                             | 2001                                                                                                                       | Biochemistry and<br>Molecular Biology |

**A. Personal Statement.**

I have worked in public health and infectious disease research for more than 10 years. As Director of the Institute of Pathogenic Microbiology at Guangdong CDC I have been involved in the study and control of several emerging zoonotic infections, including SARS CoV and most recently, H7N9 avian influenza. Our work under the Guangdong Department of Health and with several Chinese universities and international collaborators has established several syndromic disease surveillance programs and collaborative infectious disease research programs including Chikungunya, enterovirus 71, Avian influenza H7N9 and H5N1, and SARS CoV. Most recently, through partnership with the USAID PREDICT program, we have augmented our lab's ability to identify zoonotic agents in people highly exposed to wildlife such as those working in live animal markets. This ongoing surveillance program has led to the identification of people who have been exposed to animal pathogens, including SARS CoV, and supports the initiative to extend this type of surveillance to other provinces in China. I believe that there is strong evidence that spillover of animal pathogens to people is occurring in China and MERS CoV in the Middle East shows that we should pay more attention to bat coronaviruses. Given the technical expertise and capacity for disease detection at the microbiology lab at Guangdong CDC, I have high confidence that we will be able to contribute to our understanding of coronavirus circulation in human populations and to determine the risk of new CoVs emerging in China.

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

|           |                                                                                                          |
|-----------|----------------------------------------------------------------------------------------------------------|
| 1989-2000 | Doctor in Charge, Health & Epidemic Prevention Station of Guangdong Province                             |
| 1994-1996 | Participant, Department II of Virology, National Institute of Infectious Diseases, Japan                 |
| 2003-2004 | Visiting researcher, Virology Department, National Institute of Infectious Diseases, Japan               |
| 2004-     | Director, Institute of Microbiology Center for Disease prevention and Control, Guangdong province, China |

**Other Experience and Professional Memberships**

|       |                                                  |
|-------|--------------------------------------------------|
| 2004- | Member of National expert committee of Influenza |
| 2006- | Member of National Biosafety expert Committee    |

## C. Selected Peer-reviewed Publications

### Most relevant to the current application

1. Mo, H., Zeng, G., Ren, X., Li, H., Ke, C.W., Tan, Y., Cai, C., Lai, K., Chen, R., Chan-Yeung, M., Zhong, N. (2006). Longitudinal profile of antibodies against SARS-coronavirus in SARS patients and their clinical significance. *Respirology*. Jan; 11(1):49-53.
2. Qiaoli, Z.\*, Jianfeng, H., De, W., Zijun, W., Xinguang, Z., Haojie, Z., Fan, D., Zhiquan, L., Shiwen, W., Zhenyu, H., Yonghui, Z., Ke, C.W., Yuan D., Liang W., Li D., Chen, P. (2012). Maiden Outbreak of Chikungunya in Dongguan City, Guangdong Province, China: Epidemiological Characteristics. *PLOS ONE*, 7(8):1-8
3. Wu, D., Zheng H., Li, H., Monagin, C., Guo, X., Liu, L., Zeng, H., Fang, L., Mo, Y., Zhou, H., Zhang, H., Kou, J., Long, C., Hiromu, Y., & Ke, C.W. (2012). Phylogenetic and molecular characterization of Coxsackievirus A24 variant isolates from a 2010 acute hemorrhagic conjunctivitis outbreak in Guangdong, China *Virology Journal*, 9.41: 1-9
4. Guan, D., van der Sanden, S., Zeng, H., Li, W., Zheng, H., Ma, C., Su, J., Liu, Z., Guo, X., Zhang, X., Liu, L., Koopmans, M., Ke, C.W.\* (2012) Population Dynamic and Genetic Diversity of C4 Strains of Human Enterovirus 71 in Mainland China, 1998-2010. *PLOS ONE*, 7(9):1-8
5. Yang, F., He, J.\*, Zhong, H., Ke, C.W., Zhang, X., Hong, T., Ni, H., Lin, J. (2012). Temporal Trends of Influenza A (H1N1) Virus Seroprevalence following 2009 Pandemic Wave in Guangdong, China: Three Cross-Sectional Serology Surveys. *PLOS ONE*, 7(6):1-8

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

1. Ke, C.W., Li T.C., Takeda, N. (2005). Positively Charged Amino Acid Residues of VP1 Capsid Protein of Human Polyomavirus BK Influence on the Formation of Virus-like Particles Generated by Recombinant Baculoviruses. *Virologica Sinica*, 21(1)20-23
2. Ke C.W., Zheng, K., Zhang, X., Zhou H.Q., Duan J.H., Lin L.F. (2005). Detection of Dengue virus by real-time polymerase chain reaction with TaqMan MGB probe. *Chinese J Zoonosis*, 21(8)716-720
3. Yan, J., Ke, C.W., Zheng, H., et al. (2006). Rapid diagnosis and Identification of Human Enteroviruses by sequencing VP4 gene. *Chinese Journal of Vaccines and Immunization*. 12(6)469-471
4. Zheng, H.Y., Liu L., Guo, X., Ke, C.W. (2006). A Comparative Study of Three IgM ELISA Kits for Measles Detection. *Journal of Tropical Medicine*. (08) 897-899
5. Ke, C.W., Deng, F. (2007). Surveillance system based on hospital and laboratory network to discover emerging viral diseases *Journal Pathogen Biology*, 2(1): 75-76
6. Ke, C.W., Zou, L.R., Yan, J. (2007). Control strategy for emerging Zoonosis. *Chinese J Zoonosis*, 23(1)92-93.
7. Li, B., Tan, H., Wang, D., et al. (2010). Phenotypic and genotypic characterization of vibrio Cholera O139 of clinical and aquatic isolation in China. *Curr. Microbiol*.
8. Ding, X., Jiang, L., Ke, C.W. et al. (2010). Amino acid sequence analysis and identification of mutations under positive selection in Hemagglutinin of 2009 influenza A (H1N1) isolates. *Virus Genes*, 41:329-340
9. Sun, L.M., Zheng, H.Y., Zheng, X.Z. et al. (2011). An enterovirus 71 epidemic in Guangdong province of China, 2008: Epidemiological, Clinical, and Virogenic manifestations. *Jpn. J. Infect. Dis.*, 64:13-18
10. Su, S., Ning, Z.Y., Zhu, W.J., Jiao, P.R., Ke, C.W., Qi, W.B., Huang, Z., Tian, J., Cao, L., Tan, L.K., Shao, Z.W., Liang, H.B., Huang, W.M., Liao, M., Li, S.J., Zhang, G.H. (2013). Lack of evidence of avian-to-human transmission of avian influenza A (H5N1) virus among veterinarians, Guangdong, China, 2012. *Journal of Clinical Virology*. 56(4), 365-366.

## D. Research Support

### Ongoing Research Support

(b) (4)

2012-2015

National Major Projects of Major Infectious Disease Control and Prevention: the Ministry of Science and Technology of the People's Republic of China

## Completed Research Support

China–U.S. 2009-2012  
Collaborative Program on Emerging and Re-Emerging Infectious Diseases  
Enhanced surveillance on Salmonella in Guangdong province.

