UNITED STATES DEPARTMENT OF AGRICULTURE - RESEARCH, EDUCATION, AND ECONOMICS

Award Face Sheet

Agency Control No. 56269

Agency
AGRICULTURAL RESEARCH SERVICE

Type of Instrument
Cooperative Agreement

Authority
7 USC 3318(c)

Title of Project
US-UK-China Collab: Predictive Phylogenetics For Evolutionary and Transmission Dynamics of Newly Emerging Avian Influenza Viruses

Agreement Number/ FAIN
59-6040-1-004

Type of Action
New

Correction
N

CFDA No.
10.001

Period of Performance
Start 04/ 01/ 2021 End 02/ 28/ 2026

(Reserved)

Total Federal Amount
$382,852.00

Federal Amount Obligated by This Action
$382,852.00

Indirect Cost Rate
51.00%

Agency Administrative Point of Contact/ ADO
JANET S MORENO
USDA, ARS, AFM, SEA Administrative Office
Financial Management, Travel and Agreements
950 COLLEGE STATION ROAD
ATHENS GA 30605
Phone: 706-340-3096 Fax:
E-mail: jan.moreno@usda.gov

Non-Federal Entity/ Federal Agency (Legal Name and Address)
UNIVERSITY OF GEORGIA RESEARCH FOUNDATION, INC.
310 East Campus Rd,
Tucker Hall Room 409
Athens GA 30602-1589 USA
POC: RACHEL BAKER
GRANTS COORDINATOR III
Phone: (706) 542-5268 Fax: 706-542-8254
E-mail: sponprog@uga.edu DUNS ID: 004315578

Agency Principal Investigator
DARRELL R KAPCZYNSKI
U. S. National Poultry Research Center
934 College Station Road
ATHENS GA 30605
Phone: 706-546-3174 Fax:
E-mail: Darrell.Kapczynski@ars.usda.gov

Non-Federal Entity/ Federal Agency Principal Investigator
DANIEL PEREZ
RESEARCH ALLIANCE DISTINGUISHED INVESTIGATOR
DEPARTMENT OF POPULATION HEALTH- COLLEGE OF VETERINARY MEDICINE
UNIVERSITY OF GEORGIA
953 COLLEGE STATION RD.
ATHENS GA 30602 USA
Phone: 706-5421904 Fax: 706-542-5630
E-mail: DPEREZ1@#UGA.EDU

Agency Finance Office
STACEY D SANDERS
USDA, ARS, SEA AO
FINANCIAL MANAGEMENT, TRAVEL AND AGREEMENTS
950 COLLEGE STATION ROAD, ROOM 203
ATHENS GA 30605-2720
Phone: 706-546-3080 Fax:
E-mail: STACEY.SANDERS@USDA.GOV

Method of Payment
- ■ HHS/ Payment Management System
- ☐ EFT/ Treasury Check
- ☐ Agency Receives Funds
- ☐ ASAP
- ☐ Advance Payment Authorized
- ☐ Pre-Award Costs Authorized
- ☐ UES (for FAS awards only)
- ☐ IPAC

PROVISIONS

This Agreement incorporates the following:
- ☐ Statement/ Scope of Work
- ■ Proposal
- ☐ Non-Federal Entity Proposal/ Award/ Agreement
- ☐ Research & Related Budget (Total Fed + Non-Fed) or REE-454
- ■ Research & Related Budget or REE-455
- ☐ Prime Award attached (for subrecipients)
- ■ Comments (REE-451, page 2)

These are available at https://www.afm.ars.usda.gov/ agreements/ partnership/
- ■ Conflict of Interest Policy
- ■ USDA Civil Rights Policy Statement ■ USDA Civil Rights Poster (AD-475-C)
- ☐ REE-157 - Research Support Agreement Management Report Template

Reporting Requirements:
Submit to: ■ Agency PI ■ ADO ☐ Non-Federal Entity/ Federal Agency

Performance Reports	Financial Reports	Management Reports
☐ Quarterly	☐ Quarterly	☐ Monthly
☐ Semi-Annual	☐ Semi-Annual	☐ Quarterly
■ Annual	■ Annual	☐ Semi-Annual
■ Final	■ Final	☐ Final

- ■ Intellectual Property Reports (www.iEdison.gov)
- ☐ Form SF-428-B Tangible Personal Property Report - Final Report

Applicable Regulations, Terms and Conditions, and Required Certifications (available at https://www.afm.ars.usda.gov/ agreements/ partnership/)
- ■ 2 CFR Part 200 and 2 CFR Part 400
- ☐ 7 CFR Part 550 - General Administrative Policy for Non-Assistance Cooperative Agreements, published 10/ 11/ 2016
- ☐ General Provisions, Research Support Agreement (REE-452R)
- ☐ General Provisions, Trust Fund and Reimbursable Cooperative Agreements (REE-22)
- ■ AD-1047 - Certification Regarding Debarment, Suspension and other Responsibility Matters - Primary Covered Transactions
- ☐ AD-1048 - Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions
- ■ AD-1049 - Certification Regarding Drug-Free Workplace Requirements (Grants) - Alt I - For Grantees Other Than Individuals
- ☐ AD-1050 - Certification Regarding Drug-Free Workplace Requirements (Grants) - Alt II - For Grantees Who Are Individuals
- ☐ AD-1052 - Certification Regarding Drug-Free Workplace State and State Agencies
- ■ AD-3031 - Assurance Regarding Felony Conviction or Tax Delinquent Status for Corporate Applicants
- ■ Certification Regarding Lobbying
- ■ REE-26 - Organization Information, Representations, Assurances & Certifications

This agreement, subject to the provisions above, is executed by the United States Department of Agriculture:

Signature	ADO Name	Federal Award Date
JANET MORENO Digitally signed by JANET MORENO Date: 2021.06.17 14:12:10 -04'00'	JANET S MORENO	

By signing this agreement, the signor certifies that they are vested with the authority to enter into this agreement.

Non-Federal Entity/ Federal Agency Signature	Name and Title	Date
Karla Childs	Karla Childs, Grants Specialist	6/22/2021
Non-Federal Entity/ Federal Agency Signature	Name and Title	Date

U.S. DEPARTMENT OF AGRICULTURE - RESEARCH, EDUCATION, AND ECONOMICS
Award Face Sheet
REE-451, Page 2

Agreement Number/ FAIN: 59-6040-1-004
Type of Action: New
Project Number: 6040-32000-066-71A
Accession No.: 440252

Agency Control No.: 56269
BOC: 4120
PO No.:
FMMI Vendor Code : 1100150616

Agency Funds Chargeable - Agency Use Only

Account Code	FY	Amount	FMMI Fund Code	Cost Center	WBS Element
171-6040-153	2021	$382,852.00	AR0001400R	AR60401030	AR.NR.6040.01.0153

Comments:

Funding will be posted in HHS/PMS under the following acccount.

ACCT	PIN	EIN
6J23P	6J23	1581353149A4

A. ORGANIZATION OR INDIVIDUAL AWARDEE INFORMATION

The information identified in the table below will be used to report at USASpending.gov, when applicable. Please select one of the following:

	A: State Government	X	M: Nonprofit with 501C3 IRS Status (Other than Institution of Higher Education)
	B: County Government		N: Nonprofit without 501C3 IRS Status (Other than Institution of Higher Education)
	C: City or Township Government		O: Private Institution of Higher Education
	D: Special District Government		P: Individual
	E: Regional Organization		Q: For-Profit Organization (Other than Small Business)
	F: U.S. Territory or Possession		R: Small Business
	G: Independent School District		S: Hispanic-serving Institution
	H: Public/State Controlled Institution of Higher Education		T: Historically Black Colleges and Universities (HBCUs)
	I: Indian/Native American Tribal Government (Federally Recognized)		U: Tribally Controlled Colleges and Universities (TCCUs)
	J: Indian/Native American Tribal Government (Other than Federally Recognized)		V: Alaska Native and Native Hawaiian Serving Institutions
	K: Indian/Native American Tribal Designated Organization		W: Non-domestic (non-US) Entity
	L: Public/Indian Housing Authority		X: Other (specify)

Is your organization a State cooperative institution? (Refer to 7 USC 3103(18) or 7 USC 301 note) **Yes** ____ **No** _X_

Organization Legal Name *(associated with SAM registration, when applicable)*: **"Doing Business As"** *(if applicable)*

University of Georgia Research Foundation

UEI or DUNS Number: 00-431-5578

CAGE Code: 07DC3

Tax Identification Number (TIN or EIN): 58-1353149

Organization Address *(associated with SAM registration, when applicable)*:

310 East Campus Rd.
Tucker Hall Room 409
Athens, GA 30602

Authorized Representative Name and Title:

Karla Childs
Grants Specialist

Administrative Point of Contact (POC) Name: Karla Childs

Administrative POC E-mail Address and Phone Number: karla.childs@uga.edu; 706-542-3345

Principal Investigator Name, USPS Mailing Address incl. zip code plus 4, E-mail Address, and Phone Number *(Place of Performance)*:

Daniel Perez, 953 College Station Rd., Athens, GA 30602-1540; dperez1@uga.edu; 706-542-1904

B. REPRESENTATIONS

In accepting this award, the authorized representative for the organization or individual awardee identified on page 1 certifies that he or she has the authority to enter into this award on behalf of the awardee organization and the Cooperator/Awardee has the institutional, managerial, and financial capability (including funds sufficient to pay the non-Federal share of project cost, when applicable) to ensure proper planning, management, and completion of the project(s) described in the award.

C. ASSURANCES

As a condition of this award, the Cooperator/Awardee assures that it is in compliance with and will comply, over the course of the award period of performance, with the terms and conditions of the award and all applicable laws, regulations, and Federal Executive Orders (EO), including, but not limited to the following, **as applicable**:

1. **2 CFR Part 25** - Universal Identifier and System of Award Management
2. **2 CFR Part 170** - Reporting Subaward and Executive Compensation Information
3. **2 CFR Part 175** - Award Term for Trafficking in Persons
4. **2 CFR Part 180** - OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)
5. **2 CFR Part 400.2(b)** - Non-Federal entities must disclose in writing any potential conflicts of interest to the USDA awarding agency or pass-through entity.
6. **2 CFR Part 415** - General Program Administrative Regulations
7. **2 CFR Part 416** - General Program Administrative Regulations for Grants and Cooperative Agreements to State and Local Governments
8. **2 CFR Part 417** - Nonprocurement Debarment and Suspension
9. **2 CFR Part 418** - New Restrictions on Lobbying
10. **2 CFR Part 421** - Requirements for Drug-Free Workplace (Financial Assistance)
11. **2 CFR Part 422** - Research Institutions Conducting USDA Funded Extramural Research; Research Misconduct
12. **7 CFR Part 1, subpart** A - USDA implementation of the Freedom of Information Act
13. **7 CFR Part 1b** - USDA implementation of the National Environmental Policy Act (NEPA)
14. **7 CFR Part 1C** - Protection of Human Subjects. The Non-Federal entity may conduct research involving human subjects only as prescribed in the statement of work/proposal and as approved by the Non-Federal entity's Cognizant Institutional Review Board. Work under the agreement may not begin until the required approvals are completed.
15. **7 CFR Part 1c.120** - Evaluation and disposition of applications and proposals for research to be conducted or supported by a Federal Department or Agency.
16. **7 CFR Part 3** - Debt Management. USDA implementation of OMB Circular No. A-129 regarding debt collection.
17. **7 CFR Part 15, subpart A** - Nondiscrimination in Federally-Assisted Programs of the Department of Agriculture-Effectuation of Title VI of the Civil Rights Act of 1964. The Non-Federal entity must post the USDA Civil Rights Poster in buildings and facilities where research is being carried out with Federal funds.
18. **Agriculture Bioterrorism Protection Act of 2002**, as implemented at 7 CFR part 331 and 9 CFR part 121, by agreeing that it will not possess, use, or transfer any select agent or toxin without a certificate of registration issued by the Agency.
19. Interest of Member of Congress (41 U.S.C. 22)
20. **42 CFR Part 73** - Select Agents and Toxins
21. **42 U.S.C. 6962** - Resource Conservation and Recovery Act (RCRA)
22. **29 U.S.C. 794** (section 504, Rehabilitation Act of 1973), as implemented in **7 CFR Part 15b** (USDA implementation of statute) - prohibiting discrimination based upon physical or mental handicap in Federally-assisted programs.
23. **35 U.S.C. 200 et seq**. - Bayh Dole Act, controlling allocation of rights to inventions made by employees of small business firms and domestic nonprofit organizations, including universities, in Federally-assisted programs (implementing regulations are contained in 37 CFR Part 401).

24. **Federal Information System Security Management Act** (FISMA), as amended by the Federal Information Security Modernization Act of 2014, Pub. L. No. 113-283, 44 U.S.C. 3551 *et seq.*, to ensure the effectiveness of information security controls over information resources that support Federal operations and assets. Applies to a non-Federal entity if it will collect or maintain information on behalf of a Federal agency.

25. **Executive Order 13513**, "Federal Leadership on Reducing Text Messaging While Driving"

26. **Laboratory Animal Welfare Act of 1966** (PL 89-544, as amended, 7 U.S.C. §§ 2131 et seq.) and the regulations promulgated thereunder by the Secretary of Agriculture (9 CFR Parts 1, 2, 3, and 4, and subsequent rules and regulations) that pertain to the care, handling, and treatment of warm-blooded animals held or used for research, teaching, or other activities supported by REE awards. The Non-Federal entity may request registration of facilities and a current listing of licensed dealers from the Regional Office of the Animal and Plant Health Inspection Service (APHIS), USDA, for the Region in which their facility is located. The location of the appropriate APHIS Regional Office, as well as information concerning this requirement, may be obtained by contacting the Senior Staff Officer, Animal Care Staff, USDA/APHIS, 4700 River Road, Riverdale, Maryland 20737. Work under the agreement may not begin until the required registrations are completed.

27. **National Institutes of Health, DHHS, Guidelines for Research Involving Recombinant DNA Molecules**, as revised
a) APHIS issues permits for the introduction of genetically engineered organisms, including plants, insects, or microbes that may pose a plant pest risk. If the Non-Federal entity wishes to send or receive registered recombinant DNA material, which is subject to quarantine laws, permits to transfer this material into the U.S. or across state lines may be obtained from the APHIS Biotechnology Regulatory Services, Permit Staff, 4700 River Road, 6th Floor, Unit 91, Riverdale, Maryland 20737; biotechquery@aphis.usda.gov. Non-Federal entities are strongly encouraged to submit permits electronically whenever possible at ePermits http://www.aphis.usda.gov/permits/learn_epermits.shtml.
b) In the event that the Non-Federal entity has not established the necessary Institutional Biosafety Committee (IBC), a request for guidance or assistance may be made to the USDA Recombinant DNA Research Officer.

28. **15 U.S.C. 205a et seq**. "The Metric Conversion Act as amended by the Omnibus Trade and Competitiveness Act."

29. **Wild and Scenic Rivers Act of 1968** (16 U.S.C. §§ 1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

30. **41 U.S.C.A. § 4712**, "The Whistleblower Protection Act of 1989"

31. **Environmental standards** which may be prescribed pursuant to the following: (a) notification of violating facilities pursuant to EO 11738; (b) protection of wetlands pursuant to EO 11990; (c) evaluation of flood hazards in floodplains in accordance with EO 11988; (d) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451 et seq.); (e) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (f) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300f-300-j-9); and, (g) protection of endangered species under the Endangered Species Act of 1973, as amended .

32. **Section 106 of the National Historic Preservation Act of 1966**, as amended (54 U.S.C. § 306108, Effect of undertaking on historic property), EO 11593 (identification and protection of historic properties), and Section 3 of the Archaeological and Historic Preservation Act of 1974 (54 U.S.C.A. § 312502, Threat of irreparable loss of destruction of significant scientific, prehistorical, historical, or archaeological data by Federal construction projects).

33. **Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970** (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or Federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

34. **Prohibitions Against Using Funds Under Grants and Cooperative Agreements with Entities that Require Certain Internal Confidentiality Agreements.** (a) The Non-Federal Entity (NFE) may not require its employees, contractors, or subrecipients seeking to report fraud, waste, or abuse to sign or comply with internal confidentiality agreements or statements prohibiting or otherwise restricting them from lawfully reporting that waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized

to receive such information. (b) The NFE must notify its employees, contractors, or subrecipients that the prohibitions and restrictions of any internal confidentiality agreements inconsistent with paragraph (a) of this award provisions are no longer in effect. (c) The prohibition in paragraph (a) of this award does not contravene requirements applicable to any other form issued by a Federal department or agency governing the nondisclosure of classified information. (d) If the Government determines that the NFE is not in compliance with this award provision, it: (1) Will prohibit the NFE's use of funds under this award, in accordance with sections 743, 744 of Division E of the Consolidated Appropriations Act, 2016 (Pub. L. 114-113) or any successor provision of law; and (2) May pursue other remedies available for the NFE's material failure to comply with award terms and conditions.

35. **5 U.S.C. §§1501-1508 and 7324-7328** - Political Activity of Certain State and Local Employees and Provisions of the Hatch Act that limit the political activities of Federal employees.

36. **Conflict of Interest Policy** - Establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

37. **7 CFR Part 520** - Procedures for implementing NEPA (ARS awards only).

38. **49 U.S.C. 40118** - When Agency funds are used, and no Federal, statutory exceptions apply, the Cooperator/Awardee shall ensure that any air transportation of passengers and property is provided by a carrier holding a United States Government issues certificate in compliance with the International Air Transportation Fair Competitive Practices Act of 1974 (Fly America Act).

39. **Earthquake Hazards Reduction Act of 1977** and **Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction** (EO 12699) (only applicable to NACA for construction).

40. **Buy American and Hire American.** EO 13788 of April 18, 2017.

41. **Executive Order 13798 "Promoting Free Speech and Religious Freedom"** As a recipient of USDA financial assistance, you will comply with the following: 1. Do not discriminate against applicants for sub-grants on the basis of their religious character. 2. 7 C.F.R. part 16.3(a), Rights of Religious Organizations. 3. Statutory and National policy requirements including those prohibiting discrimination and those described in EO 13798 prompting free speech and religious freedom, 2 C.F.R. 200.300.

42. **Freedom of Information Act.** Public access to culturally sensitive data and information of Federally recognized Tribes may also be explicitly limited by P.L. 110-246, Title VII Subtitle B § 8106 (2008 Farm Bill).

The full text of Code of Federal Regulations (CFR) references may be found at: http://www.ecfr.gov/cgi-bin/ECFR?page=browse
The full text of United States Code (U.S.C.) references may be found at: http://uscode.house.gov/search/criteria.shtml

D. CERTIFICATIONS

See the Award Face Sheet, REE-451, for required certifications.

Karla Childs, Grants Specialist

U.S. DEPARTMENT OF AGRICULTURE
RESEARCH, EDUCATION, AND ECONOMICS

GRANT AND COOPERATIVE AGREEMENT BUDGET

Recipient Name: UNIVERSITY OF GEORGIA

Agreement No.: 59-6040-1-004

Type of Action: New

PRINCIPAL INVESTIGATOR
DANIEL PEREZ

	FUNDS REQUESTED BY PROPOSER	FUNDS APPROVED BY AGENCY (If different)
A. Salaries and Wages		
1. Senior/Key Person(s)	$24,793.00	$0.00
2. Other Personnel (Post-Doctoral Associates, Graduate Students, Undergraduate Students)	$146,708.00	$0.00
3. Support Personnel/ Secretarial/ Clerical	$0.00	$0.00
Total Salaries and Wages	$171,501.00	$0.00
B. Fringe Benefits (If charged as Direct Costs)	$37,043.00	$0.00
C. Total Salaries, Wages, and Fringe Benefits (A plus B)	$208,544.00	$0.00
D. Equipment *(Provide supporting data. List items and dollar amounts for each item exceeding $5,000.)*	$0.00	$0.00
E. Materials and Supplies	$23,500.00	$0.00
F. Travel (List destination and amount for each trip)		
1. Domestic (Include Canada, Mexico, and U.S. Possessions)	$2,000.00	$0.00
2. Foreign	$6,000.00	$0.00
G. Publication Costs	$7,500.00	$0.00
H. ADP/ Computer Services	$0.00	$0.00
I. Subawards	$0.00	$0.00
J. All Other Direct Costs (Provide supporting data. List items and dollar amounts.)	$6,000.00	$0.00
K. Total Direct Costs (C through J)	$253,544.00	$0.00
L. Indirect Costs (Specify rate(s) and base(s) for on/off campus activity.) (Where both are involved, identify itemized costs included in on and off campus bases.) Rate : 51.00 % Base : $253,544.00	$129,308.00	$0.00
M. Total Direct and Indirect Costs (K plus L)	$382,852.00	$0.00
N. Amount of Deobligation (If applicable)	$0.00	$0.00
O. TOTAL AMOUNT of this REQUEST (M minus N)	$382,852.00	$0.00
P. COST SHARING	$0.00	

Karla Childs, Grants Specialist

REE-455 (10/ 15)

Karla Childs, Grants Specialist

National Science Foundation
Grant Application Cover Page

OMB Number: 3145-0058
Expiration Date: 10/31/2020

Please complete the following NSF forms in conjunction with the relevant Research and Related forms.

1. Funding Opportunity Number

Funding Opportunity Number: 19-592 Opportunity closing date: 11/20/2019

2. NSF Unit Consideration

Go to https://www.fastlane.nsf.gov/pgmannounce.jsp and follow the instructions to find the Division and Program information for this funding opportunity.

Division Code: 08010000 Division Name: DIVISION OF ENVIRONMENTAL BIOL

Program Code: 7242 Program Name: Ecology of Infectious Diseases

3. Principal Investigator (PI) Information

☒ Check here if you are currently serving (or have previously served) as a PI, co-PI or Program Director (PD) on any Federally funded project.

4. Other Information

Check Appropriate Box (es) if this proposal includes any of the items listed below.

☐ Beginning Investigator (Proposal & Award Policies & Procedures Guide (PAPPG) Chapter II.D.2)

☐ AccomplishmentBased Renewal (PAPPG Chapter V.B)

☐ Disclosure of Lobbying Activities (PAPPG Chapter II.C.1.d and Exhibit II-5)

☐ Funding of an International Branch Campus of a U.S. IHE, including through use of a subaward or consultant arrangement (PAPPG Chapter I.E.1)

☐ Funding of a Foreign Organization including through use of a subaward or consultant arrangement (PAPPG Chapter I.E.6)

Attach PDF files only for any attachments below

5. Additional Single-Copy Documents

☒ Add Attachments | Delete Attachments | View Attachments

6. Data Management Plan Data_Management_Plan.pdf — Add Attachment | Delete Attachment | View Attachment

7. Mentoring Plan Postdoctoral Researcher Mentoring Plan, required for proposals that request funding to support postdoctoral researchers (PAPPG Chapter II.C.2.j)

US-UK post doc mentoring program.pdf — Add Attachment | Delete Attachment | View Attachment

8. GOALI - Industrial PI Confirmation Letter

Add Attachment | Delete Attachment | View Attachment

9. RAISE - Program Officer Concurrence Emails

Add Attachment | Delete Attachment | View Attachment

10. Type of Proposal (select one) Research

11. Authorized Representative (AOR)

Provide the NSF ID associated with the AOR for this application:

NSF ID: 000497287

Data Management Plan and Program Management.

The PI and Co-PI, Dr. Darrell R. Kapczynski and Dr. Daniel R. Perez, will be responsible for overall management of the project. Dr. Kapczynski has experience as a USDA-ARS Lead Scientist in the Mucosal Immunology and the Avian Influenza research programs. Dr. Perez has prior experience supervising large and complex projects like this. Both PIs will ensure that resources are available as necessary to meet the administrative needs of the project. Further support will be available from the ARS, Information Technology Services Division (ITSD) and the ARS Office of Communications (OC). At the University of Georgia, the Office of Information Technology (OIT) of the College of Veterinary Medicine, has computer support technicians and system administrators on staff to meet the demands of information collection, classification, sharing and storage.

Integrated Implementation.

Accomplishment of these research objectives will involve the participation of all project leaders. Communication among the different members in this proposal is first priority to achieve the goals proposed. Harmonized protocols and operating procedures will be discussed and implemented to insure consistency of results obtained in different laboratories. We will assure that clear channels exist for official communication including establishment of tasks, deliverables, schedules, and changes to those elements. Scientific level communication is encouraged among all participants to assure that technical information is freely and efficiently disseminated and thoroughly discussed. The management approach is designed to communicate clearly to all project members the tasks to be done, the requirements for those tasks, and the schedule and resources available, and to track progress so that problems can be identified and resolved at the earliest possible time.

The first planning meeting (first annual meeting) will be held at the beginning of the granting period to establish the research assignments to the various participating collaborating groups, as well as determine the milestones and deliverables for the first year, to evaluate progress. A document will be generated from this first meeting that will serve as the *blueprint* for the specific tasks and will be implemented during the first year. These meetings will be repeated in years 2 to 5 to discuss progress and plan programmatic activities for subsequent years.

A Work Implementation List (WIL) will be the key planning and control document. This document will contain several levels. The top level consists of the Specific Aims or Objectives of the grant, as outlined in the Project Description. Each Principal Investigator with their key personnel will develop the second level WIL for their group. The WIL is designed to breakdown the Objectives listed in the Project Description into well-defined tasks. This includes goals from which the lower-level tasks are derived as well as the experimental requirements and measurable outcomes. The list of tasks, the relationships between the tasks, and the schedule will be incorporated. The individuals, who will actually perform the tasks, increasing their commitment and serving as an internal review, will provide estimates of time and other resources. A single person will be responsible for the successful completion of each WIL element, within previously agreed resource and schedule allocations. These individuals will enter quarterly reports on the progress reports area of the secure website. On a yearly basis, the Pi or Co-PI will perform sites visits to the UK or China groups in order to evaluate progress and share results on site and identify additional research opportunities.

Tracking progress will be accomplished primarily by quarterly review of the reports entered into the secure website, particularly the near-term milestones. Any task that is falling behind schedule, is consuming more resources than planned, or is encountering unforeseen difficulties becomes the focus of corrective action. The process of evaluating progress is

constant: estimating what remains to be done, iterating the schedule, and communicating the results to all concerned. Monthly video/teleconference will take place in order to further discuss progress and share findings, coordinate shipment of reagents to and from surveillance sites.

Data:

The proposed research will generate research models that will address the following questions:
How do avian influenza viruses evolve in wild birds?
What amino acid sites are variable in terms of virus evolution?
What role does innate and adaptive immunity (vaccines) play in virus evolution from domestic poultry or mallards?
Do these viruses demonstrate the ability to jump from avian to mammalian species during the course of passage?

All collected data will be stored in a database server that allows database modification, access to information, manages remote access as well as backup creation and multiuser sessions. Several databases will be used for data analysis and management in safety mode. We will continue with our routine submission of sequences to Genbank along with metadata using the Influenza Research Database (IRD, http://www.fludb.org). All of the research data generated by this project will be documented in publications. In addition, the website will have public links to access to information about materials and methods. AIV isolates and reagents prepared for them will be made available to the research community at large.

Publications:

Each PI in the group will prepare and submit scholarly articles about the results of the research to journals such as Emerging Infectious Diseases, Journal of Virology, Veterinary Microbiology, and similar journals that publish on epidemiology of infectious diseases.

Postdoctoral Mentoring Plan

Postdoctoral training at the USDA-ARS-U.S. National Poultry Research Center (USNPRC) and the University of Georgia (UGA), Department of Population Health, occurs in a rich scholarly environment where the postdoctoral trainee is in partnership with their mentor within the Southeast Poultry Research Laboratory or Poultry Diagnostic Research Center. Postdoctoral researchers and scientists are a critical part of the USNPRC/UGA research community, bringing valuable expertise, national prestige, and additional research funding into Center. The time spent as a postdoctoral appointee is in preparation for a career progression in academe, industry, government, or the nonprofit sector. For many, postdoctoral work is a critical step in securing future employment. USDA and UGA welcome qualified researchers with postdoctoral fellowships in all disciplines to Athens, GA, and hopes that the relationships formed and research done during their tenure here will be most helpful in their professional development.

USDA-ARS and UGA are committed to produce highly competitive and knowledgeable individuals in the area of this proposal, molecular evolution of avian influenza viruses. To enhance the postdoctoral researcher's experience and development a mentoring plan will be developed that best matches the individual's long term career goals (1, 2). The mentoring plan will include: 1) the opportunity to perform cross-institutional projects between the groups; 2) to attend seminars; 3) the participation in teaching and mentoring workshops including the ability to guest lecture in relevant topic and journal club meetings; 4) interact with visiting scholars through seminars 5) participation in meetings of high level of U.S. government scientists that produce national policy changes on avian influenza; 6) attend two scientific conferences per year that could include the American Society of Virologists or national meetings sponsored American Society for Microbiology, the OFFLU network and the International Society for Influenza and Other Respiratory Diseases; and **7)** participate and present their work in monthly laboratory meetings, quarterly reports and participation in monthly video/teleconferences with investigators of collaborating institutions. Yearly written and oral interviews with the postdoctoral researcher will be used to assess the effectiveness of the mentoring plan and to make adjustments as needed.

At the Roslin Institute, University of Edinburgh, postdoctoral researchers will be encouraged in their career development by attendance at several of the institutes seminar series and divisional meetings, specialist journal clubs and discussion groups, the Postdoctoral and Early Career group meetings, training courses offered through the University of Edinburgh Institute for Academic Development, other on-campus training courses, and specialist training courses (e.g. high performance computing and bioinformatics). Individual development plans (IDPs) will be discussed and created yearly for the postdoctoral associates. IDP plans for the UK postdoctoral associates are based on the University of Edinburgh performance development review process and the UK Researcher Professional Development framework (https://www.vitae.ac.uk).

References:

1. **Biology, T. F. o. A. S. f. E.** Individual Development Plan for Postdoctoral Fellows.

2. **National Academy of Science, N. A. o. E., Institute of Medicine.** 2000. Enhancingthe Postdoctoral Experience for Scientists and Engineers: A guide for Postdoctoral Scholars, Advisers, Institutions, Funding Organizations, and Disciplinary Societies. National Academies Press.

USDA
United States Department of Agriculture
Research, Education, and Economics
Agricultural Research Service

November 15, 2019

RE: Letter of commitment

TO: NSF Ecology and Evolution of Infectious Diseases Program (EEID)

I am writing to formally confirm that we intend to collaborate on the project "US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses". This tri-country proposal includes Dr. Paul Digard, PhD as the project director from the UK (submitted through BBSRC) and Dr. Wenjen Liu, Ph.D, as project director from China (submitted through National Academy of Sciences China).

As detailed in the proposal, our teams at the USDA and UGA will focus on more on the in vivo side of things, characterizing viral evolution in different types of birds and with varying levels of immunity. I agree to undertake the tasks assigned to me or my organization, as described in the proposal, and I commit to provide or make available resources specified in this application.

Kind regards,

Darrell R. Kapczynski, Ph.D.
Exotic & Emerging Avian Viral Diseases
SEPRL, ARS, USDA
934 College Station Rd
Athens, Ga 30605
P-706.546.3471
F-706.546.3161
E-darrell.kapczynski@ars.usda.gov

UNIVERSITY OF
GEORGIA

College of Veterinary Medicine
Department of Population Health

November 18, 2019

To: NSF Ecology and Evolution of Infectious Diseases Program

From: Daniel R. Perez, University of Georgia

By signing below, I acknowledge that I am listed as a collaborator on this proposal, entitled "US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses" with Darrell Kapczynski, PhD as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the proposal, and I commit to provide or make available resources specified in this application.

Signed:

Daniel R. Perez, PhD
Georgia Research Alliance Distinguished Investigator
Caswell S. Eidson Chair in Poultry Medicine
Poultry Diagnostic and Research Center
Department of Population Health
College of Veterinary Medicine
University of Georgia, Athens, GA
e-mail: dperez1@uga.edu
Phone: 706-542-5506

THE ROSLIN INSTITUTE
The University of Edinburgh
Easter Bush
Midlothian
EH25 9RG
Telephone: +44 (0)131 651 9100
www.ed.ac.uk/roslin

Letter of Collaboration
(please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program
From: Professor Paul Digard

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Roslin Institute, University of Edinburgh, UK

Date: 16 Nov 2019

Letter of Collaboration (please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr. Wenjun Liu

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Institute of Microbiology, Chinese Academy of Sciences, China

Date: 16 Nov 2019

Letter of Collaboration (please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr. Samantha Lycett

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Roslin Institute, University of Edinburgh, UK

Date: 11 Nov 2019

Letter of Collaboration (please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Prof. Lonneke Vervelde

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Roslin Institute, University of Edinburgh, UK

Date: 14 Nov 2019

November 15, 2019

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program
From: Dr. Lisa Boden

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Sincerely,

Dr. Lisa Boden AB BVSc LLM PhD MANCVSc DipECVPH
Senior lecturer in population medicine and animal health policy
Deputy Director of EPIC, Scottish Government's Centre of Expertise on Animal Disease Outbreaks
The Royal (Dick) School of Veterinary Studies and The Roslin Institute
Easter Bush Campus, Midlothian, EH25 9RG

Letter of Collaboration (please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr. Lu Lu

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Usher Institute, University of Edinburgh, UK

Date: 11 Nov 2019

Letter of Collaboration (please provide using the below template, per NSF requirements)

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr Barbara Shih

(Printed name of the individual collaborator or name of the organization and name and position of the official submitting this memo)

By signing below (or transmitting electronically), I acknowledge that I am listed as a collaborator on this proposal, entitled "**US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses**" with **Dr. Darrell Kapczynski** as the Principal Investigator. I agree to undertake the tasks assigned to me or my organization, as described in the project description of the proposal, and I commit to provide or make available the resources specified therein.

Signed:

Organization: Roslin Institute, University of Edinburgh, UK

Date: 14 Nov 2019

BBSRC
Polaris House, North Star Avenue, Swindon, Wiltshire,
United Kingdom SN2 1UH
Telephone +44 (0) 1793 413200
Web http://www.bbsrc.ac.uk/

COMPLIANCE WITH THE DATA PROTECTION ACT 1998

In accordance with the Data Protection Act 1998, the personal data provided on this form will be processed by BBSRC, and may be held on computerised database and/or manual files. Further details may be found in the **guidance notes**

Small Grants PROPOSAL

Document Status: With Owner
BBSRC Reference:

UK Partner Funding

Organisation where the Grant would be held

Organisation	University of Edinburgh	Research Organisation Reference:	9611792
Division or Department	The Roslin Institute		

Project Title [up to 150 chars]
US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses

Start Date and Duration

a. Proposed start date	01 June 2020	b. Duration of the grant (months)	36

Applicants

Role	Name	Organisation	Division or Department	How many hours a week will the investigator work on the project?
Principal Investigator	Professor Paul Digard	University of Edinburgh	The Roslin Institute	3.75
Co-Investigator	Dr Samantha Lycett	University of Edinburgh	The Roslin Institute	7.5
Co-Investigator	Professor Lonneke Vervelde	University of Edinburgh	The Roslin Institute	3.75
Co-Investigator	Dr Lisa Anne Boden	University of Edinburgh	Roslin Institute	3.75

Objectives

List the main objectives of the proposed research in order of priority [up to 4000 chars]

Avian influenza viruses (AIV) are endemic in certain wild bird populations, and from there, spill over into domestic birds and human populations where they cause outbreaks of severe disease. Some strains of AIV pose a greater threat than others, because of a combination of their pathogenicity, geographic and host range; exemplified in recent years by four major incursions of H5 and H7 subtype viruses.