30972591 2010-2011  
National Natural Science Foundation of China  
Epidemiology and molecular mechanism of virulence mutation of dengue viruses in Guangdong

World Bank 2005  
Establish Laboratory Network for Emergency Response and Surveillance of Infectious Diseases in Guangdong Province and Training.

WHO 07.03.01.AW.01.  
Epidemiological study on Transmission on Influenza A Virus from Animals to Human

WHO grant: 07.02.01.AW.01.  
Surveillance on emerging and reemerging infectious diseases pathogen in Guangdong Province

## BIOGRAPHICAL SKETCH

|                                                                   |                                                                        |
|-------------------------------------------------------------------|------------------------------------------------------------------------|
| NAME<br>Jonathan H. Epstein                                       | POSITION TITLE<br>Associate Vice President & Asia Regional Coordinator |
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>(b) (6) |                                                                        |

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)

| INSTITUTION AND LOCATION                     | DEGREE<br>(if applicable) | YEAR(S) | FIELD OF STUDY            |
|----------------------------------------------|---------------------------|---------|---------------------------|
| Brandeis University, MA                      | BA                        | 1996    | Biology                   |
| Tufts University, Sch. Vet. Med., Boston, MA | DVM                       | 2002    | Wildlife Med., Intl. Med. |
| Tufts University, Sch. Vet. Med., Boston, MA | MPH                       | 2002    | Epidemiology              |
| Tufts University, Sch. Vet. Med., Boston, MA | Cert Intl Med             | 2002    | Zoonotic Diseases         |

### A. Personal Statement

The goal of the proposed research is to investigate the ecology, evolutionary history and transmission dynamics of mammalian coronaviruses at the human-animal interface. Specifically, we will conduct field studies in China to obtain high quality samples from bats and other mammals found in wet market systems and identify and characterize known and novel coronaviruses. We will analyze the patterns of coronavirus transmission among bats and other wildlife, and the risk of spillover to humans. This research will address fundamentally important issues about the diversity of coronaviruses in mammalian hosts and the risk of inter-species transmission and emergence in human populations. My research has focused on the epidemiology and ecology of emerging zoonotic viruses carried by bats (Nipah virus, Ebolavirus, and SARS CoV), and other wildlife, and the drivers that lead to emergence. My work on SARS CoV ecology, in collaboration with co-investigators Daszak (PI), Zhang and Shi led to the discovery of several SARS-Like coronaviruses in bats, which appear to be ancestral to SARS-CoV and most recently which utilize the same ACE2 receptor as SARS CoV, suggesting direct spillover to humans is possible. Recently, I led a field team in Saudi Arabia in collaboration with the KSA Ministry of Health, to identify the animal origins of the newly discovered **MERS CoV**. I continue to be involved in this ongoing investigation along with co-investigators Daszak and Olival. I have also conducted pathogen discovery work in bats, utilizing next generation sequencing technologies, which led to the discovery of a novel flavivirus related to Hepatitis C virus (GBV D). This team brings a high level of expertise in disease ecology, epidemiology, and pathogen discovery, and includes China's leading experts on wildlife zoonoses in partnership with key provincial CDCs. Our team has maintained a highly productive collaboration under several NIH and non-federally funded research projects, generating peer-reviewed papers in high impact journals (including *Science*, *PNAS*, and *PLoS Pathogens*). We have proven through previous work that we can manage logistically challenging projects involving people, wildlife, and animals in the wet markets in China, which gives this proposal a high likelihood of success. Under several federal awards, I have successfully managed the field and molecular investigations of zoonotic viruses in bats in several countries including Saudi Arabia, China, India, Malaysia, Thailand, and Bangladesh, all of which have logistical and political challenges. Using the bat and human samples we have already collected; and new animal samples we propose to collect; we will have the resources available to achieve the aims of this proposal.

### B. Positions and Honors

#### Positions and Employment

|       |                                                                                                 |
|-------|-------------------------------------------------------------------------------------------------|
| 1999  | Intern, Brisbane South Public Health Unit & DPI Queensland Animal Research Institute, AUS.      |
| 2002  | Extern, Division of Viral and Rickettsial Diseases, CDC, Atlanta, GA                            |
| 2002  | Veterinary Intern, Small animal emergency and critical care, Ocean State Vet. Spec., RI         |
| 2003- | Senior Research Scientist, EcoHealth Alliance, New York, NY.                                    |
| 2003- | Adjunct Faculty, Ecology, Columbia Univ., NY & Tufts University Sch. of Vet. Med., MA.          |
| 2006- | Adjunct Faculty, Mailman School of Public Health, Columbia Univ, NY                             |
| 2007- | Adjunct Asst. Clinical Professor, Public Health & Family Med, Tufts Univ School of Medicine, MA |

- 2008- Postdoctoral fellow, Center for Infection and Immunity, Columbia University, NY, Adjunct Associate Professor, Mt. Sinai School of Medicine
- 2008- Review Editor - *EcoHealth*
- 2009- Associate Vice President, Conservation Medicine Program EcoHealth Alliance, NY
- 2009- Executive Director, Consortium for Conservation Medicine, EcoHealth Alliance, NY
- 2009- Asia Regional Coordinator, USAID EPT (PREDICT)
- 2011- Admissions committee, Tufts University Masters in Conservation Medicine degree program
- 2012- Board of Directors, International Association of Ecology and Health; Scientific Advisory Board, Lube Bat Conservancy

### **Other Experience and Professional Memberships**

- 1998- Member: American Veterinary Medicinal Association, American Association of Zoo Vets, Wildlife Disease Association, New York Academy of Sciences,
- 2003- Member, IUCN Veterinary Specialist Group
- 2004 Invited speaker, WHO, Emerging Zoonotic Diseases Working Group meeting
- 2004 Member and Health Advisor, IUCN Bat Specialist Group; Advisory committee, Suffolk County Board of Public Health; International Assoc. Ecology and Health
- 2006 Member, Delta Omega Public Health Honors Society
- 2007- Leader, Vertebrate Health Task Force, Smithsonian Institution Geological Earth Observatory Program (SIGEO)
- 2010- Scientific Committee Member, DIVERISTAS ecoHEALTH cross-cutting network (ICSU-UNESCO)
- 2008-13. (selected) Invited presentations: University of Malaysia, Sarawak – Emerging zoonoses; **IOM-NAS** Committee on Achieving sustainable global capacity for surveillance and response to emerging infectious diseases; Nipah virus colloquium, University Malaya, Kuala Lumpur, Malaysia, Nipah virus symposium, American Society for Tropical Medicine & Hygiene; International Bat Research Symposium, Prague; American Society of Microbiology, Washington, DC; Australian Animal Health Laboratory (AAHL), Geelong; International Meeting on Emerging Diseases (IMED), Vienna; **IOM** meeting on MERS CoV and H7N9, Washington DC.

### **Honors**

- 2002 First recipient, Certificate of International Veterinary Medicine, Tufts University Sch. Vet. Med.
- 2002 Hills award for excellence in veterinary clinical nutrition
- 2002 Sylvia Mainzer award for outstanding achievement in the field of public health
- 2004 NIH Loan Repayment Award (competitive award for Nipah virus research)
- 2006 Inducted into Delta Omega Honor Society for Public Health (Alpha Rho Chapter – 1<sup>st</sup> alumni inductee; 1<sup>st</sup> Inaugural Keynote Speaker)
- 2007 Outstanding Alumnus award, Tufts Cummings School of Veterinary Medicine
- 2012 Young Alumni Achievement Award, Tufts University (selected from all alumni who graduated in past 10 yrs)

### **D. Selected peer-reviewed publications (from 45). \* indicates corresponding author**

#### **Most relevant to the application (in chronological order)**

1. Li, W., Shi, Z., Yu, M., Ren, W., Smith, C., Epstein, J.H., Wang, H., Crameri, G., Hu, Z., Zhang, H., Zhang, J., McEachern, J., Field, H., Daszak, P., Eaton, B.T., Zhang, S. & Wang, L-F. (2005). Bats are natural reservoirs of SARS-like coronaviruses. *Science* 310: 676-679.
2. Epstein, J.H.\*, Quan, P.L., Briese, T., Street, C., Jabado, O., Conlan, S., Khan, S.A., Verdugo, D., Hossain, M.J., Hutchison, S.K., Egholm, M., Luby, S.P., Daszak, P., & Lipkin, W.I. (2010). Identification of GBV-D, a Novel GB-like Flavivirus from Old World Frugivorous Bats (*Pteropus giganteus*) in Bangladesh. *PLoS Pathogens* 6(7): e1000972. doi:10.1371/journal.ppat.1000972.
3. Anthony, S.J, Ojeda-Flores, R., Rico-Chávez, O., Navarrete-Macias, I., Zambrana-Torrel, C.M., Rostal, M.K., Epstein, J.H., Tipps, T., Liang, E., Sanchez-Leon, M., Sotomayor-Bonilla, J., Aguirre, A.A., Ávila, R., Medellín, R.A., Goldstein, T., Suzán, G., Daszak, P., Lipkin, W.I. (2013). Coronaviruses in bats from Mexico. *J. Gen Virol.* Published ahead of print January 30, 2013, doi:10.1099/vir.0.049759-0

4. Wacharapluesadee, S., Sintunawa, C., Kaewpom, T., Khongnomnan, K., Olival, K.J., Epstein, J.H., et al. (2013). Group C betacoronavirus from bat guano 11 fertilizer, Thailand. *Emerg Infect Dis.* Aug. 12 <http://dx.doi.org/10.3201/eid1908.130119>
5. Quan, P.L., Firth, C., Conte, J.M., Williams, S.H., Zambrana-Torrel, C.M., Anthony, S.J., Ellison, J.A., Gilbert, A.T., Kuzmin, I.V., Niezgod, M., Osinubi, M.O.V., Recuenco, S., Markotter, W., Breiman, R.F., Kalemba, L., Malekani, J., Lindblade, K.A., Rostal, M.K., Ojeda-Flores, R., Suzan, G., D., Lora B., Blau, D.M., Ogunkoya, A.B., Alvarez C., Danilo A., Moran, D., Ngam, S., Akaibe, D., Agwanda, B., Briese, T., Epstein, J.H., Daszak, P., Rupprecht, C.E., Holmes, E.C., & Lipkin, W.I. (2013). Bats are a major natural reservoir for hepaciviruses and pegiviruses. *PNAS.* doi:10.1073/pnas.1303037110

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

1. Epstein, J.H.\* , Field, H.E., Luby, S., Pulliam, J., & Daszak, P. (2006). Nipah Virus: Impact, Origins, and Causes of Emergence. *Current Infectious Disease Reports* 8: 59-65.
2. Epstein, J.H.\* , Rahman, S.A., Zambriski, J.A., Halpin, K., Meehan, G., Jamaluddin, A.A., Hassan, S.S., Field, H.E., Hyatt, A.D., Daszak, P. & HERG. (2006). Feral cats (*Felis catus*) as possible vectors for Nipah virus. *Emerging Infectious Diseases.* 12: 1178-1179.
3. Field, H.E., Wang, L.F., Zhang, S., Daszak, P., Smith, C.S., Epstein, J.H., Shi, Z. (2007). Searching for the natural reservoir of the SARS virus. *Preventive Veterinary Medicine.* 81(1-3): 216-216 Sp. Issue.
4. Epstein, J.H.\* , Prakash, V., Smith, C.S., Daszak, P., McLaughlin, A.B., Meehan, G., Field, H.E., and Cunningham, A.A. (2008). Evidence for Henipavirus infection in Indian *Pteropus giganteus* (Chiroptera: Pteropodidae) fruit bats. *Emerging Infectious Diseases* 14(8). 1309-11.
5. Epstein, J.H.\* , Olival, K.J., Pulliam, J.R.C., Smith, C., Westrum, J., Hughes, T., et al. (2009). *Pteropus vampyrus*, a hunted migratory species with a multinational home-range and a need for regional management. *Journal of Applied Ecology.* 46(5):991-1002.
6. Epstein, J.H.\* , Price, J.T. (2009). The Significant but Understudied Impact of Pathogen Transmission from Humans to Animals. *Mount Sinai Journal of Medicine* 76(5):448-55.
7. Homaira, N., Rahman, M., Hossain, M. J., Epstein, J.H., Sultana, R., Khan, M.S.U., Podder, G., Nahar, K., Gurley, E.S., Daszak, P., Lipkin W.I., Rollin, P.E., Comer, J.A., Ksiazek, T.G., Luby, S.P. (2010). Nipah outbreak with person-to-person transmission in Thakurgaon, Bangladesh, 2007. *Epidemiology and Infection.* 138: 1630-1636.
8. Sohayati, A., Rahman, Hassan, S.S, Olival, K.J., Mohamed, M., Chang, L-Y., Hassan, L., Suri, A.S., Saad, N.M., Shohaimi, S.A., Mamat, Z.C., Epstein, J.H., Field, H.E., Daszak, P., & HERG. (2010). Genetic characterization of Nipah virus isolated from naturally infected *Pteropus vampyrus* in Malaysia. *Emerging Infectious Diseases.* 16(12).1990-3.
9. Pulliam, J.R., Epstein, J.H., Dushoff, J., Rahman, S.A., Meehan, G., Bunning, M., HERG, Jamaluddin, A.A., Hyatt, A.D., Field, H.E., Dobson, A.P. & Daszak, P. (2011). Agricultural intensification, priming for persistence, and the emergence of Nipah virus: a lethal bat-borne zoonoses. *Journal of the Royal Society, Interface.* Doi:10.1098/rsif.2011.0223 (journal's most cited article in 2012)
10. Halpin, K., Hyatt, A.D., Fogarty, R., Middleton, D., Bingham, J., Epstein, J.H., Rahman, S.A., Hughes, T., Smith, C., Field, H.E., Daszak, P., & the Henipavirus Ecology Research Group. (2011). Pteropid Bats are Confirmed as the Reservoir Hosts of Henipaviruses: A Comprehensive Experimental Study of Virus Transmission. *Am J Trop Med Hyg.* 85:946-951; doi:10.4269/ajtmh.2011.10-0567
11. Sohayati, R., Hassan, L., Sharifah, S.H., Lazarus, K., Zaini, C.M., Epstein, J.H., Naim, N.S., Field, H. E., Arshad, S.S., Aziz, J.A., & Daszak, P. (2011). Evidence for Nipah virus recrudescence and serological patterns of captive *Pteropus vampyrus*. *Epidemiology and Infection.* 139, pp 1570-1579 doi:10.1017/S0950268811000550
12. Daszak, P., Zambrana-Torrel, C., Bogich, T.L., Fernandez, M., Epstein, J.H., Murray, K.A. & Hamilton, H. (2012). Interdisciplinary approaches to understanding disease emergence: The past, present and future drivers of Nipah virus emergence. *PNAS* doi:10.1073/pnas.1201243109