We hypothesise that mathematical models of viral evolution with genuine predictive value can now be constructed using a combination of experimental in vitro and in vivo studies and field viral sequence data. We will generate and parameterise these models, and produce spread and host range risk maps for specific AIV strains that can be used to inform vaccination and other control strategies.

The proposed research is a US-UK-China collaborative project and is split into three work packages with specific aims -

Work package 1. Modelling evolution of AIV across scales
SA1.1 Key amino acid sites model - (China, UK)
SA1.2 Fitness landscape model - (UK)
SA1.3 AIV sampling in China (China)
SA1.4 Phylodynamic model - (UK).

Work package 2. Immune-driven evolution of AIV
SA2.1 Influence of innate immunity and host species on evolution of AIV (UK, US).
SA2.2 Influence of adaptive immunity on AIV evolution (US).
SA2.3 Testing of models generated from these studies with current outbreak strains (US, China).

Work package 3. Assessing Risk, Predictions and Science-Policy Interface
SA3.1 Generating Risk Maps and predictions from models - (UK, China)
SA3.2 Science-policy engagement and communication - (UK)

Summary

Describe the proposed research in simple terms in a way that could be publicised to a general audience [up to 4000 chars]

Influenza virus is a global problem, causing widespread harm to human health and the food production system because it also infects chickens and pigs. Vaccination is difficult because of the variety and changeability of flu strains found in nature - primarily in wild birds, where often they cause little harm. However, when these strains of virus spill over into domestic poultry or humans, they can cause massive economic losses and fatal disease respectively. In the last twenty years, this has been graphically illustrated by the H5N1 and H7N9 outbreaks. Global surveillance programmes track the virus' movement and as part of this, characterise the sequence of the viral genome. Some aspects of virus behaviour can be accurately predicted from these sequences. However, many other important aspects of virus biology, such as whether it will travel across continents, which species it will infect and whether it will cause serious harm, are much harder to forecast. Our premise is that the volume of sequencing data now available, along with recent advances in computational methods of using such data, will make it possible for the first time to generate virtual models of how the virus will evolve under specific circumstances and how these viral variants will behave. Such models have the potential to produce risk estimates of new strains as they arise that can be used to inform policy and direct strategies to head off impending threats.

To achieve this goal, we have brought together a team of international experts with interdisciplinary expertise in mathematical modelling, influenza surveillance and biology, and the infectious disease-public and animal health interface. Importantly, this includes colleagues from China, the likely epicentre of the virus. Together, we will create the computer models that can understand and forecast virus evolution; models that will be made accurate and then tested through a series of focussed laboratory experiments designed to produce the needed data, and whose types of output will be tailored

to the needs of end users through a series of workshops that include the primary stake holders so they can inform the scientists on what information they need.

Technical Summary

Describe the proposed research in a manner suitable for a specialist reader. This summary will be made publicly available if the proposal is funded. [up to 2000 characters]

Influenza A virus poses one of the greatest infectious disease challenges of the 21st Century. It is a fast evolving ubiquitous avian pathogen with vast antigenic diversity that hinders conventional vaccine approaches, especially in low-value livestock species like poultry. It causes huge economic losses and drains public health budgets. Surveillance programmes generate huge amounts of viral sequence data; surpassing 1 million entries on Genbank. Aspects of virus behaviour could be predicted from these sequences, knowledge of host immune pressures, and epidemiological drivers and we think that advances in computational approaches mean that the construction of modelling tools with genuine predictive power for the future evolution and spread of avian influenza is possible. To achieve this, we have assembled an international team of experts with interdisciplinary expertise in mathematical/phylodynamic modelling, influenza, and the infectious disease-public and animal health interface. Importantly this includes Chinese colleagues who run a surveillance programme in the epicentre of viral diversity. The prediction tool will be the sum of three separate models: one which identifies key viral sequence polymorphisms; one which models virus evolution within host under selection pressure; and one that integrates outputs from the first two along with additional inputs from surveillance programs. The primary data inputs are virus sequence information, both at quasi-species and consensus level. We will parameterise the models from existing data (public and unpublished data held by the team) and a series of planned "wet lab" experiments that measure virus fitness. We wish the tool outputs to be useful to stakeholders such as the OIE and WHO as well as small and large poultry holders; development will therefore be informed by a series of knowledge-exchange exercises to get input from these groups on viral evolution risk and predictions.

Academic Beneficiaries

Describe who will benefit from the research [up to 4000 character]

This research will be of interest to a broad range of researchers:

1. Scientists active in the area of mathematical analysis of viral evolution and predictive phylodynamics. Advances in sequencing technology have arguably outstripped our ability to fully utilise the data. The creation of innovative computational models to take advantage of high depth sequence information on a relatively small and very quickly evolving genome are the core of our proposal. These models will be of interest not just to specialists in influenza virus, but anyone who wishes to apply similar approaches to other pathogens.
2. Scientists who specialise in influenza virus; both those interested in viral epidemiology and those in the molecular aspects of viral pathogenesis and host range. If successful, this proposal will provide new tools for understanding IAV transmission and spread. Furthermore, the individual "wet lab" modules are designed to test specific hypotheses regarding virus biology and will by themselves, provide important information to the field.
3. Multi- & transdisciplinary approaches are employed in this collaborative cross-boundary partnership, offering the potential for mutual learning between researchers in natural sciences & social science/humanities disciplines. Researchers, practitioners & decision-makers interested in improving science-policy communication & implementation of outputs from data-driven predictive tools will be important beneficiaries. Lessons learned from this exemplar will generate a set of transferrable skills which will be useful in other science-policy domains.

Impact Summary

Impact Summary (please refer to the help for guidance on what to consider when completing this section) [up to 4000 chars]

What is the benefit of this research?

The primary benefit will be improved means to forecast and therefore control the spread of avian influenza virus.

Who will benefit and how?

For each beneficiary the timescale of the impact has been estimated as immediate (I, during the time frame of the project), medium term (M, 1-5 years after the project has been completed) or long term (L, >5 years after the project has been completed). Note that although the UK side of the project will only be funded for the first three years, the whole project is for 5 years.

1. Policy makers. This project will provide data-driven, scientifically rigorous advice to formulate strategies to control outbreaks of avian influenza. This will benefit policy makers in the UK, EU, Asia and US; all areas regularly at high risk of avian influenza. The research proposed here is harmonised with the project currently funded by the Scottish government "Centre of Expertise on Animal Outbreaks (EPIC III)" whose remit is to provide similar outbreak and control advice, as well as a US-UK joint NIFA-NSF-NIH-BBSRC-funded project "Drivers of diversity and transmission of co-circulating viral lineages in host meta-population" which aims to provide advice towards controlling the porcine pathogen, PRRSV. (I, M, L)
2. Rural communities. Provision of advice that restricts the spread of avian influenza will benefit communities that keep backyard poultry flocks -both hobby flocks in the UK, EU and US, and subsistence farmers in low and middle income countries also at risk of avian influenza (M, L).
3. Commercial poultry enterprises. Experience proves that poultry biosecurity even in Western countries is not always sufficient to keep avian influenza out - whether in lower security "free range" farms or industrial housing. Advice that reduces the probability of these low frequency but high impact events will thus directly benefit the producers and indirectly benefit the economies of the countries they are situated in. This includes the UK, where winter incursions of highly pathogenic avian influenza have occurred in several of the last few years. (M, L).
4. Vaccine companies. Poultry influenza vaccines are routinely used in many countries and have recently been used to great effect to control H7N9 influenza in China. Advice that helps with virus strain selection will therefore benefit this important market (M, L).

Animal Species

Does the proposed research involve the use of non-human primates?	Yes	✓No
Does the proposed research involve the use of dogs?	Yes	✓No
Does the proposed research involve the use of cats?	Yes	✓No
Does the proposed research involve the use of equidae?	Yes	✓No

Please select any other species of animals that are to be used in the proposed research.

Fish	Sheep
Rabbit	Rat
Amphibian	Poultry
Cow	Mouse
Reptile	Guinea Pig
Pig	Other Rodent
✓Bird	Other Animal

Species : Bird

Statistical Analysis

Experimental Design and Statistical Framework: Please justify your use of the species proposed and describe the experimental design, including any plans to reduce bias such as blinding or randomisation if appropriate. A justification of the proposed sample size must be given along with details of the planned statistical analyses. Power calculations must be

included in this section if appropriate.

In this collaborative proposal, the UK is performing in vitro experiments and computational modelling. The US is performing in vivo transmission experiments, and China is performing in vivo experiments and viral surveillance in birds. This proposal is about avian influenza and the virus is being studied in its host species, including chickens, ducks and quail.

Numbers of birds used for experiments are determined by previous studies of the collaborators and are based on sample sets sufficient to demonstrate statistical significance. All procedures will be performed under Institutional Animal Care and Use Committee (IACUC) approved animal use protocols. Data will be analyzed by ANOVA. Treatment means will be separated by Tukeys multiple comparison test. All data will be evaluated for approximately normal distribution and similar group variance. Transformations, such as log10, will be used to correct for skewness.

Implications

Are there ethical implications arising from the proposed research? No

Provide details of what they are and how they would be addressed [up to 4000 characters]

Summary of Resources Required for Project

Financial resources

Summary fund heading	Fund heading	Full economic Cost	BBSRC contribution	% BBSRC contribution
Directly Incurred	Staff	391873.00	313498.40	80
	Travel & Subsistence	59900.00	47920.00	80
	Other Costs	131609.00	105287.20	80
	Sub-total	**583382.00**	**466705.60**	
Directly Allocated	Investigators	134352.90	107482.32	80
	Estates Costs	179448.00	143558.40	80
	Other Directly Allocated	32188.00	25750.40	80
	Sub-total	**345988.90**	**276791.12**	
Indirect Costs	Indirect Costs	379672.00	303737.60	80
Exceptions	Travel & Subsistence	0.00	0.00	100
	Other Costs	0.00	0.00	100
	Sub-total	**0.00**	**0.00**	
	Total	**1309042.90**	**1047234.32**	

Summary of staff effort requested

	Months
Investigator	17.75
Researcher	89
Technician	0
Other	0
Visiting Researcher	0
Student	0
Total	106.75

Other Support

Details of support sought or received from any other source for this or other research in the same field.

Awarding Organisation	Awarding Organisation's Reference	Title of project	Decision Made (Y/N)	Award Made (Y/N)	Start Date	End Date	Amount Sought / Awarded (£)
BBSRC	BB/T004401/1	[18-EEID US-UK DDCOVMP] Drivers of diversity and transmission of co-circulating viral lineages in host meta-populations	Y	Y	01/09/2019	31/08/2023	499131
The Scottish Government	EPIC III (Roslin)	Centre of Expertise on Animal Disease Outbreaks	Y	Y	01/04/2016	31/03/2021	1750000
BBSRC	BBS/E/D/20002173	Pathogen diversity, host specificity and virulence (Roslin Institute Strategic Programme 2.2)	Y	Y	01/04/2017	31/03/2022	1512490
BBSRC	BB/S00114X/1	Identification of interferon stimulated genes that restrict cross-species transmission of influenza A virus	Y	Y	01/03/2019	28/02/2022	756000
European Commission	727922	DELTA-FLU: Dynamics of avian influenza in a changing world	Y	Y	01/06/2017	31/05/2022	525000

Staff

Directly Incurred Posts

			EFFORT ON PROJECT							
Role	**Name /Post Identifier**	**Start Date**	**Period on Project (months)**	**% of Full Time**	**Scale**	**Increment Date**	**Basic Starting Salary**	**London Allowance (£)**	**Super-annuation and NI (£)**	**Total cost on grant (£)**
Researcher	Dr B B Shih	01/06/2020	36	14	UE07	01/08/2020	39609	0	12632	22515
Researcher	Dr Lu Lu	01/06/2020	36	100	UE07	01/08/2020	40322	0	13509	168322
Researcher	PDRA Vacancy	01/06/2020	36	100	UE07	01/08/2020	37345	0	12433	158309
Researcher	Vacancy	01/06/2021	12	100	UE06	01/08/2021	31302	0	10300	42727
									Total	391873

Applicants

Role	Name	Post will outlast project (Y/N)	Contracted working week as a % of full time work	Total number of hours to be **charged** to the grant over the duration of the grant	Average number of hours per week **charged** to the grant	Rate of Salary pool/banding	Cost estimate
Principal Investigator	Professor Paul Digard	Y	100	495	3.8	122778	36833
Co-Investigator	Dr Samantha Lycett	Y	100	990	7.5	75648	45389
Co-Investigator	Professor Lonneke Vervelde	Y	100	495	3.8	90942	27283
Co-Investigator	Dr Lisa Anne Boden	Y	100	495	3.8	82827	24848
						Total	134353

Travel and Subsistence

Destination and purpose		Total £
Outside UK	Attendance at 4 European conferences	4000
Within UK	Attendance at UK conferences and Courses	3000
Outside UK	Visits to Collaborators in China	8000
Outside UK	Visits to collaborators in US	8000
Outside UK	Accommodation and subsistence for Workshops	8400
Within UK	Domestic flights and travel for workshop participants (£100 pp x 30 persons x 3 events)	9000
Outside UK	Workshop participants accommodation	13500
Outside UK	International flights for travel between UK and partner countries	6000
	Total £	59900

Other Directly Incurred Costs

Description	Total £
1 high spec desktop - Mac 27" = iMac (core i9, 2TB fussion drive, 32GB RAM)	2187
1 standard desktop for PDRA vacancy	700
2 x SciQuip Tube Rotator Disc Pro machines with accessory plates for different size tubes	1690
2 x MacBook Pro (core i7, 1TB SSD, 16GB RAM)	3876
Consumables	60000
Laser Scanning Confocal Microscopy	3750
Computer software	2500
Transcription and translation costs (English-Mandarin)	2000
Interpreter for workshop	3000
Illumina Sequencing	30818
Purchase of Eggs	7238
Recruitment costs	1730
Workshop venue and catering	12120
Total £	131609

Other Directly Allocated Costs

Description	Total £
Infrastructure Technicians	12564
Total £	12564

Research Facilities/Existing Equipment

Description	Total £
2Tb of Data Archive	1000
1TB of Eddie storage (Fast Access) x 3 years	1200
24 core years on Eddie (8 cores x 3 years)	4224
15Tb Data storage	13200
Total £	19624

Research Council Facilities

details of any proposed usage of national facilities
Research Council Facilities are not relevant to this application.

Ethical Information

Please answer the following questions as appropriate

a) Human Participation

Would the project involve the use of human subjects?		Yes	No✓
	If yes, would equal numbers of males and females be used?	Yes	No✓
Would the project involve the use of human tissue?		Yes	No✓
Would the project involve the use of biological samples?		Yes✓	No

Would the project involve the administration of drugs, chemical agents or vaccines to humans?	Yes	No✓
Will personal information be used?	Yes	No✓
If yes, will the information be anonymised and unlinked?	Yes	No✓
Or will it be anonymised and linked?	Yes	No✓
Will the research participants be identifiable?	Yes	No✓

b) Animal Research

Would the project involve the use of vertebrate animals or other organisms covered by the Animals (Scientific Procedures) Act?	Yes✓	No
If yes, what would be the maximum severity of the procedures?	Mild or non-recovery	
	Moderate	
	Severe	✓
Please provide details of any areas which are Moderate or Severe:		
No animal experiments covered by the Animals (Scientific Procedures) Act will be carried out in the UK. However, our US and Chinese collaborators will perform virus challenge experiments in animals in various avian (chicken, duck, goose and quail) species and mice respectively. All experiments will be carried out according to Institutional Animal Care and Use Committee (IACUC)-approved animal use protocols.		

c) Genetic and Biological Risk

Would the project involve the production and/or use of genetically modified animals?	Yes	No✓
If yes, will genetic modification be used as an experimental tool, e.g., to study the function of a gene in a genetically modified organism?	Yes	No✓
And will the research involve the release of genetically modified organisms?	Yes	No✓
And will the research be aimed at the ultimate development of commercial or industrial genetically modified products or processes?	Yes	No✓
Would the project involve the production and/or use of genetically modified plants?	Yes	No✓
If yes, will genetic modification be used as an experimental tool, e.g., to study the function of a gene in a genetically modified organism?	Yes	No✓
And will the research involve the release of genetically modified organisms?	Yes	No✓
And will the research be aimed at the ultimate development of commercial or industrial genetically modified products or processes?	Yes	No✓
Would the project involve the production and/or use of genetically modified microbes?	Yes✓	No
If yes, will genetic modification be used as an experimental tool, e.g., to study the function of a gene in a genetically modified organism?	Yes✓	No
And will the research involve the release of genetically modified organisms?	Yes	No✓
And will the research be aimed at the ultimate development of commercial or industrial genetically modified products or processes?	Yes	No✓

d) Approvals

Have the following necessary approvals been given by:			
The Regional Multicentre Research Ethics Committee (MREC) or Local Research Ethics Committee (LREC)?	Yes	No	Not required✓
The Human Fertilisation and Embryology Authority?	Yes	No	Not required✓
The Home Office (in relation to personal and project licences, and certificates of designation)?	Yes	No	Not required✓
The Gene Therapy Advisory Committee?	Yes	No	Not required✓
The UK Xenotransplantation Interim Regulatory Authority?	Yes	No	Not required✓
Administration of Radioactive Substances Advisory Committee (ARSAC)?	Yes	No	Not required✓
Other bodies as appropriate? Please specify.			

e) Other Issues

Are there any other details of which the Council should be aware?	Yes	No✓
If yes, please give details.		

Classification of Proposal

(a) Highlight Areas

Not in a Highlight Area	x

(b) Strategic Priorities

Animal health	x
Bioenergy; generating new replacement fuels for a greener, sustainable future	
Collaborative research with users	
Combatting antimicrobial resistance	
Data driven biology	x
Food, nutrition and health	
Healthy ageing across the lifecourse	
Integrative Microbiome Research	
International partnerships	x
New strategic approaches to industrial biotechnology	
Reducing waste in the food chain	
Replacement, refinement and reduction (3Rs) in research using animals	
Research to inform public policy	x
Sustainably enhancing agricultural production	
Synthetic biology	
Systems approaches to the biosciences	x
Technology development for the biosciences	
Welfare of managed animals	

(ii) Keywords

Keyword	Research Topic	Science Area
Disease modelling	Animal diseases	Animal science
Disease transmission	Animal diseases	Animal science
Epidemiology	Animal diseases	Animal science
Viral diseases	Animal diseases	Animal science
Zoonoses	Animal diseases	Animal science
Communication	Social sciences	Sciences interacting with biological sciences

Proposal Classifications

Research Area:

Research Areas are the subject areas applicable to your proposal and you should select at least one of these. Once you have selected the relevant Research Area(s), please ensure that you set one as primary to facilitate the reviewer selection process. To add or remove Research Areas use the relevant link below. To set a primary area, click in the corresponding checkbox and then the Set Primary Area button that will appear.

Subject	Topic	Keyword
Animal science	Animal diseases [Primary]	
Animal science	Animal diseases [Primary]	Epidemiology
Animal science	Animal diseases [Primary]	Viral diseases (animals)
Animal science	Animal diseases [Primary]	Zoonoses
Animal science	Animal diseases [Primary]	
Animal science	Animal diseases [Primary]	Disease modelling (animals)
Animal science	Animal diseases [Primary]	
Animal science	Animal diseases [Primary]	
Animal science	Animal diseases [Primary]	
Animal science	Animal diseases [Primary]	Disease transmission

Staff Researcher *(see Directly Allocated for Investigators)*

Travel & subsistence:

per diem

Other Directly Incurred Costs:

in vitro *in vivo*

Directly

Allocated for High Performance Compute

in vitro

High Performance Compute and Data storage

Staff Investigators

in vitro

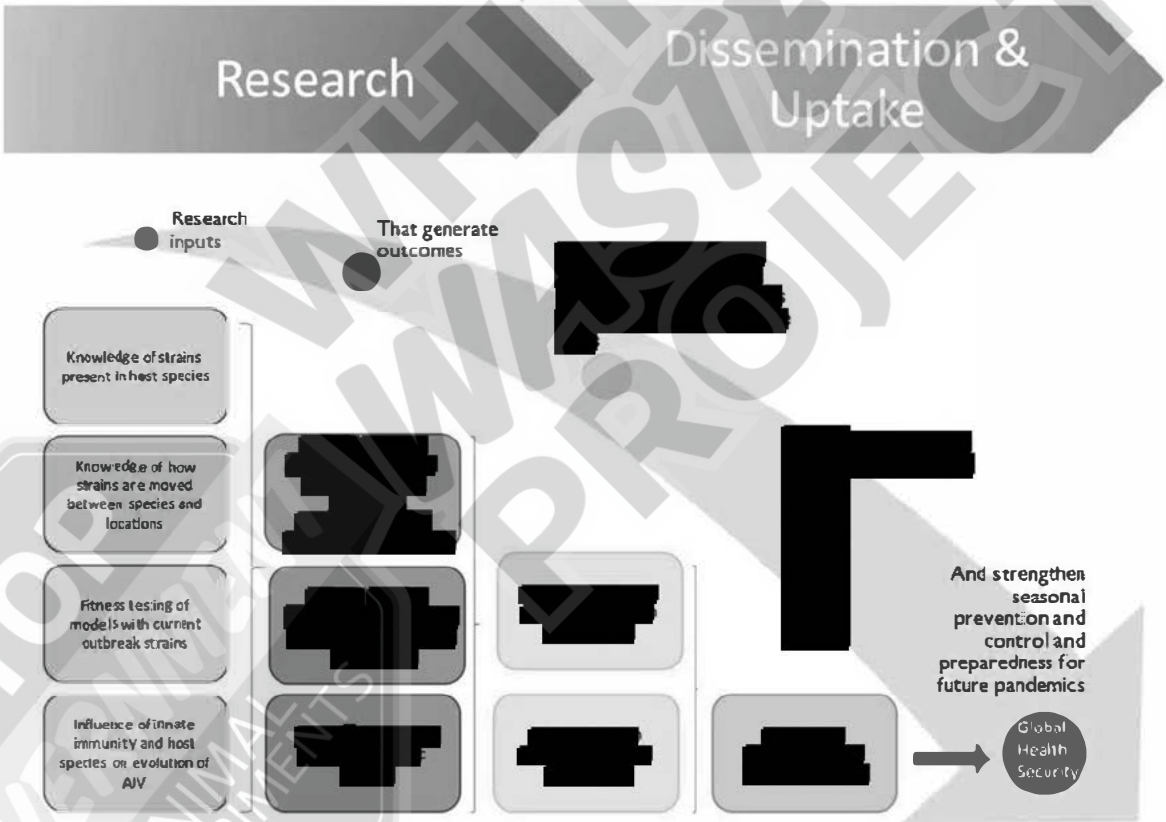
PATHWAYS TO IMPACT

This collaborative US-UK-China project involves creating computational models to investigate, understand and generate predictions about avian influenza evolution and spread, using a combination of in vivo, in vitro and field detailed viral sequence data and corresponding host and epidemiological information. Ultimately this work will enable scientific advice to government and industry about the risks of AIV evolution and allow suggestions of appropriate strategies to counteract the effects of strain evolution.

The main beneficiaries in the UK are anticipated to be (i) farming, food and health sector policy makers; (ii) livestock industry and animals; (iii) wider public, as well as the academic research community (see Academic Beneficiaries section).

This project incorporates particular objectives to generate a predictive capability and assessment of risk, to enable communication of risk to government, industry, veterinary, health, and public audiences; and objectives for stakeholder engagement at the science-policy interface.

The outputs of the project are designed to be accessible to users and stakeholders through face-to-face meetings, social and traditional media, and IT tools.



To help maximize the impact of this project in the UK, the following groups and activities are considered;

(i) Farming, food and health sector policy makers:
Policy makers will potentially be interested in the results of the predictive models, for example in answer to the questions 'which strain(s) might arrive or cause outbreaks next year', and 'what is

the potential for a severe highly pathogenic incursion affecting different species', and of course 'what is the zoonotic potential of a strain?'. In order to engage policy makers, we will: make use of best-practice frameworks for communication of scientific outputs at the science-policy interface in the different partner countries; coordinate a series of knowledge exchange activities with stakeholder groups around issues in model development (e.g. what factors are important to include), how model results can be evaluated in real situations and what form model outputs should take.

Results will be publicised and distributed by presenting at Science/Industry/Policy interface symposia and conferences, and social media, especially building on existing relationships between The Global Academy for Agriculture and Food Sciences / Roslin (led by LB) and policy makers. LB and SL are members of the Scottish Government's Centre for Expertise on Animal Disease Outbreaks consortium (EPIC, http://www.epicscotland.org/), and help to advise on livestock and avian diseases, SL specifically with insights from pathogen sequence data. As part of this ongoing programme (EPIC is funded from 2016 to 2021), there are several scientific and policy meetings per year, and also the opportunity to present at the EPIC organised conferences which invite industry stakeholders, policy makers, economists and scientists.

(ii) Livestock industry and animals:
Farmers and their animals, and small scale producers (including households) in the US, UK and China will benefit from better information about up-coming AIV strains enabling timely pro-active risk reduction strategies, thus avoiding the large economic losses associated with control of outbreaks and subsequent trading restrictions. Engagement with this community will be through attendance at industry focused symposia and workshops, agricultural shows (see also iii), and contribution to non-academic publications.

The work will also generate improved temporal and geographic understanding of AIV diversity, which has the potential to be used in vaccine design. Therefore there is a potential relevance to companies interested in vaccine development, and outcomes from this project may lead to further collaborations with these companies (whether US, UK or China). Appropriate commercialisation routes, or commercial partners for project outputs can be identified and facilitated by Roslin Technologies Ltd, a partnership between the University of Edinburgh, the agriculture-focused private equity advisors JB Equity, and the British Innovation Fund, which develop business opportunities arising from animal science research.

(iii) Wider public:
Public audiences will be engaged by participating in the Roslin Institute's existing programme of public engagement activities, at the Easter Bush Science Outreach Centre (a purpose-built outreach facility that provides hands-on workshops for teachers, school pupils and adults), and at science festivals and agricultural events including the Royal Highland Show (which also has attendance by farming and agricultural policymaker stakeholders). We will generate a public facing website to explain and show the results of the models, including maps and animations of the spread of AIV. We will also make the code and model tutorials available online to support the development of digital and data skills in line with the Scottish Curriculum for Excellence, and the Data Driven Innovation initiative of the Edinburgh and South East Scotland City Region Deal.

DATA MANAGEMENT PLAN

DATA AREAS AND DATA TYPES

Outline the volume, type and content of data that will be generated e.g. experimental measurements, models, records and images

This project will generate quantitative data about avian influenza viruses in avian hosts; including raw read and consensus sequence genomic data, viral titre data, and cellular imaging data. Data analysis and simulations including statistical analysis and phylogenetic /phylogeography/ phylodynamic analysis, will generate further electronic data: parameter values, phylogenetic trees and networks. Estimated size: 15Tb raw and intermediate (partprocessed), 2tb final.

STANDARDS AND METADATA

Outline the standards and methodologies that will be adopted for data collection and management, and why these have been selected

Next generation sequencing data will be generated from the transmission experiments (deep sequencing) and avian population study (consensus), from international partners.

RELATIONSHIP TO OTHER DATA

State the relationship to other data available in public repositories

Phylogenies will be generated with our new data together with existing influenza sequences from Genbank and GISAID in order to evalutate the evolution and phylodynamics of influenza.

SECONDARY USE

Outline the further intended and/or foreseeable research uses for the completed dataset(s)

Influenza sequences and phylogenies can be used in further studies on viral evolution and to help choose suitable vaccine strains.

METHODS FOR DATA SHARING

Outline the planned mechanisms for making these data available, e.g. through deposition in existing public databases or on request, including access mechanisms where appropriate

Influenza sequences generated as part of this project from the avian population study in China will be deposited on GISAID/Genbank together with their location (at least province level) and date of isolation. The US partners will continue their routine submission of sequences to Genbank along with metadata using the Influenza Research Database. Next generation sequencing deep data will be deposited on the Short Read Archive as appropriate.

PROPRIETARY DATA

Outline any restrictions on data sharing due to the need to protect proprietary or patentable data

Some of the detailed data from the *in vitro* experiments and vaccine evaluations may be proprietary/patentable, and detailed data on farm/market/household locations and infection status will not be released for privacy reasons.

TIMEFRAMES

State the timescales for public release of data

Sequence data will be released to co-incide with publications, and an aggregation and temporalspatial anonymization process will be used before any data release / publication of the field data.

FORMATS

State the format of the final dataset

Consensus sequence data will be in fastA format, and raw-sequence data will be converted to fastA or fastQ as part of the bioinformatic processing. Non-genomic data from the in vivo and in vitro experiments, and meta-data associated with the samples (host species, location, date) will be in tabular format. Trees will be in nexus/newick format and networks will be in an convertible structured text format (e.g. GraphML or json).

USDA
United States Department of Agriculture
Research, Education, and Economics
Agricultural Research Service

November 19, 2019

National Science Foundation
2415 Eisenhower Avenue
Alexandria, VA 22314

Re: Letter of Commitment

To Whom It May Concern:
On behalf of the USDA, Agricultural Research Service, I wish to convey our intent that Dr. Darrell Kapczynski collaborate on NSF Ecology and Evolution of Infectious Diseases Program: US-UK-China Collab: "Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses." This submission will build important collaborations to improve protection of poultry from avian influenza virus, both nationally and internationally. Dr. Kapczynski will conduct and/or supervise the work needed to perform the immunology studies and perform the challenge work. He anticipates $1,000,000.80 in funding to support this research. If the proposal is funded, we will establish the necessary agreements and make appropriate resources available to support the project, contingent upon the availability of appropriated funds for ARS research programs. We will provide the infrastructure to perform the testing as specified in the project description. Specifically, the ARS has designated that existing resources such as space that is already in use to perform the animal experiments outlined in this proposal. In addition, we have the equipment and expertise to complete the downstream *in silico* analysis to support this research in order to accomplish the objectives of this grant.

Dr. Kapczynski can be reached by telephone at (706) 546.3471 or by email at darrell.kapczynski@usda.gov for any additional technical or scientific detail. Please contact Janet Moreno, USDA, ARS, Grant Management Specialist by telephone at (706) 340-3096 or via e-mail at Jan.Moreno@usda.gov if you need additional information.

Sincerely,

ELLEN HARRIS Digitally signed by ELLEN HARRIS Date: 2019.11.19 12:35:59 -06'00'

Ellen Harris, DrPH
Associate Area Director, SEA

Area Office
Southeast Area, Jamie Whitten Delta States Research Center
141 Experiment Station Road, P. O. Box 225
Stoneville, MS 38776-0225

ROSLIN

THE UNIVERSITY of EDINBURGH
The Royal (Dick) School of Veterinary Studies

THE ROSLIN INSTITUTE
The University of Edinburgh
Easter Bush
Midlothian
EH25 9RG
Telephone: +44 (0)131 651 9100
www.ed.ac.uk/roslin

Our ref: 9611792

18 November 2019

Dear Committee

US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses

I am writing in support of the proposal from Prof Paul Digard, Dr Samantha Lycett, Prof Lonneke Vervelde and Dr Lisa Boden "US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses" in collaboration with Dr Darrell Kapczynski, Dr Daniel Perez and Prof Wenjun Liu.

This proposal is about the evolution and epidemiology of avian influenza virus and includes a mixture of "wet lab", fieldwork and computational studies to be carried out by an interdisciplinary team of scientists for the University of Edinburgh (UK), the USDA South Eastern Poultry Research Laboratory, the University of Georgia (USA) and the Chinese Academy of Science Institute of Microbiology. The concept of the proposal has been approved by the Science Management Group of the Roslin Institute, and the proposal complements our existing BBSRC Institute Strategic Programme - Control of Infectious Diseases, but the research proposed in the current application is unique and does not duplicate or overlap substantially with this and other research supported at Roslin. I confirm that if this application is successful that the resources requested will be available, and have been costed according to our standard Roslin Institute, University of Edinburgh model applicable for BBSRC funding.

Mark Stevens

Professor Mark Stevens
Deputy Director (research)
The Roslin Institute
University of Edinburgh

Tel: 0131 651 9128
Email: mark.stevens@roslin.ed.ac.uk

College of Veterinary Medicine

Associate Dean, Research and Graduate Affairs

November 18, 2019

RE: **"US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses."**

To Whom It May Concern:

The programmatic and administrative personnel at The University of Georgia are in support of the proposed collaboration between The University of Georgia Research Foundation Inc. ("UGARF; EIN 58-1353149; DUNS 00-431-5578) and USDA ARS. Dr. Daniel Perez will serve as principal investigator for our institution. The total subaward budget, as reflected on the attached budget forms, is in the amount of $382,852 for the period of August 1, 2020 until July 31, 2025. We agree to establish the necessary agreements to participate in the project if the proposal is awarded funding.

As a point of clarification, all research awards garnered by faculty at The University of Georgia (UGA), a state-supported institution of higher education, are made to The University of Georgia Research Foundation, Inc., which is a private, non-profit organization affiliated with UGA. UGARF is the legal entity designated by the Board of Regents of the University System of Georgia to receive funds for research projects to be conducted at UGA. UGARF will subcontract this research award to UGA, and UGA will perform the research.

I am writing this letter of institutional support in accordance with decentralized institutional signatory authority delegated to me. Award documentation should be directed Tammi Childs, Grant Officer, at tachilds@uga.edu or (706) 542-5069.

Please contact me at (706) 542-5268 or via e-mail at rachelg4@uga.edu should you need additional information.

Sincerely,

Rachel Baker
Grants Coordinator III
College of Veterinary Medicine

Suite 227 | 501 DW Brooks Dr. | Athens, GA 30605
Telephone 706-542-5734 | Fax 706-542-8254

THE UNIVERSITY of EDINBURGH

The University Court of the University of Edinburgh
Old College,
South Bridge
Edinburgh EH8 9YL.
United Kingdom

Tel:+44 (0) 131 650 1000

Institutional Endorsement

Our ref: WT - 9611792

19th November, 2019

National Science Foundation
2415 Eisenhower Avenue
Alexandria
Virginia
22314

Dear Sir/Madam

BBSRC/NSF Ecology and Evolution of Infectious Diseases Programme: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses

I confirm on behalf of The Roslin Institute, University of Edinburgh that the US-UK-China Collaborative proposal between Dr. Darrell Kapczynski, United States Department of Agriculture and Prof. Paul Digard is endorsed and has been submitted by The University of Edinburgh Research Support Office.