**D. Research Support****Ongoing Research Support****Ongoing Research Support**

|                                                                                                                                                                                                                                               |               |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------|
| USAID                                                                                                                                                                                                                                         | Daszak (PI)   | 10/01/09 – 09/30/14 |
| Emerging Pandemic Threats: PREDICT                                                                                                                                                                                                            |               |                     |
| Modeling hotspots for disease emergence and conducting surveillance in wildlife for new emerging zoonoses.                                                                                                                                    |               |                     |
| Role: Asia Regional Coordinator: coordinating field and lab activities in Bangladesh, India, Thailand, Malaysia, Indonesia and China; Surveillance Team and Molecular Diagnostic team member.                                                 |               |                     |
| 2 R01TW005869                                                                                                                                                                                                                                 | Daszak (PI)   | 09/01/08 – 08/31/14 |
| 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: Co-PI                                                                                                                                                                                                                                   |               |                     |
| 1 R01AI079231                                                                                                                                                                                                                                 | Daszak (PI)   | 09/18/08 – 08/31/13 |
| NIAID Non-Biodefense Emerging Infectious Diseases                                                                                                                                                                                             |               |                     |
| Risk of viral emergence from bats. This project is to model hotspots for viral diversity and emergence in bats, to identify new viruses from bats, and to examine the pathogenicity and infectiousness for these novel pathogens. Role: Co-PI |               |                     |
| 0955897 NSF Research Coordination Network                                                                                                                                                                                                     | Daszak (PI)   | 07/01/10-06/30/15   |
| EcoHealthNet: Environmental Science and Health Research Network                                                                                                                                                                               |               |                     |
| The major goal of this research is to run a series of workshops and student research exchange programs focused on collaborations among the human medical, veterinary, ecological and economic sciences.                                       |               |                     |
| Role: Co-PI, Program Director                                                                                                                                                                                                                 |               |                     |
| USFWS, F12AP01117                                                                                                                                                                                                                             | Epstein (PI). | 09/13/12 - 09/13/14 |
| Development of a Great Ape Health Unit in Sabah, Malaysia                                                                                                                                                                                     |               |                     |
| USFWS, 4500036150                                                                                                                                                                                                                             | Epstein (PI)  | 09/15/12 - 09/14/14 |
| Characterization of Climatic Parameters within Bat Hibernacula, their Influence on Environmental Loads of <i>Geomyces destructans</i> , and Implications for the Migration of White-Nose Syndrome in Bats                                     |               |                     |

**Completed Research Support**

|                                                                                                    |              |                    |
|----------------------------------------------------------------------------------------------------|--------------|--------------------|
| 1K08AI067549                                                                                       | Epstein (PI) | 07/1/07 – 07/30/11 |
| Understanding the Ecology of Nipah Virus in Bangladesh (NIAID)                                     |              |                    |
| Modeling the dynamics of Nipah virus in <i>Pteropus giganteus</i> and risk of spillover to humans. |              |                    |
| Role: PI (collecting Nipah virus epidemiological data from Bats in Bangladesh)                     |              |                    |



**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

| NAME<br>Olival, Kevin James                                                                                                                                                 |                           | POSITION TITLE<br>Senior Research Scientist |                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------|----------------------------------------|
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>(b) (6)                                                                                                           |                           |                                             |                                        |
| EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.) |                           |                                             |                                        |
| INSTITUTION AND LOCATION                                                                                                                                                    | DEGREE<br>(if applicable) | MM/YY                                       | FIELD OF STUDY                         |
| Colorado State University                                                                                                                                                   | B.S.                      | 05/97                                       | Biology                                |
| Columbia University                                                                                                                                                         | MA                        | 10/03                                       | Conservation<br>Biology                |
| Columbia University                                                                                                                                                         | PhD                       | 05/08                                       | Ecology and<br>Evolutionary<br>Biology |
| American Museum of Nat. History                                                                                                                                             | Postdoctoral              | 08/09                                       | Molec.<br>Parasitology                 |
| NIH Fogarty US Global Health Fellow                                                                                                                                         | Postdoctoral              | 08/11                                       | Int'l. Emerg.<br>Inf. Dis              |

**A. Personal Statement**

The goal of our proposal is to study the ecology, evolution, and spillover potential of bat coronaviruses. Specifically, we will use a combination of fieldwork, mathematical modeling, and phylogenetic and molecular methods to test several hypotheses related to zoonotic spillover risk and the limits to host range for bat coronaviruses. My research experiences are strongly complementary to these aims. I have been conducting research on bat evolution, ecology, population genetics, and viral discovery for the past 11 years. During my dissertation at Columbia University, I used host population genetics and phylogeography to understand the dynamics of Nipah virus in Southeast Asian fruit bats. As a post-doc at AMNH I discovered several novel malaria parasites in bats, and used molecular systematics to understand the co-evolution and origins of non-human *Plasmodium*. I developed new approaches that combine phylogenetic, ecological and species life-history variables to predict viral diversity in bats, and have tested these using data from the literature. As an NIH Global Health Fellow, I expanded our knowledge of Nipah virus ecology in Bangladesh through population genetic analyses of the putative primary reservoir host, *Pteropus giganteus*, led field investigations on role of non-*Pteropus* fruit bats in Nipah virus circulation, and discovered a number of novel bat pathogens in these species. I have led field research projects and training workshops to conduct viral discovery throughout Asia, including Malaysia, Bangladesh, India, Vietnam, Cambodia, Thailand, and the Philippines. This included several expeditions to collect Nipah virus samples in Bangladesh and Malaysia, and a three-week long Ebola Reston investigation of bats in the Philippines. Most recently I have led field teams on two 3-week expeditions in Saudi Arabia to identify the animal reservoir of MERS-CoV; this work is ongoing. My latest research is focused on: 1) global viral discovery in bats; 2) integrating phylogenetic and molecular evolution analyses with ecological information to better understand the risk of bat viral spillover. In summary, for the past decade my research has been focused on the evolution and ecology of bats and their associated pathogens, and my current focus of using phylogenetic and evolutionary approaches model viral spillover risk in bats is highly complementary to the aims in this proposal.

## B. Positions and Honors

### Positions and Employment

- 2000-02 Mentor, NSF Undergraduate Mentoring in Environmental Biology (UMEB) for Pacific Islander undergraduates, University of Hawaii
- 2002-08 Research Collaborator, Consortium for Conservation Medicine, New York
- 2003- Member, Henipavirus Ecology Research Group
- 2003 Lecturer in Disease Ecology, Columbia University Continuing Education course
- 2003-08 Visiting researcher – bat genetics, Veterinary Research Institute, Malaysia
- 2005 Visiting researcher – bat genetics, Institute for Ecology and Biological Resources, Vietnam
- 2005 Visiting researcher – bat genetics, Pasteur Institute, Cambodia
- 2005 Judge, NY Science and Engineering Fair
- 2006-07 Mentor, Conservation Genetics High School Internship Program, AMNH, New York
- 2006-13 Instructor, Columbia University Secondary School Summer Program, New York
- 2007 Steering Committee, Small Matters: Microbes and Their Role in Conservation, New York
- 2007 Symposium Organizer, Bat Hunting and Bushmeat, Phuket, Thailand
- 2009 Symposium Organizer, Bat migration and disease, 1<sup>st</sup> Int'l Workshop on Bat Migration, Germany
- 2009 Organizer and Scientific Review Committee, Exploring the Dynamic Relationship Between Health and the Environment, AMNH Spring Symposium, New York
- 2009- Review Editor, EcoHealth
- 2009- Adjunct Research Faculty, Center for Environmental Sustainability, Columbia University, New York.
- 2009- Visiting Research Scientist, American Museum of Natural History, Mammalogy Department.
- 2010 Mentor and Scientific Review Committee, Student Conference on Conservation Science New York
- 2010- Key Personnel and Lead Country Liaison: Thailand, Bangladesh, and Vietnam - USAID PREDICT
- 2010- Lead Field Researcher, FAO-EHA investigation of Ebola Reston reservoirs in Philippines
- 2011- Steering Committee, NSF RCN grant, South-east Asian Bat Conservation Research Group
- 2011- Internship Mentor, NSF RCN grant EcoHealthNet, graduate training in One Health
- 2013- EHA Team lead; MERS-CoV animal reservoir investigations with MoH in Saudi Arabia

### Honors

- 1993-97 Colorado State University Distinguished Scholar Award
- 2003 NSF Graduate Student Fellowship, Honorable Mention
- 2005-07 Bat Conservation International Student Award and Scholarship
- 2004-07 US Environmental Protection Agency STAR Fellowship Award
- 2008 PhD Dissertation with Distinction, Columbia University
- 2013 Plenary talk on bat virus modeling at 11<sup>th</sup> Annual ASM Biodefense and EID Research Meeting
- 2013 Invitation to participate in Institute of Medicine panel on novel Coronavirus

## C. Selected Peer-reviewed Publications (Selected from 25 peer-reviewed publications)

### Most relevant to the current application

1. Turmelle, A. & Olival, K.J. (2009). Correlates of viral richness in bats (Order Chiroptera). *EcoHealth* 6(4): 522-39.
2. Rahman, S.A., Hassan, SS, Olival, K.J., Mohamed, M., Chang, L.Y., Hassan, L., Saad, N.M., Shohaimi, S.A., Mamat, Z.C., Naim, M.S., Epstein, J.H., Suri, A.S., Field, H.E., Daszak, P. & HERG. (2010). Characterization of Nipah virus from Naturally Infected *Pteropus vampyrus* Bats, Malaysia. *Emerging Infectious Diseases* 16(12): 1990-93.
3. Olival, K.J., Epstein, J.H., Wang, L.F., Field, H.E., & Daszak, P. (2012). Are bats unique viral reservoirs? in A. A. Aguirre, R. S. Ostfeld, and P. Daszak, editors. *New Directions in Conservation Medicine: Applied Cases of Ecological Health*. Oxford University Press, Oxford. pp. 195-212.
4. Levinson, J., Bogich, T.L., Olival, K.J., Epstein, J.H., Johnson, C.K., Karesh, W. & Daszak, P. (2013). Targeted surveillance for zoonotic virus discovery. *Emerging Infectious Diseases* 19(5): 743-47.
5. [REDACTED] (b) (4)

Identification of Group C Betacoronavirus from Bat guano fertilizer, Thailand. *Emerging Infectious Diseases*.

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

1. Olival, K.J. & Daszak, P. (2005). The ecology of emerging neurotropic viruses. *Journal of NeuroVirology* 11: 440-45.
2. Pulliam, J.R.C., Field, H.E., Olival, K.J. & HERG. (2005). An alternative explanation of Nipah virus strain variation. *Emerging Infectious Diseases* 11(12): 1978-1979.
3. Daszak, P., Plowright, R., Epstein, J.H., Pulliam, J.R.C., Rahman, S.A., Field, H.E., Smith, C.S., Olival, K.J., Luby, S., Halpin, K., Hyatt, A.D., & HERG. (2006). The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum. In: *Disease Ecology: Community structure and pathogen dynamics*, In Collinge and Ray, ed. Oxford University Press: Oxford. pp. 188-203.
4. Olival, K.J., Stiner, E.O., & Perkins, S.L. (2007). Detection of *Hepaticystis* sp. in Southeast Asian Flying Foxes (Pteropodidae) using Microscopic and Molecular Methods. *Journal of Parasitology* 93(6): 1538-1540.
5. Epstein, J.H., Olival, K.J., Pulliam, J.R.C., Smith, C.S., Westrum, J., Hughes, T., Dobson, A., Zubaid, A., Rahman, S.A., Basir, M.M., Field, H.E., & Daszak, P. (2009). Management of *Pteropus vampyrus*, a hunted migratory species with a multinational home-range. *Journal of Applied Ecology* 46(5): 991-1002.
6. Murdock, C., Olival, K.J. & Perkins, S.L. (2010). Feeding preference of snow-melt mosquitoes (Culicidae: Culiseta and Ochelerotatus) show a link between cervid amplifying hosts for Jamestown Canyon Virus (Bunyaviridae: Orthobunyavirus) and humans. *Journal of Medical Entomology* 47(2): 226-229
7. Smith, C.S., Epstein, J.H., Breed, A., Plowright, R., Olival, K.J., de Jong, C., Daszak, P. & Field, H.E. (2011). Satellite Telemetry and Long-Range Bat Movements. *PLoS One* 6(2): e14696.
8. Bogich, T.L., Olival, K.J., Hosseini, P., Mazet, J., Morse, S., Karesh, W.B., Jones, K.E., Levy, M., Funk, S., Brito, I., Epstein, J.H., Brownstein, J., Joly, D., & Daszak, P. (2012). Using Mathematical Models in a Unified Approach to Predicting the Next Emerging Infectious Disease. *New Directions in Conservation Medicine: Applied Cases of Ecological Health*. In Aguirre, Ostfeld and Daszak, ed. Oxford University Press. pp. 607-18.
9. Morse, S.F., Olival, K.J., Kosoy, M., Billeter, S.A., Patterson, B.D., Dick, C.W., & Dittmar, K. (2012). Global distribution and genetic diversity of Bartonella in bat flies (Hippoboscoidea, Streblidae, Nycteribiidae). *Infection, Genetics and Evolution* 12(8): 1717-23.
10. Olival, K.J. (2012). Correlates and evolutionary consequences of population genetic structure in bats. In Gunnell and Simmons, ed. *Evolutionary History of Bats: Fossils, Molecules, and Morphology*. Cambridge University Press, Cambridge. pp. 267-316.
11. Olival, K.J., Islam, A., Yu, M., Anthony, S.J., Epstein, J.H., Khan, S.A., Khan, S.U., Crameri, G., Wang, L.F., Lipkin, W.I., Luby S.P., & Daszak, P. (2013). Ebolavirus Antibodies in Fruit Bats, Bangladesh. *Emerging Infectious Diseases* 19(2): 270-273.