Yours faithfully

Edinburgh Research Office
The University of Edinburgh

INSTITUTE OF MICROBIOLOGY
CHINESE ACADEMY OF SCIENCES
Add: Datun Road, Chaoyang District, Beijing, China 100101
Tel: 86-10-64807462 Fax: 86-10-64807468

RECOMMENDATION

Viral Infection and Biological Pharmacy Research Center (Wenjun Liu's lab) at Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences. And, the Chinese Academy of Sciences Center for Influenza Research and Early-warning (CASCIRE) was established in 2014. The center has built a surveillance network of wild and domestic birds throughout China. Using this network, they showed that wild and domestic birds played an important role of in newly emerging avian influenza virus genesis, evolution and transmission. Meanwhile, they have discovered H5N1 high pathogenic avian influenza virus (HPAIV) infection and transmission amongst seasonal birds, and found that H5N6 AIV has replaced H5N1 AIV as the dominant subtype in southern China. The genesis and molecular evolution of H5N6 AIV have been illustrated by our studies. In addition, the mechanism of H5N1、H9N2、H10N8、H6N1 interspecies transmission to humans were also clarified. These findings were published in *Science*, *Nature*, *Cell Host & Microbe*, etc.

Avian influenza virus (AIVs) caused many deaths every year in China. It is important to evaluate the potential threat of rare and novel AIVs to humans. We believe the experience and expertise of Wenjun Liu's lab will ensure them to conduct the project perfectly, and we are willing to recommend Wenjun Liu's lab as the project implementation unit.

Institute of Microbiology, Chinese Academy of Science

November 8, 2019

USDA
United States Department of Agriculture

Research, Education, and Economics
Agricultural Research Service

Sharing of unattributed reviews

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr. Darrell R Kapczynski

(Unattributed reviews will be shared with the NSFE. The following text must be included in a Single CopyDocument and signed by the lead investigator, confirming that the investigators involved in the proposal acknowledge and confirm this fact.)

On behalf of the proposal investigators, I, (Darrell Kapczynski), consent that the proposal as well as its unattributed reviews will be shared with the EEID partner-funding agencies.

Signed: _____

Organization: USDA-ARS-SEPRL

Date: 19 Nov 2019

USDA-ARS, U.S. National Poultry Research Center
Southeast Poultry Research Laboratory
934 College Station Rd. Athens, GA 30605
Voice: 706-546-3434 • Fax: 706-546-3161

THE ROSLIN INSTITUTE
The University of Edinburgh
Easter Bush
Midlothian
EH25 9RG
Telephone: +44 (0)131 651 9100
www.ed.ac.uk/roslin

Sharing of unattributed reviews

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program
From: Prof. Paul Digard

(Unattributed reviews will be shared with the NSFC. The following text must be included in a Single CopyDocument and signed by the lead investigator, confirming that the investigators involved in the proposal acknowledge and confirm this fact.)

On behalf of the proposal investigators, I, (Paul Digard), consent that the proposal as well as its unattributed reviews will be shared with the EEID partner-funding agencies.

Signed:

Organization: Roslin Institute, University of Edinburgh, UK

Date: 16 Nov 2019

Sharing of unattributed reviews

To: NSF Ecology and Evolution of Infectious Diseases (EEID) Program

From: Dr. Wenjun Liu

(Unattributed reviews will be shared with the NSFC. The following text must be included in a Single CopyDocument and signed by the lead investigator, confirming that the investigators involved in the proposal acknowledge and confirm this fact.)

On behalf of the proposal investigators, I, (Wenjun Liu), consent that the proposal as well as its unattributed reviews will be shared with the EEID partner-funding agencies.

Signed:

Organization: Institute of Microbiology, Chinese Academy of Sciences, China

Date: 16 Nov 2019

Budget statement

Dr. Wenjun Liu-Chinese Academy of Sciences

Prof Wenjun Liu focuses on the molecular biology of viruses, the interactions of viruses with host cells, the pathogenesis of viral diseases, the post-translational modification of viral proteins, and mechanisms of host defense. The research works are designed to increase fundamental knowledge as well as to facilitate the development of new approaches to control of viral infection. Funding includes awards from NSFC, CAS, Ministry of Science and Technology of China and Ministry of Agriculture and Rural Affairs of China.

(Please follow the relevant requirements of the National Natural Science Foundation Project Budget Statement, etc., and make necessary explanations on the main purposes of the various expenditures and the reasons for the calculation, as well as the cooperative research on the funds to be transferred and the equipment cost

The total direct budget of this project is 4.5 million yuan.

1. Equipment fee

Equipment costs totaled 200,000 yuan, accounting for 4.44% of the funds.

The project undertaker has good scientific research conditions, but considering the actual needs and ease of use of scientific research work in the laboratory, the experimental instruments and equipment to be purchased are as follows:

yuan.

observation and counting of expressed proteins.

yuan, used for mouse

experiments and cell manipulation.

Small and vulnerable equipme

2. Material fee

The material cost totaled 1.8 million yuan, accounting for 40.00% of the funds.

The material fee is mainly used to purchase molecular biology and cell biology reagents, kits, and conventional biochemical reagent consumables and laboratory animals related to this subject. It mainly includes:

raction, purification, gene amplification, etc. The use of the kit can greatly improve the speed and accuracy of the experiment, and is the basic condition for the effective completion of the research task.

used in molecular biology experiments.

plates, and the like.

infection.

The correlation between the material cost and the research of the subject, the calculation method and the calculation basis are as follows:

yuan.

Nucleic Acid Isolation and Purification Kit: According to the task of the subject, this subject will carry out gene separation and purification work, and it is used for the recovery of conventional clone

-length clone of the unknown

.

yuan.

yuan.

, for RNA co-precipitation, budget 2 yuan. Plasmid

yuan.

According to the project task, many routine experiments in molecular biology are needed. In order to complete the above tasks, you need to purchase:

yuan

yuan.

tandard of the

fetal bovine

yuan.

yuan.

yuan.

This project involves experiments such as sample centrifugation and fluorescence quantification, and requires a large number of disposable consumables. Mainly purchase disposable needles, PCR reaction tubes, microplates, centrifuge tubes, petri dishes, and other consumables. The carrier construction involved in this subject requires a large number of disposable consumables:

of 2

-

yuan.

bottles, and

total yuan.

3. Test and processing fee

The project test and processing fee is estimated to be 450,000 yuan, accounting for 10% of the special funds.

laboratory processing paid to external units (including the independent economic accounting unit within

yuan. In this research, related experiments involving gene required for this purpose. Special sequencing companies are entrusted to perform routine sequencing, and instruments and equipment of the large-scale instrument service platform of the Chinese Academy of Sciences are used to pay for testing. It is estimat

yuan. According to the task of this subject, it is necessary to

ers need to be

yuan. In this research, mass spectrometry related experiments are involved. For this purpose, mass spectrometry analysis is required, and a professional sequencing company is commissioned to perform mass spectrometry analysis to pay for the test. The

The Chinese Academy of Sciences Beijing large-scale instrument service platform instrument

transmission electron microscopy and scanning electron microscopy:

yuan

4. Fuel power fee

no.

5. Travel expenses / conference / international cooperation and exchange

The travel expenses/conference/international cooperation and exchange budget of this topic is 540,000 yuan, accounting for 12.00% of the expenditure.

In order to better complete the project research tasks and timely exchange research results with

academic exchange meetings, and in order to strengthen the communication between researchers and research peers of the project, the project is planned to dispatch business. The backbone went to the peer

yuan

conduct academic seminars and coor

The

3. International cooperation and exchange fee: 2 yuan

At present, the "Ministry of Foreign Affairs of the Ministry of Finance has issued a Notice on

inistry of Foreign Affairs of the

The research work of this project requires exchanges between countries. The international cooperation and exchange fees of this project are mainly used for the expenses incurred by the members of this project team to go abroad to participate in relevant academic conferences due to scientific research and to exchange relevant technologies and study abroad and related well-known laboratories

uan, including round-trip airfare, accommodation, transportation subsidy, conference registration fee, etc., total

6. Publication/Documentation/Information Communication/Intellectual Property Fees

The project publication/documentation/information dissemination/IP transaction fee budget is 210,000 yuan, accounting for 4.67% of the total funding.

yuan. Apply for 2 domestic invention patents, patent fees (including patent application fees, patent strains,

access fees and online purcha

7. Labor costs

The labor cost of the project is 1.2 million yuan, accounting for 26.67% of the expenditure.

Mainly for labor costs for postgraduate and project hiring staff, refer to "Administrative Measures

students, participating in the research work time of t -months, each person pays monthly

-months, each person pays

8. Expert consultation fee

The expert consultation fee is 100,000 yuan, accounting for 2.22% of the total expenditure.

ds at home and abroad to give us timely

-site consultation fee for professional technical title

9. Other expenses are not available.

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

APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)

3. DATE RECEIVED BY STATE | **State Application Identifier**

1. TYPE OF SUBMISSION

☐ Pre-application ☒ Application ☐ Changed/Corrected Application

4.a. Federal Identifier

b. Agency Routing Identifier

2. DATE SUBMITTED 11/19/2019 **Applicant Identifier**

c. Previous Grants.gov Tracking ID

5. APPLICANT INFORMATION

Organizational DUNS: 064539612000

Legal Name: USDA-ARS-South Atlantic Area

Department: USDA Division: ARS

Street1: 934 College Station Rd

Street2:

City: Athens County / Parish: Athens-Clarke

State: GA: Georgia Province:

Country: USA: UNITED STATES ZIP / Postal Code: 30605-2720

Person to be contacted on matters involving this application

Prefix: Ms. First Name: Jan Middle Name:

Last Name: Moreno Suffix:

Position/Title: Grants Management Specialist

Street1: 21276 Loop Road

Street2:

City: Andalusia County / Parish: Georgia

State: AL: Alabama Province:

Country: USA: UNITED STATES ZIP / Postal Code: 36421-7798

Phone Number: 7063403046 Fax Number: 7065463161

Email: jan.moreno@usda.gov

6. EMPLOYER IDENTIFICATION *(EIN) or (TIN)*: 720564834

7. TYPE OF APPLICANT: X: Other (specify)

Other (Specify): USDA Agency

Small Business Organization Type ☐ Women Owned ☐ Socially and Economically Disadvantaged

8. TYPE OF APPLICATION:

☒ New ☐ Resubmission

☐ Renewal ☐ Continuation ☐ Revision

If Revision, mark appropriate box(es).

☐ A. Increase Award ☐ B. Decrease Award ☐ C. Increase Duration ☐ D. Decrease Duration

☐ E. Other (specify):

Is this application being submitted to other agencies? Yes ☒ No ☐ What other Agencies? US-UK-China collabor

9. NAME OF FEDERAL AGENCY: National Science Foundation

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:

TITLE:

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses

12. PROPOSED PROJECT:

Start Date: 06/01/2020 Ending Date: 05/31/2025

13. CONGRESSIONAL DISTRICT OF APPLICANT GA

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: Dr. First Name: Darrell Middle Name: R
Last Name: Kapczynski Suffix:
Position/Title: Microbiologist
Organization Name: U.S. National Poultry Research Laboratory
Department: USDA Division: ARS
Street1: 934 College Station Rd
Street2:
City: Athens County / Parish: Athens-Clarke
State: GA: Georgia Province:
Country: USA: UNITED STATES ZIP / Postal Code: 30605-2720
Phone Number: 7065462471 Fax Number: 7065463161
Email: darrell.kapczynski@usda.gov

15. ESTIMATED PROJECT FUNDING

a. Total Federal Funds Requested	1,000,000.00
b. Total Non-Federal Funds	0.00
c. Total Federal & Non-Federal Funds	1,000,000.00
d. Estimated Program Income	0.00

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:
DATE:

b. NO ☒ PROGRAM IS NOT COVERED BY E.O. 12372; OR
☐ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

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

☒ I agree

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

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

Add Attachment | Delete Attachment | View Attachment

19. Authorized Representative

Prefix: Ms. First Name: Jan Middle Name:
Last Name: Moreno Suffix:
Position/Title: Extramural Agreements Specialists
Organization: Southeast Poultry Research Laboratory
Department: USDA Division: ARS
Street1: 21376 Loop Road
Street2:
City: Andalusia County / Parish:
State: AL: Alabama Province:
Country: USA: UNITED STATES ZIP / Postal Code: 36421-7798
Phone Number: 7063403046 Fax Number:
Email: jan.moreno@usda.gov

Signature of Authorized Representative: Completed on submission to Grants.gov

Date Signed: Completed on submission to Grants.gov

20. Pre-application Add Attachment | Delete Attachment | View Attachment

21. Cover Letter Attachment Add Attachment | Delete Attachment | View Attachment

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

RESEARCH & RELATED PERSONAL DATA
Project Director/Principal Investigator and Co-Project Director(s)/Co-Principal Investigator(s)

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PDs/PIs and co-PDs/PIs. To gather information needed for this important task, the applicant should submit the requested information for each identified PD/PI and co-PDs/PIs with each proposal. Submission of the requested information is voluntary and is not a precondition of award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information received from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. Upon receipt of the application, this form will be separated from the application. This form will not be duplicated, and it will not be a part of the review process. Data will be confidential.

Project Director/Principal Investigator

Prefix: Dr. *** First Name:** Darrell **Middle Name:** R

*** Last Name:** Kapczynski **Suffix:**

Gender: Male

Race (check all that apply):
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☒ Do Not Wish to Provide

Ethnicity: Do Not Wish to Provide

Disability Status (check all that apply):
- ☐ Hearing
- ☐ Visual
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None
- ☒ Do Not Wish to Provide

Citizenship: US Citizen

Co-Project Director/Co-Principal Investigator 1

Prefix: Prof. *** First Name:** Daniel **Middle Name:**

*** Last Name:** Perez **Suffix:**

Gender: Male

Race (check all that apply):
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☒ Do Not Wish to Provide

Ethnicity: Do Not Wish to Provide

Disability Status (check all that apply):
- ☐ Hearing
- ☐ Visual
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None
- ☒ Do Not Wish to Provide

Citizenship: US Citizen

OMB Number: 4040-0010
Expiration Date: 12/31/2019

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: Southeast Poultry Research Laboratory

DUNS Number: 0645396120000

* Street1: 934 College Station Rd

Street2:

* City: Athens County: Athens-Clarke

* State: GA: Georgia

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: 30605-2720 * Project/ Performance Site Congressional District: GA-All

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: University of Georgia

DUNS Number: 6190031270000

* Street1: 310 East Campus Rd Tucker Hall Room 409

Street2:

* City: Athens County: Athens-Clarke

* State: GA: Georgia

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: 30602-1589 * Project/ Performance Site Congressional District: GA-010

Project/Performance Site Location 2

☐ 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: University of Edinburgh

DUNS Number: 2290443000000

* Street1: Charles Stewart House

Street2: 9-16 Chambers Street

* City: Edinburgh County:

* State:

Province:

* Country: GBR: UNITED KINGDOM

* ZIP / Postal Code: EH1 1HT * Project/ Performance Site Congressional District: 00-000

Additional Location(s)

Add Attachment | Delete Attachment | View Attachment

RESEARCH & RELATED Other Project Information

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

1. Are Human Subjects Involved? ☐ Yes ☒ No

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations? ☐ Yes ☐ No

If yes, check appropriate exemption number. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

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: 10/10/2017

Animal Welfare Assurance Number: A4298-01

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

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

4.b. If yes, please explain:

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

4.d. If yes, please explain:

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

5.a. If yes, please explain:

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

6.a. If yes, identify countries: United Kingdom- China

6.b. Optional Explanation: US-UK-China Collaboration

7. Project Summary/Abstract Project Summary.pdf | Add Attachment | Delete Attachment | View Attachment

8. Project Narrative Kapczynski EEID Project Narrative.pdf | Add Attachment | Delete Attachment | View Attachment

9. Bibliography & References Cited References.pdf | Add Attachment | Delete Attachment | View Attachment

10. Facilities & Other Resources FACILITIES AND RESOURCES-NSF.pdf | Add Attachment | Delete Attachment | View Attachment

11. Equipment Equipment.pdf | Add Attachment | Delete Attachment | View Attachment

12. Other Attachments Add Attachments | Delete Attachments | View Attachments ☐

PROJECT SUMMARY

Overview

Influenza virus is a global problem, causing widespread harm to human health and the food production system because it also infects chickens and pigs. Vaccination is difficult because of the variety and changeability of flu strains found in nature - primarily in wild birds, where often they cause little harm. However, when these strains of virus spill over into domestic poultry or humans, they can cause massive economic losses and fatal disease respectively. In the last twenty years, this has been graphically illustrated by the H5N1 and H7N9 outbreaks. Global surveillance programmes track the virus' movement and as part of this, characterise the sequence of the viral genome. Some aspects of virus behaviour can be accurately predicted from these sequences. However, many other important aspects of virus biology, such as whether it will travel across continents, which species it will infect and whether it will cause serious harm, are much harder to forecast. Our premise is that the volume of sequencing data now available, along with recent advances in computational methods of using such data,

To achieve this goal, we have brought together a team of international experts from the USA, UK and China with interdisciplinary expertise in mathematical modelling, influenza surveillance and biology, and the infectious disease-public and animal health interface. Together, we will create the computer models that

will be tailored to the needs of end users through a series of workshops that include the primary stake holders so they can inform the scientists on what information they need.

Intellectual Merit

As the world population continues to expand so is the need to maximize agricultural practices that guarantee food security. Integrated livestock and/or agricultural farming can be efficient and ecologically friendly but creates a major conundrum since in such agricultural systems there is an inherent risk of emergence of zoonotic pathogens, of which avian influenza is the prime example. Therefore, a more comprehensive understanding of the environmental factors, agricultural practices and virus mechanisms that lead to interspecies transmission and host-switching is important to curtail the effects of potentially pandemic pathogens. Our application utilizes state of the art computational and wet lab tools to better understand interspecies transmission of influenza viruses and develop predictive models of virus emergence. To our knowledge, there is no prior attempt as integrated as ours to generate the information necessary to build such predictive models. If successful,

Broader Impact

The emergence of several lineages of avian influenza viruses, with zoonotic capacity and inherent ability for transcontinental travel highlights the imminent pandemic threat of these viruses, and their consequences. By combining available sequence information, animal studies aimed at triggering specific aspects of virus evolution and the latest next generation sequencing technologies, we can develop computational models that predict the zoonotic/pandemic potential of influenza viruses and infer specific phenotypic characteristics using sequencing data. The success of our approach will lead to better understanding of influenza viruses host switching and will increase our disease response arsenal against emerging influenza viruses. Results from this application will be disseminated through peer-review journals, scientific venues, and international organizations such as the WHO, OIE and FAO.

Project Overview

Avian influenza viruses (AIV) are endemic in certain wild bird populations, and from there, spill over into domestic birds and human populations where they cause outbreaks of severe disease. Some strains of AIV pose a greater threat than others, because of a combination of their pathogenicity, geographic and host range; exemplified in recent years by four major incursions of H5 and H7 subtype viruses. Surveillance backed up by laboratory assessment of these traits underpin attempts to risk assess and predict behaviour of a highly mutable virus. This surveillance effort, coupled with the development of sequencing technology has led to an exponential rise in the amount of viral sequence data, both at consensus level and (via Next Generation Sequencing [NGS]) at quasi-species level [1, 2]. In parallel, recent advances in phylodynamic modelling techniques (including structured coalescents, multi-species birth-death models and integration of time-dependent predictors in generalised linear model phylogeographic approaches [3-6] have provided methods to fully use this wealth of data. Accordingly, [redacted]

Figure 1. Overview of proposal. [redacted]. *Together, these models will give estimates of the likely future circulating AIV strains and their predicted fitness in various hosts; thus providing a risk prediction tool that ultimately, can be used to inform policy.*

In order to predict which AIV strains could pose the greatest threats in the near future, various parameters need to be considered: knowledge of which strains are currently present in different host species; how they are moved between species and locations; how fit they are in the respective species and compared to each other; and what they are likely to evolve into. We think that insightful and actionable predictions under stable conditions are potentially possible with suitable data. However, AIV also undergo rapid genetic change in response to changing environments, especially the host-species immune environment, and this makes 'out of sample' extrapolations challenging. Consequently, we propose to [redacted]

Statistical and machine learning techniques will be used to cross-calibrate the results of the models, and simulating the population scale model forward in time will give an estimate of the likely future circulating strains – and their predicted fitness. Model parameterisation is crucial and data for this aspect will both be generated within this project through a series of "wet lab" modules and pulled in from existing data sources.

China has the largest human population, the biggest poultry and animal production industries, and one of the most complex ecological systems in the world. This puts the country under significant threat of viral infectious disease. Repeated experience proves that a viral outbreak in China can become a global problem, making the development of better prediction and control strategies that integrate global sources of data and expertise an urgent unmet need [7].

Ultimately this work will enable scientific advice to government and industry about the risks of AIV evolution and allow suggestions of appropriate strategies to counteract the effects of strain evolution.

Background

The virus. Avian influenza is caused by influenza A virus (IAV), classified in the family *Orthomyxoviridae* [8]. The virus has a segmented, negative-sense RNA genome (~ 13.5 kb in total) wrapped in enveloped, pleomorphic particles [9]. The genome consists of eight segments, which code for 10 core viral proteins, including the haemagglutinin (HA), matrix (M1), ion channel (M2), neuraminidase (NA), nucleoprotein (NP), non-structural protein 1 (NS1), nuclear export protein (NS2/NEP), and three proteins associated with polymerase activity (PA, PB1 and PB2) [10]. Most strains of virus also encode one or more non-essential accessory gene products, *e.g.* the PB1-F2 and PA-X proteins [10-12]. The segmented nature of the virus genome allows for reassortment of genes when a susceptible host is co-infected with different strains. Antigenically, 16 (H1-H16) and 9 (N1-N9) different subtypes of AIV have been described [8]. These subtypes are found in all continents and a wide diversity of avian hosts, particularly waterfowl. Although generally viewed as a relatively benign infection in wild birds, regular spill-over events into domestic poultry and a range of mammalian species, including swine, horses and man, cause large economic, animal welfare and public health effects. Subtype diversity of these spill-over events is generally much less than in the anseriforme reservoir, indicating that although AIVs can infect many other species of host, there are nonetheless substantial evolutionary host range barriers. In man, global pandemics are known to have occurred with H1, H2 and H3 subtype viruses, while recurrent dead-end infections with H5 and H7 subtypes have caused much concern in recent years [13, 14]. In poultry, epidemics are most often seen with H5, H7 and H9 subtypes [15, 16]. Of particular concern are highly pathogenic (HPAI) variants of the H5 and H7 subtypes which cause very high (> 75%) mortality in poultry [17]. However, low pathogenic AIVs also cause economically important outbreaks in domestic birds and severe disease in humans and thus should not be neglected. Virulence in man also varies substantially, with case fatality rates from the four major pandemics of the last 100 years varying by several orders of magnitude [18].

Decades of effort have identified many of the viral sequence polymorphisms that underlie host tropism and virulence of IAV. These include aspects of virus biology that are relatively easy to predict from genome sequence. For instance, the HPAIV phenotype is unquestionably associated with the evolution of an extended ("polybasic") protease cleavage site in HA that confers systemic replication and thus severe disease in poultry [19]. Similarly, species and tissue tropism can, to some extent, be predicted from the sequence of HA and modelling of whether binding to -2,3 or -2,6 sialic acid (SA) receptors are likely [20]. Mammalian or avian tropism

can also be predicted from the identity of residue 627 of the viral polymerase subunit PB2 [21, 22]. However, these "rules" are often violated by epistatic effects. For instance, the HPAI phenotype of an HA containing a polybasic cleavage site can be masked by glycosylation elsewhere in HA that hinders protease access [23]. The unexpected fitness in humans of the 2009 H1N1 pandemic virus despite its PB2 containing an AIV marker of 627E was traced to epistasis with sequence polymorphisms elsewhere in the protein [24]. The effects of variation in many other genetic features of the virus that affect host range or pathogenicity cannot yet be predicted with certainty. For example, expression of the accessory protein PA-X is predictable, but the effects of knocking it out are not [25, 26], for reasons that are currently unknown. Thus overall, the vast amount of IAV sequence data that are publicly available represent a resource that can only be partially exploited with the existing tools and knowledge base [7].

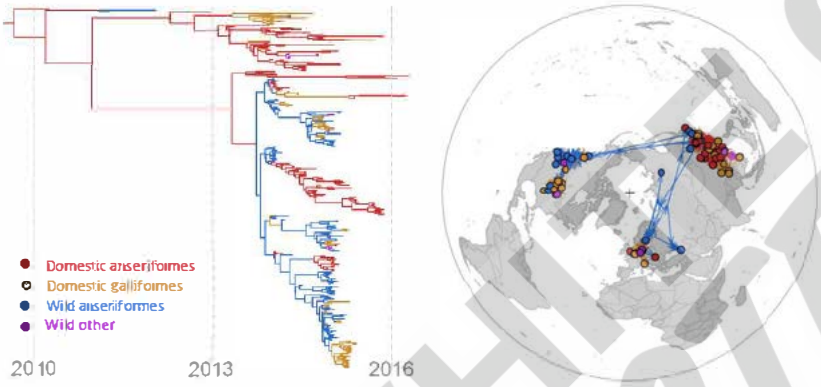


Figure 2: *Time scaled phylogeny of AIV H5N8/X 2014/2015 global outbreak with host-type (left) and spatial reconstruction viewed from the North pole (right). The map shows the inferred transmission route of H5NX from Asia to Europe and North America via wild birds in 2014/2015. Coloured edges represent transmission from host-types. Dots represent sampled sequences (right only). Sequence data was shared in the Global Consortium for H5N8 and related viruses via GISAID. See [27] for details.*

AIV ecology. Water fowl, especially Anseriformes (ducks, geese and swans) and Charadriiformes (gulls, terns and sandpipers), are thought to be the natural reservoir of AIV and infection in these host species is not only typically low pathogenic but can be asymptomatic [8, 28, 29]. This LPAI phenotype facilitates long range transmission of the virus, leading to global distribution. Human-facilitated transport via poultry trade also plays a role, as seen for the spread of H9N2 strains across Asia [30]. Disturbingly however, long range spread of HPAI strains has also been seen in recent decades [15]. Since 2003, HPAI H5 AIV has diversified in South East Asia amongst domestic chicken and duck populations. It has also been transmitted to and spread within wild bird populations, causing at least 3 major trans-continental events: 2005-2007 (H5N1 Qinghai lake & eventually Europe-Mediterranean-Africa), 2014/2015 (H5NX Asia-Europe-North America via Bering Strait) (Fig 2) and 2016/2017 (H5NX Asia-Europe-Africa). In these events, it was the ability of the wild birds (primarily anseriformes) to tolerate the strain of HPAI and still fly which lead to long-range spread. On the basis of their startlingly high mortality, HPAI viruses pose the greatest direct threat to poultry flocks. They pose an even greater indirect threat, as depopulation of flocks within the affected locale is the primary method of control [17]. For instance, the two-dozen non-H5N1 HPAI outbreaks recorded between 1959 and 2005 resulted in the culling of around 100 million birds [16]. From 1997 to 2012, more than 250 million birds were killed or culled [31]. Not only do these outbreaks cause devastating losses to the poultry industry and thereby threaten food security, but they also pose risks to human health [32]. HPAI H5N1 zoonotic infections have been reported in humans in Asia and elsewhere, although sustained human to human transmission has so far not occurred. Additionally, from 2013 there have been five seasonal waves of an LPAI H7N9 in domestic poultry and humans in China, including the appearance of HA variants in 2016/2017 with markers of potential human adaptation and/or HPAI polybasic cleavage sites. The initiation of a mass poultry vaccination policy in China currently seems to have abated this threat [33].

RESEARCH PLAN

We propose four specific aims (SA) in this work package:

Figure 3. *A class weight-biased logistic regression model that can predict IAV replication* in vitro. *(A) The model can accurately classify whole genome sequences of H7N9 IAV as human or avian isolates. (B) Individual isolates that score as low probability for human infectivity (SD183 and TZ30) replicate poorly in (C) A549 human lung cells but better in (D) DF1 chicken fibroblasts. Conversely, isolates classified as human replicate better in A549 cells than DF1s.*

Examples of methods are published here: [57, 60, 61].

Work package 2. Immune-driven evolution of AIV

models generated in WP1 and 3. A general overview of WP2 is provided below (Fig 4).

-

[redacted]

[redacted]

Data analysis- Numbers of birds used for experiments are determined by previous studies of the authors and produce sample sets sufficient to demonstrate statistical significance [69, 76, 77]. Data will be analyzed by ANOVA. Treatment means will be separated by Tukeys multiple comparison test. All data will be evaluated for approximately normal distribution and similar group variance. Transformations, such as $\log_{10}$, will be used to correct for skewness. NGS analysis will be performed at the 1% minimum variant frequency and minimum depth of coverage of 1000 [70]. We will use longitudinal analyses to explore the relationships between groups and species over time points. Based on our preliminary data and published reports we expect to see significant differences in virus evolution between the viruses and species [69, 76, 78].

Pitfalls and alternative approaches: We do not anticipate technical difficulties with the *in vivo* characterization of the AIVs because of our extensive experience in this area, as well as with NGS. Minor modification of the protocols (time of swabbing, collection of tissues, dose of virus) might be necessary based on the obtained results. Similarly, we do not anticipate technical difficulties with the *in vitro* characterization of the AIVs in chicken and quail fibroblasts because of our extensive experience growing these tissues *in vitro*. Tracheal organ cultures have been grown previously for all species and our group is experienced in the technique (*e.g.* [65, 79]).

[redacted]

The outcome of this section of work will be a detailed genomic understanding of the evolution of avian influenza viruses of high global consequence.

***Potential pitfalls**:* The techniques we propose are all well-established, published methods, most of which are already in routine use within our laboratories, so the risk of technical hitches is low. It is possible that some birds may develop enough immunity to limit virus replication below the levels needed for NGS; in such case the depth of coverage will be reduced to capture virus evolution in the samples, or a different vaccine will be utilized. Additional vaccines may include the Chinese reverse engineered vaccines, as available.

As shown (*e.g.* [85, 86]), HPAIVs are consistently pathogenic in chickens but virulence in mallards varies considerably, despite similar levels of virus replication.

The outcome of this section of work will be tests of model prediction veracity. In addition, the outcomes of the experiments will also inform on fundamental IAV biology.

Potential pitfalls: The techniques proposed will have already been confirmed by this stage, so the risk of technical problems is minimal. If time and resources permit, the current field isolates will be tested in the suboptimal vaccine model of chickens described in SA2.2 and compared to the predicative results generated by the models.
Activities hazardous to personnel: our project revolves around the use of IAV, a pathogen with the potential to infect man. All work will be carried out under the appropriately maintained and licensed facilities, using microbiological safety cabinets for operator protection; either at BSL3 (SEPRL/UGA/IMCAS) or BSL2 (UGA/IMCAS).

Work package 3. Assessing Risk, Predictions and Science-Policy Interface
3.1 Overview and experimental design

In this work package we combine the experimental data, surveillance data (of virus and host species) and tested models, to generate a predictive capability and assessment of risk, in order to enable communication of risk to government, industry, veterinary, health, and public audiences.

China agriculture year book), climate data (worldclim.org), human population density (worldpop.org), and wild bird migration routes have been shown to be useful predictive factors for avian influenza phylogeography (e.g. [58, 87-89]). Specifically, potential predictive (and possibly time varying) factors are used to inform phylogeographic transition rate matrices or dispersion rate estimates between places [4, 57, 60],

SA3.2 Science-policy engagement and communication – (UK)

The WHO Global Influenza Strategy (2019) recommends a holistic cross-sectoral approach (*i.e.* human, animal and environmental health) for the development of national programmes to strengthen seasonal prevention and control and preparedness for future pandemics. One of the WHO's strategic goals is to develop "better global tools" to enhance, integrate and expand virological and disease surveillance. This needs to be underpinned by a "focused and consensus-driven plan" for the prevention, detection, control and treatment of influenza. This is challenging to achieve without appropriate levels of engagement, legitimacy and trust between policy makers,

scientists and the public or in the absence of appropriate levels of access or literacy to adopt new technological or analytical tools and interpret their outputs for decision making.

Proposed Activities are:
(3.3.1) **Knowledge Architecture for AI Decision-making:** We will map current knowledge gaps and policy development pathways, and the interactions between key institutions, stakeholders and beneficiaries for horizon-scanning and evidence-informed decision-making for preparedness and control of Avian Influenza within partner countries.
(3.3.2) **Strategic Communication**: We will assess available One Health policy-relevant frameworks and successful models to support evidence-informed policy making (such as EPIC, Scottish Government's Centres of Expertise on Animal Disease Outbreaks) in order to design best practice guidelines for the communication and coordination of model outputs at the science-policy interface in different partner countries.
(3.3.3) **Stakeholder Participation**: We will conduct a stakeholder impact analysis and coordinate a series of knowledge exchange activities directed at interested stakeholder groups throughout the project to identify opportunities and challenges associated with model development, implementation, monitoring and evaluation. Multi-sector focus groups (comprising policy, industry practitioner and public audiences) will be conducted to explore stakeholder beliefs and risk perceptions about important environmental, technological, societal, political, and legal determinants of HPAI occurrence, early detection and reporting. These will also provide an opportunity to assess the perceived impacts of the tool on effectiveness and efficiency of decision-making under different scenarios for AI incursion and spread via wild birds and/or through poultry or poultry products.
(3.3.4) **Effective Knowledge Exchange:** We will engage throughout the lifespan of the project with stakeholders and decision-makers about the parameterisation and use of new analytical frameworks and intelligent data tools to optimise AI horizon scanning and operationalisation of disease preparedness activities- including resource allocation (people, vaccines, other on-the-ground surveillance activities). We will ensure exchange of information by fostering a close working relationship with key end-users and beneficiaries, developing networks and ensuring knowledge exchange is dynamic and multidirectional. Information will be accessible to all users and stakeholders through face-to-face interactions, IT-based tools and social and traditional media. Interface meetings will be held with relevant policy stakeholders (from IGOs, national and local) to ground-truth models, and explore uncertainties and assumptions.

Project management and responsibilities of co-Is and senior personnel
This proposal brings together a set of experts from China, the USA and UK with complementary expertise in IAV and broader infectious disease in a multidisciplinary team to tackle one of the foremost problems of our time. While all investigators will assist in study design and interpretation of data, primary areas of expertise and responsibilities are listed in Table 1. Monthly Skype meetings and annual in- person meetings will be held, as well as post-doctoral exchanges to facilitate training and collaboration.

Intellectual Merit
This proposal brings together a set of experts from China, the USA and UK with complementary expertise in IAV and broader infectious disease in a multidisciplinary team to tackle one of the foremost problems of our time. The overall aim, of developing truly useful models to forecast 'flu, is ambitious and at the cutting edge of what is achievable with current technology. If successful, it will be truly transformative. However, the proposal is "de-risked" by its structure; the individual models will be useful by themselves and will help drive the field forward, even if their overall integration into a risk prediction tool is not achieved within the timespan of the grant. Furthermore, the

[redacted] Each will therefore produce individually significant scientific outputs that again, will help drive this important field forward.