12. [REDACTED] (b) (4)

13. [REDACTED] (b) (4)

#### **D. Research Support**

##### **Ongoing Research Support**

NIH 1 R01AI079231

Daszak (PI)

09/18/08 – 08/31/13

NIAID Non-Biodefense Emerging Infectious Diseases. "Risk of viral emergence from bats".

This project is to model hotspots for viral diversity and emergence in bats, to identify new viruses from bats, and to examine the pathogenicity and infectiousness for these novel pathogens.

Role: Key Personnel: lead project implementation, study design, and phylogenetic modeling



**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

| NAME<br>Parvies R Hosseini                                                                                                                        |                                  | POSITION TITLE<br>Senior Research Fellow |                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------|-----------------------------------------------|
| eRA COMMONS USER NAME<br>(b) (6)                                                                                                                  |                                  |                                          |                                               |
| EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i> |                                  |                                          |                                               |
| INSTITUTION AND LOCATION                                                                                                                          | DEGREE<br><i>(if applicable)</i> | MM/YY                                    | FIELD OF STUDY                                |
| Brown University<br>University of California, Santa Barbara                                                                                       | Sc. B.<br>Ph.D                   | 12/94<br>06/02                           | Applied Math – Biology<br>Biological Sciences |

**A. Personal Statement**

The aims of the proposed research include disease ecology, evolutionary biology, and understanding the transmission dynamics of coronaviruses among wildlife hosts and their spillover to people. The latter includes analyzing patterns of viral prevalence, building and parameterizing mathematical models of pathogen transmission and evolution, and field research on these dynamics. In my career, I have used my training as theoretical ecologist and my broad experience in mathematics, statistics and ecology to focus on analyzing and explaining the process of disease emergence. I have studied disease ecology, with a strong focus on analytical and computation modeling approaches for the past 9 years. This work has involved leading the modeling component of several major research projects across a wide array of disease systems including *Mycoplasma gallisepticum* in House Finches, Barley and Cereal Yellow Dwarf viruses in California grasslands, Chikungunya virus, Rift Valley fever, and avian influenza. I am now the lead researcher on the modeling component for Influenza and Arbovirus Dynamics at EcoHealth Alliance. My strong interest in the impact of population structure on the emergence of novel pathogens, and my experience in working with computational modeling of emerging diseases give me a perfect background for the current proposed work. I also have considerable experience in working within national and international collaborative groups which will prove invaluable in the current project.

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

- 2002-2005 Post-doctoral Associate, Cornell University, Lab of Ornithology, Ithaca, NY  
 2005-2009 Associate Research Scholar, Princeton University, Dept. of Ecology and Evolutionary Biology, Princeton, NJ  
 2009- Senior Research Fellow, EcoHealth Alliance, NY

**Professional Activities:**

- 2003 – 2005 Participant, Seasonality and the Population Dynamics of Infectious Diseases, NCEAS, Santa Barbara, CA  
 2004 Invited Speaker, Ecology of Infectious Disease Meeting, Emory University, Atlanta  
 2004 Invited Speaker, Dept. of Zoology, Oregon State University  
 2006 Invited Speaker, Dept. of Biology, EEOB Seminar Series, University of North Carolina  
 2007 Invited Speaker, Dept. of Ecology and Evolutionary Biology, University of Tennessee  
 2008 Invited Speaker, Dept. of Zoology, Oxford University, UK

- 2008 Invited Speaker, Dept. of Biology, Stanford University, CA  
2009 – present Member of modeling team, USAID-EPT PREDICT  
2010 – present Review Editor, EcoHealth

**Selected Honors:**

- 2003 NSF RTG/GRT Fellowship on Spatial ecology  
2004 Invited to speak at EEID in 2004 and 2011  
2004 Member NCEAS group on Recovery plans and de-listing  
2005 Member NCEAS group on designing ecological protected areas research  
2005 Member NCEAS group on complex population dynamics  
2007 *PNAS* 2007 paper cited by Faculty of 1000 Biology as “Must Read”  
2007 *PNAS* paper listed as Science Editor’s choice, 6<sup>th</sup> April 2007

**C. Peer-reviewed publications**

**Most relevant to the current application**

1. Hosseini, P.R. (2003). How localized consumption stabilizes predator-prey systems with finite frequency of mixing. *American Naturalist* 161:567-585. doi:10.1086/368293
2. Hosseini, P.R., Dobson, A. & Dhondt, A.A. (2004). Seasonality and wildlife disease: How seasonal birth, aggregation and variation in immunity affect the dynamics of *Mycoplasma gallisepticum* in House Finches. *Proceedings of the Royal Society of London: Biological Sciences*. 271:2569-2577. doi:10.1098/rspb.2004.2938
3. Hosseini, P.R. (2006) Pattern Formation and Individual-Based Models: The Importance of Understanding Individual-Based Movement. *Ecological Modeling* 194: 357-371. doi:10.1016/j.ecolmodel.2005.10.041
4. Seabloom, E.W., Hosseini, P.R., Power, A.G., Borer, E.T. (2009). Causes and implications of co-infection by RNA viruses in natural grasslands. *American Naturalist*. 173:E79-E98. doi: 10.1086/596529
5. Hosseini, P.R., Sokolow, S.H., Vandegrift, K.J., Kilpatrick, A.M. & Daszak, P. (2010). Predictive power of air travel and socio-economic data for early pandemic spread *PLoS One*. 5(9):e12763. doi:10.1371/journal.pone.0012763.

**Additional recent publications of importance to the field**

1. Campbell, S.P., Clark, A., Crampton, L., Guerry, A.D., Hatch, L.T., Hosseini, P.R., Lawler, J.J., O’Connor R.J. (2002). An assessment of monitoring efforts in endangered species recovery plans. *Ecological Applications*. 12:674-681. doi:10.1890/1051-0761(2002)012[0674:AAOMEI]2.0.CO;2
2. Kollias, G.V., Sydenstricker, K.V., Kollias, H.W., Ley, D.H., Hosseini, P.R., Connolly, V. & Dhondt, A.A. (2004). Experimental infection of individually caged House Finches with *Mycoplasma gallisepticum*. *J. Wildlife Diseases*. 40: 79-86.
3. Dhondt, A.A., Altizer, S., Cooch, E.G., Davis, A.K., Dobson, A., Driscoll, M.J.L., Hartup, B.K., Hawley, D. M., Hochachka, W.M., Hosseini, P.R., Jennelle, C.S., Kollias, G.V., Ley, D.H., Swarthout, E.C.H., Sydenstricker, K.V. (2005). Dynamics of a novel pathogen in an avian host: *Mycoplasmal conjunctivitis* in house finches. *Acta Tropica* 94(1):77-93. doi:10.1016/j.actatropica.2005.01.009
4. Altizer, S., Dobson, A., Hosseini, P., Hudson, P. Pascual, M., & Rohani, P. (2006). Seasonality and the dynamics of infectious diseases. *Ecology Letters* 9:467-484. doi:doi:10.1111/j.1461-0248.2005.00879.x
5. Hosseini, P.R., Dhondt, A.A., & Dobson, A.P. (2006). Spatial Spread of an Emerging Infectious Disease: *Conjunctivitis* in House Finches – Seasonal Rates and Geographic Barriers, *Ecology*. 87: 3037–3046. esajournals.org.
6. Borer, E., Hosseini, P.R., Seabloom, E., & Dobson, A.P. (2007). Pathogen-induced reversal of native dominance in a grassland community *PNAS*. 104:5473-5478 doi:10.1073/pnas.0608573104
7. Ballantyne, F., Menge, D., Ostling, A., & Hosseini, P.R. (2008). Nutrient recycling affects autotroph and ecosystem stoichiometry, *American Naturalist*. 171:511-523. doi:10.1086/528967
8. Barseghian, D., Altintas, I., Jones, M. B., Crawl, D., Potter, N., Gallagher, J., Cornillon, P., Schildhauer, M., Borer, E.T., Seabloom, E.W. & Hosseini, P.R. (2009). Workflows and extensions to the Kepler scientific

workflow system to support environmental sensor data access and analysis. *Ecological Informatics*. 5(1):42-50 doi:10.1016/j.ecoinf.2009.08.008