Table 1. PI responsibilities.

PI	Institution	Specific Aims					Primary responsibilities
Boden	UoE					3.2	The science/policy interface
Digard	UoE			2.1	2.1		Oversight, coordination.
Kapczynski	SEPRL				2.1, 2.2, 2.3		In vivo experiments (chickens, ducks, geese)
Liu	IMCAS	1.1	1.3		2.3		Modelling, surveillance, model testing
Lycett	UoE	1.1, 1.2, 1.4, 3.1					Modelling
Perez	UGA				2.1, 2.2, 2.3		In vivo experiments (quail)
Vervelde	UoE				2.1		In vitro experimentation

Table 2. Timeline

Broader Impacts

Developing tools for general risk assessment of fast-evolving pathogens. Our proposal is aimed at AIV, but we expect that the models we develop will be broadly applicable to many other pathogens where surveillance systems generate large amount of sequence data: *e.g.* FMDV, PRRSV, HIV, HCV, dengue fever.

Enhancing public scientific literacy through public engagement. Each of the partners have active public engagement programmes, through which work in this proposal will be discussed and disseminated. Furthermore, seeking stakeholder input is integral to the project design and the series of workshops involved in this part (WP3) will provide an important avenue to discuss the nature of probabilistic risk forecasting with non-scientists.

Dissemination of results to industry stakeholders. The proposed workshops will also provide us with direct access to the poultry industry to canvas their views on what is needed for forecasting, and conversely, for us to explain the benefits and inherent limitations of the science.

Increased economic competitiveness. AIV causes huge losses to the global poultry industry. In the medium to long term, successful development and use of our prediction tool will aid control strategies and thus reduce the burden of disease.

Prior NSF Support – UK (BSRC: BB/T004401/1**)**

Dr Lycett receives BBSRC support for the UK component of the US-UK joint NIFA-NSF-NIH-BBSRC Ecology and Evolution of Infectious diseases collaborative project: Drivers of diversity and transmission of co-circulating viral lineages in host meta-populations. This 4 year project started in September 2019 between the University of Edinburgh and University of Minnesota, and involves research to develop models for studying the evolution of Porcine Reproductive and Respiratory Syndrome Virus strains in partially immune swine herds using a combination of deep sequence data from transmission experiments, consensus sequence data from field studies, and other epidemiological data. Data is currently being collected according to the project timeline by the US partners, and the UK has started preliminary data analyses and modelling work

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FACILITIES AND RESOURCES

Darrell R Kapczynski-USDA

Southeast Poultry Research Laboratory (SEPRL), USDA, ARS, has both biosafety Level (BSL)-2 enhanced (2E) and BSL-3 enhanced (3E) laboratory and animal facilities, which are permitted by the USDA for AIV work including strains classified as select agents. All BSL-3E laboratory and BSL-2E and BSL-3E animal facilities have an effluent decontamination system to sterilize liquid waste and solid waste is decontaminated by autoclaving and/or incineration. BSL-3E facilities and animal facilities are equipped with shower facilities and directional HEPA filtration ventilation systems.

Both BSL-2E and BSL-3E laboratories are fully equipped with standard microbiological and molecular biological equipment. Class II biological safety cabinets (BSC) are installed in each laboratory and full exhaust BSCs (class II B2) are available in each building. Equipment includes PCR thermal cyclers for conventional (MG Research, Applied Biosytems, BioRad) and real time PCR (Applied Biosystems 7500 FAST, Cepheid Smart Cycler 2), electrophoresis equipment (PAGE and agarose), magnetic particle processors (24 and 96 sample capacity) for RNA extraction, UV and white light digital gel documentation systems, UV spectrophotometers, FACS analyzer (Beckman-Coulter), automated ELISPOT reader, Nexcelom cellometer, centrifuges (standard and ultra-speed), inverted and up-right light microscopes with UV lamps and digital cameras, bacteriological incubators, CO2 incubators, refrigerators, freezers (standard and ultra-low), egg incubators, water baths, shakers, a water purification and deionization system. SEPRL also has a core DNA sequencing facility with two Applied Biosystems 3730XL sequencers and an Illumina MiSeq which is operated by a dedicated technician.

Computers are available for each researcher with bioinformatics software (Lassergene, BEAST, PAUP, Bioedit, MEGA, and Geneious), standard word processing, spreadsheet and Office suite software (Microsoft), Adobe Acrobat and Photoshop, Statistics software (SigmaPlot, Systat; Graphpad, PRISM) and Endnote reference manager. Secure email and internet access to numerous journals and the National Agriculture Library are provided through the USDA. A UNIX workstation is available for advanced bioinformatics and analysis of next generation sequencing data.

The animal facilities at both ABSL-2E and ABSL-3E have been designed specifically for poultry with both isolation units and open caging. SEPRL has a staff of full-time, dedicated animal caretakers to ensure the animals receive proper and humane care.

Each investigator has a full-time technician dedicated to the project at the same percentage as the scientist. In addition we have three support scientists who work primarily in this unit.

SEPRL also has a substantial AIV repository, which contains hundreds of type A influenza viruses of diverse lineages, hosts and subtypes. New viruses are continually added to the repository through collaborations with numerous researchers and laboratories worldwide.

There are three in-house specific pathogen free poultry flocks: single comb White Leghorn chickens (layer-type breed), White Plymouth Rock chickens (broiler-type breed), and Small Beltsville White turkeys, which serve as a source of influenza antibody free eggs and animals.

Finally, SEPRL was just funded to update the entire facility with a plan to replace all animal and laboratories with state-of-the-art facilities. The new animal biosafety level 3 facilities are scheduled to be completed within the next year.

FACILITIES AND RESOURCES

Daniel Perez lab - UGA

Environment:

The University of Georgia (founded in 1785), College of Veterinary Medicine (CVM) houses a diverse, yet collaborative group of highly productive scientists. Faculty include immunologists, virologists, bacteriologists, and parasitologists. The College has seen significant growth in the past decade, which continues to enrich the research environment with a mix of new young investigators and senior scholars. Faculty are distributed among departments (Population Health, Infectious Disease, Cell Biology, and Pathology, and others), as well as multiple University Centers. The Departments and Centers across campus have active seminar series in addition to journal clubs and cross-disciplinary discussion groups. These, as well as local and regional conferences provide opportunities to regularly present, discuss and enrich research projects. Dr. Perez is a Project Leader in the CRIP Center of Excellence in Influenza Research and Surveillance (CEIRS). As a member of one of five NIAID Centers, Dr. Perez interacts extensively with the influenza research community. As a member of the UGA Interdisciplinary Life Sciences program, the Perez/Rajao lab can recruit from >100 top quality graduate student and post-doc candidates each year.

The CVM houses the Cytometry Core Facility that provides expertise and training in general principles of flow cytometry, confocal microscopy and bead-based multiplexing technology, experimental design, operation of core equipment, data collection and analysis. The following equipment is available to UGA investigators on a fee for service basis: BD Biosciences FACSAriall SORP with 2 lasers (blue, red), 6-color, 8 parameter digital high-speed sorter that allows isolation. Enrichment and purification of target cells and single cell sorting; BD Biosciences LSRII #1 (3-laser, violet, blue, red; 11-color, 13-parameter digital analyzer) and BD Biosciences LSRII #2 (2-laser, blue, red; 6-color, 8-parameter digital analyzer) for various cell applications. The Cytometry Core Facility offers also confocal microscopy services having access to the Nikon A1R Confocal Microscope that includes 7-Laser Lines, 4-Channel Detector Hybrid scanning head (resonant and galvano) Enhanced spectral detector on a Nikon Eclipse Ti-E inverted microscope that allows multi-dimensional image acquisition, high speed spectral acquisition and mixing, ultra-high speed imaging and foto-activation, fluorescence resonance energy transfer (FRET), 4 color imaging. The CVM also houses a histopathology and electron microscopy core facility for section and slide preparation available to all laboratories on a fee for service basis.

The Georgia Genomics and Bioinformatics Core (GGBC) is the UGA's core laboratory for nucleic acid sequencing and bioinformatics. The combined lab space includes separate pre- and post-PCR laboratories (600 and 2830 sq. ft., respectively) located in the Riverbend North lab complex on the UGA campus in Athens. The GGBC offers hardware based on the following sequencing platforms: Illumina MiSeq (n=2) and NextSeq500 (n=2) sequencers, PacBio Sequel sequencer, Oxford Nanopore MinIon sequencer, and ABI 3730xl sequencer. In addition, the following equipment is available for use Roche Lightcycler 480 RT-PCR, MJ research thermocyclers (5), Bio-Rad T100 thermocyclers (2), ABI 9700 thermocyclers (3 dual 96-well, and 2 dual 384-well), PCR cabinets (2), epMotion@ 5070/5075 Liquid Handling Stations (2), Covaris E220 Evolution, NanoDrop 2000, Qubits fluorometers (2), Agilent BioAnalyzer 2000, Fragment Analyzer Automated CE System, Qiagen Tissuelyzer, Labconco class II biosafety cabinet. The GGBC runs the following analysis software and tools: Illumina BaseSpace Bioinformatics Apps, SMART Analysis Software, Geneious Molecular Biology and NGS analysis software, Galaxy open-source, web-based, NGS analysis software, BioNano Access software, and many open-source and command-line based bioinformatics and computational biology tools and software. The GGBC runs and have access to the following computational resources: Many Dell Linux and Macintosh Workstations, ThinkMate Xeon Phi Workstation, and the High-Performance computer clusters (GACRC, see below)

Laboratories:

The Perez Laboratory and offices are located at the Poultry Diagnostic and Research Center on the eastern side of main campus. The laboratories have all equipment necessary for modern molecular virology research, including HEPA-filtered biosafety cabinets (5), CO2 tissue culture incubators (8), egg incubators (2), vortex mixers (10), inverted light (2) and fluorescent microscopes (1), mid-speed and high-speed centrifuges (2 each), pH meters (2), microfuges (10), full-sized -70º/-80ºC ultrafreezers (5), full-sized -20º freezers (3), full-sized 4ºC refrigerators (3), analytical balances (1), digital balances (2), Universal Hood II Gel Doc XR system (1), protein electrophoresis and blotting systems (2 each), NanoDrop 2000 UV-Vis Spectrophotometer and Qubit 3.0 Fluorometer to measure nucleic acid concentration (1 each), UVP High-Performance UV Transilluminator (1) and DNA thermal cyclers (4), among other minor equipment. Major equipment includes a CRI Nuance FX Multispectral Tissue Imaging system, SASS 2000 aerosol sampler, Buxco Mass dosing system (Aerosol Infection Chamber & Controller), Perkin Elmer Victor X3 2030 Multilabel Plate Reader, Perkin Elmer IVIS (In-Vivo Imaging System) Lumina Series III, AID Diagnostika MultiSpot Reader System, Applied Biosystems Genetic analyzer (3500), Applied Biosystems QuantStudio 3 Real-time PCR system, Roche MagnaPure LC automated nucleic acid extraction system, ThermoFisher Kingfisher Duo Prime Purification System for nucleic acids, Diagenode Bioruptor Pico Sonicator DNA shearing system, Agilent 2100 Electrophoresis Bioanalyzer sample quality control instrument, Qiagen Tissue Lyser (2) and MiSeq NGS sequencer. Down the hallway there is a fully equipped glassware preparation area including autoclaves, glassware washers and dryers, and an ultrapure water station. Located next to that area is a 500 sq. ft. room containing long-term -80 freezer storage, an ultracentrifuge, walk in cold room and a walk-in warm room. The PIs have allocated spaces with access cold rooms, dark room, freezer rooms, common

equipment rooms, glassware processing and autoclaving rooms. Faculty also have access to a BSL3 / ABSL3 / BSL3-Ag facility for animal and non-animal research.

Laboratories and animal spaces are USDA inspected/permitted for storage, use, and shipping/receiving of avian, swine, equine, canine, and other types of influenza virus. BSL3 facilities are certified annually and registered for storage and use of Select Agents, including Highly Pathogenic Avian Influenza.

Drs Perez and Rajao maintain >1,200 sqft of ABSL3 laboratory space the Animal Health Research Center (AHRC). The AHRC is a controlled-access 78,000 sqft BSL2, BSL3, and BSL3Ag biocontainment facility that can house a variety of animal species including small (e.g. rodents and fowl) and large (e.g. swine, ruminants, horses) animals. Animal biocontainment spaces are supported by dedicated animal care personnel and veterinary staff. ABSL3 labs include HEPA racked caging for mouse studies. In addition, there are two ABSL2 mouse rooms (~500 sqft) with HEPA caging for non-BSL3 mouse studies. Additional space for freezers, storage and shared equipment is also available.

Computer/IT:

Personnel have desktop and/or laptop computers in their offices and access to computer peripherals at the work site. Computers, printers, and other items are current generation and linked to the UGA intranet and have internet access. Common computer software suites as well as bioinformatics software (DNAStar, MEGA, etc) and access to the internet are readily available to all lab personnel. In addition, the laboratories have server access in the Georgia Advanced Computing Research Center (GACRC) at UGA. The GACRC was established in late 2003 as a partnership between the Office of the Chief Information Officer (CIO) and the Office of the Vice President for Research (OVPR). It was founded, in large part, because it was apparent that the time and technical expertise required to manage high-performance computing and database platforms, software, storage, physical security, cyber security and telecommunications can be very significant. The GACRC has a fulltime technical staff of six, specializing in Linux/UNIX system administration, storage administration, computational computing, virtualization, and database administration, in support of researchers using the GACRC-managed resources. The GACRC provides better than 99.99% uptime to its users of computing and storage resources and serves over 100 principal investigators and over 400 total users. GACRC has several computing clusters with hundreds of nodes. A multitude of standard scientific software packages, as well as many compilers are installed on the GACRC computers. Ample storage space and backup solutions are also part of the GACRC infrastructure, ensuring that the simulated data is stored safely. More details can be found at http://gacrc.uga.edu/.

Office space:

Dr. Perez has a 250 sq. ft. office adjacent to his laboratory and Dr. Rajao has a similar office in an adjacent building close to the lab. Support staff, students and post-docs share a 200 sq. ft. office within the laboratory and two additional 200 sq ft. offices down the hallway from the lab. Appropriate office and desk space is also available for all personnel for break, teleconference, and meeting rooms.

Other support services:

Support services include animal care, IT, monoclonal antibody production, imaging, and flow cytometry facilities, library services, and related facilities. The College has electronics technicians and machine shop facilities available. The CVM provides administrative, grants, and accounting support for all faculty.

AHRC Vivarium space is available to investigators on a fee-for-use basis for ABSL3 studies. Accredited facilities, resources, and personnel are available for ferret studies with highly pathogenic avian influenza viruses. Additional facilities are available through the CVM for housing and ABSL2 ferret studies.

FACILITIES AND RESOURCES

Paul Digard, Samantha Lycett, Lonneke Vervelde, Lisa Boden-UK, Roslin Institute, UoE

The Roslin Institute receives strategic investment funding from the Biotechnology and Biological Sciences Research Council. It is located on the Easter Bush Campus with the Royal (Dick) School of Veterinary Studies, and is part of the College of Medicine and Veterinary Medicine, University of Edinburgh. The Roslin Institute building spans 3 floors and contains 16000sq ft of open plan office space, 60 group leader offices, 10 meeting rooms, a large (300 person) auditorium, in addition to 26000sq ft of laboratory space. The Global Academy of Agriculture and Food Security, University of Edinburgh is an interdisciplinary hub of research, teaching and consulting expertise, to support decision making to transform agri-food systems and food security. It is co-located on the Easter Bush Campus along with the Roslin Institute.

Office space: The University of Edinburgh team laboratories are available for data modelling/simulation, analysis and writing within the Roslin Institute building, and Global Academy building. Office space is equipped with Ethernet and phone connectivity, printer/copy scanner machines, and wifi is available throughout campus.

Computers: A computer will be purchased for the Roslin computational post-doctoral researcher, which will be dedicated to data analysis, simulation and modelling. Laptops will be purchased for additional data analysis and remote access to the servers, especially important for when visiting the US and China partners. As well as the existing desktop computers and laptops of the Roslin investigators, the Roslin team has direct access to their own secure servers (32 dedicated nodes, not shared with others). All Roslin computers are linked to the Roslin internal network and University of Edinburgh network, and therefore have the most current (office) software updates and virus scanning capabilities, as well as access to electronic mail and the internet from a variety of national and university servers. PCs and Macs have current licenses (Windows 10 for PCs), R/Rstudio and a variety of other bioinformatics programs. Servers run scientific linux and have a variety of bioinformatics programs installed centrally (e.g. assembly programs, BLAST, BEAST etc).

Relevant Core Facilities (Compute): The University of Edinburgh has the Edinburgh Compute and Data Facility which runs the ECDF Linux Compute Cluster (Eddie), available to all University of Edinburgh researchers. It consists of 7000 Intel® Xeon® cores with up to 3 TB of memory available per compute node; and 38 NVIDIA Tesla K80, and 96 NVidia TitanX GPGPU devices. Additionally Roslin has 800 priority Roslin only cores on this cluster. Research groups can take advantage of priority compute and

guaranteed throughput for their projects by requesting an allocation in the priority compute tier, and the priority use of these supercomputing resources has been costed as part of this proposal. Network data storage and backup, both normal network speed access (e.g. to a desktop on the network) and fast read-write access (for the High Performance Compute nodes) is also available through ECDF and has been costed as part of this proposal.

Laboratory Facilities: The Digard and Vervelde groups have their primary laboratory space on the second floor of the main building of the Roslin Institute, with a separate shared facility dedicated for avian influenza work only (for reasons of biosecurity) in the adjoining Middle Wing building located across the central quadrangle. These laboratories operate at BSL2 and have the requisite equipment for modern molecular virology research: HEPA-filtered biosafety cabinets (a total of 8, including one room dedicated to uninfected tissue culture only), CO2 incubators (8), mid-speed and high-speed centrifuges (2 of each), as well as egg incubators (4 in total). Two BSL3 facilities are also available for virology use: one in the main Roslin building and one in the Middle Wing. Sample storage is achieved through -80 °C freezers in an upstairs "freezer farm" and an avian-virus-specific freezer in the Middle Wing, where all units (8 in total are remotely monitored with a 24h alarm system in case of failure. Standard molecular/cellular biology equipment (e.g. vortexers, PCR machines, plate readers, UV transilluminators, LiCor western blot imagers etc) are viewed as communal equipment in the Roslin and are readily available. The segregated "bird flu" facility contains a dedicated fluorescent and phase microscope, vortexer, computer, water baths and other minor equipment.

Laboratories are inspected and approved for use by the UK Health and Safety Executive, and are registered for storage and use of Select Agents ("Schedule 5" in UK terminology).

Other support services and facilities: The Easter Bush campus also houses the UK's National Avian Research Facility, consisting of conventional poultry facilities (the Greenwood building, next door to the Roslin) and an SPF facility (the Bumstead building) 0.5 miles away. These facilities house chickens and quail and will provide eggs for the project. The Roslin building also hosts core facilities for bioimaging (confocal and standard microscopes, including super resolution and multiphoton capability) and flow cytometry, and a mass spectrometry facility.

FACILITIES AND RESOURCES

Wenjun Liu-IMCAS

The Institute of Microbiology of the Chinese Academy of Sciences (IMCAS) is the largest microbiological research institution in China. It was founded on December 3, 1958, through the merger of the Institute of Applied Mycology and the Beijing Laboratories of Microbiology, both of which were affiliated to the Chinese Academy of Sciences (CAS). In early 2007, the major part of the Institute was relocated to the CAS Life Science Park near the Olympic Village in Chaoyang District, Beijing. After over 50 years of development, it has become the nation's largest comprehensive research institution of microbiological science.

IMCAS owns the largest fungal herbarium in Asia with nearly 500,000 specimens and the largest microbiological culture collection in China with more than 41,000 strains. In addition, it possesses a microbiological information center, a core facility, a Biosafety Level-3 laboratory and other supporting platforms. It also has a specialized library with more than 50,000 books/journals and an electronic library with more than 20,000 e-books and 9,000 e-journals in Chinese or English.

The Information Network Center of IMCAS devotes itself to the digitalization and network sharing of the microbiological information resource and undertakes the development of the national scientific data sharing platform, the national scientific digital library and the informationization of CAS. It has already established a series of microbiological resource databases and the fungi digital specimen museum. It has also successively developed China Microbiological Resource Information Network, China Biotechnology Information Network, China Bio-mirror Network, China Bio-Grid, and the Avian Flu Information Network, on which the accessible information amounts to over 1TB, making it the largest gateway of microbiology domain. As China's sub-center of International Bio-mirror Network, it provides online search service of over 20 world renowned biological databases, including International Nucleotide Sequence Database. Being the newly-elected host of WFCC World Data Center for Microorganisms (WDCM), the center has integrated records of nearly 584 culture collections from 68 countries.

The Department of Core Facility is equipped with most of the valuable instruments of the institute, including transmission and scanning electron microscopes, confocal microscope, fluorescence/live cell imaging microscopes, ultracentrifuge, protein purifier, 2D electrophoresis unit, Proteome Works spot cutter, MALDI tof-tof mass spectrometer, flow cytometers, SPR Instrument, isothermal titration calorimeter, dynamic light scattering instrument, biomacromolecular single crystal X-ray diffractometer, single crystal growth cabinet, etc.. They are applied in microscopic morphology observation and analysis, proteomics, structural microbiology, biomolecular interaction measurements, cytology, virology and other research fields.

China General Microbiological Culture Collection Center (CGMCC) is a non-profit organization financed by the Chinese Academy of Sciences. CGMCC harbors the largest fungal herbarium in Asia with over 500,000 specimens, and the biggest culture collection in China, with 41,000 isolates of microorganisms. CGMCC is entitled one of international preservative bases by the World Intellectual Property Organization (WIPO) according to the Budapest Treaty. To maintain microbial diversity and use microbial resources sustainably, CGMCC is committed to microbial resource management, including collecting, preserving, identifying, characterizing microbes and sharing of isolates and information. In 2010, CGMCC is certified with ISO 9001 quality assurance system. Research is focused on microbial taxonomy, identifying and developing preservative methods for biological materials.

The library provides convenient and efficient online service over the Internet.Readers can access to more than 9,600 foreign full text periodicals, more than 9,500 full text Chinese journals, more than 80,000 Chinese eBooks, more than 80,000 foreign eBooks. Through interlibrary loans, readers of the institute can also use documents of many other libraries, including more than 70 research institutes of the Chinese Academy of Sciences, and more than 10 University libraries in Beijing.

Equipment

USDA-ARS-SEPRL
The PD has BSL-2E and BSL-3E laboratories which are fully equipped with standard microbiological and molecular biological equipment. Class 2 biological safety cabinets, recirculating and total exhaust, are installed in each laboratory. Equipment includes PCR thermal cyclers for conventional (MG Research, Applied Biosytems, BioRad) and real time PCR (Applied Biosystems 7500 FAST, Cepheid Smart Cycler 2), Illumina MiSeq for NGS, flow cytometry (Beckman-Coulter EPICS XL), confocal cytometry (Cellometer Nexcellom), ELISpot plate reader (CTL Limited, ImmunoSpot), electrophoresis equipment (PAGE and agarose), magnetic particle processors (24 and 96 sample capacity) for RNA extraction, digital gel documentation systems, UV spectrophotometers, centrifuges (standard and ultra-speed), inverted and up-right light microscopes with UV lamps and digital cameras, bacteriological incubators, CO2 incubators, refrigerators, freezers (standard and ultra-low), egg incubators, water baths, shakers, a water purification and deionization system. SEPRL also has a core DNA sequencing facility with an Applied Biosystems 3730XL sequencer which is operated by a full-time, dedicated technician. General technical, secretarial, accounting and other laboratory support services are also available at SEPRL. The PD has adjunct faculty appointments in the UGA-College of Veterinary Medicine at the University of Georgia with complete access to facilities.

University of Georgia
The laboratories have all equipment necessary for modern molecular virology research, including HEPA-filtered biosafety cabinets (5), CO2 tissue culture incubators (8), egg incubators (2), vortex mixers (10), inverted light (2) and fluorescent microscopes (1), mid-speed and high-speed centrifuges (2 each), pH meters (2), microfuges (10), full-sized -70º/-80ºC ultrafreezers (5), full-sized -20º freezers (3), full-sized 4ºC refrigerators (3), analytical balances (1), digital balances (2), Universal Hood II Gel Doc XR system (1), protein electrophoresis and blotting systems (2 each), NanoDrop 2000 UV-Vis Spectrophotometer and Qubit 3.0 Fluorometer to measure nucleic acid concentration (1 each), UVP High-Performance UV Transilluminator (1) and DNA thermal cyclers (4), among other minor equipment. Major equipment includes a CRI Nuance FX Multispectral Tissue Imaging system, SASS 2000 aerosol sampler, Buxco Mass dosing system (Aerosol Infection Chamber & Controller), Perkin Elmer Victor X3 2030 Multilabel Plate Reader, Perkin Elmer IVIS (In-Vivo Imaging System) Lumina Series III, AID Diagnostika MultiSpot Reader System, Applied Biosystems Genetic analyzer (3500), Applied Biosystems QuantStudio 3 Real-time PCR system, Roche MagnaPure LC automated nucleic acid extraction system, ThermoFisher Kingfisher Duo Prime Purification System for nucleic acids, Diagenode Bioruptor Pico Sonicator DNA shearing system, Agilent 2100 Electrophoresis Bioanalyzer sample quality control instrument, Qiagen Tissue Lyser (2) and MiSeq NGS sequencer. Down the hallway there is a fully equipped glassware preparation area including autoclaves, glassware washers and dryers, and an ultrapure water station. Located next to that area is a 500 sq. ft. room containing long-term -80 freezer storage, an ultracentrifuge, walk in cold room and a walk-in warm room. The PIs have allocated spaces with access cold rooms, dark room, freezer rooms, common equipment rooms, glassware processing and autoclaving rooms. Faculty also have access to a BSL3 / ABSL3 / BSL3-Ag facility for animal and non-animal research.

UoE-Roslin
These laboratories operate at BSL2 and have the requisite equipment for modern molecular virology research: HEPA-filtered biosafety cabinets, CO2 incubators (8), mid-speed and high-speed centrifuges, as well as egg incubators (4 in total). Two BSL3 facilities are also available for virology use: one in the main Roslin building and one in the Middle Wing. Sample storage is achieved through -80 °C freezers in an upstairs “freezer farm” and an avian-virus-specific freezer in the Middle Wing, where all units (8 in total

are remotely monitored with a 24h alarm system in case of failure. Standard molecular/cellular biology equipment (e.g. vortexers, PCR machines, plate readers, UV transilluminators, LiCor western blot imagers etc) are viewed as communal equipment in the Roslin and are readily available. The segregated “bird flu” facility contains a dedicated fluorescent and phase microscope, vortexer, computer, water baths and other minor equipment.

Chinese Academy of Science
The Department of Core Facility is equipped with transmission and scanning electron microscopes, confocal microscope, fluorescence/live cell imaging microscopes, ultracentrifuge, protein purifier, 2D electrophoresis unit, Proteome Works spot cutter, MALDI tof-tof mass spectrometer, flow cytometers, SPR Instrument, isothermal titration calorimeter, dynamic light scattering instrument, biomacromolecular single crystal X-ray diffractometer, single crystal growth cabinet, etc. They are applied in microscopic morphology observation and analysis, proteomics, structural microbiology, biomolecular interaction measurements, cytology, virology and other research fields.

NSF Senior/Key Person Profile (Expanded)

OMB Number: 3145-0058
Expiration Date: 10/31/2020

PROFILE - Project Director/Principal Investigator

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Enter the NSF ID associated with the PI/Co-PI

NSF ID: 00816295

Degree Type:
Degree Year:
To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

***Attach Biographical Sketch**	Kapczynski biosketch 2019 usd	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	NSF-Current-Pending_Kapczynsk	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	coa_kapczynski.pdf	Add Attachment	Delete Attachment	View Attachment

PROFILE - Senior/Key Person 1

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NSF ID: 00813774

Degree Type:
Degree Year:
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Attach Biographical Sketch	BiographicalSketchPerez.pdf	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	CurrentPendingSupportPerez.pd	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	CollaboratorsOtherAffiliation	Add Attachment	Delete Attachment	View Attachment

NSF Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 2

Prefix: Prof. * First Name: Paul Middle Name:

* Last Name: Digard Suffix:

Position/Title: Professor Department: The Roslin Institute

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Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_Digard_17Nov2019.pd	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_Digard_19	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_Digard_16Nov2019.pdf	Add Attachment	Delete Attachment	View Attachment

PROFILE - Senior/Key Person 3

Prefix: Dr. * First Name: Samantha Middle Name:

* Last Name: Lycett Suffix:

Position/Title: Group Leader Department: The Roslin Institute

Organization Name: University of Edinburgh Division:

* Street1: Easter Bush

Street2:

* City: Midlothian County/ Parish:

* State: Province:

* Country: GBR: UNITED KINGDOM * Zip / Postal Code: EH25 9RG

* Phone Number: (+44) 131 651 9232 Fax Number:

* E-Mail: samantha.lycett@ed.ac.uk

*** Project Role:** Co-PD/PI **Other Project Role Category:**

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 000814408

Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_Lycett_15Oct2019.pd	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_Lycett_19	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_Lycett_7Nov2019.pdf	Add Attachment	Delete Attachment	View Attachment

NSF Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 4

Prefix: Prof. * First Name: Lonneke Middle Name:

* Last Name: Vervelde Suffix:

Position/Title: Professor Department: The Roslin Institute

Organization Name: University of Edinburgh Division:

* Street1: Easter Bush

Street2:

* City: Midlothian County/ Parish:

* State: Province:

* Country: GBR: UNITED KINGDOM * Zip / Postal Code: EH25 9RG

* Phone Number: +44 (0)131 6513619 Fax Number:

* E-Mail: lonneke.vervelde@roslin.ed.ac.uk

*** Project Role:** Co-PD/PI **Other Project Role Category:**

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 000816181

Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_Vervelde_12Nov2019	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_Vervelde	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_Vervelde_14Nov2019.pdf	Add Attachment	Delete Attachment	View Attachment

PROFILE - Senior/Key Person 5

Prefix: Dr. * First Name: Barbara Middle Name:

* Last Name: Shih Suffix:

Position/Title: Research Fellow Department: The Roslin INstitute

Organization Name: University of Edinburgh Division:

* Street1: Easter Bush

Street2:

* City: Midlothian County/ Parish:

* State: Province:

* Country: GBR: UNITED KINGDOM * Zip / Postal Code: EH25 9RG

* Phone Number: (+44) 131 6519207 Fax Number:

* E-Mail: barbara.shih@roslin.ed.ac.uk

*** Project Role:** Faculty **Other Project Role Category:**

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 000816146

Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_BShih 2019_Final_19	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_BShih_EEI	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_BarbaraShih_2019.pdf	Add Attachment	Delete Attachment	View Attachment

NSF Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 6

Prefix: Dr. * First Name: Lisa Middle Name:

* Last Name: Boden Suffix:

Position/Title: Senior Lecturer Department: The Roslin Institute

Organization Name: University of Edinburgh Division:

* Street1: Easter Bush

Street2:

* City: Midlothian County/ Parish:

* State: Province:

* Country: GBR: UNITED KINGDOM * Zip/ Postal Code: EH25 9RG

* Phone Number: 0131650 6094 Fax Number:

* E-Mail: Lisa.boden@ed.ac.uk

*** Project Role:** Co-PD/PI **Other Project Role Category:**

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 00081629

Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_LisaBoden_16Nov2019	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_LisaBoden	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_LisaBoden_16Nov.pdf	Add Attachment	Delete Attachment	View Attachment

PROFILE - Senior/Key Person 7

Prefix: Dr. * First Name: Lu Middle Name:

* Last Name: Lu Suffix:

Position/Title: Post doctoral fellow Department: The Roslin Institute

Organization Name: University of Edinburgh Division:

* Street1: West Mains Road

Street2:

* City: Edinburgh County/ Parish:

* State: Province:

* Country: GBR: UNITED KINGDOM * Zip/ Postal Code: EH9 3JT

* Phone Number: (+44) 131 650 5445 Fax Number:

* E-Mail: lu.lu@ed.ac.uk

*** Project Role:** Post Doctoral **Other Project Role Category:**

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 00081617

Degree Type:

Degree Year:

To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_LuLu_15Oct2019_b.pd	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_LuLu_nov	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_LuLu_15Nov2019.pdf	Add Attachment	Delete Attachment	View Attachment

NSF Senior/Key Person Profile (Expanded)

PROFILE - Senior/Key Person 8

Prefix: Prof. * First Name: Wenjun Middle Name:

* Last Name: Liu Suffix:

Position/Title: Professor and Deputy Director Department: Institute of Microbiology

Organization Name: Chinese Academy of Sciences Division: CAS Key Laboratory of Pathogen

* Street1: No.1 Beichen West Road

Street2:

* City: Beijing County/ Parish:

* State: Province:

* Country: CHN: CHINA *Zip/Postal Code: 100101

* Phone Number: +86(010)64807497 Fax Number:

* E-Mail: liuwj@im.ac.cn

* Project Role: Co-PD/PI Other Project Role Category:

Enter the NSF ID associated with the PI/Co-PI

NSF ID: 00816175

Degree Type:
Degree Year:
To update the Degree Type and Degree Year information please login as a PI at www.Research.gov; and update it in the 'View My Roles' page.

Attach Biographical Sketch	Biosketch_Wenjun Liu_EEID_16N	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support	nsf_current_pending_Wenjun Li	Add Attachment	Delete Attachment	View Attachment
***Attach Collaborators & Other Affiliations**	Coa_Wenjun_Liu_16Nov2019.pdf	Add Attachment	Delete Attachment	View Attachment

CURRICULUM VITAE

Darrell R Kapczynski
Research Microbiologist
Southeast Poultry Research Laboratory, U.S. National Poultry Research Center
Agricultural Research Service, United States Department of Agriculture
934 College Station Rd, Athens, Ga 30605
Telephone +1.706.546.3471
darrell.kapczynski@usda.gov

Professional Preparation
State University of West Georgia, Carrollton, GA, USA, B.Sc., 1983-1987, Biology
University of Georgia, Athens, GA, USA, M.S., 1994-1996, Medical Microbiology
University of Georgia, Athens, GA, USA, Ph.D., 1996-1998, Medical Microbiology
USDA-ARS-SEPRL, Athens, GA, USA, Post doc, 1999-2000, Avian Immunology

Appointments
Microbiologist, Southeast Poultry Research Laboratory, Exotic & Emerging Avian Viral Diseases Research Unit, USDA, Athens, GA. 2000-present.
Adjunct Professor, Department of Veterinary Pathology, College of Veterinary Medicine, University of Georgia. 2001-present

Publications
Five most closely related to this application

1. **Kapczynski DR**, Pantin-Jackwood MJ, Spackman E, Chrzastek K, Suarez DL, Swayne DE. Homologous and heterologous antigenic matched vaccines containing different H5 hemagglutinins provide variable protection of chickens from the 2014 U.S. H5N8 and H5N2 clade 2.3.4.4 highly pathogenic avian influenza viruses. Vaccine. 2017 Nov 1;35(46):6345-6353. doi: 10.1016/j.vaccine.2017.04.042. Epub 2017 Apr 26.