9. Brandt, A.J., Seabloom, E.W., & Hosseini, P.R. (2009). Phylogeny and provenance affect plant-soil feedbacks in invaded California grasslands. *Ecology* 90:1063-1072.
10. Moore, S.M., Borer, E.T., Hosseini, P.R. (2010). Predators indirectly control vector-borne disease: linking predator-prey and host-pathogen models, *Journal of the Royal Society Interface*. 7:161-176 doi:10.1098/rsif.2009.0131

## D. Research Support

### Ongoing Research Support

NSF EF-1015791 Mitchell (PI) 07/01/10 – 6/30/15

National Science Foundation/National Institutes of Health: Ecology of Infectious Diseases program. The community ecology of viral pathogens – Causes and consequences of coinfection in hosts and vectors. To conduct mathematical modeling and fieldwork to understand implications in a wild grass, aphid-vectored disease system.

Role: Co-PI

NSF Daszak (PI) 06/21/10 - 06/20/15

Collaborative research: the community ecology of viral pathogens - causes and consequences of coinfection in hosts and vectors.

Role: Co-PI

GHN-A-00-09-00010-00 Morse (PI) 10/1/09-09/30/14

USAID Emerging Pandemic Threats

PREDICT - Wildlife SMART Surveillance

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

Role: Hotspots Modeler

National Institutes Of Health Daszak (PI) 09/17/12 - 08/31/13

Fogarty International Center

Comparative Spillover Dynamics of Avian Influenza in Endemic Countries

Role: Co-PI

### Completed Research Support

NIH 3R01TW005869-07S1 Daszak (PI) 07/01/10 – 06/30/11

Research: The Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh, Supplement: Understanding and predicting the spread of H5N1 in Bangladesh, China and Globally, Modeling Research Award. To conduct model development and research to understand the role of wild and domestic poultry and livestock in creating the conditions that allow sustained spillover of human-pathogenic influenza viruses into people.

Role: Key Personnel

NIH 3R01TW005869-07S2 Daszak (PI) 07/01/10 – 06/30/11

Research: The Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh, Supplement: Understanding and predicting the spread of H5N1 in Bangladesh, China and Globally, Field Research Award. To conduct fieldwork to understand the role of wild and domestic poultry and livestock in creating the conditions that allow sustained spillover of human-pathogenic influenza viruses into people.

Role: Key Personnel

NIH 3R01TW005869-06S4 Daszak (PI) 07/01/09 – 06/30/10

Research: The Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh, Supplement: Understanding and predicting the spread of H5N1 in Bangladesh, China and Globally, Modeling Research

Award. To conduct model development and research to understand the role of wild and domestic poultry and livestock in creating the conditions that allow sustained spillover of human-pathogenic influenza viruses into people.

Role: Key Personnel

NIH 3R01TW005869-06S3

Daszak (PI)

07/01/09 – 06/30/10

Research: The Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh, Supplement: Understanding and predicting the spread of H5N1 in Bangladesh, China and Globally, Field Research Award. To conduct field work to understand the role of wild and domestic poultry and livestock in creating the conditions that allow sustained spillover of human-pathogenic influenza viruses into people.

Role: Key Personnel

NSF EID 05-25666

Borer (PI)

09/01/05 – 8/31/10

Research: Predicting the effects of environmental change and host diversity on the dynamics of insect-vectored generalist pathogens.

Role: Key Personnel

The goal of this project was to assess a community-based strategy for reducing alcohol abuse among older individuals.

Role: PI



## BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

|                                                                                                                                                                                    |                                        |       |                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-------|---------------------------------------|
| NAME<br>Ge, Xing Yi                                                                                                                                                                | POSITION TITLE<br>Assistant Researcher |       |                                       |
| eRA COMMONS USER NAME (credential, e.g., agency login)                                                                                                                             |                                        |       |                                       |
| EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)</i> |                                        |       |                                       |
| INSTITUTION AND LOCATION                                                                                                                                                           | DEGREE<br><i>(if applicable)</i>       | MM/YY | FIELD OF STUDY                        |
| Huazhong Agricultural University, Wuhan, China                                                                                                                                     | Ph.D                                   | 07/05 | Biotechnology                         |
| Huazhong Agricultural University, Wuhan, China                                                                                                                                     |                                        | 07/08 | Preventive Veterinary<br>Medicine     |
| Wuhan Institute of Virology, Chinese Academy of<br>Sciences, Wuhan, China                                                                                                          |                                        | 12/11 | Biochemistry and<br>Molecular Biology |

### A. Personal Statement

Throughout my career, I have received extensive molecular training, including deep sequencing, and collaborated in multiple publications in the field of viral genetic diversity in bats in China. I have investigated the genetic diversity of bat adeno-associated viruses and their virus-host interactions, and isolated 22 novel ssDNA viruses from bat fecal samples using inverse PCR, which were then identified to belong in the Circoviridae family. Additionally, using metagenomic analyses, I participated in the characterization of a totivirus from bat feces in China, which showed its capacity of infecting various insect cell lines, thus having a wide geographical distribution. Our most recent work on SARS-like coronaviruses in bats has shown that there are SARS-like CoVs in bats that use the ACE2 receptor, and therefore could be directly transmissible to humans. The discovery of MERS CoV shows that there are other coronaviruses, most likely from bats, that use different receptors to infect people. For this reason, we should understand the diversity of bat coronaviruses in China and determine whether they can infect people. In the current proposal, which aims to study coronaviruses in China, I will be responsible for the diagnosis, genomics and isolation of coronaviruses and for analyzing their receptor binding domains, in order to understand their viral spillover risk and geographic distribution. We have shown that our lab at Wuhan has the ability to identify and test these viruses for receptor usage, and I am confident that this study will allow us to find many other coronaviruses in nature with zoonotic potential.