2. Pantin-Jackwood MJ, Costa-Hurtado M, Shepherd E, DeJesus E, Smith D, Spackman E, **Kapczynski DR**, Suarez DL, Stallknecht DE, Swayne DE. Pathogenicity and Transmission of H5 and H7 Highly Pathogenic Avian Influenza Viruses in Mallards. J Virol. 2016 Oct 14;90(21):9967-9982. doi: 10.1128/JVI.01165-16. Print 2016 Nov 1.

3. Segovia KM, Stallknecht DE, **Kapczynski DR**, Stabler L, Berghaus RD, Fotjik A, Latorre-Margalef N, França MS. Adaptive Heterosubtypic Immunity to Low Pathogenic Avian Influenza Viruses in Experimentally Infected Mallards. PLoS One. 2017 Jan 20;12(1):e0170335. doi: 10.1371/journal.pone.0170335. eCollection 2017.

4. Segovia KM, França MS, Leyson CL, **Kapczynski DR**, Chrzastek K, Bahnson CS, Stallknecht DE. Heterosubtypic immunity increases infectious dose required to infect Mallard ducks with Influenza A virus. PLoS One. 2018 Apr 26;13(4):e0196394. doi: 10.1371/journal.pone.0196394. eCollection 2018.

5. Chrzastek K, Lee DH, Gharaibeh S, Zsak A, **Kapczynski DR**. Characterization of H9N2 avian influenza viruses from the Middle East demonstrates heterogeneity at amino acid position 226 in the hemagglutinin and potential for transmission to mammals. Virology. 2018 May;518:195-201. doi: 10.1016/j.virol.2018.02.016. Epub 2018 Mar 15.

Five additional publications relevant to this application

6. Bertran K, Swayne DE, Pantin-Jackwood MJ, **Kapczynski DR**, Spackman E, Suarez DL. Lack of chicken adaptation of newly emergent Eurasian H5N8 and reassortant H5N2 high pathogenicity avian influenza viruses in the U.S. is consistent with restricted poultry outbreaks in the Pacific flyway during 2014-2015. Virology. 2016 Jul;494:190-7. doi: 10.1016/j.virol.2016.04.019. Epub 2016 Apr 26.

7. DeJesus E, Costa-Hurtado M, Smith D, Lee DH, Spackman E, **Kapczynski DR**, Torchetti MK, Killian ML, Suarez DL, Swayne DE, Pantin-Jackwood MJ. Changes in adaptation of H5N2 highly pathogenic avian influenza H5 clade 2.3.4.4 viruses in chickens and mallards. Virology. 2016 Dec;499:52-64. doi: 10.1016/j.virol.2016.08.036. Epub 2016 Sep 12.

8. Spackman E, Pantin-Jackwood M, Swayne DE, Suarez DL, **Kapczynski DR.** Impact of route of exposure and challenge dose on the pathogenesis of H7N9 low pathogenicity avian influenza virus in chickens. Virology. 2015 Mar;477:72-81. doi: 10.1016/j.virol.2015.01.013. Epub 2015 Feb 6.

9. **Kapczynski DR**, Pantin-Jackwood M, Guzman SG, Ricardez Y, Spackman E, Bertran K, Suarez DL, Swayne DE. Characterization of the 2012 highly pathogenic avian influenza H7N3 virus isolated from poultry in an outbreak in Mexico: pathobiology and vaccine protection. J Virol. 2013 Aug;87(16):9086-96. doi: 10.1128/JVI.00666-13. Epub 2013 Jun 12.

10. Pantin-Jackwood MJ, Smith DM, Wasilenko JL, Cagle C, Shepherd E, Sarmento L, Kapczynski DR, Afonso CL. Effect of age on the pathogenesis and innate immune responses in Pekin ducks infected with different H5N1 highly pathogenic avian influenza viruses. Virus Res. 2012 Aug;167(2):196-206. doi: 10.1016/j.virusres.2012.04.015. Epub 2012 May 15

Synergistic Activities

- Served on editorial board of Avian Diseases (2004-present)
- Member of the organizing committee for the 9th International Symposium on Avian Influenza (2015)
- Member of the Program Committee for the American Association of Avian Pathologist (2019)
- Guest lecturer in graduate level POPH 8050 Avian Virology, Department of Population Health, University of Georgia, as subject matter expert in Avian Immunology and Avian Influenza (2008-present)
- Served as grant reviewer for USDA NRI program (2008)

Post Graduate Instruction-Training.

Dr. Kapczynski has no formal teaching responsibilities, but he has supervised over 20 individuals including graduate students, post-docs, visiting scientists and other laboratory and administrative personnel. Many of his past mentees currently hold independent faculty positions in the academia or have transitioned into research positions in government agencies or the industry.

Current and Pending Support

KAPCZYNSKI, DARRELL R

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: Intervention Strategies to Prevent and Control Disease Outbreaks Caused by Emerging Strains of Avian Influenza Viruses

Source of Support: USDA CRIS

Project Location: USDA-ARS-SEPRL (Role: Co-Investigator)

Total Award Amount: $3,606,001

Total Award Period Covered: 2016-2021

Person-Months Per Year Committed to the Project: Academic: 5 persons-12months per yr

Support:
Current _X_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: US-UK Collab:
Evolution of the highly pathogenic phenotype in avian influenza virus

Source of Support: USDA-NIFA

Project Location: USDA-ARS-SEPRL (Role: PD and Co-PI)

Total Award Request: $325,000

Total Award Period Covered: 2014-2019

Person-Months Per Year Committed to the Project: Academic: 0.1 Summer: 0.0 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: Broadly Protective Modified Live Attenuated Influenza Vaccines For Poultry

Source of Support: USDA NIFA

Project Location: USDA-ARS-SEPRL (Role: Co-PI)

Total Award Request: $499,999

Total Award Period Covered: 4/1/2020-3/31/2023

Person-Months Per Year Committed to the Project: Academic: 0.1 Summer: 0.03 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: US-UK-CHINA Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses.

Source of Support: NSF

Project Location: USDA-ARS-SEPRL (Role: PD and Co-PI)

Total Award Request: $1,000,000

Total Award Period Covered: 2020-2025

Person-Months Per Year Committed to the Project: Academic: 0.1 Summer: 0.0 Calendar: 0.0

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.
1 Note that graduate advisors are no longer required to be reported.
2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Darrell R Kapczynski	USDA-ARS-Southeast Poultry Research Laboratory	

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.
R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
	Holly S. Sellers	Spouse	UGA-Department of Population Health	

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.
G: The individual's Ph.D. advisors; and
T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
T:	Chrzastek, Klaudia	Pirbright Institute	
G:	Dickerson, Dickerson	University of Georgia	
G:	Jackwood, Mark	University of Georgia	
G:	Jiang, Haijun	China University	
T:	Liljebjelke, Karen	University of Calgary	
T:	Petkov, Daniel	Charles River, Edinburgh, UK	
G:	Poet, Steven	Unknown	
G:	Seal, Bruce	Oregon State University-Cascades	
T:	Segovia, Karen	University of Missouri	

G:	Villegas, Pedro	University of Georgia	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**

C: **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Afonso, Claudio	USDA-ARS-SEPRL		
A:	Bahnson, Charlie	University of Georgia		
A:	Balzli, Charles	USDA-ARS-SEPRL		
A:	Bielke, Lisa	The Ohio State University		
A:	Berghaus, Roy	University of Georgia		
A:	Berghman, Luc	Texas A&M University		
A:	Bonfante, Francesco	Istituto Zooprofilattico Sperimentale delle Venezie		
A:	Bertran, Kateri	USDA-ARS-SEPRL		
A:	Briggs, Whitney	The Ohio State University		
A:	Brown, Corrie	University of Georgia		
A:	Carnaccini, Silvia	University of Georgia		
A:	Chou, Wen-Ko	Texas A&M University		
C:	Chrzastek, Klaudia	Pirbright Institute		
A:	Chvala, Irina	Federal Center for Animal Health-Russia		
A:	Costa-Hurtado, Mar	USDA-ARS-SEPRL		
A:	Criado, Miria	USDA-ARS-SEPRL		
A:	Dauphin, Gwenaelle	Food and Agriculture Organization of the United Nations		
A:	Dejesus, Eric	USDA-FSIS		
A:	de Wit, Sjaak	Gezondheidsdienst voor Dieren Animal Healt		
C:	Digard, Paul	University of Edinburgh		
A:	Dorsey, Kristi	Ceva Biomune		
A:	Drygin, Vladimir	Federal Center for Animal Health-Russia		
C:	Dunn, John	USDA-ARS-SEPRL		
A:	El Attrache, John	Ceva Biomune		
A:	Ewald, Sandra	Auburn University		
A:	Franca, Monique	University of Gerogia		
A:	Faulkner, Olivia	University of Arkansas		
A:	Fotlik, Alinde	University of Georgia		
A:	Frolov, Sergy	Federal Center for Animal Health-Russia		
A:	Garcia, Stivalis	University of Georgia		
A:	Gardin, Yannick	Ceva Biomune		
A:	Gharaibeh, Saad	University of Minnesota		
A:	Gonder, Eric	Butterball		
A:	Guzman, Sophia	SENASCIA		
A:	Hargis, Billy	University of Arkansas		
A:	Hidajat, Rachmat	Medigen, Inc		
A:	Hunt, Henry	USDA-ARS		
A:	Irza, Anna	Federal Center for Animal Health-Russia		
A:	Jiang, HaiJun.	China University		
A:	Killian, Mary	USDA-APHIS		
A:	Jonas, Melina	Medion Vaccine Company-Indonesia		
A:	Kilany, Walid	National Reference Laboratory for Veterinary Quality Control on Poultry Production		
A:	Killmaster,Lindsey	USDA-ARS-SEPRL		

A:	Kogut, Michael	USDA-ARS		
A:	Kulkarni, Raj	USDA-ARS		
A:	Latorre-Margalef, Neus	Linnaeus University		
A:	Lee, Dong Hun	The Ohio State University		
A:	Leyton, Christina	USDA-ARS-SEPRL		
A:	Liljebjelke, Karen	University of Calgary		
A:	Linnemann, Eric	University of Georgia		
A:	Lippert, Ron	Minnesota Turkey Growers Assoc		
A:	Livant, Emily	Auburn University		
A:	Lone, nazir	USDA-ARS		
A:	Moraes, Mauro	Ceva Biomune		
A:	Obadan, Adebimpe	University of Georgia		
A:	Miller, Patti	Uiversity of Georgia		
A:	Pantin-Jackwood, Mary	USDA-ARS-SEPRL		
A:	Palya, Vilmos	Ceva Biomune		
C:	Perez, Daniel	University of Georgia		
A:	Petkov, Daniel	Charles River-Edinburgh		
C:	Pushko, Peter	Medigen, Inc		
A:	Rauw, Fabienne	Sciensano, Belgium		
A:	Santos, Jefferson	University of Georgia		
A:	Segovia, Karen	University of Missouri		
A:	Sellers, Holly	University of Georgia		
A:	Sharma, Poonam	USDA-FSIS		
A:	Shepherd, Eric	University of Georgia		
A:	Smith, Diane	USDA-ARS-SEPRL		
A:	Stabler, Lisa	Uiversity of Georgia		
A:	Soejoedono, Retno	Bogor Agricultural University		
A:	Steensels, Mieke	Sciensano, Belgium		
C:	Spackman, Erica	USDA-ARS-SEPRL		
A:	Stallknecht, David	University of Georgia		
C:	Stice, Steve	University of Georgia		
A:	Suarez, David	USDA-ARS-SEPRL		
A:	Swayne, David	USDA-ARS-SEPRL		
A:	Sylte, Matt	USDA-ARS		
A:	Tilley, Becky	Butterball		
A:	Torchetti, Mia	USDA-APHIS		
A:	Tretyakova, Irina	Medigen, Inc		
A:	Tripodi, Astrid	Food and Agriculture Organization of the United Nations		
A:	Tumpey, Terrence	CDC		
C:	Vervelde, Lonneke	University of Edinburgh		
A:	Volkova, Marina	Federal Center for Animal Health-Russia		
A:	Vuong, Christine	Texas A&M University		
A:	Wasilenko, Jamie	USDA-FSIS		
A:	West, Franklin	University of Georgia		
A:	Wojcinski, Helen	Hendrix Turkeys		
A:	Wolfenden, Amanda	University of Arkansas		
A:	Yu, Qing	USDA-ARS-SEPRL		
A:	Zsak, Aniko	USDA-ARS-SEPRL		
C:	Zsak, Lazslo	USDA-ARS-SEPRL		
A:				

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
B:	Saif, Mo	The Ohio State University	Avian Diseases	
E:	Schultz-Cherry, Stacey	St. Jude Children's Research Hospital	Journal of Virology	
E:	Tumpey, Terry	Centers for Disaese Control	Virology	
E:	Van Den Berg, Thierry	Sciensano, Belgium	Avian Pathology	

Daniel R. Perez
Professor of Virology
Department of Population Health, College of Veterinary Medicine
University of Georgia, Athens, GA 30602
Phone: (706)-542-5506 – E-mail: dperez1@uga.edu

Professional Preparation

Universidad Nacional de Cordoba, Cordoba, Cordoba, Argentina; BSc, 1989		Biochemistry
University of Nebraska Medical Center, Lincoln, Nebraska, USA; PhD, 1995		Mol. Virology
University of Nebraska, Lincoln, Nebraska, USA; Postdoctoral Fellow, 1996-2000		Mol. Virology

Appointments

2000 - 2003	Junior Faculty, St Jude Children's Research Hospital, Memphis, TN
2003 - 2007	Assistant Professor, University of Maryland, College Park, MD
2007 - 2013	Associate Professor, University of Maryland, College Park, MD
2013 - 2015	Professor of Virology, University of Maryland, College Park, MD
2015 -	GA Research Alliance Distinguished Investigator, University of Georgia, Athens
2015 -	Caswell S. Eidson Chair in Poultry Medicine, University of Georgia, Athens, GA

Publications

Five most closely related to this application

1. Perez DR, Lim W, Seiler JP, Yi G, Peiris M, Shortridge KF, Webster RG. Role of quail in the interspecies transmission of H9 influenza A viruses: molecular changes on HA that correspond to adaptation from ducks to chickens. J Virol. 2003 Mar;77(5):3148-56. PubMed PMID: 12584339
2. Hossain MJ, Hickman D, Perez DR. Evidence of expanded host range and mammalian-associated genetic changes in a duck H9N2 influenza virus following adaptation in quail and chickens. PLoS One. 2008 Sep 9;3(9):e3170. PubMed PMID: 18779858.
3. Sorrell EM, Wan H, Araya Y, Song H, Perez DR. Minimal molecular constraints for respiratory droplet transmission of an avian-human H9N2 influenza A virus. Proc Natl Acad Sci U S A. 2009 May 5;106(18):7565-70. PubMed PMID: 19380727.
4. Kimble JB, Angel M, Wan H, Sutton TC, Finch C, Perez DR. Alternative reassortment events leading to transmissible H9N1 influenza viruses in the ferret model. J Virol. 2014 Jan;88(1):66-71. PubMed PMID: 24131710.
5. Obadan AO, Santos J, Ferreri L, Thompson AJ, Carnaccini S, Geiger G, Gonzalez Reiche AS, Rajão DS, Paulson JC, **Perez DR**. Flexibility in vitro of amino acid 226 in the receptor-binding site of an H9 subtype influenza A virus and its effect in vivo on virus replication, tropism, and transmission. J Virol. 2018 Dec 19. pii: JVI.02011-18. doi: 10.1128/JVI.02011-18.

Five additional publications relevant to this application

6. Wan H, Perez DR. Quail carry sialic acid receptors compatible with binding of avian and human influenza viruses. Virology. 2006 Mar 15;346(2):278-86. PubMed PMID: 16325879
7. Ferreri LM, Ortiz L, Geiger G, Barriga GP, Poulson R, Gonzalez-Reiche AS, Crum JA, Stallknecht D, Moran D, Cordon-Rosales C, Rajao D, Perez DR. Improved detection of influenza A virus from blue-winged teals by sequencing directly from swab material. Ecol Evol. 2019 Jun;9(11):6534-6546. doi: 10.1002/ece3.5232. eCollection 2019 Jun.

8. Rimondi A, Gonzalez-Reiche AS, Olivera VS, Decarre J, Castresana GJ, Romano M, Nelson MI, van Bakel H, Pereda AJ, Ferreri L, Geiger G, **Perez DR**. Evidence of a fixed internal gene constellation in influenza A viruses isolated from wild birds in Argentina (2006-2016). Emerg Microbes Infect. 2018 Nov 28;7(1):194. doi: 10.1038/s41426-018-0190-2.
9. Gonzalez-Reiche AS, Nelson MI, Angel M, Müller ML, Ortiz L, Dutta J, van Bakel H, Cordon-Rosales C, **Perez DR**. Evidence of Intercontinental Spread and Uncommon Variants of Low-Pathogenicity Avian Influenza Viruses in Ducks Overwintering in Guatemala. mSphere. 2017 Apr 5;2(2). pii: e00362-16. doi: 10.1128/mSphere.00362-16. eCollection 2017 Mar-Apr.
10. Santos JJS, Abente EJ, Obadan AO, Thompson AJ, Ferreri L, Geiger G, Gonzalez-Reiche AS, Lewis NS, Burke DF, Rajão DS, Paulson JC, Vincent AL, **Perez DR**. Plasticity of Amino Acid Residue 145 Near the Receptor Binding Site of H3 Swine Influenza A Viruses and Its Impact on Receptor Binding and Antibody Recognition. J Virol. 2019 Jan 4;93(2). pii: e01413-18. doi: 10.1128/JVI.01413-18. Print 2019 Jan 15.

Synergistic Activities

International Research. Dr. Perez is the lead scientist in two international collaborating sites aimed at better understanding the ecology and evolution of influenza viruses in wild birds and in swine, particularly at the animal-human interface. The first site was established in 2005 in collaboration with Dr. Maria Eugenia Morales at Universidad del Valle de Guatemala (UVG), Guatemala City, Guatemala. Currently run by Dr. Celia Cordon-Rosales, at Centro de Estudios de Salud at UVG, the collaboration with Guatemala led to the first true long-term surveillance of influenza in wild aquatic birds in Central America. Nowadays, the bulk of the sequence and virus characterization from Central America comes from this collaboration in Guatemala. The second site was established in 2006 in collaboration with Dr. Ariel Pereda at the Instituto Nacional de Tecnologia Agropecuaria (INTA), Castelar, Argentina. The collaboration with Dr. Pereda, Argentina produced the first batch of influenza viruses of wild bird origin over systematic surveillance in multiple sites in the country (previous studies were focused on limited disease outbreaks in poultry in Chile). These studies led to the realization of a South American lineage of influenza viruses in wild birds with unique evolutionary trajectories and with infrequent reassortment with viruses from other latitudes. In addition, through these efforts, Argentina was the first country in South America to report the presence of swine-origin influenza viruses, also with unique evolutionary patterns. Both of these sites continue with long term influenza virus surveillance with support from the CEIRS-NIAID-NIH network.

Graduate Instruction-Training. Dr. Perez has no teaching responsibilities, but he has supervised over 40 people including graduate students, post-docs, visiting scientists and other laboratory and administrative personnel. Many of his past mentees currently hold independent faculty positions in the academia or have transitioned into research positions in government agencies or the industry.

Strategic Research. Dr. Perez is lead scientist within the Center for Research of Influenza Pathogenesis (CRIP, Adolfo Garcia-Sastre PI), part of the CEIRS-NIAID-NIH. Within CRIP, Dr. Perez leads several projects aimed at understanding interspecies transmission of influenza viruses, particularly of influenza strains that have shown expanded host range in Asia. Previously, Dr. Perez was Program Director of the project entitled “Prevention and Control of Avian Influenza in the US”, the largest ever coordinated agricultural program (AICAP) funded by the USDA-NIFA (2005-2011). The AICAP had a comprehensive structure that encompassed the four pillars of influenza prevention and control: surveillance/ecology, basic and applied research, education and outreach.

Current and Pending Support

PEREZ, DANIEL

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Host dependence of influenza A virus reassortment**

Source of Support: NIH / subaward to UGA from Emory

Project Location: Emory, UGA (Role: Co-Investigator)

Total Award Amount: $1,062,208 (subaward to UGA)

Total Award Period Covered: 12/05/2016-11/30/2019

Person-Months Per Year Committed to the Project: Academic: 0.5 Summer: 0.0 Calendar: 0.0

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Improving mucosal immunity after influenza A virus vaccination to reduce virus shedding and zoonotic transmission**

Source of Support: Confidential

Project Location: UGA (Role: Co-Investigator)

Total Award Amount: $90,025

Total Award Period Covered: 5/1/2019-4/30/2020

Person-Months Per Year Committed to the Project: Academic: 0.25 Summer: 0.0 Calendar: 0.0

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Drug Discovery Targeting the Influenza A Virus M2-S31 N Proton Channel**

Source of Support: NIH

Project Location: University of Arizona, UGA (Role: Co-Investigator)

Total Award Amount: $217,174 (subaward to UGA)

Total Award Period Covered: 7/6/2017-6/30/2020

Person-Months Per Year Committed to the Project: Academic: 0.0 Summer: 1.2 Calendar: 0.0

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **NIAID CEIRS - Animal Influenza Surveillance in Argentina & Guatemala/Transmission of H9 and H7 Flu Viruses**

Source of Support: NIH

Project Location: Mount Sinai Medical, UGA (Role: Subaward PI)

Total Award Amount: $4,723,453 (awarded to UGA)

Total Award Period Covered: 4/1/2017-8/29/2020

Person-Months Per Year Committed to the Project: Academic: 0. Summer: 1.2 Calendar: 0.0

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Efficacy of a Vectored Vaccine Candidate Against Highly Pathogenic Avian Influenza Virus H7N3 subtype in SPF Chickens**

Source of Support: Confidential

Project Location: UGA (Role: Co-PI)

Total Award Amount: $92,403

Total Award Period Covered: 6/1/2018-5/31/2021

Person-Months Per Year Committed to the Project: Academic: 0.15 Summer: 0.0 Calendar: 0.0

Support:
Current _x_ Pending __ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Flu-IGIP: Live attenuated influenza virus vaccines with improved stimulation of IgA responses**

Source of Support: NIH

Project Location: UGA, University of California-Irvine (Role: PI)

Total Award Amount: $432,813

Total Award Period Covered: 8/8/2019-7/31/2021

Person-Months Per Year Committed to the Project: Academic: 0.08 Summer: 0.0 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title**: "US-UK Collab: The evolutionary ecology of pathogen emergence via cross-species transmission in the avian-equine influenza system"**

Source of Support: NSF

Project Location: UGA (Role: Senior Personnel)

Total Award Request: $330,135 (Subcontract to UGA)

Total Award Period Covered: 6/1/2020-5/31/2025

Person-Months Per Year Committed to the Project: Academic: 0.0 Summer: 0.0 Calendar: 2.4

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **"US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses."(THIS PROPOSAL)**

Source of Support: NSF

Project Location: UGA (Role: Senior Personnel)

Total Award Request: $382,852 (Subcontract to UGA)

Total Award Period Covered: 6/1/2020-5/31/2025

Person-Months Per Year Committed to the Project: Academic: 0.0 Summer: 0.24 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Transmission bottlenecks and within-host evolutionary dynamics of influenza A virus**

Source of Support: USDA NIFA

Project Location: UGA (Role: Co-PI)

Total Award Request: $499,999

Total Award Period Covered: 3/1/2020-2/28/2023

Person-Months Per Year Committed to the Project: Academic: 0.1 Summer: 0.0 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Broadly Protective Modified Live Attenuated Influenza Vaccines For Poultry**

Source of Support: USDA NIFA

Project Location: UGA (Role: PI)

Total Award Request: $499,999

Total Award Period Covered: 4/1/2020-3/31/2023

Person-Months Per Year Committed to the Project: Academic: 0.0 Summer: 0.03 Calendar: 0.0

Support:
Current __ Pending _x_ Submission Planned in Near Future __ Transfer of Support* __

Proposal Title: **Studying the role of feral pigeons (Columbia livia) as a potential vector of diseases carrying them across dairy farms**

Source of Support: Binational Agricultural Research and Development Fund (BARD)

Project Location: Tel Aviv University, UGA (Role: UGA PI)

Total Award Request: $42,000

Total Award Period Covered: 1/1/2020-12/31/2020

Person-Months Per Year Committed to the Project: Academic: 0.01 Summer: 0.0 Calendar: 0.0

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.

1 Note that graduate advisors are no longer required to be reported.

2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department

Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and

To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.

You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable

For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.

"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Daniel R. Perez	University of Georgia, Athens GA	

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and

T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
T:	Angel, Matthew	University of Maryland, College Park	
T:	Cai, Yibin	University of Maryland, College Park	
T:	Carnaccini, Silvia	University of Georgia, Athens GA	
G:	Donis, Ruben	BARDA, HHS	
T:	Finch, Courtney	University of Maryland, College Park	
T:	Geiger, Ginger	University of Georgia, Athens GA	
T:	Gonzalez-Reiche, Ana	University of Maryland, College Park	
T:	Hickman, Danielle	University of Maryland, College Park	
T:	Kimble, Brian	University of Maryland, College Park	
T:	Obadan, Adebimpe	University of Georgia, Athens GA	
T:	Ortiz, Lucia	University of Georgia, Athens GA	
T:	Pena, Lindomar	University of Maryland, College Park	
T:	Ramirez Nieto, Gloria	University of Maryland, College Park	
T:	Santos, Jefferson	University of Georgia, Athens GA	
T:	Seibert, Brittany	University of Georgia, Athens GA	
T:	Shao, Hongxia	University of Maryland, College Park	
T:	Sorrell, Erin	University of Maryland, College Park	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and

C: Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Abente, Eugenio	USDA-ARS, Ames IA		
A:	Aguirre, Isabel	Universidad de Concepcion, Chile		
C:	Anderson, Tavis	USDA-ARS, Ames IA		
A:	Angel, Matthew	NIH, Bethesda MD		
A:	Aznar, Maria	INTA, Argentina		
A:	Badapanda, Chandan	Xcelris Lab Limited, Ahmedabad, India		
A:	Baker, Steven	University of Rochester, NY		
A:	Barnard, Karen	Cornell University		
A:	Barrales, Hernan	Universidad Nacional de La Plata, Argentina		
C:	Barrat-Boyes, Simon	University of Pittsburgh, PA		
A:	Bessone, Fernando	Grupo Salud, Marcos Juarez, Argentina		
A:	Bichara, Dario	Fundacion Instituto Leloir, Argentina		
A:	Bissel, Stephanie	University of Pittsburgh, PA		
A:	Bouwer, Anthea	University of Pittsburgh, PA		
A:	Bowling, Jennifer	University of Pittsburgh, PA		
A:	Braucher, Douglas	USDA-ARS, Ames IA		
A:	Breen, Michael	University of Rochester, NY		
A:	Brockmeier, Susan	USDA-ARS, Ames IA		
C:	Burke, David	University of Cambridge, UK		
C:	Cappuccio, Javier	INTA, Argentina		
A:	Cardenas-Garcia, Stivalis	University of Georgia, Athens GA		
A:	Carnaccini, Silvia	University of Georgia, Athens GA		
A:	Carney, Jonathan	University of Pittsburgh, PA		
A:	Castresana, Gabriel	Organismo Provincial para el Desarrollo Sostenible, Buenos Aires, Argentina		
A:	Chan, Louisa	The University of Hong Kong, SAR, China		
C:	Chan, Michael	The University of Hong Kong, SAR, China		

A:	Chan, Renee	The University of Hong Kong, SAR, China		
A:	Chen, Hongjun	Shanghai Veterinary Research Institute, China		
A:	Cian, Melina	Universidad Nacional de Cordoba, Argentina		
A:	Cole, Kelly	University of Pittsburgh, PA		
C:	Cordon-Rosales, Celia	Universidad del Valle, Guatemala		
A:	Cortes, Paulo	Universidad Nacional de Cordoba, Argentina		
A:	Dangelo, Marta	INTA, Argentina		
A:	Decarre, Julieta	INTA, Argentina		
A:	Dibarbora, Marina	INTA, Argentina		
A:	Duangkhae, Parichat	University of Pittsburgh, PA		
A:	Duran, Rosario	Instituto Pasteur de Montevideo, Uruguay		
A:	Dutta, Jayeeta	Icahn School of Medicine at Mount Sinai, NY		
C:	Echenique, Jose	Universidad Nacional de Cordoba, Argentina		
A:	Fan, Zhonglei	Yangzhou University, China		
A:	Feng, Kurtis	Cornell University, Ithaca NY		
A:	Ferreri, Lucas	University of Georgia, Athens GA		
A:	Finch, Courtney	Battelle, MD		
A:	Flynn, JoAnne	University of Pittsburgh, PA		
A:	Frye Jr, Lonnie	University of Pittsburgh, PA		
A:	Gauger, Phillip	Iowa State University, Ames IA		
A:	Geiger, Ginger	University of Georgia, Athens GA		
A:	Gonzalez-Reiche, Ana	Icahn School of Medicine at Mount Sinai, NY		
A:	Hartman, Amy	University of Pittsburgh, PA		
A:	Hernandez, Jorge	University of Florida, FL		
A:	Hughes, Holly	USDA-ARS, Ames IA		
A:	Hwang, Hye-Suk	Georgia State University, Atlanta, GA		
A:	Iqbal, Munir	The Pirbright Institute, Woking, UK		
A:	Jung, Yu-Jin	Georgia State University, Atlanta, GA		
C:	Kang-Sang-Moo	Georgia State University, Atlanta, GA		
C:	Kapczynski, Darrell	USDA-ARS, Athens GA		
A:	Kaplan, Bryan	USDA-ARS, Ames IA		
A:	Khedri, Zahra	Cornell University, Ithaca NY		
A:	Killian, Mary	USDA-ARS, Ames IA		
A:	Kim, Ki-Hye	Georgia State University, Atlanta, GA		
A:	Kim, Min-Chul	Georgia State University, Atlanta, GA		
A:	Kim, Yu Jin	Georgia State University, Atlanta, GA		
A:	Kimble, Brian	USDA-ARS, Ames IA		
A:	Kitikoon, Pravina	USDA-ARS, Ames IA		
A:	Ko, Eun-Jo	Georgia State University, Atlanta, GA		
A:	Lager, Kelly	USDA-ARS, Ames IA		
A:	Lai, Jimmy	The University of Hong Kong, SAR, China		
A:	Lee, Young-Tae	Georgia State University, Atlanta, GA		
A:	Lee, Youri	Georgia State University, Atlanta, GA		
A:	Lee, Yu-Na	Georgia State University, Atlanta, GA		
A:	Lenschow, Deborah	Washington University School of Medicine, St. Louis, MO		
C:	Lewis, Nicola	University of Cambridge, UK		
A:	Li, Weizhong	University of Maryland, College Park		
A:	Lopez, Diego	University of Maryland, College Park		
C:	Loving, Crystal	USDA-ARS, Ames IA		
A:	Lozada, Ines	Universidad Nacional de La Plata, Argentina		
A:	Maiello, Pauline	University of Pittsburgh, PA		
C:	Martinez-Sobrido, Luis	University of Rochester, NY		

A:	Mok, Chris	The University of Hong Kong, SAR, China		
A:	Monte, Kristen	Washington University School of Medicine, St. Louis, MO		
A:	Muller, Maria	Universidad del Valle, Guatemala		
C:	Nelson, Martha	Fogarty, Bethesda, MD		
A:	Nicholls, John	The University of Hong Kong, SAR, China		
A:	Nicholson, Tracy	USDA-ARS, Ames IA		
A:	Nogales, Aitor	University of Rochester, NY		
A:	O'Malley, Katherine	University of Pittsburgh, PA		
A:	Obadan, Adebimpe	University of Georgia, Athens GA		
A:	Ola, Pablo	Ministerio de Agricultura, Ganaderia y Alimentacion, Guatemala		
A:	Olivera, Valeria	INTA, Argentina		
A:	Olivero, Nadia	Universidad Nacional de Cordoba, Argentina		
A:	Olson, Zahra	USDA-ARS, Ames IA		
A:	Orellana, David	Ministerio de Agricultura, Ganaderia y Alimentacion, Guatemala		
A:	Ortiz, Lucia	University of Georgia, Athens GA		
A:	Ossiboff, Robert	Cornell University, Ithaca NY		
A:	Paniagua, Jorge	Universidad del Valle, Guatemala		
C:	Pantin-Jackwood, Mary	USDA-ARS		
A:	Parrish, Colin	Cornell University		
A:	Paulson, James	The Scripps Res. Institute, La Jolla CA		
A:	Peiris, J.S. Malik	The University of Hong Kong, SAR, China		
A:	Pena, Lindomar	University of Maryland, College Park		
C:	Pereda, Ariel	INTA, Argentina		
A:	Perez, Estefania	Universidad Nacional de La Plata, Argentina		
A:	Perfumo, Carlos	Universidad Nacional de La Plata, Argentina		
A:	Piñas, German	Universidad Nacional de Cordoba, Argentina		
A:	Piscitelli, Hernan	Grupo Salud, Marcos Juarez, Argentina		
A:	Platt, Ratree	Iowa State University, Ames IA		
A:	Qian, Kun	Yangzhou University, China		
A:	Qin, Aijian	Yangzhou University, China		
A:	Quiroga, Alejandra	Universidad Nacional de La Plata, Argentina		
C:	Rajao, Daniela	University of Georgia, Athens GA		
A:	Ramirez, Ana	Universidad del Valle, Guatemala		
A:	Rathore, Ankita	Xcelris Lab Limited, Ahmedabad, India		
A:	Reed, Douglas	University of Pittsburgh, PA		
A:	Reinoso-Vizcaino, Nicolas	Universidad Nacional de Cordoba, Argentina		
C:	Rimondi, Agustina	INTA, Argentina		
A:	Rodriguez-Sanchez, Irene	University of Rochester, NY		
A:	Rodriguez, Laura	University of Rochester, NY		
A:	Romano, Marcelo	ECOSUR, Santa Fe, Argentina		
A:	Roth, James	Iowa State University, Ames IA		
A:	Samal, Siba	University of Maryland, College Park		
A:	Sandbulte, Matthew	Iowa State University, Ames IA		
A:	Santos, Jefferson	University of Georgia, Athens GA		
A:	Scanga, Charles	University of Pittsburgh, PA		
A:	Seibert, Brittany	University of Georgia, Athens GA		
A:	Shanks, G. Dennis	Australian Army Malaria Institute, Enoggera, QLD, Australia		
A:	Shao, Hongxia	Yangzhou University, China		
A:	Skepner, Eugene	Iowa State University, Ames IA		
A:	Sosa, Silvia	Universidad del Valle, Guatemala		
A:	Souza, Carine	USDA-ARS		
A:	Sturgeon, Timothy	University of Pittsburgh, PA		