### B. Positions and Honors

#### Positions and Employment

|           |                                                                                                                        |
|-----------|------------------------------------------------------------------------------------------------------------------------|
| 2005-2008 | Master's Training, College of Veterinary Medicine, Huazhong Agricultural University, China                             |
| 2008-2011 | Doctoral Training, Wuhan Institute of Virology, Chinese Academy of Sciences, China                                     |
| 2010      | Doctoral Training, Unit of Molecular Genetics of RNA Viruses, Department of Virology, Institute Pasteur, Paris, France |
| 2012-     | Assistant Researcher, Wuhan Institute of Virology, Wuhan, China                                                        |

#### Honors

|      |                                                       |
|------|-------------------------------------------------------|
| 2005 | Excellent Thesis of Bachelor Degree of Hubei province |
| 2005 | Innovation Award of Huazhong Agricultural University  |
| 2007 | First Prize of Excellent Graduate student             |
| 2012 | CAS Presidential Scholarship (Excellence Prize)       |

### C. Selected Peer-reviewed Publications

### **Most relevant to the current application**

1. Li, Y., Ge X.Y., Hon C.C., Zhang, H., Zhou P., Zhang Y., Wang L.F., Shi Z. (2010). Prevalence and genetic diversity of adeno-associated viruses in bats, China. *Journal of General Virology*, 91(10), 2601-9.
2. Ge\* X.Y., Rameix-Welti\*, M.A., Gault\* E., Chase, G., dos Santos Afonso, E., Picard D., Schwemmle, M., Naffakh, N. (2011). Influenza Virus Infection Induces the Nuclear Relocalization of the Hsp90 Co-Chaperone p23 and Inhibits the Glucocorticoid Receptor Response. *PLoS One*, 6(8), e23368. (\*equal contribution)
3. Moisy, D., Jacob, Y., Laoide, B.M., Ge, X.Y., Baudin, F., Naffakh, N., Jestin, J.L. (2012). The HMGB1 protein binds to influenza virus nucleoprotein and promotes viral replication. *Journal of Virology*, 86(17), 9122-33.
4. Ge, X.Y., Li, Y., Yang X., Zhang H., Zhou P., Zhang Y., & Shi Z. (2012). Metagenomic Analysis of Viruses from the Bat Fecal Samples Reveals Many Novel Viruses in Insectivorous Bats in China. *Journal of Virology*, 86(8), 4620-30.
5. Wu L., Zhou, P., Ge X.Y., Wang, L.F., Baker M., Shi Z. (2013). Deep RNA sequencing reveals a complex transcriptional landscape of a bat adenovirus. *Journal of Virology*, 87(1), 503-11.

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

1. Li, Y., Ge, X.Y., Zhang, H., Zhou, P., Zhu, Y., Zhang, Y., Yuan, J., Wang, L.F., Shi, Z. (2010). Host range, prevalence, and genetic diversity of adenoviruses in bats. *Journal of Virology*, 84(8), 3889-97.
2. Zhang, Y., Zhang, H., Dong, X., Yuan, J., Zhang, H., Yang, X., Zhou, P., Ge, X.Y., Li, Y., Wang, L.F., Shi, Z. (2010). Hantavirus outbreak associated with laboratory rats in Yunnan, China. *Infection, Genetics and Evolution*, 10(5), 638-44.
3. Ge, X.Y., Li, J., Peng, C., Wu, L., Yang, X., Wu, Y., Zhang, Y., Shi, Z. (2011). Genetic diversity of novel circular ssDNA viruses in bats in China. *Journal of General Virology*, 92, 2646–2653.
4. Yang, X., Zhang, Y., Ge, X.Y., Yuan, J., Shi, Z. (2012). A novel totivirus-like virus isolated from bat guano. *Archives of Virology*, 157(6), 1093-9.

## **D. Research Support**

### **Ongoing Research Support**

### **Completed Research Support**

**BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

|                                                                                                                                                                             |                           |                                        |                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------------------------------------|---------------------------------------|
| NAME<br>Zhu, Gunagjian                                                                                                                                                      |                           | POSITION TITLE<br>Assistant Researcher |                                       |
| eRA COMMONS USER NAME (credential, e.g., agency login)<br>XXXX                                                                                                              |                           |                                        |                                       |
| EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.) |                           |                                        |                                       |
| INSTITUTION AND LOCATION                                                                                                                                                    | DEGREE<br>(if applicable) | MM/YY                                  | FIELD OF STUDY                        |
| East China Normal University, Shanghai, China                                                                                                                               | B.S.                      | 07/03                                  | Biology Science                       |
| Hainan Normal University, Haikou, China                                                                                                                                     | M.S.                      | 07/03                                  | Ecology                               |
| East China Normal University, Shanghai, China                                                                                                                               | Ph.D                      | 6/12                                   | Biochemistry and<br>Molecular Biology |

**A. Personal Statement**

Throughout my graduate studies and work with East China Normal University, I have carried out molecular biology and field ecology 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 Dr. Shuyi Zhang. I have also worked actively with EcoHealth Alliance on the USAID- EPT PREDICT program as a field team leader for China. For this program I have been responsible for the identification of high-risk interfaces between wildlife and people, where close contact might allow for zoonotic pathogen spillover (e.g. live animal markets). I have also led wildlife surveys which involved bat and rodent capture and sampling for viral discovery. Through this work we have conducted 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 several hundred bat samples which have been tested for coronaviruses (and several other viral families) at the Wuhan Institute of Virology. Under this current proposal, I would be responsible for developing and leading a wildlife team to sample bats, rodents, and other small mammals in the live animal markets of 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. This combination of experiences allows me to understand the whole process of bringing samples from field to lab with an understanding of how to maximize opportunity for viral detection. I think that the aims of this proposal are important for providing the most current information about viral dynamics in live animal markets in China, particularly in rural areas where wildlife trade still occurs and where there is little data on spillover. I am very enthusiastic about participating in this study and confident that it has the right experts and study plan to succeed.

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

2007- Assistant Researcher, Guangdong Entomological Institute, China

**Other Experiences and Professional Memberships****Honors**

2009 Biology Prize of the 2009 Ig Nobel Prize

**C. Selected Peer-reviewed Publications****Most relevant to the current application**

1. 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. (in Chinese)
2. 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. (in Chinese)
3. Sun, Y., Yu, D., Zhu, G., Liu, X., Zhang, S.Y., Chen, J. (2009). Isolation and characterization of 11 microsatellite loci in *Scotophilus kuhlii* (Lesser Asiatic Yellow House Bat). *Conservation Genetics*, 10, 1857-1859
4. Mao, X., Zhu, G., Zhang, S.Y., Rossiter, S.J. (2010). Pleistocene climatic cycling drives intra-specific diversification in the intermediate horseshoe bat (*Rhinolophus affinis*) in Southern China. *Molecular Ecology*, 19(13), 2754-2769.
5. Hua, P., Zhang, L., Zhu G., Jones, G., Zhang, S., Rossiter, S.J. (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)**

1. 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. (in Chinese)
2. Zhang, L., Zhu, G., Jones, G., Zhang, S.Y. (2009). Conservation of bats in China: problems and recommendations. *ORYX*, 43(2), 179-182.
3. 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.
4. 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.
5. Zhu, G., Chmura, A., Zhang, L. (2011). Morphology, echolocation calls and diet of *Scotophilus kuhlii* (Chiroptera: Vespertilionidae) on Hainan Island, south China. *Acta Chiropterologica*, 14(1), 175-181.
6. [REDACTED] (b) (4)

**D. Research Support**

**Ongoing Research Support**

GHN-A-00-09-00010-00 Morse (PI) 10/01/09-09/30/14  
PREDICT-Wildlife SMART Surveillance/PREDICT Project to pre-empt at the earlier stages possible, zoonotic diseases that impose significant threat to public health.  
Role: Field Team Leader

**Completed Research Support**

stylos 8/5/13 2:21 PM

Comment [1]: Other support?