C:	Suarez, David	USDA-ARS		
A:	Sutton, Troy	Penn State University		
A:	Swan, Zachary	University of Pittsburgh, PA		
A:	Tian, Xiaoyan	Yangzhou University, China		
A:	Tao, Kim	The University of Hong Kong, SAR, China		
A:	Thompson, Andrew	The Scripps Res. Institute, La Jolla CA		
A:	van Bakel, Harm	Icahn School of Medicine at Mount Sinai, NY		
A:	Varki, Ajit	University of California-San Diego, La Jolla CA		
C:	Vincent, Amy	USDA-ARS, Ames IA		
A:	Walia, Rasna	USDA-ARS, Ames IA		
A:	Walker, Reagan	University of Pittsburgh, PA		
A:	Wan, Hongquan	FDA, Silver Spring MD		
A:	Wan, Zhimin	Yangzhou University, China		
A:	Wang, Jieru	University of Pittsburgh, PA		
A:	Wasik, Brian	Cornell University, Ithaca NY		
A:	Wiley, Clayton	University of Pittsburgh, PA		
A:	Wonderlich, Elizabeth	University of Pittsburgh, PA		
A:	Yandar Barahona, Nubia	Universidad Nacional de Cordoba, Argentina		
A:	Ye, Jianqiang	Yangzhou University, China		
A:	Yu, Hai	Cornell University, Ithaca NY		
A:	Zhang, Jianqiang	Iowa State University, Ames IA		
A:	Zhou, Xiaoxiang	Yangzhou University, China		

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
B:	Garcia-Sastre, Adolfo	Icahn School of Medicine at Mount Sinai, I	Journal of Virology	
E:	Fouchier, Ron	Erasmus University, The Netherlands	PLoS Pathogens	
B:	Schultz-Cherry, Stacey	St. Jude Children's Research Hospital	Journal of Virology	
B:	Pekoz, Andrew	John Hopkins Hospital, Baltimore MD	PLoS Pathogens	
B:	Subbarao, Kanta	University of Melbourne, Australia	PLoS Pathogens	

Biographical Sketch

Name	Paul Digard
Job Title	Chair of Virology
Address	The Roslin Institute, University of Edinburgh, Easter Bush, Midlothian, EH25 9RG, U.K.
Telephone	+44 (0)131 6519240
Email	paul.digard@roslin.ed.ac.uk

(a) Professional Preparation

1982-1985	MA in Natural Sciences, University of Cambridge, UK
1985-1989	PhD in Virology, University of Cambridge, UK

(b) Appointments

2012-present	Chair of Virology, University of Edinburgh, UK
2014-present	Head of Division (Infection & Immunity), The Roslin Institute, University of Edinburgh, UK
2015-present	Affiliate Researcher, Glasgow University, Institute of Infection, Immunity and Inflammation, UK
2005-2011	Senior Lecturer, University of Cambridge, UK
2006-2011	Honorary Researcher, Cambridge University Hospitals NHS Foundation Trust
2004-2005	University Lecturer, University of Cambridge, UK
2003-2004	Senior Research Associate, University of Cambridge, UK
1995-2003	Royal Society University Research Fellow, University of Cambridge, UK
1993-1995	Research Associate, University of Cambridge, UK
1989-1993	Fellow, Department of Biological Chemistry and Molecular Pharmacology, Harvard Medical School

(c) Products

(i) related to the proposed project (107 publications in total, h index = 49)

1. Hussain, S., Turnbull, M.L., Wise, H.M., Jagger, B.W., Beard, P.M., Kovacikova, K., Taubenberger, J.K., **Vervelde, L.**, Engelhardt, O.G. and **Digard, P**. (2019). Mutation of influenza A virus PA-X decreases pathogenicity in chicken embryos and can increase the yield of reassortant candidate vaccine viruses. *J. Virol.* **93**:e01551-18. https://doi.org/10.1128/JVI .01551-18.
2. Turnbull, M.L., Wise, H.M., Nicol, M.Q., Smith, N., Dunfee, R.L., Beard, P.M., Jagger, B.W., Ligertwood, Y., Hardisty, G.R., Xiao, H., Benton, D.J., Paulo, J.A., Gygi, S.P. McCauley, J.W., Taubenberger, J.K., **Lycett, S.J.**, Weekes, M.P., Dutia, B.M., **Digard, P**. (2016). The role of the B-Allele of the influenza A virus segment 8 in setting mammalian host range and pathogenicity. *J. Virol*. **90**: 9263-84. DOI:10.1128/JVI.01205-16
3. Smith J., Smith N., Yu L., Paton I.R., Gutowska M.W., Forrest H.L., Danner A., Seiler J.P., **Digard P**., Webster R.G., Burt D.W. (2015). A comparative analysis of host responses to avian influenza infection in ducks and chickens highlights a role for the interferon-induced transmembrane proteins in viral resistance. *BMC Genomics* **16**:574. DOI: 10.1186/s12864-015-1778-8.
4. Jagger, B.W., Wise, H.M., Kash, J.C., Walters, K.-A., Wills, N.M., Xiao, Y., Dunfee, R.L., Schwartzman, L.M., Ozinsky, A., Bell, G.L., Dalton, R.M., Lo, A., Efstathiou, S., Atkins, J.F., Firth, A.E., Taubenberger, J.K. and **Digard, P**. (2012). An overlapping protein-coding region in influenza A virus segment 3 modulates the host response. *Science* **337**:199-204. DOI: 10.1126/science.1222213
5. US Provisional Patent Application No. 62/817,163 filed March 2019 entitled 'Influenza Virus Mutants and Uses Thereof'; **D.R. Kapczynski**, D. Swayne, **L. Vervelde**, **P. Digard** [joint USDA-BBSRC funding]

(ii) other significant publications/products

1. Patent: Improved flu vaccine yield. **P. Digard**, The University Court of the University of Edinburgh. UK patent application no 1602535.5 (22/2/16).
2. Everitt, A.R., Clare, S., John, S.P., Wash, R.S., Smith, S.E., Chin, C.R., Feeley, E.M., Sims, J.S., Adams, D.J., Wise, H.M., Kane, L., Goulding, D.A., **Digard, P**., Anttila, V., Baillie, J.K., Walsh, T.S., Hume, D.A., Palotie, A., Dunning, J., Openshaw, P., The GenISIS Investigators, The MOSAIC Consortium, Dougan, G., Brass, A.L. and Kellam, P. IFITM3 restricts the morbidity and mortality associated with influenza. Nature 484: 519-23. Doi:10.1038/nature10921.
3. Muratore, G., Goracci, L., Mercorelli, B., Foeglein, A., **Digard, P**., Cruciani, G., Palu, G. and Loregian, A. (2012). New small molecule inhibitors of influenza A and B viruses that act by disrupting subunit interactions of the viral polymerase. *Proc. Natl. Acad. Sci. USA* **109**:6247-52. doi: 10.1073/pnas.1119817109
4. Wise H.M., Hutchinson E.C., Jagger B.W. , Stuart, A.D., Kang Z.H., Robb N., Schwartzman L.M., Kash J.C., Fodor E., Firth A.E., Gog J.R., Taubenberger J.K. and **Digard P**. (2012). Identification of a novel splice variant form of the influenza A virus M2 ion channel with an antigenically distinct ectodomain. *PLoS Pathogens* **8**:e1002998. doi:10.1371/journal.ppat.1002998
5. Beale, R., Wise, H., Stuart, A., **Digard, P**. and Randow, F. (2014). A LIR motif in influenza A virus M2 is required for virion stability. *Cell Host Microbe* **15**(2):239-47. doi: 10.1016/j.chom.2014.01.006.

(d) Synergistic Activities

Grant panels

2019	Wellcome Trust Expert Review Group, Pathogen Biology and Disease Transmission
2019-2021	BBSRC Pool of Experts
2012	Italian National agency for the Evaluation of Universities and Research Institutes (ANVUR) eValuation of Quality of Research (VQR) 2004-2010; member of Groups of Experts in Evaluation (GEV).
2008-2012	Health Protection Agency, Strategic Research & Development Fund
2006-2007	MRC Infection and Immunity Panel; guest DBM.
2006-2014	French National Research Agency (ANR), Microbiology, Immunology and Emerging Diseases programme (MIME).
2006-2009	Academy of Finland Research Council for Health
2006	MRC Pandemic Influenza Oversight & Assessment Committee.

Editorial commitments

2017-2018	Editor, Journal of General Virology
2014-2015	Academic Editor, Journal of General Virology
2013-2021	Editorial Board, Journal of Virology (3 terms)
2010-2015	Editorial Board, Virology
2006-08, 2010-16	Academic Editor, Public Library of Science ONE.
2005-2011	Editorial Board, Virology Journal.
2001-05, 2014-16	Editorial Board, J. Gen. Virol.

Recent conference organisation

2017 Influenza Update Meeting, Edinburgh. Sponsored by the Microbiology Society and Medimmune

2014-16	Scientific Organising Committee (Virology & Pathogenesis Work Group) for Options for the Control of Influenza IX, Chicago 2016.
2014	Scientific Organising Committee, Influenza 2014, Oxford.
2012-13	Scientific Organising Committee, 2nd International Symposium on Neglected Influenza Viruses, held in Dublin, Eire.

Current and Pending Support – Professor Paul Digard

Current:

Project / Proposal Title: A GeCKO library for candidate genes involved in Newcastle disease virus replication
Source of Support: Tropical Animal Genetics Ltd., (UK).
Total Award Amount: $359,000
Total Award Period Covered: 08/01/19 – 11/30/19
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: Identification of interferon stimulated genes that restrict cross-species transmission of influenza A virus.
Source of Support: BBSRC (UK)
Total Award Amount: $969,000
Total Award Period Covered: 03/01/19 – 02/28/22
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6 Cal mos.

Project / Proposal Title: Single chain antibodies as antiviral PRRSV agents
Source of Support: BBSRC Eco Animal Health plc (UK)
Total Award Amount: $187,000
Total Award Period Covered: 06/01/18 - 05/31/20
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.1 Cal mos.

Project / Proposal Title: Pathogen diversity, host specificity and virulence (Roslin Institute Strategic Programme 2)
Source of Support: BBSRC (UK)
Total Award Amount: $1.978M
Total Award Period Covered: 4/1/2017 – 4/1/2023
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 2.4 Cal mos.

Project / Proposal Title: DELTA-FLU: Dynamics of avian influenza in a changing world.
Source of Support: EU-Horizon2020
Total Award Amount: $5M total ($584,900 for UoE)
Total Award Period Covered: 2017-2023 (2018-2021 at RI)
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 2.4 Cal mos.

Pending:

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/2020 – 5/31/2023

Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.

1 Note that graduate advisors are no longer required to be reported.

2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department

Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and

To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.

You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable

For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.

"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Digard, Paul	Roslin Institute, University of Edinburgh	

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
R:	Beard, Phillipa	Partner		

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and

T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Inglis, Stephen C	retired, ex-NIBSC, UK	
T:	Bishop, Konrad	DEFRA, UK	
T:	Poole, Emma	University of Cambridge, UK	
T:	Amorim, Maria	Gulbenkian Institute, Portugal	
T:	Noton, Sarah	Boston University, USA	
T:	Bruce, Emily	University of Vermont, USA	
T:	Wu, Yin	University College London, UK	
T:	Jagger, Brett	Western Michigan University, USA	
T:	Jasim, Seema	University of Glasgow, USA	
T:	Harrison, Kate	University of Oxford, UK	
T:	Goncheva, Mariya	University of Western Ontario, Canada	
T:	Dewar, Rebecca	NHS Lothian, UK	
T:	Brazel, Ailbhe	Max Planck Institute, Germany	
T:	Conceicao, Carina	The Pirbright Institute, UK	
T:	Pinto, Rute Maria	University of Glasgow, UK	
T:	Turnbull, Matthew	University of Glasgow, UK	
T:	Hutchinson, Edward	University of Glasgow, UK	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**

C: **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A	Akram, K.M.			2018
A	Angus, T.			2016
A	Archibald, Alan	University of Edinburgh, UK		
A	Atkinson, Nicky			2016
A	Auer, M			2019
A	Barclay, Wendy S	Imperial College London, UK		
A	Barnett, Mark W	University of Edinburgh, UK		
A	Beard, Philippa	The Pirbirght Institute, UK		
A	Benton, Donald J.	The Crick Institute, UK		2016
A	Bingle, Craig D.			2018
A	Bingle, L.			2018
A	Boyer, B.			2016
C	Brierley, Ian	University of Cambridge, UK		
A	Burkard, Christine	University of Edinburgh, UK		
C	Burkard, Christine	University of Edinburgh		
C	Burt, David	University of Adelaide, Australia		
A	Castro, A			2018
A	Cauchemez, S			2016
A	Chen, S.			2016
A	Curran, Martin	NHS, Addenbrooke's Hospital, UK		2016
C	Donachie, Willie	The Moredun Institute, UK		2017
A	Duchatel, Florian	University of Edinburgh, UK		
A	Dunfee, Rebecca L.			2016
A	Dutia, Bernadette	University of Edinburgh, UK		

C	Dutia, Bernadette	University of Edinburgh		
A	Engelhardt, Othmar G	NIBSC, UK		
C	Engelhardt, Othmar G	NIBSC, UK		
A	Enstone, J.E.			2016
C	Firth, Andrew	University of Cambridge, UK		
A	Freeman, Tom C.	University of Edinburgh, UK		
C	Gally, David	University of Edinburgh		
A	Gao, J.			2016
A	Garcia, F			2016
A	Gauger, Priscilla			2018
A	Gaunt, Eleanor	University of Edinburgh, UK		
A	Gerber, P.F.			2018
A	Gilhooley, H.J.			2018
A	Gill, Andrew C	University of Lincoln, UK		2018
A	Gillet, D			2016
A	Goodbourn, Steven	University of London, UK		
A	Greatorex, Jane	University of Cambridge, UK		
A	Grey, Finn	University of Edinburgh, UK		
C	Grey, Finn	University of Edinburgh, UK		
A	Griffiths, Samantha	University of Edinburgh, UK		
A	Gygi, S.P.			2016
A	Haas, Juergen	University of Edinburgh, UK		
A	Haga, Ismar	The Pirbirght Institute, UK		
A	Halbur, P.G.			2018
A	Hardisty, Gareth			
A	Harrison, Kate	University of Oxford, UK		2016
A	Hayward, A.			2016
A	Herron, Lissa R			2018
A	Highton, A			2016
A	Hiscox, Julian	University of Liverpool		
C	Hiscox, Julian	University of Liverpool		
A	Hume, David A	University of Sydney, Australia		
A	Hussain, Saira	The Crick Institute, UK		
A	Iqbal, Munir	The Pirbirght Institute, UK		
A	Jagger, Brett W.			
A	James, Joe	The Pirbirght Institute, UK		
A	Jasim, Seema	University of Glasgow, UK		
A	Jiang, X.			2018
C	Kapczynski, Darrell	USDA-SEPRL, USA		
A	Killingley, Benjamin	University of Nottingham, UK		2016
A	Kipar, A.			2018
A	Klenerman, Paul	University of Oxford, UK		2016
A	Klionsky, D.J.			2016
A	Kovacikova, Kristina			2019
A	Kurian, Dominic	University of Edinburgh, UK		
A	Lee, Abraham	University of Edinburgh, UK		
A	Leeming, Gail			2018
A	Li, L			2016
A	Ligertwood, Yvonne			2016
A	Lilico, Simon	University of Edinburgh, UK		
A	Lim, W.S.			2016
A	Livigni, A			2016

A	Lycett, Samantha	University of Edinburgh, UK		
A	McCauley, John W.	The Crick Institute, UK		
C	Mettenleiter, Thomas	Friedrich Loeffler Institute, Germany		
A	Moyo, N.			2018
A	Murphy, Lita			2018
A	Nguyen-Van-Tam, Jonatho	University of Nottingham, UK		
A	Nicholson,K.G.			2016
A	Nicol, Marlynne	University of Edinburgh, UK		
A	O'Hara, L			2016
A	Opriessnig, Tanja	University of Edinburgh, UK		
C	Pantin-Jackwood, Mary	USDA-SEPRL, USA		
A	Papadakо, G.			2018
A	Paulo, J.A.			2016
A	Pechenik Jowers, Tali			2016
A	Pereira, Carina F			
A	Pham, N.T.			2019
A	Pinto, Rute M	University of Glasgow, UK		
A	Pridans, Claire	University of Edinburgh, UK		2018
C	Raut, Anamika	ICAR-NISAD, India		
C	Raut, Ashwin	ICAR-NISAD, India		
A	Raza, S.			2016
A	Read, Eliot K			
A	Read, R.C.			2016
A	Rehwinkel, Jan	University of Oxford, UK		
A	Rigby, Rachel E	University of Oxford, UK		
A	Ross, C			2019
A	Sang, Helen M	University of Edinburgh, UK		
A	Schmitt-John, T			2016
A	Schorlemmer, A.			2018
A	Shelton, Holly	The Pirbright Institute, UK		
A	Sherman, Adrian	University of Edinburgh, UK		
A	Shohet, R.V.			2018
A	Simmonds, Peter	University of Oxford, UK		
A	Smith, Donald			2016
C	Smith, Jacqueline	University of Edinburgh		
A	Smith, L.B.			2016
A	Smith, Nikki	University of Sheffield, UK		
A	Stewart, James P	University of Liverpool		
A	Tan, M.			2018
A	Taubenberger, Jefferey K	NIAID, USA		
A	Templeton, Kate	NHS Lothian, UK		
A	Theocharidis			2016
A	Tripp, Ralph A			2018
A	Turnbull, Matthew	University of Glasgow, UK		
A	Varsani, H			2016
A	Vervelde, Lonneke	University of Edinburgh, UK		
C	Vervelde, Lonneke	University of Edinburgh		
A	Wang, C			2016
A	Wear, M.			2018
A	Weekes, Michael P	University of Cambridge, UK		
A	Wise, Helen	NHS Lothian, UK		
C	Wise, Helen	NHS Lothian, UK		

A	Wright, D.			2016
A	Wu, W			2016
A	Xia, D			2016
A	Xia, M.			2018
A	Xiao, H.			2016
A	Xiao, Y			2016
A	Zhang, M.			2016
A	Zhang, R			2016
A	Zhou, En-Min			

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
B:	Harris, Mark	University of Leeds, UK	Journal of General Virology	12/31/2018
E:				

Biographical Sketch

Dr Samantha Lycett *MA DIC PhD MRes MInstP CPhys MIET MRSB*
Group Leader, Pathogen Phylodynamics
Infection & Immunity Division
Roslin Institute and R(D)SVS of the University of Edinburgh, UK
Easter Bush EH25 9RG, UK
Tel: (+44) 131 651 9232
E-mail: samantha.lycett@ed.ac.uk

(a) Professional Preparation

Kings College, University of Cambridge	Cambridge, UK	Physics	BA/MA (HONS) 1993
Imperial College	London, UK	Physics	PhD 1997
Newcastle University	Newcastle, UK	Bioinformatics	MRes, 2007

(b) Appointments

2019 – present Group Leader, Pathogen Phylodynamics, Infection & Immunity Division Roslin Institute, University of Edinburgh, UK

2014 – 2019 Chancellor's Fellow, Infection & Immunity Division Roslin Institute, University of Edinburgh, UK

2013 – 2014 Post doctoral research fellow, Institute of Biodiversity Animal Health and Comparative Medicine, University of Glasgow, UK

2007 – 2013 Post doctoral research fellow, Institute of Evolutionary Biology, University of Edinburgh, UK

2005 – 2006 Expert-Group Leader, Radar Signal Processing, Centre for Signal and Information Processing, QinetiQ, Malvern, UK

1999 – 2005 Senior Research Scientist, Radar Imaging Systems group, QinetiQ / Defence Evaluation Research Agency (DERA), Malvern, UK

1998 – 1999 Research Scientist, Radar Signal Processing group, DERA, Malvern, UK

1997 – 1998 Communication Systems Engineer, Digital Signal Processing group, Matra Marconi Space, Stevenage, UK

(c) Publications

*(i) 5 publications most closely related to the proposal. Total = 39 since 2007, *=first or senior author*

*Lu L, Leigh Brown A, **Lycett S**: Quantifying predictors for the spatial diffusion of avian influenza virus in China BMC Evolutionary Biology 13 Jan 2017

***Lycett SJ**, Bodewes R, Pohlmann A, et al, Woolhouse M, Kuiken T (The Global Consortium for H5N8 and Related Influenza Viruses) (2016): Role for migratory wild birds in the global spread of avian influenza H5N8 Science 354(6309) 213-217

O'Hare A, **Lycett SJ**, Doherty T, Salvador LCM, Kao RR: Broadwick: a framework for computational epidemiology. BMC Bioinformatics 2016, 17(1):65.

Lu L, **Lycett S**, Leigh Brown A: Determining the Phylogenetic and Phylogeographic Origin of Highly Pathogenic Avian Influenza (H7N3) in Mexico (2014) PLos One Vol: 9

*Ragonnet-Cronin M, Hodcroft E, Hue S, Fearnhill E, Delpech V, Brown A, **Lycett S**, Automated analysis of phylogenetic clusters. BMC Bioinformatics 2013, 14(1):317.

(ii) List up to five (5) other publications, whether or not related to the proposed project.

*Duchatel F, Bronsvoort BMdecC, **Lycett S**. (2019) Phylogeographic analysis and identification of factors impacting the diffusion of Foot-and-Mouth disease virus in Africa. Front. Ecol. Evol. doi: 10.3389/fevo.2019.00371

Kao RR, Haydon DT, **Lycett SJ**, Murcia PR: Supersize me: how whole-genome sequencing and big data are transforming epidemiology. Trends in microbiology 2014, 22(5):282-291.

Woolhouse M, Brierley L, McCaffery C, **Lycett S**: Assessing the epidemic potential of RNA and DNA viruses, Emerging Infectious Diseases (2016) Vol: 22 Pages: 2037-2044

Lam T, Wang J, Shen Y, Zhou B, Duan L, Cheung C-L, Ma C, **Lycett S**, Leung C, Chen X et al: The genesis and source of the H7N9 influenza viruses causing human infections in China. Nature 2013, 502(7470):241-244.

Smith GJD, Vijaykrishna D, Bahl J, **Lycett SJ**, Worobey M, Pybus OG, Ma SK, Cheung CL, Raghwani J, Bhatt S, Peiris JSM, Guan Y, Rambaut A: Origins and evolutionary genomics of the 2009 swine-origin H1N1 influenza A epidemic (2009) Nature 459 (7250), 1122

(d) Synergistic Activities

- Lecturer/Instructor for Outbreak Phylogenetics & Phylodynamics workshop given to Masters students, and post-doctoral and other researchers (2015 – present).
- Lecturer/Instructor on Roslin Science Insights programme to high school students "How to use viral sequence data in outbreak investigations" (2015, 2016)
- EPIC consortium member, including providing advice to Scottish Government (SG) about animal disease outbreaks. Presentations to SG, and APHA conferences on Avian Influenza & BVD (audience includes policy makers & industry stake-holders) (2015 – present)
- Peer reviewer for UK grants: BBSRC, MRC, EPSRC; International peer review for granting bodies in France and Belgium (2015 – present)
- Associate Editor for Virus Evolution journal, Oxford University Press, (2017-present)

Current and Pending Support – Dr Samantha Lycett

Current:

Project / Proposal Title: US-UK collab: Drivers of diversity and transmission of co-circulating viral lineages in host meta-populations
Source of Support: BBSRC(UK); US-UK joint NIFA-NSF-NIH-BBSRC EEID
Total Award Amount: $0.520M UK ($2,395,749 US part)
Total Award Period Covered: 9/1/2019 – 9/1/2023
Location of Project: UK-University of Edinburgh (US-University of Minnesota)
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: A strategic approach to identifying and combating porcine reproductive and respiratory syndrome virus outbreaks and other porcine viral diseases
Source of Support: BBSRC (UK)
Total Award Amount: $1.029M
Total Award Period Covered: 4/1/2018 – 4/1/2021
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: Bilateral BBSRC-SFI: Tackling a multi-host pathogen problem - phylodynamic analyses of the epidemiology of M. bovis in Britain and Ireland
Source of Support: BBSRC (UK)
Total Award Amount: $0.586M
Total Award Period Covered: 9/1/2017 – 9/1/2020
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6 Cal mos.

Project / Proposal Title: Centre of Expertise on Animal Outbreaks (EPIC III)
Source of Support: Scottish Government (UK)
Total Award Amount: $2.289M
Total Award Period Covered: 4/1/2016 – 4/1/2021
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.8 Cal mos.

Project / Proposal Title: Pathogen diversity, host specificity and virulence (Roslin Institute Strategic Programme 2.2)
Source of Support: BBSRC (UK)
Total Award Amount: $1.978M
Total Award Period Covered: 4/1/2017 – 4/1/2022
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 2.4 Cal mos.

Pending:

Project / Proposal Title: US-UK Collab: Combined influence of imperfect vaccines, host genetics, and non-genetic drivers on virus transmission and virulence evolution
Source of Support: BBSRC(UK); US-UK joint NIFA-NSF-NIH-BBSRC EEID
Total Award Amount: $2,452,703 (UK contribution)
Total Award Period Covered: 6/1/2020 – 5/31/2023
Location of Project: University of Edinburgh, UK
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/2020 – 5/31/2023
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 2.4 Cal mos.

Project / Proposal Title: "VEO": Virtual Emerging infectious diseases Outbreak forecasting, nowcasting and tracking system
Source of Support: European Horizon 2020
Total Award Amount: $0.45M (UK part)
Total Award Period Covered: 1/1/2020 – 1/1/2025
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6 Cal mos.

Project / Proposal Title: Tackling the threat of emerging MDR Rhodococcus equi: genomics, evolution, control.
Source of Support: Racing Foundation Funding (HBLB Equine Grants), UK
Total Award Amount: $0.25M
Total Award Period Covered: 1/1/2020 – 1/1/2023
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6 Cal mos.

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.

1 Note that graduate advisors are no longer required to be reported.
2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department (optional) to
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and abbreviate,
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable sorting.
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Lycett, Samantha J	The Roslin Institute, University of Edinburg	6-Nov-19

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
R:		(none applicable)		

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and
T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Raymond Murray	Imperial College, London (UK)	Physics (Emeritus Professor)
T:	Melissa Ward		
T:	Mojca Zelnikar		
T:	Lu Lu	University of Edinburgh (UK)	Usher Institute
T:	Manon Ragonnet-Cronin	University of California, San Diego	
T:	Andrew Mason	University of York (UK)	
T:	Florian Duchatel	University of Edinburgh (UK)	Roslin Institute
T:	Kajetan Stanski	University of Edinburgh (UK)	Roslin Institute
T:	Jordan Ashworth	University of Edinburgh (UK)	Usher Institute
T:	Heather Grant	University of Edinburgh (UK)	Institute of Evolutionary Biology
T:	Rachel Bragg	University of Edinburgh (UK)	Royal Dick School of Veterinary Studies
T:	Oumie Kuyateh	University of Edinburgh (UK)	Institute of Evolutionary Biology

T:	Chiara Crestani	University of Glasgow(UK)	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**

C: **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Abroi A.	University of Tartu, Institute of Technology, Tartu,50411, Estonia		2019
A:	Adriaenssens E.M.	European Virus Bioinformatics Center, Jena,7743, Germany, Quadram Institute Bioscien		2019
A:	Bachanek-Bankowska K.	The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, United Kingdom		2019
A:	Bitsouni V.	Roslin Institute and R(D)SVS, University of Edinburgh, Easter Bush Campus, Midlothian,		2019
A:	Bronsvoort B.M.C.	Roslin Institute, University of Edinburgh, Edinburgh, United Kingdom,		2019
A:	Clokie M.R.J.	Department of Genetics and Genome Biology, University of Leicester, Leicester, LE1 7RH		2019
A:	Deinhardt-Emmer S.	European Virus Bioinformatics Center, Jena,7743, Germany, Institute of Medical Microb		2019
A:	Digard P.	Roslin Institute, University of Edinburgh, Edinburgh, United Kingdom ,		2019
A:	Doeschl-Wilson A.	Roslin Institute and R(D)SVS, University of Edinburgh, Easter Bush Campus, Midlothian,		2019
A:	Duchatel F.	Roslin Institute, University of Edinburgh, Edinburgh, United Kingdom,		2019
A:	Dutilh B.E.	European Virus Bioinformatics Center, Jena,7743, Germany, Theoretical Biology and Bio		2019
A:	Escalera-Zamudio M.	Department of Zoology, University of Oxford, Parks Rd, Oxford, OX1 3PS, United Kingdo		2019
A:	Hall M.	Institute of Evolutionary Biology, University of Edinburgh, Edinburgh, EH9 3JR, United Ki		2019
A:	Hufsky F.	European Virus Bioinformatics Center, Jena,7743, Germany, RNA Bioinformatics and Hig		2019
A:	Ibrahim B.	European Virus Bioinformatics Center, Jena,7743, Germany, Chair of Bioinformatics, Ma		2019
A:	Kelly J.N.	Institute of Virology and Immunology, Bern,3012, Switzerland, Department of Infectious		2019
A:	King D.P.	The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, United Kingdom		2019
A:	Knowles N.J.	The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, United Kingdom		2019
A:	Lamkiewicz K.	European Virus Bioinformatics Center, Jena,7743, Germany, RNA Bioinformatics and Hig		2019
A:	Lu L.	Usher Institute of Population Health Sciences & Informatics, Ashworth Laboratories, Un		2019
A:	Marz M.	European Virus Bioinformatics Center, Jena,7743, Germany, RNA Bioinformatics and Hig		2019
A:	Mazeri S.	The Roslin Institute at The Royal (Dick) School of Veterinary Studies, University of Edinb		2019
A:	Mioulet V.	The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, United Kingdom		2019
A:	Modha S.	MRC-University of Glasgow Centre for Virus Research, Glasgow, G61 1QH, United Kingd		2019
A:	Morgan K.L.	Institute of Ageing and Chronic Disease and School of Veterinary Science, University of I		2019
A:	Ngu Ngwa V.	School of Veterinary Medicine and Sciences, B.P. 454, University of Ngaoundere, Ngaou		2019
A:	Opriessnig T.	Roslin Institute and R(D)SVS, University of Edinburgh, Easter Bush Campus, Midlothian,		2019
A:	Robertson D.L.	European Virus Bioinformatics Center, Jena,7743, Germany, MRC-University of Glasgow		2019
A:	Sicheritz T.	Natural History Museum of Denmark, University of Copenhagen, Copenhagen, DK-1123		2019
A:	Simmonds P.	Nuffield Department of Medicine, University of Oxford, Peter Medawar Building, South		2019
A:	Susat J.	Institute of Clinical Molecular Biology, Kiel University, Kiel,24118, Germany		2019
A:	Tanya V.N.	Cameroon Academy of Sciences, P.O. Box 1457, Yaoundé, Cameroon,		2019
A:	Thiel V.	European Virus Bioinformatics Center, Jena,7743, Germany, Institute of Virology and Im		2019
A:	Wadsworth J.	The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, United Kingdom		2019
A:	AanensenD.M.	Centre for Genomic Pathogen Surveillance,Hinxton,United Kingdom,Department of Infe		2018
A:	Bacigalupe R.	The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh, E		2018
A:	Corander J.	Wellcome Trust Sanger Institute, Hinxton, United Kingdom, Helsinki Institute for Inform		2018
A:	Feil E.J.	Milner Centre for Evolution, University of Bath, Bath, United Kingdom,		2018
A:	Fitzgerald J.R.	The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh, E		2018
A:	Harrison E.M.	Department of Medicine, University of Cambridge, Cambridge, United Kingdom,		2018
A:	Holden M.T.G.	School of Medicine, University of St Andrews, St Andrews, United Kingdom,		2018
A:	Holmes M.	Department of Veterinary Medicine, University of Cambridge, Cambridge, United Kingd		2018
A:	Hoskisson P.A.	University of Strathclyde, Glasgow, United Kingdom		2018
A:	Parkhill J.	Wellcome Trust Sanger Institute, Hinxton, United Kingdom		2018
A:	Paterson G.K.	Royal (Dick) School of Veterinary Studies, University of Edinburgh, Edinburgh, United Ki		2018
A:	Peacock S.J.	London School of Hygiene and Tropical Medicine, London, United Kingdom		2018

A:	Richardson E.J.	The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh,	2018
A:	Robb K.	University of Strathclyde, Glasgow, United Kingdom	2018
A:	Shittu A.	Department of Microbiology, Obafemi Awolowo University, Ile-Ife, Nigeria,	2018
A:	Tong S.Y.C.	Victorian Infectious Disease Service, The Royal Melbourne Hospital and The University	2018
A:	van Wamel W.	Department of Medical Microbiology and Infectious Diseases, Erasmus MC, Rotterdam,	2018
A:	Vrieling M.	The Roslin Institute, Royal (Dick) School of Veterinary Studies, University of Edinburgh,	2018
A:	Weinert L.A.	Department of Veterinary Medicine, University of Cambridge, Cambridge, United Kingd	2018
A:	Ambrose N.	Animal Health and Welfare Division, Direc. for Agriculture and Rural Economy, Scottish	2017
A:	Bachofen C.	Moredun Research Institute, Pentlands Science Park, Midlothian, EH26 0PZ, United King	2017
A:	Biek R.	University of Glasgow, Institute of Biodiversity, Animal Health, and Comparative Medici	2017
A:	Brown A.J.L.	School of Biological Sciences, Institute of Evolutionary Biology, University of Edinburgh,	2017
A:	Burr P.D.	Biobest Laboratories Ltd, Edinburgh Technopole, Penicuik, Midlothian, EH26 0PY, Unite	2017
A:	Caldow G.L.	SAC Consulting: Veterinary Services, Allan Watt Building, Bush Estate, Penicuik, Midloth	2017
A:	Colijn C.	Department of Mathematics, Imperial College London, London, United Kingdom,	2017
A:	Collins D.M.	AgResearch, Hopkirk Research Centre, Palmerston North, New Zealand,	2017
A:	Cori A.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Crispell J.	University of Glasgow, Institute of Biodiversity, Animal Health, and Comparative Medici	2017
A:	Davie K.	Animal Health and Welfare Division, Direc. for Agriculture and Rural Economy, Scottish	2017
A:	Dearlove B.	Department of Veterinary Medicine, Cambridge Veterinary School, Cambridge, United K	2017
A:	de-Lisle G.W.	AgResearch, Hopkirk Research Centre, Palmerston North, New Zealand,	2017
A:	Didelot X.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Fraser C.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Frost S.	Department of Veterinary Medicine, Cambridge Veterinary School, Cambridge, United K	2017
A:	Grant D.M.	Moredun Research Institute, Pentlands Science Park, Midlothian, EH26 0PZ, United King	2017
A:	Gunn G.J.	SRUC Epidemiology Research Unit, An Lochran, Beechwood Campus, Inverness, IV2 5NA	2017
A:	Harris S.R.	Wellcome Trust Sanger Institute, Wellcome Genome Campus, Hinxton, Cambridge, Unit	2017
A:	Hodcroft E.B.	School of Biological Sciences, Institute of Evolutionary Biology, University of Edinburgh,	2017
A:	Joy J.B.	Department of Medicine, University of British Columbia, Vancouver, BC, Canada, British	2017
A:	Kao R.R.	University of Glasgow, Institute of Biodiversity, Animal Health, and Comparative Medici	2017
A:	Kendall M.	Department of Mathematics, Imperial College London, London, United Kingdom,	2017
A:	Kuhnert D.	Department of Environmental Systems Science, ETH Zurich, Zurich, Switzerland, Departr	2017
A:	Leigh Brown A.J.	Institute of Evolutionary Biology, Ashworth Laboratories, University of Edinburgh, Edinb	2017
A:	Leventhal G.E.	Department of Environmental Systems Science, ETH Zurich, Zurich, Switzerland, Departr	2017
A:	Liang R.	British Columbia Centre for Excellence in HIV/AIDS, Vancouver, BC, Canada,	2017
A:	Livingstone P.	TBfree New Zealand, PO Box 3412, Wellington,6140, New Zealand	2017
A:	Md Mukarram Hossain A.S	Department of Veterinary Medicine, Cambridge Veterinary School, Cambridge, United K	2017
A:	Neill M.A.	TBfree New Zealand, PO Box 3412, Wellington,6140, New Zealand	2017
A:	Paterson B.	TBfree New Zealand, PO Box 3412, Wellington,6140, New Zealand	2017
A:	Pickles M.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Plazzotta G.	Department of Mathematics, Imperial College London, London, United Kingdom,	2017
A:	Poon A.F.Y.	Department of Pathology and Laboratory Medicine, Western UniversityON, Canada	2017
A:	Price-Carter M.	AgResearch, Hopkirk Research Centre, Palmerston North, New Zealand ,	2017
A:	Rasmussen D.A.	Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland,	2017
A:	Ratmann O.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Russell G.C.	Moredun Research Institute, Pentlands Science Park, Midlothian, EH26 0PZ, United King	2017
A:	Stadler T.	Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland,	2017
A:	Volz E.	Department of Infectious Disease Epidemiology, MRC Centre for Outbreak Analyses and	2017
A:	Weis C.	Department of Biosystems Science and Engineering, ETH Zurich, Basel, Switzerland,	2017
A:	Zadoks R.N.	Moredun Research Institute, Pentlands Science Park, Midlothian, EH26 0PZ, United King	2017
A:	Allen A.R.	Veterinary Sciences Division, Agri-Food and Biosciences Institute, Stormont, Belfast, No	2016
A:	Aubert V.	Division of Immunology and Allergy, Centre Hospitalier Universitaire Vaudois and Unive	2016
A:	Banks J.	Virology Department, Animal and Plant Health Agency, Woodham Lane, Addlestone, KT	2016
A:	Bányai K.	Institute for Veterinary Medical Research, Centre for Agricultural Research, Hungarian A	2016
A:	Beard P.M.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea	2016
A:	Beer M.	Institute of Diagnostic Virology, Friedrich Loeffler Institut, Greifswald-Insel Riems, D-17	2016

A:	Benton D.J.	The Francis Crick Institute, Mill Hill Laboratory, Mill Hill, London, United Kingdom	2016
A:	Bodewes R.	Department of Farm Animal Health, Faculty of Veterinary Medicine, University of Utrec	2016
A:	Boni M.F.	Centre for Tropical Medicine, Nuffield Department of Medicine, University of Oxford, ●	2016
A:	Böni J.	Institute of Medical Virology, University of Zurich, Zurich, Switzerland,	2016
A:	Bouwstra R.	Department of Virology, Central Veterinary Institute, Wageningen University and Resea	2016
A:	Breadon E.L.	Veterinary Sciences Division, Agri-Food and Biosciences Institute, Stormont, Belfast, No	2016
A:	Breed A.C.	Department of Epidemiological Sciences, Animal and Plant Health Agency, Woodham La	2016
A:	Brierley L.	University of Edinburgh, Edinburgh, United Kingdom	2016
A:	Brown I.H.	Virology Department, Animal and Plant Health Agency, Woodham Lane, Addlestone, KT	2016
A:	Brown A.E.	Public Health England, London, United Kingdom	2016
A:	Chen H.	Harbin Veterinary Research Institute, Chinese Academy of Agricultural Sciences, Harbin	2016
A:	Coburn A.M.	The Centre for Virus Research, The University of Glasgow, Glasgow, United Kingdom,	2016
A:	Dán A.	Veterinary Diagnostic Directorate, National Food Chain Safety Office, Budapest, H1149,	2016
A:	DeLiberto T.J.	National Wildlife Research Center, Wildlife Services, US Department of Agriculture, Fort	2016
A:	Delpech V.	Public Health England, London, United Kingdom	2016
A:	Diep N.	Oxford University Clinical Research Unit, Wellcome Trust Major Overseas Programme, H	2016
A:	Doherty T.	University of Glasgow, Institute of Biodiversity, Animal Health and Comparative Medici	2016
A:	Dorigatti I.	MRC Centre for Outbreak Analysis and Modelling, Department of Infectious Disease Epi	2016
A:	Dunfee R.L.	Viral Pathogenesis and Evolution Section, Laboratory of Infectious Diseases, Division of	2016
A:	Dunn D.	MRC Clinical Trials Unit, London, United Kingdom	2016
A:	Dutia B.M.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea	2016
A:	Fearnhill E.	MRC Clinical Trials Unit, London, United Kingdom	2016
A:	Fouchier R.A.M.	Department of Viroscience, Erasmus University Medical Center, Rotterdam, 3015 CN, N	2016
A:	Fusaro A.	Istituto Zooprofilattico Sperimentale delle Venezie, Italy,	2016
A:	Galbraith J.	Glasgow Polyomics, College of Medical Veterinary and Life Sciences, University of Glasg	2016
A:	Gascuel ●.	Institut de Biologie Computationnelle, LIRMM, UMR 5506 CNRS, Université de Montpel	2016
A:	Gilbert M.	Spatial Epidemiology Laboratory (SpELL), Université Libre de Bruxelles, Brussels, B-1050	2016
A:	Günthard H.F.	Division of Infectious Diseases and Hospital Epidemiology, University Hospital Zurich, U	2016
A:	Gygi S.P.	Department of Cell Biology, Harvard Medical School, Boston, MA, United States	2016
A:	Hardisty G.R.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea	2016
A:	Herzyk P.	Glasgow Polyomics, College of Medical Veterinary and Life Sciences, University of Glasg	2016
A:	Hill S.	Department of Zoology, University of Oxford, Oxford, OX1 3PS, United Kingdom	2016
A:	Hué S.	London School of Hygiene and Tropical Medicine, United Kingdom,	2016
A:	Ip H.S.	Wildlife Disease Diagnostic Laboratories Branch, National Wildlife Health Center, US Ge	2016
A:	Jagger B.W.	Viral Pathogenesis and Evolution Section, Laboratory of Infectious Diseases, Division of	2016
A:	Johnson P.	Boyd Orr Centre for Population and Ecosystem Health, Institute for Biodiversity Animal	2016
A:	Jung M.	Institut de Biologie Computationnelle, LIRMM, UMR 5506 CNRS, Université de Montpel	2016
A:	Ke C.W.	Institute of Microbiology, Center for Diseases Control and Prevention of Guangdong Pro	2016
A:	Kida H.	Research Center for Zoonosis Control, Hokkaido University, Sapporo, Hokkaido 001-002	2016
A:	Killian M.L.	National Veterinary Services Laboratories, Veterinary Services, US Department of Agricu	2016
A:	Klimkait T.	Department Biomedicine-Petersplatz, University of Basel, Basel, Switzerland,	2016
A:	Koopmans M.P.	Department of Viroscience, Erasmus University Medical Center, Rotterdam, 3015 CN, N	2016
A:	Kouyos R.	Division of Infectious Diseases and Hospital Epidemiology, University Hospital Zurich, U	2016
A:	Kuiken T.	Department of Viroscience, Erasmus University Medical Center, Rotterdam, 3015 CN, N	2016
A:	Kwon J.-H.	Avian Disease Laboratory, College of Veterinary Medicine, Konkuk University, Seoul, 14	2016
A:	Lee D.-H.	Southeast Poultry Research Laboratory, US Department of Agriculture, Athens, GA 3060	2016
A:	Lee Y.J.	Avian Disease Division, Animal and Plant Quarantine Agency, Gimcheon, South Korea,	2016
A:	Ligertwood Y.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea	2016
A:	Mallon T.R.	Veterinary Sciences Division, Agri-Food and Biosciences Institute, Stormont, Belfast, No	2016
A:	McCaffery C.	University of Edinburgh, Edinburgh, United Kingdom	2016
A:	McCauley J.W.	The Francis Crick Institute, Mill Hill Laboratory, Mill Hill, London, United Kingdom	2016
A:	McCormick C.	Veterinary Sciences Division, Agri-Food and Biosciences Institute, Stormont, Belfast, No	2016
A:	Monne I.	Istituto Zooprofilattico Sperimentale delle Venezie, Italy,	2016
A:	Mulatti P.	Istituto Zooprofilattico Sperimentale delle Venezie, Italy,	2016
A:	Nickbakhsh S.	Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical V	2016

A:	Nicol M.Q.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea		2016
A:	O'Hare A.	University of Glasgow, Institute of Biodiversity, Animal Health and Comparative Medici		2016
A:	Orton R.J.	Boyd Orr Centre for Population and Ecosystem Health, Institute for Biodiversity Animal		2016
A:	Pasick J.	National Centre for Foreign Animal Disease, Canadian Food Inspection Agency, Winnipe		2016
A:	Paulo J.A.	Department of Cell Biology, Harvard Medical School, Boston, MA, United States		2016
A:	Pohlmann A.	Institute of Diagnostic Virology, Friedrich Loeffler Institut, Greifswald-Insel Riems, D-17		2016
A:	Pybus O.G.	Department of Zoology, University of Oxford, Oxford, OX1 3PS, United Kingdom		2016
A:	Ragonnet-Cronin M.L.	University of Edinburgh, Edinburgh, United Kingdom		2016
A:	Rambaut A.	Institute of Evolutionary Biology, University of EdinburghEH9 3FL, United Kingdom, Cen		2016
A:	Robinson T.P.	Livestock Systems and Environment (LSE), International Livestock Research Institute (ILR		2016
A:	Sakoda Y.	Graduate School of Veterinary Medicine, Hokkaido University, Sapporo, Hokkaido 060-		2016
A:	Salvador L.C.M.	University of Glasgow, Institute of Biodiversity, Animal Health and Comparative Medici		2016
A:	Shilaih M.	Division of Infectious Diseases and Hospital Epidemiology, University Hospital Zurich, U		2016
A:	Skuce R.A.	School of Biological Sciences, Queen's University Belfast, Belfast, Northern Ireland, Unit		2016
A:	Smith N.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea		2016
A:	Song C.-S.	Avian Disease Laboratory, College of Veterinary Medicine, Konkuk University, Seoul, 14		2016
A:	Swayne D.E.	Southeast Poultry Research Laboratory, US Department of Agriculture, Athens, GA 306		2016
A:	Taubenberger J.K.	Viral Pathogenesis and Evolution Section, Laboratory of Infectious Diseases, Division of		2016
A:	To T.-H.	Institut de Biologie Computationnelle, LIRMM, UMR 5506 CNRS, Université de Montpel		2016
A:	Torchetti M.K.	National Veterinary Services Laboratories, Veterinary Services, US Department of Agricu		2016
A:	Trewby H.	Boyd Orr Centre for Population and Ecosystem Health, Institute for Biodiversity Animal		2016
A:	Tsai H.-J.	Animal Health Research Institute, Council of Agriculture, New Taipei City,25158, Taiwan		2016
A:	Turnbull M.L.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea		2016
A:	Weekes M.P.	Cambridge Institute for Medical Research, University of Cambridge, Cambridge, United		2016
A:	Wise H.M.	Division of Infection and Immunity, The Roslin Institute, The University of Edinburgh, Ea		2016
A:	Woolhouse M.E.J.	University of Edinburgh, Edinburgh, United Kingdom		2016
A:	Woolhouse M.	Centre for Immunity, Infection and Evolution, University of Edinburgh, Edinburgh, EH9 3		2016
A:	Wright D.	School of Biological Sciences, Queen's University Belfast, Belfast, Northern Ireland, Unit		2016
A:	Xiao H.	The Francis Crick Institute, Mill Hill Laboratory, Mill Hill, London, United Kingdom, Labor		2016
A:	Yang W.-L.	Division of Infectious Diseases and Hospital Epidemiology, University Hospital Zurich, U		2016
A:	Yerly S.	Laboratory of Virology and AIDS Center, Geneva University Hospital, Geneva, Switzerlan		2016
A:	Zohari S.	Department of Virology, Immunobiology and Parasitology, National Veterinary Institute		2016
A:	Bedford T.	Vaccine and Infectious Disease Division, Fred Hutchinson Cancer Research Center, Seatt		2015
A:	Dudas G.	Institute of Evolutionary Biology, University of Edinburgh, Edinburgh, United Kingdom,		2015
A:	Hedman K.	Department of Virology, University of Helsinki, Haartmaninkatu 3, Helsinki,290, Finland		2015
A:	Palo J.U.	Department of Forensic Medicine, University of Helsinki, Kytösuontie 11, Helsinki,300, F		2015
A:	Perdomo M.F.	Department of Virology, University of Helsinki, Haartmaninkatu 3, Helsinki,290, Finland		2015
A:	Sajantila A.	Department of Forensic Medicine, University of Helsinki, Kytösuontie 11, Helsinki,300, F		2015
A:	Söderlund-Venermo M.	Department of Virology, University of Helsinki, Haartmaninkatu 3, Helsinki,290, Finland		2015
A:	Toppinen M.	Department of Virology, University of Helsinki, Haartmaninkatu 3, Helsinki,290, Finland		2015
A:	Dolling D.I.	Medical Research Council Clinical Trial Unit, United Kingdom,		2014
A:	Haydon D.T.	Boyd Orr Centre for Population and Ecosystem Health, College of Medical Veterinary an		2014
A:	Murcia P.R.	Medical Research Council (MRC) Centre for Virus Research, College of Medical, Veterina		2014
A:	Pillay D.	Department of Infection, University College London, Cruciform Building, Gower Street,		2014
A:	Pozniak A.	HIV and Sexual Health Clinic, Chelsea and Westminster Hospital, London, United Kingdo		2014
C:	VanderWaal K.	University of Minnesota		11/6/19
C:	Cheeran M.C.J.	University of Minnesota		11/6/19
C:	Corzo C.A.	University of Minnesota		11/6/19
C:	Rovira A.	University of Minnesota		11/6/19
C:	Schroeder D.C.	University of Minnesota		11/6/19
C:	Craft M.E.	University of Minnesota		11/6/19
C:	Rowland Kao	University of Edinburgh, United Kingdom		11/6/19
C:	Piran White	University of York, United Kingdom		11/6/19
C:	Christine Tait-Burkard	University of Edinburgh, United Kingdom	Roslin Institute	11/6/19
C:	Tanja Opriessnig	University of Edinburgh, United Kingdom	Roslin Institute	11/6/19

C:	David Gally	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	TAHAR AIT-ALI	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Rona Barron	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Sarah Brown	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Michael Cheeseman	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Paul Digard	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Andrea Doeschl-Wilson	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Tom Freeman	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Anew Gill	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Liz Glass	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Wilfred Goldmann	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Finn Grey	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Fiona Houston	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	David Hume	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Neil Mabbott	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Jean Manson	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Gerry McLachlan	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Aian Muwonge	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Clare Pridans	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Tim Regan	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	K Salamat	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Helen Sang	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Jacqueline Smith	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Nikki Smith	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Nick Sparks	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Mark Stevens	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Lonneke Vervelde	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Michael Watson	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Mark Bronsvoort	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Thibaud Porphyre	University of Edinburgh, UK	Roslin Institute	11/6/19
C:	Dominic Mellor	University of Glasgow, UK		11/6/19
C:	George Russell	Moredun Research Institute, UK		11/6/19
C:	Harriet Auty	SRUC Inverness, UK		11/6/19
C:	Iain McKendrick	BioSS, Edinburgh, UK		11/6/19

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
B:	Santiago Elena	Santa Fe Institute & CSIC Valencia, Spain	Virus Evolution, Oxford University Press	11/6/19
B:	Oliver Pybus	University of Oxford (UK)	Virus Evolution, Oxford University Press	11/6/19

Biographical Sketch

Name	Lonneke Vervelde
Job Title	Chair of Veterinary Immunology and Infectious Diseases
Address	The Roslin Institute, University of Edinburgh, Easter Bush, Midlothian, EH25 9RG, U.K.
Telephone	+44 (0)131 6513619
Email	lonneke.vervelde@roslin.ed.ac.uk

Professional Preparation

1984-1985	BSc in Biology, Agricultural University, Wageningen, The Netherlands
1985-1990	MSc in Biology, Agricultural University, Wageningen, The Netherlands Majors in Immunology, Parasitology and Ethology
1990-1995	PhD, Thesis entitled '*Eimeria tenella* infections in chickens; to recognise or to be recognised'

Performed at the Central Veterinary Institute, Lelystad, and graduated from the Medical Faculty of The Free University Amsterdam, The Netherlands

Appointments

2018-present	Chair of Veterinary Immunology and Infectious Diseases, University of Edinburgh, U.K.
2015-2018	Reader, The Roslin Institute, The University of Edinburgh, U.K.
2013-2015	Senior Research Fellow, The Roslin Institute, University of Edinburgh, U.K.
2003-2013	Group leader, Faculty of Veterinary Medicine, Utrecht University, The Netherlands
1998-2003	Senior Research Fellow, Faculty of Veterinary Medicine, Utrecht University, The Netherlands
1995-1998	Postdoctoral Research Assistant, Institute for Animal Health, Compton, U.K.

Publications

(i) related to the proposed project

1. S. Hussain, M.L. Turnbull, H.M. Wise, B.W. Jagger, P.M. Beard, K. Kovacikova, J.K. Taubenberger, **L. Vervelde**, O.G. Engelhardt, P. Digard. (2018) Mutation of influenza A virus PA-X decreases pathogenicity in chicken embryos and can increase the yield of reassortant candidate vaccine viruses. Journal of Virology, 93(2), pii: e01551-18. doi: 10.1128/JVI.01551-18
2. T.J. Hagenaars, E.A.J. Fischer, C.A. Jansen, J.M.J. Rebel, D. Spekreijse, **L. Vervelde**, J.A. Backer, M.C.M. de Jong, A.P. Koets. (2016) Modelling the Innate Immune Response against Avian Influenza Virus in Chicken. PLoS ONE 11(6): e0157816. doi:10.1371/ journal.pone. 0157816
3. C.A. Jansen, E.D. Geus, D.A. van Haarlem, P.M. van de Haar, B.Z. Löndt, S.P. Graham, T.W. Göbel, W. van Eden, S.M. Brookes, **L. Vervelde**. (2013) Differential lung NK cell responses in avian influenza virus infected chickens correlate with pathogenicity. Scientific Reports, 3, 2478. doi: 10.1038/srep02478
4. E.D. de Geus, B. Tefsen, D.A. van Haarlem, W. van Eden, I. van Die, **L. Vervelde**. (2013) Glycans from avian influenza virus are recognized by chicken dendritic cells and are targets for the humoral immune response in chicken. Molecular Immunology, 56, 452-462. doi: 10.1016/j.molimm.2013.06.007

5. E.D. de Geus, J.M. Rebel, **L. Vervelde**. (2012) Kinetics of the avian influenza-specific humoral responses in lung are indicative of local antibody production. Developmental and Comparative Immunology, 36, 317-322.

(ii) other significant publications/products

1. **L. Vervelde** and D.R. Kapczynski. The innate and adaptive response to avian influenza virus. In: Animal Influenza, 2nd Edition, 2016, chpt 6, pp135-152. Ed. D. Swayne. Wiley Blackwell.
2. **L. Vervelde** and J. Kaufman. Avian immune responses to virus infection. In: Avian Virology: Current Research and Future Trends, 2019, chpt 14, pp377-395. Ed. S.K. Samal. Caister Academic Press, U.K.
3. Priority patent, number P206221.GB.01 filed in July 2019 entitled 'Avian Enteroids'; L. Vervelde and E. Nash
4. US Provisional Patent Application No. 62/817,163 filed March 2019 entitled 'Influenza Virus Mutants and Uses Thereof'; **D.R. Kapczynski**, D. Swayne, **L. Vervelde**, **P. Digard** [joint USDA-BBSRC funding]
5. S. Ellis, S. Keep, P. Britton, J.J. de Wit, E. Bickerton, **L. Vervelde**. (2018) Recombinant Infectious Bronchitis Viruses expressing chimeric Spike glycoproteins induce partial protective immunity against homologous challenge despite limited replication in vivo. Journal of Virology, 92, doi: 10.1128/JVI.01473-18.

Synergistic Activities

International Research Prof Vervelde has a long-standing experience in the field of avian immunology, and is at the international forefront in exploiting avian immunology to understand host/pathogen interactions, host disease resistance mechanisms, and vaccine development. Funding includes awards from BBSRC, European Commission, Merck Animal Health, Novozymes, Boehringer Ingelheim, Proxima Concepts and Cobb-Vantress.

Editorial commitments Prof Vervelde is Associate Editor of the major reference book *'Avian Immunology'* (3rd Edition 2020), and serves as an academic editor for Avian Pathology and Veterinary Immunology and Immunopathology.

Peer reviewer for the BBSRC, Medical Research Council, Wellcome Trust, National Science Foundation, Canadian Poultry Research Council, German Research Foundation, Dutch Technology Foundation, Belgium Agency for Innovation by Science and Technology and others.

Teaching activities Prof Vervelde is lecturing at the UoE; Masters Animal Biosciences, Avian module, and the continuous training of UoE and Erasmus graduate and postgraduate students supporting their laboratory and PhD projects. She has supervised 30 PhD students and postdoctoral researchers.

International board memberships Prof Vervelde was a Scientific Board member of the XXth World Veterinary Poultry Association Congress (2017) and organized a workshop on Genome engineering of poultry and the wider applications. She co-organised an EU consortium COST-FA1207 (2013-2017) entitled 'Towards control of avian coronaviruses: strategies for diagnosis, surveillance and vaccination'. The consortium consisted of 176 participants from 25 countries.

Current and Pending Support – Prof Lonneke Vervelde

Current:

Project / Proposal Title: Towards edible vaccines for chickens.
Source of Support: MRC IVVN award
Total Award Amount: $130k
Total Award Period Covered: 2019
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0

Project / Proposal Title: Development of in vitro chicken enterocyte and organoid cultures
Source of Support: Novozymes
Total Award Amount: $177k
Total Award Period Covered: 12/1/2018 - 3/1/2020
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0.6

Project / Proposal Title: The intestinal M cell as vaccine target and porte d'entree for pathogens: a double-edged sword.
Source of Support: University Edinburgh, Enlightenment studentship
Total Award Amount: $100k
Total Award Period Covered: 9/1/2018-9/1/2022
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0

Project / Proposal Title: DELTA-FLU: Dynamics of avian influenza in a changing world.
Source of Support: EU-Horizon2020
Total Award Amount: $5M total ($584,900 for UoE)
Total Award Period Covered: 2017-2023 (2018-2021 at RI)
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0.6

Project / Proposal Title: Broad spectrum avian influenza vaccine based on epitopes of low variability.
Source of Support: BBSRC Impact Accelerator Account
Total Award Amount: $26k
Total Award Period Covered: 1/1/2019 - 12/31/2019
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0

Project / Proposal Title: Avian M cells: identification of universal markers and production of antibodies.
Source of Support: BBSRC Institute Strategic Pump Priming
Total Award Amount: $17k
Total Award Period Covered: 1/1/2019 – 12/31/2019
Location of Project: UK, University Edinburgh
Person Months Per Year Committed to the Project: 0 (consumables only)

Project / Proposal Title: Glycoengineering of veterinary vaccines.
Source of Support: BBSRC sLoLa.
Total Award Amount: $7.4M total $1.4M for UoE
Total Award Period Covered: 2016-2021
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6

Project / Proposal Title: A systems-wide approach to the control of Campylobacter in the food chain: exploiting genetic variation
Source of Support: Scottish Government RESAS initiative
Total Award Amount: $583k
Total Award Period Covered: 2016-2019
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0.6

Project / Proposal Title: Chicken intestinal organoids: a novel system to study mucosal vaccine targeting.
Source of Support: BBSRC iCASE studentship (with MSD Animal Health)
Total Award Amount: $154k
Total Award Period Covered: 2015-2021
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0

Project / Proposal Title: The key to unlock cross-protective IBV vaccines: epitopes of limited variability
Source of Support: Boehringer Ingelheim
Total Award Amount: $415k
Total Award Period Covered: 2020-2022
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2

Project / Proposal Title: Identification of selection targets and development of analytical tools to optimise breeding programmes in African chicken populations
Source of Support: CTLGH
Total Award Amount: $1,047,813 ($472,315 to UoE)
Total Award Period Covered: 2019-2022
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2

Project / Proposal Title: The chicken or the egg unravelling immunological mechanisms of in ovo vaccination
Source of Support: EastBio Case studentship (with MSD Animal Health)
Total Award Amount: $143k
Total Award Period Covered: 2020-2024
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0

Pending:

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/2020 – 5/31/2023
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title Development of in vitro bovine 2D enterocyte cultures
Source of Support: Novozymes
Total Award Amount: $325k
Total Award Period Covered: 2020-2021
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2

Project / Proposal Title Chicken enteroids; exploring applications of the vitro model
Source of Support: BBSRC Impact Accelerator Account
Total Award Amount: $39k
Total Award Period Covered: 2020
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 0

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.
1 Note that graduate advisors are no longer required to be reported.
2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Lonneke Vervelde	Roslin Institute, University of Edinburgh	2019

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
R:		Family		

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and

T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Jeurissen, S (dec.)	Central Veterinary Insititute, Lelystad, Netherlands	
G:	Sminia, T	Free University Amsterdam, Netherlands	
G:	Cornelissen, A	University Utrecht, the Netherlands	
T:	de Geus, Eveline	University Utrecht, the Netherlands	
T:	Reemers, Sylvia	University Utrecht, the Netherlands	
T:	Matthijs, Mieke	University Utrecht, the Netherlands	
T:	Ariaans, Mark	University Utrecht, the Netherlands	
T:	Nash, Esther	University of Edinburgh, UK	
T:	Keep, Sarah	University of Edinburgh, UK	
T:	Jadhav, Archana	University of Edinburgh, UK	
T:	Hussein, Marwa	University of Edinburgh, UK	
T:	Conceicao, Carina	University of Edinburgh, UK	
T:	Billington, Lizzie	University of Edinburgh, UK	
T:	Clements, Anabel	University of Edinburgh, UK	
T:	Owen, James	University of Edinburgh, UK	
T:	Ferguson, Jack	University of Edinburgh, UK	
T:	Dewar, Rebecca	University of Edinburgh, UK	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and

C: Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
C:	Athanasiadou, Spiridoula	SRUC		2019
C:	Brookes, Sharon	APHA, UK		
A:	Bush, Stephen	RI		
A:	Cassidy-Cain, Robin	RI		
A:	Chakraborty, Pankaj	RI		
A:	Chanteloup, Nathalie	INRA, France		
A:	Chintoan-Uta, Cosmin	RI		
A:	Clohisey, Sara	RI		
C:	Dalgaard, Tina	AU		2019
A:	Dalziel, Robert	RI		
A:	de Costa, Taiana	RI		
C:	de Wit Johannes	GD		2019
C:	Digard, Paul	RI		2019
A:	Donaldson, David	RI		

A:	Dupont, Joëlle	INRA		
A:	Dutia, Bernadette	RI		
A:	Elleder, daniel	IMGAS, Czechia		
C:	Ellis, Samantha	RI		2019
A:	Engelhardt, O	NIBSC, UK		
A:	Ferguson, David	Oxford University, UK		
A:	Freem, Lucy	RI		
A:	Garrido, Damien	INRA		
C:	Georgios Banos	SRUC, UK		2019
C:	Glendinning, Laura	RI		2019
C:	Guabiraba, Rodrigo	INRA		2019
C:	Hans Christian Phillip	Boehringer Ingelheim, Germany		2019
A:	Hartle, Sonja	LMU		
A:	Hu, Tuanjun	RI		
A:	Hume, David	RI		
A:	Hussein, Saira	RI		
A:	Jagger, B	NIH USA		
C:	Jo Houdijk	SRUC		2019
A:	Juul-Madsen, Helle (dec.)	AU		
A:	Kaiser, Pete (dec.)	RI		
C:	Kapczynski, Darrell	USDA		2019
C:	Kaspers, Bernd	LMU		2019
A:	Kaufman, Jim	UoC		
A:	Keep Sarah	TPI		
A:	Kim, Sungwon	RI		
A:	Kovacikova, K	RI		
A:	Kuo, Richrad	RI		
A:	Küster, Tatiana			
A:	Kut, Emmanuel	INRA		
C:	Lamont, Susan	ISU		2019
A:	Lion, Adrien	INRA		
C:	Mabbott, Neil	RI		2019
A:	Mark Stevens	RI		
A:	Marugán-Hernández, Virgi	RVC		
C:	McLachlan, Gerry	RI		2019
C:	Mike McGrew	Roslin Istitute, UK		2019
C:	Neil Mabbott	RI		2019
C:	Olivier Hanotte	ILRI, Ethiopia		2019
A:	Pastor-Fernández, Ivan	RVC		
C:	Paul Vermeij	MSD, The Netherlands		2019
C:	Roger New	Proxima, UK		2019
A:	Roll, S	LMU		
A:	Sang Helen	RI		
C:	Schouler, Catherine	INRA		2019
A:	Schusser, Benjamin	LMU		
C:	Smith, Jacqueline	RI		2019
A:	Staudt, A	LMU		
C:	Stevens, Mark	RI		2019
C:	Stina Rikke Jensen	Novozymes, Denmark		2019
C:	Sutton, Kate	RI		2019
A:	Taubenberger, J	NIH USA		

A:	Tedin, Karsten	IME, Germany		
C:	Thijs Kuiken	EMC, The Netherlands		2019
C:	Thomas Mettenleiter	FLI, Germany		2019
C:	Tomley, Fiona	RVC		2019
C:	Trapp, Sascha	INRA		2019
A:	Trotereau, Angélica	INRA		
A:	Turnbull, Mattew	RI		
A:	Vela, Andrea	RI		
A:	Vohra, Perna	RI		
A:	Wise, Helen	RI		

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
B:	Blake, Damer	RVC, UK	Avian Pathology	1/1/17
E:	de Wit, Johannes	GD, The Netherlands	Avian Pathology	
E:	Rauthenschlein, Silke	University Hannover, Germany	Avian Pathology	
B:	Glass, Elizabeth	University of Edinburgh, UK	Veterinary Immunology and Immunopathology	
B:	Scheerlink, Jean-Pierre	University of Melbourne, Australia	Veterinary Immunology and Immunopathology	
B:	Sharif, Shayan	University of Guelph, Canada	Veterinary Immunology and Immunopathology	

BIOGRAPHICAL SKETCH

Barbara Bo-Ju Shih
Computation Biology Analyst/Research Fellow
Roslin Institute and R(D)SVS of the University of Edinburgh, UK
Easter Bush EH25 9RG, UK
Tel: (+44) 131 6519207
E-mail: barbara.shih@roslin.ed.ac.uk

(a) Professional Preparation

2013	PhD (by publication), School of Dermatological Research, University of Manchester, UK
2007	MSc Immunology and Immunogenetics, University of Manchester, UK
2006	BSc (Hons) Cell biology, University of Manchester, UK

(b) Appointments

2015- present	Research Fellow, The Roslin Institute and R(D)SVS, University of Edinburgh, UK
2013-2015	Postdoctoral researcher, University of Manchester, UK
2007-2013	Research Assistant, University of Manchester, UK

(c) Publications

*(i) 5 publications most closely related to the proposal. Total = 20, *=first or senior author*

1. Nazarie F.W.*, **Shih B.***, Angus T., Barnett M.W., Chen S.-H., Summers K.M., Klein K., Faulkner G.J., Saini H.K., Watson M., Dongen S.v., Enright A.J., Freeman T.C. Visualization and analysis of RNA-Seq assembly graphs. Nucleic Acids Research. 2019;47(14):7262-75. doi: 10.1093/nar/gkz599.Freeman, Tom C. Visualization and analysis of RNA-Seq assembly graphs. Nucleic Acids Research. 2019;47(14):7262-75. doi: 10.1093/nar/gkz599. * = joint first author
2. Patir A., **Shih B.**, McColl B.W., Freeman T.C. A core transcriptional signature of human microglia: Derivation and utility in describing region-dependent alterations associated with Alzheimer's disease. GLIA. 2019;67(7):1240-53. doi: 10.1002/glia.23572.
3. Nirmal A.J., Regan T., **Shih B.B.**, Hume D.A., Sims A.H., Freeman T.C. Immune cell gene signatures for profiling the microenvironment of solid tumors. Cancer Immunology Research. 2018;6(11):1388-400. doi: 10.1158/2326-6066.CIR-18-0342.
4. **Shih B.B.***, Nirmal A.J., Headon D.J., Akbar A.N., Mabbott N.A., Freeman T.C. Derivation of marker gene signatures from human skin and their use in the interpretation trancriptional changes associated with dermatological disorders. The Journal of Pathology. 2016.
5. Ashrafi M., Sebastian A., **Shih B.**, Greaves N., Alonso-Rasgado T., Baguneid M., Bayat A. Whole genome microarray data of chronic wound debridement prior to application of dermal skin substitutes. Wound Repair and Regeneration. 2016;24(5):870-5. doi: 10.1111/wrr.12460.

(ii) List up to five (5) other publications, whether or not related to the proposed project.

6. **Shih B.B.***, Farrar M.D., Cooke M.S., Osman J., Langton A.K., Kift R., Webb A.R., Berry J.L., Watson R.E.B., Vail A., de Gruijl F.R., Rhodes L.E. Fractional Sunburn Threshold UVR Doses Generate Equivalent Vitamin D and DNA Damage in Skin Types I–VI but with Epidermal DNA Damage Gradient Correlated to Skin Darkness. Journal of Investigative Dermatology. 2018;138(10):2244-52. doi: 10.1016/j.jid.2018.04.015.

7. **Shih B.B.***, Allan D., De Gruijl F.R., Rhodes L.E. Robust Detection of Minimal Sunburn in Pigmented Skin by 785 nm Laser Speckle Contrast Imaging of Blood Flux. Journal of Investigative Dermatology. 2015;135(4):1197-9. doi: 10.1038/jid.2014.507.
8. **Shih B.***, Watson S., Bayat A. Whole genome and global expression profiling of Dupuytren's disease: Systematic review of current findings and future perspectives. Annals of the Rheumatic Diseases. 2012;71(9):1440-7. doi: 10.1136/annrheumdis-2012-201295.
9. **Shih B.***, Tassabehji M., Watson J.S., Bayat A. DNA copy number variations at chromosome 7p14.1 and chromosome 14q11.2 are associated with Dupuytren's disease: Potential role for MMP and Wnt signaling pathway. Plastic and Reconstructive Surgery. 2012;129(4):921-32. doi: 10.1097/PRS.0b013e3182442343.
10. **Shih B.***, Sultan M.J., Chaudhry I.H., Tan K.T., Johal K.S., Marstan A., Tsai M., Baguneid M., Bayat A. Identification of biomarkers in sequential biopsies of patients with chronic wounds receiving simultaneous acute wounds: A genetic, histological, and noninvasive imaging study. Wound Repair and Regeneration. 2012;20(5):757-69. doi: 10.1111/j.1524-475X.2012.00832.x.

(d) Synergistic Activities

- External examiner for a PhD thesis at the University of Western Australia. (2016)
- Reviewer for Cellular Oncology (2019) and Burns (2018).

Current and Pending Support – Dr. Barbara Bo-Ju Shih

Current:

Project / Proposal Title: The control of tempo during embryonic development: insights from hybrid vertebrates
Source of Support: Wellcome Trust (UK)
Total Award Amount: £30,000
Total Award Period Covered: 10/1/19 - 2/28/20
Location of Project: University of Edinburgh, UK
Person Months Per Year Committed to the Project: 1 Cal mos.

Project / Proposal Title: Defining early entry mechanisms of Mycobacterium avium paratuberculosis into the host
Source of Support: BBSRC (UK)
Total Award Amount: £679,284 (University of Edinburgh, UK) and £564,012 (Moredun Research Institute, UK) (awaiting for the award letter for the final approved amount)
Total Award Period Covered: 1/1/20 – 12/31/22
Location of Project: University of Edinburgh and Moredun Research Institute joint project
Person Months Per Year Committed to the Project: 0.7 Cal mos.

Pending:

Project / Proposal Title: US-UK Collab: Combined influence of imperfect vaccines, host genetics, and non-genetic drivers on virus transmission and virulence evolution
Source of Support: BBSRC(UK); US-UK joint NIFA-NSF-NIH-BBSRC EEID
Total Award Amount: $2,452,703 (UK contribution)
Total Award Period Covered: 6/1/20 – 5/31/23
Location of Project: University of Edinburgh, UK
Person Months Per Year Committed to the Project: 1 Cal mos.

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/20 – 5/31/23
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: Interferon-stimulated genes as resilience factors for PRRSV infection
Source of Support: BBSRC (UK)
Total Award Amount: £809,529.77 / £633,069.62 (80%FEC)
Total Award Period Covered: 6/1/20 – 5/31/23
Location of Project: University of Edinburgh, UK
Person Months Per Year Committed to the Project: 0.7 Cal mos.

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
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COA template Table 2:
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COA template Table 3:
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- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

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This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.
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2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Shih, Barbara Bo-Ju	The Roslin Institute, University of Edinburgh	

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.
R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.
to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active

Table 3: **List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.**

G: **The individual's Ph.D. advisors; and**

T: **All of the individual's Ph.D. thesis advisees.**

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Dr Ardeshir Bayat	University of Manchester, UK	
T:	Prof Rachel Watson	University of Manchester, UK	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**

C: **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Summers, Kim M.	The University of Queensland, Australia		1/8/19
A:	Angus, Tim	University of Edinburgh, UK		1/8/19
A:	Nazarie, Fahmi W.	University of Edinburgh, UK		1/8/19
A:	Chen, Sz-Hau	University of Edinburgh, UK		1/8/19
A:	Klein, Karsten	Konstanz University, Germany		1/8/19
A:	Faulkner, Geoffrey J.	The University of Queensland, Australia		1/8/19
A:	Saini, Harpreet K.	Astex Pharmaceuticals, UK		1/8/19
A:	Watson, Mick	University of Edinburgh, UK		1/8/19
A:	van Dongen, Stijn	Wellcome Genome Campus, UK		1/8/19
A:	Enright, Anton J.	University of Cambridge, UK		1/8/19
A:	Freeman, Tom C.	University of Edinburgh, UK		1/8/19
A:	Patir, Anirudh	University of Edinburgh, UK		1/7/19
A:	McColl, Barry W.	University of Edinburgh, UK		1/7/19
A:	Nirmal, Ajit J.	University of Edinburgh, UK		1/11/18
A:	Hume, David A.	The University of Queensland, Australia		1/11/18
A:	Sims, Andrew H.	University of Edinburgh, UK		1/11/18
A:	Farrar, Mark D.	University of Manchester, UK		1/10/18
A:	Cooke, Marcus S.	Florida International University, USA		1/10/18
A:	Osman, Joanne	University of Manchester, UK		1/10/18
A:	Langton, Abigail K.	University of Manchester, UK		1/10/18
A:	Kift, Richard	University of Manchester, UK		1/10/18
A:	Webb, Ann R.	University of Manchester, UK		1/10/18
A:	Berry, Jacqueline L.	University of Manchester, UK		1/10/18
A:	Watson, Rachel E.B.	University of Manchester, UK		1/10/18
A:	Vail, Andy	University of Manchester, UK		1/10/18
A:	de Gruijl, Frank R.	University Medical Centre, Netherlands		1/10/18
A:	Rhodes, Lesley E.	University of Manchester, UK		1/10/18
C:	Rhodes, Lesley E.	University of Manchester, UK		

C:	Malbbott, Neil A.	University of Edinburgh, UK		
C:	Freeman, Tom C.	University of Edinburgh, UK		
C:	Akbar, Arne N.	University College London		
C:	Davey, Megan	University of Edinburgh, UK		
C:	Hope, Jayne	University of Edinburgh, UK		
C:	Beard, Pip	University of Edinburgh, UK		
C:	Law, Andy	University of Edinburgh, UK		

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active

Lisa Boden
Senior Lecturer in Population Medicine and Animal Health Policy
The Royal (Dick) School of Veterinary Studies and The Roslin Institute
Easter Bush Campus, Midlothian, EH25 9RG
01316506094
Lisa.boden@ed.ac.uk

(a) Professional Preparation

Dartmouth College	Hanover, NH, USA	Biology	AB, 1994
University of Queensland	Queensland, Australia	Veterinary Science	BVSc, 1999
University of Melbourne	Victoria, Australia	Epidemiology	PhD, 2006
University of Edinburgh	Scotland, UK	Law	LLM, 2014
Australian and New Zealand College (Epidemiology)	Australia	Epidemiology	MANZCVSc, 2006
European College of Veterinary Public Health	EU	Population Medicine	DipECVPH 2006
Royal College of Veterinary Surgeons	UK	Veterinary Public Health	UK specialist in veterinary public health, 2016

(b) Appointments

2018-Present	University of Edinburgh, Global Academy of Agriculture and Food Security Senior Lecturer in Population Medicine and Animal Health Policy
2016-2017	University of Glasgow Senior Research Fellow
2012-2015	University of Glasgow Post-doctoral Research Fellow
2008-2012	University of Glasgow Post-doctoral Researcher
2006-2008	University of Edinburgh Veterinary Training Research Initiative (VTRI) Defra Post-Doctoral Research Fellow

(c) Products

(i) List up to five (5) publications/products most closely related to the proposed project

1. **Boden L.A.** et al. (2017) Animal health surveillance in Scotland in 2030: Using scenario planning to develop strategies in the context of "Brexit" In: *Frontiers in Veterinary Science*, vol. 4, no. NOV DOI: https://doi.org/10.3389/fvets.2017.00201
2. **Boden L.A.** and McKendrick I.J. (2017) Model-Based Policymaking: A Framework to Promote Ethical 'Good Practice' in Mathematical Modelling for Public Health Policymaking. *Frontiers in Public Health 5:68*. DOI: 10.3389/fpubh.2017.00068
3. **Bessell, P.R.**, Robinson, **R.A., Golding, N.**, Searle, K.R., Handel, I.G., **Boden, L.A.**, Purse, B.V., and Bronsvoort, B.M.d. C. (2015) Quantifying the risk of introduction of West Nile virus into Great Britain by migrating passerine birds. Transboundary and Emerging Diseases, 63, no. 5, pp. e347-e359 https://doi.org/10.1111/tbed.12310 Contributed to the policy-related impacts of this work and the writing of the manuscript.
4. **Porphyre, T., Boden, L.A.**, Correia-Gomes C., Auty, H.K., Gunn, G.J., Woolhouse, M.E.J. (2015) Using national movement databases to help inform responses to swine disease outbreaks in Scotland: the impact of uncertainty around incursion time. Scientific Reports Nature.
5. **Porphyre, T., Boden, L.A.**, Correia-Gomes C., Auty, H.K., Gunn, G.J., Woolhouse, M.E.J. (2016) Using national movement databases to help inform responses to swine disease outbreaks in Scotland: the impact of uncertainty around incursion time. Scientific Reports Nature, 6, 20258 DOI: https://doi.org/10.1038/srep20258.

(ii) List up to five (5) other significant publications/products

1. Auty H, Mellor D, Gunn G, **Boden LA**, (2019) The risk of foot and mouth disease transmission posed by public access to the countryside during an outbreak. *Frontiers in Veterinary Research* https://doi.org/10.3389/fvets.2019.00381 See also
2. Wenham, C.; Katz, K.; Birungi, C.; **Boden L.A.**, Eccleston-Turner, M, Gostin, L., Guinto, R, Hellowell, M., Husøy Onarheim, K., Hutton, J., Kapilashrami, A., Mendenhall, E., Phelan, A., Tichenor, M, and Sridhar, D. (2018) Global Health Security and Universal Health Coverage: From a Marriage of Convenience to a Strategic, Effective Partnership. BMJ *Accepted 28 October 2018.*
3. **Boden, L. A.** et al. (2015) Scenario planning: the future of the cattle and sheep industries in Scotland and their resiliency to disease. Preventive Veterinary Medicine, 121(3-4), pp. 353-364. (doi:10.1016/j.prevetmed.2015.08.012) (PMID:26349432)
4. **Boden, L.**, Auty, H., Goddard, P., Stott, A., Ball, N., and Mellor, D. (2014) Working at the science-policy interface. Veterinary Record, 174(7), pp. 165-167. (doi:10.1136/vr.g1430).
5. Scottish. Government Veterinary Risk Assessments: VRA. Likelihood of transmission of BTV-8 to an uninfected farm via transport of infected animals for slaughter and/or vectors from premises within restricted zones to designated abattoirs?

(d) Synergistic Activities

1. Deputy Director of EPIC, Scottish Government's Centre of Expertise on Animal Disease Outbreaks (2016-present)
2. Junior Vice President of the European College of Veterinary Public Health (ECVPH) (2019-present) and elected member of the Council (2016-present)
3. Member of Edinburgh Infectious Diseases (EID) Board (2018-present)
4. University of Edinburgh representative on the UNA Europa One Health Initiative (2019-present)
5. Associate Editor of: Epidemiology and Infection (2018-present), Frontiers in Veterinary Science (2019-present), SVEPM Special Edition, Preventive Veterinary Medicine (2018-present)

(e)Major collaborators: *EPIC:* Paul Bessell, Rowland Kao, Thibaud Porphyre, Mark Bronsvoort, Sam Lycett (The Roslin Institute); Luiza Toma, Andrew Barnes, George Gunn, Harriet Auty, Aaron Reeves (SRUC), Prof Dominic Mellor, Prof. Louise Matthews, Prof Lucy Gilbert (University of Glasgow), George Russell (The Moredun Research Institute); Iain McKendrick, Giles Innocent, Glenn Marion (BioSS)), Orla Shortall, Katrina Brown (James Hutton Institute); HIVE project (surveillance): William Weir, Shufan Yang, Lorenzo Viora, Yunhyong Kim, Pauline McBride (University of Glasgow), Rob Barker (University of Kent); MEASURE (AMR) project: Dominic Moran, Luiza Toma, Nick Sparks, Ikka Leinonen, Shailesh Shrestha, Adrian Muwonge; SyrianFood Futures: Clara Calia (UoE), Corinne Reid (UoE), Tom Parkinson (UKent) Suk-Jun Kim (Aberdeen), Shaher Abdullateef, Tefide Kizildeniz, Manaf Aldakhil(Cara Syria Programme); USyd-UoE collaboration Sinead Boylan and Geoff Simm UoE Co-Is: Liz Grant, Fiona Borthwick, Geraldine McNeil, Alfred Gathorne-Hardy; USyd Co-Is: Michael Skilton, Andy Holmes, David Raubenheimer, Tim Gill, Arunima Malik; UDublin-UoE One Health network: Stephen Gordon (UCD), Geoff Simm (UoE)

Postdoctoral associates: May Fujiwara (2019-) Post-doctoral fellow on the EPIC project

Thesis supervisor: Lina Gordon Gonzalez, PhD 2019- (co-supervisors Dominic Moran (UoE), Luiza Toma (SRUC)); Yasmin Abdalla, PhD 2019- (co-supervisor Dominic Moran (UoE)); Laura Higham, 2019-(Co-supervisor Dominic Moran); Rosemary McManus, PhD 2019- (co-supervisors William Weir, Shufan Yang, Lorenzo Viora, Yunhyong Kim, Pauline McBride (University of Glasgow), Rob Barker (University of Kent)); Frederieke Peto, PhD 2016-2020 (co-supervisor Sally Wyke (Primary), Lisa Boden, Catherine O'Donnell, Dr Frank Katzer; Richard Reardon, 2009-2012 completed (co-supervisors Tim Parkin); Teresita Zambruno (Masters 2015-2017 completed (co-supervisors Tim Parkin); ***Other professionals*** (ECVPH residents): Harriet Auty (SRUC, completed 2016); Paolo Motta (FAO, ongoing), Stella Mazeri (UoE, ongoing), Carla Gomes (SRUC, ongoing), Rosemary McManus (UoE, ongoing) ; ***Research Assistants:*** Julia Yates (UoGlasgow – between 2010-2011)

Current and Pending Support – Lisa Boden

Current:

Project / Proposal Title: Centre of Expertise on Animal Disease Outbreaks
Source of Support: Scottish Government
Total Award Amount: $327k (Global Academy Part)
Total Award Period Covered: Start date 31/03/2016 Duration 5 years
Location of Project: Edinburgh University
Person Months Per Year Committed to the Project: 1.2 months/year

Project / Proposal Title: Environmental and Economic Impacts of Improved Antibiotics Stewardship in Poultry Systems.
Source of Support: BBSRC
Total Award Amount: $1.029M
Total Award Period Covered: Start date: 01/08/2019 Duration 34 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project:1.3 month/year

Project / Proposal Title**:** *Leadership in Ethics, Integrity and Research Conduct in Complex LMIC-UK partnership projects.*
Source of Support: SFC Global Challenges
Total Award Amount: $104k
Total Award Period Covered: Start date: 31/03/2019 Duration 6 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project: 1 month/year

Project / Proposal Title**:** *Fragile and Conflict Affected States*
Source of Support: *Global Theme Development Fund.*
Total Award Amount: $26k
Total Award Period Covered: Start date: 31/03/2019 Duration: 4 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project: 4 months/ year

Project / Proposal Title**:** *Cultures of expertise: Academics in exile and their role in the future food security agenda for Syria (SyrianFoodFutures)*
Source of Support: *UKRI Global Challenges Research Fund Collective Programme*
Total Award Amount: $246k
Total Award Period Covered: Start date: 01/12/2019 Duration 12 months
Location of Project: The University of Edinburgh
Person Months Per Year Committed to the Project: 1 month/year

Pending:

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/2020 – 5/31/2023

Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 Cal mos.

Project / Proposal Title: *SCOPE: Skills and Competencies Outcomes from Pedagogies in Education: Co-designing and evaluating cross-sectoral education for sustainable development*
Source of Support: *UKRI Global Challenges Research Fund Collective Programme*
Total Award Amount: $2.577M
Total Award Period Covered: Start date:01/02/2020 Duration: 36 months
Location of Project: St Andrews University, UK
Person Months Per Year Committed to the Project: 1.3 months/year

Project / Proposal Title: *Creating Hope in Conflict: A Humanitarian Grand Challenge "Developing a transportable self-powered sanitation facility for conflict-stricken communities*
Source of Support: Grand Challenges Canada
Total Award Amount: CA $200 000
Total Award Period Covered: Start date 01/04/2020. Duration 24 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 months per year.

Project / Proposal Title: WaterFOre:
Source of Support: Innovate UK
Total Award Amount: $65k
Total Award Period Covered: Start date 01/04/2020. Duration 6 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project: 1 month/ year

Project / Proposal Title: Supporting Malawi's One Health Research Network to evaluate innovations in rabies elimination and reduce food-borne disease transmission.
Source of Support: GCRF Networking Grant
Total Award Amount: $32k
Total Award Period Covered: Start date: 01/03/2020 Duration 12 months
Location of Project: University of Edinburgh
Person Months Per Year Committed to the Project: 1.2 months/ year

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For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12 mo	Last Active Date
	Boden, Lisa A	University of Edinburgh, Global Academy of Agriculture and Food Security	Since Januray 2018

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.
R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
R:	Tim Parkin	Family	tim.parkin@glasgow.ac.uk	

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.
G: The individual's Ph.D. advisors; and
T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	John Morton	University of Sydney, Australia	
G:	Kenton Morgan	University of Liverpool , UK	
	Jenny Charles	Universit of Melbourne, Australia	
	Ron Slocombe	University of Melbourne, Australia	
T:	Frederieke Peto	University of Glasgow, UK	
T:	Lina Gonzales	University of Edinburgh, UK	
T:	Yasmin Abdalla	University of Edinburgh, UK	
T:	Rosemary McManus	University of Edinburgh, UK	
T:	Laura Higham	University of Edinburgh, UK	
T:	Richard Reardon	University of Edinburgh, UK	

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and

C: Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Wrenham, Clare	London School Economics and Political Science, UK		2/1/19
A:	Katz, Rebecca	Georgetown University, USA		2/1/19
A:	Birungi, Charles	University College London, UK		2/1/19
A:	Eccleston-Turner, Mark	Keele University, UK		2/1/19
A:	Gostin, Lawence	Georgetown University, USA		2/1/19
A:	Guinto, Renzo	Harvard University, USA		2/1/19
A:	Hellowell, Mark	University of Edinburgh, UK		2/1/19
A:	Onarheim, Kristine	University of Bergen, Norway		2/1/19
A:	Hutton, Joshua	University of Sussex, UK		2/1/19
A:	Kapilashrami, Anuj	Queen Mary University, UK		2/1/19
A:	Mendenhall, Emily	Georgetown University, USA		2/1/19
A:	Phelan, Alexandra	Georgetown University, USA		2/1/19
A:	Tichenor, Marlee	University of Edinburgh, UK		2/1/19
A:	Sridhar, Devi	University of Edinburgh, UK		2/1/19
A:	Auty, Harriet	University of Edinburgh, UK		11/27/17
A:	Reeves, Aaron	University of Edinburgh, UK		11/27/17
A:	Rydevik, Gustaf	University of Edinburgh, UK		11/27/17
A:	Bessell, Paul	University of Edinburgh, UK		11/27/17
A:	McKendrick, Iain	University of Edinburgh, UK		11/27/17
A:	Duckett, Dominic	James Hutton Institute, UK		1/1/17
A:	McKee, Annie	James Hutton Institute, UK		1/1/17
A:	Sutherland, Lee-Ann	James Hutton Institute, UK		1/1/17
A:	Kyle, Carol	James Hutton Institute, UK		1/1/17
A:	Porphyre, Thibaud	University of Edinburgh, UK		2/1/16
A:	Correia-Gomes, Carla	Scotland's Rural College, UK		2/1/16
A:	Gunn, George	Scotland's Rural College, UK		2/1/16
A:	Woolhouse, Mark	University of Edinburgh, UK		2/1/16
A:	Gaythorne-Hardy, Alfy	University of Edinburgh, UK		11/1/18
A:	Wilson, Marisa	University of Edinburgh, UK		11/1/18
A:	Alexander, Peter	University of Edinburgh, UK		11/1/18
A:	Roberts, Emma	University of Edinburgh, UK		7/23/16
A:	Ramsey, Ian	University of Edinburgh, UK		7/23/16
A:	Parkin, Tim	University of Glasgow		11/1/19
A:	Bronsvoort, Mark	University of Edinburgh, UK		11/1/19
A:	Searle, Kate	Centre for Ecology and Hydrology		2/1/16
A:	Handel, Ian	University of Edinburgh, UK		2/1/16
A:	Purse, Bethan	Centre for Ecology and Hydrology		2/1/16
C:	Abbassi Monjezi, Alireza	Waterwhelm		11/1/19
C:	Abdullateef, Shaher	Cara Syria Programme		11/1/19
C:	Kizildeniz, Tefide	Cara Syria Programme		11/1/19
C:	Boylan, Sinead	University of Sydney		11/1/19
C:	Simm, Geoff	University of Edinburgh, UK		11/1/19
C:	Grant, Elizabeth	University of Edinburgh, UK		11/1/19
C:	Borthwick, Fiona	University of Edinburgh, UK		11/1/19
C:	Moran, Dominic	University of Edinburgh, UK		11/1/19

C:	Toma, Luiza	Scotland's Rural College, UK		11/1/19
C:	McNeil, Geraldine	University of Edinburgh, UK		11/1/19
C:	Skilton, Michael	University of Sydney		11/1/19
C:	Holmes, Andy	University of Sydney		11/1/19
C:	Raubenheimer, David	University of Sydney		11/1/19
C:	Gill, Tim	University of Sydney		11/1/19
C:	Malik, Arunima	University of Sydney		11/1/19
C:	Parkinson, Tom	University of Kent		11/1/19
C:	Aldakhil, Manaf	Cara Syria Programme		11/1/19
C:	Banda, Evelyn	Public Health Institute of Malaw		11/1/19
C:	Chikungwa, Patrick	Dept of Animal Health and Livestock Development ,Malawi		11/1/19
C:	Malkewa, Mac	Queen Elizabeth Hospital (QEH), Malawi		11/1/19
C:	Kambalame, Dzinkambani	PHIM, Malawi		11/1/19
C:	Mitambo, Colins	PHIM, Malawi		11/1/19
C:	Kasambara,Watipaso	PHIM, Malawi		11/1/19
C:	O'Connell,Donnamarie	RSPCA, Malawi		11/1/19
C:	White, Rehema	St Andrews University, UK		11/1/19
C:	Mannion, Gregg	University of Stirling, UK		11/1/19
C:	Gajpara, Jaya	London, South Bank University, UK		11/1/19
C:	Higgins, Peter	University of Edinburgh, UK		11/1/19
C:	Calia, Clara	University of Edinburgh, UK		11/1/19
C:	Kim, Suk-Jun	University of Aberdeen		11/1/19
C:	Gordon, Stephen	UC Dublin		11/1/19
C:	Sparks, Nick	Scotland's Rural College, UK		11/1/19
C:	Leinonen, Ikka	Scotland's Rural College, UK		11/1/19
C:	Shrestha, Shailesh	Scotland's Rural College, UK		11/1/19
C:	Weir, William	University of Glasgow		11/1/19
C:	Yang, Shufan	University of Glasgow		11/1/19
C:	Viora, Lorenzo	University of Glasgow		11/1/19
C:	Kim, Yunhyong	University of Glasgow		11/1/19
C:	McBride, Pauline	University of Glasgow		11/1/19
C:	Barker, Rob	University of Kent		11/1/19
C:	Wyke,Sally	University of Glasgow		11/1/19
C:	O'Donnell, Catherine	University of Glasgow		11/1/19
C:	Mellor, Dominic	University of Glasgow		11/1/19
C:	Kao, Rowland	University of Edinburgh, UK		11/1/19
C:	Matthews, Louise	University of Glasgow		11/1/19
C:	Zadoks, Ruth	University of Sydney		11/1/19
A:	Reeves, Aaron	Scotland's Rural College, UK		11/1/19
C:	Fitzpatrick, Julie	Moredun Research Institute		11/1/19
C:	Russell, George	Moredun Research Institute		11/1/19
C:	Shortall, Orla	James Hutton Institute, UK		11/1/19
C:	Brown, Katrina	james Hutton Institute, UK		11/1/19
C:	Innocent, Giles	BioSS		11/1/19
C:	Lycett, Samantha	University of Edinburgh, UK		11/1/19
C:				
C:				
C:				
C:				
C:				

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
	Norman Noah	London School of Tropical Medicine, UK	Epidemiology and Infection	11/1/19
	Michael Edelstein	London School of Tropical Medicine, UK	Epidemiology and Infection	11/1/19
	Andrew Breed	APH, Australia	Epidemiology and Infection	11/1/19
	Amy Delgado	USDA, USA	Frontiers in Veterinary Medicine	11/1/19
	Amy Hagerman	Oklahoma State University, USA	Frontiers in Veterinary Medicine	11/1/19
	John Grewar	University of Pretoria, South Africa	Frontiers in Veterinary Medicine	11/1/19
	Thibaud Porphyre	University of Edinburgh,UK	Frontiers in Veterinary Medicine	11/1/19
	Harriet Auty	Scotland's Rural College, UK	Frontiers in Veterinary Medicine	11/1/19
	George Russell	Moredun Institute, UK	Frontiers in Veterinary Medicine	11/1/19
	Fernanda Dorea	SVA, Sweden	SVEPM, Preventive Veterinary Med	11/1/19
	Timothy Vergne	Université de Toulouse, France	SVEPM, Preventive Veterinary Med	11/1/19
	Marie Mcintyre	University of Liverpool, UK	SVEPM, Preventive Veterinary Med	11/1/19
	Mo Salman	Colorado State University, USA	SVEPM, Preventive Veterinary Med	11/1/19

Biographical Sketch

Dr Lu Lu *BSc MSc PhD*
Postdoctoral research associate
Usher Institute of Population Health Sciences & Informatics, the University of Edinburgh, UK
West Mains Road, Edinburgh, UK EH9 3JT
Tel: (+44) 131 650 5445
E-mail: lu.lu@.ed.ac.uk

(a) Professional Preparation

Nanjing Agricultural University	Nanjing, China	Veterinary Medicine	B.Sc. 2003-2008
Institute of Microbiology, Chinese Acedemy of Science	Beijing, China	Molecular Virology	M Sc. 2008-2011
University of Edinburgh	Edinburgh, UK	Evolutionary Biology	PhD 2011-2015

(b) Appointments

2015 – present Postdoctoral research associate, Institute of Evolutionary Biology, University of Edinburgh, UK

(c) Publications

*(i) 5 publications most closely related to the proposal. Total = 39 since 2007, *=first or senior author*

***Lu L**, Leigh Brown A, Lycett S: Quantifying predictors for the spatial diffusion of avian influenza virus in China BMC Evolutionary Biology 13 Jan 2017

Lycett SJ, Bodewes R, Pohlmann A, **Lu L** et al, Woolhouse M, Kuiken T (The Global Consortium for H5N8 and Related Influenza Viruses) (2016): Role for migratory wild birds in the global spread of avian influenza H5N8 Science 354(6309) 213-217

***Lu L,** Lycett S, Leigh Brown A: Determining the Phylogenetic and Phylogeographic Origin of Highly Pathogenic Avian Influenza (H7N3) in Mexico (2014) PLos One Vol: 9

(ii) List up to five (5) other publications, whether or not related to the proposed project.

***Lu Lu**, Liam Brierley,Mark Woolhouse, et al. Evolutionary origins of epidemic potential among human RNA viruses (bioRxiv preprint). doi: 10.1101/771394.

***Lu, Lu**, Van Dung, N., Ivens, A., et al. Genetic diversity and cross-species transmission of kobuviruses in Vietnam. *Virus Evolution* 2018. 4, 1, p. vey002 9 p.

***Lu Lu**, Van Dung N, Woolhouse ME. Evolution and phylogeographic dissemination of endemic porcine picornaviruses in Vietnam. *Virus evolution* 2016, 2(1):vew001.

Yuhai Bi[1],***Lu Lu**[1], Jing Li, et al. Novel genetic reassortants in H9N2 influenza A viruses and their diverse pathogenicity to mice. *Virology Journal*. 2011, **8**:505**(Co-first author)**

***Lu Lu,** Yianbo Yin, George F Gao, Wenjun (Frank) Liu, et al. Genetic correlation between current circulating H1N1 swine and human influenza viruses. *Journal of Clinical Virology*. 2010, **186**:191

(d) Synergistic Activities

- Co-Supervisor for research projects for Bachelor students and Masters students (2014 – present).

Current and Pending Support – Dr Lu Lu

Current:

Project / Proposal Title: COMPARE: COllaborative Management Platform for detection and Analyses of (Re-)emerging and foodborne outbreaks in Europe
Source of Support: EU government bodies
Total Award Amount: $0.69M (UK)
Total Award Period Covered: 12/1/2014 – 11/30/2019
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 12 Cal mos.

Pending:

Project / Proposal Title: US-UK-China Collab: Predictive phylogenetics for evolutionary and transmission dynamics of newly emerging avian influenza viruses (this proposal)
Source of Support: BBSRC(UK); US-UK-China joint NIFA-NSF-NIH-BBSRC-National Natural Science Foundation of China EEID
Total Award Amount: $1.686M (UK)
Total Award Period Covered: 6/1/2020 – 5/31/2023
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 12 Cal mos.

Project / Proposal Title: "VEO": Virtual Emerging infectious diseases Outbreak forecasting, nowcasting and tracking system
Source of Support: European Horizon 2020
Total Award Amount: $0.45M (UK part)
Total Award Period Covered: 1/1/2020 – 1/1/2025
Location of Project: UK-University of Edinburgh
Person Months Per Year Committed to the Project: 6 Cal mos (first year).

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.

1 Note that graduate advisors are no longer required to be reported.
2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department (optional) to
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and abbreviate,
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable sorting.
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12	Last Active Date
	Lu Lu	Usher Institute, University of Edinburgh	15-Nov-19

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Department)	Last Active
R:		(none applicable)		

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and
T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Leigh-Brown Andrew	University of Edinburgh (UK)	Institute of Evolutionary Biology
G:	Lycett Samantha	University of Edinburgh (UK)	Roslin Institute

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and
C: Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Department)	Last Active
A:	Woolhouse Mark	Usher Institute of Population Health Sciences & Informatics, Ashworth Laboratories, Kin		2019
A:	Brierley Liam	Department of Biostatistics, Waterhouse Building,University of Liverpool		2019

A:	Robertson Gail	School of Mathematics, James Clerk Maxwell Building, King's Buildings, University of Edi	2019
A:	Zhang Feifei	Usher Institute of Population Health Sciences & Informatics, Ashworth Laboratories, Kin	2019
A:	Lycett Samantha	Roslin Institute, University of Edinburgh	2019
A:	Smith Donald	Institute of Evolutionary Biology, Ashworth Laboratories, Kings Buildings, University of E	2019
A:	Chase-Topping Margo	Roslin Institute, University of Edinburgh	2019
A:	Simmonds Peter	Nuffield Department of Medicine, University of Oxford	2019
A:	Ashworth Jordan	Usher Institute of Population Health Sciences & Informatics, University of Edinburgh	2019
A:	Pham Hong Anh	Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam	2019
A:	Shi Ting	Centre for Global Health Research, Usher Institute, University of Edinburgh	2019
A:	Ivens Alasdair	Institute of Evolutionary Biology, Ashworth Laboratories, Kings Buildings, University of E	2019
A:	Thwaites Guy	Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam	2019
A:	Baker Stephen	Department of Medicine, University of Cambridge, Cambridge, United Kingdom	2019
A:	Van Dung Nguyen	Nuffield Department of Medicine, University of Oxford	2018
A:	Bogaardt Carlijn	Institute of Evolutionary Biology, Ashworth Laboratories, Kings Buildings, University of E	2018
A:	O'Toole Aine	Institute of Evolutionary Biology, Ashworth Laboratories, Kings Buildings, University of E	2018
A:	Bryant Juliet	Centre for Tropical Medicine, University of Oxford, Oxford, United Kingdom	2018
A:	Carrique-Mas Juan	Centre for Tropical Medicine, University of Oxford, Oxford, United Kingdom	2018
A:	Van Cuong Nguyen	Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam	2018
A:	Rabaa Maia	Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam	2018
A:	Tri Tue Ngo	Oxford University Clinical Research Unit, Ho Chi Minh City, Vietnam	2018
A:	Leigh-Brown Andrew	Institute of Evolutionary Biology, Ashworth Laboratories, Kings Buildings, University of E	2017

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active

Biographical Sketch

Name Wenjun Liu
Job Title Professor and Deputy Director of CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences
Address No.1 Beichen West Road, Chaoyang District, Beijing 100101, PR China.
Telephone +86(010)64807497
Email liuwj@im.ac.cn

Professional Preparation

1977-1982	BSc in Veterinary, Beijing Agricultural University, China
1982-1985	MSc in Animal Histology and Embryology, Beijing Agricultural University, China
1991-1996	PhD in Molecular and Cell Biology, University of Florida, USA

Appointments

2004-present	Professor, Deputy Director of CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences
2001-2004	Senior Scientist, Genzyme Corporation, USA
1997-2000	Research Scientist, Howard Hughes Medical Institute and Program in Molecular and Cell Biology, Oklahoma Medical Research Foundation
1996-1997	Postdoctoral Research Fellow, Department of Medicine of University of Oklahoma Medical Center
1989	Visiting Scientist, Swine Disease Unit of National Animal Disease Center, USDA
1987-1991	Assistant Professor, Animal Virology at Institute of Laboratory Animal Sciences of Beijing Agricultural University
1986-1987	Research Assistant, College of Veterinary Medicine of Beijing Agricultural University

Publications

(i) related to the proposed project

1. J Li, Y-H Rao, Q-L Sun, X-X Wu, J Jin, Y-H Bi, J Chen, F-M Lei, Q-Y Liu, Z-Y Duan, J-C Ma, George Fu Gao, D Liu, **W-J Liu***. 2015. Identification of climate factors related to human infection with avian influenza A H7N9 and H5N1 viruses in China. ***Scientific reports***, 18094, doi: 10.1038/srep18094
2. W Liu[#], J Li[#], W-N Zheng, Y-L Shang, Z-D Zhao, S-S Wang, Y-H Bi, S Zhang, C-F Xu, Z-Y Duan, L-F Zhang, Y Wang, Z-F Jiang, **W-J Liu**[*], L Sun[*]. 2017. Cyclophilin A-regulated ubiquitination is critical for RIG-I-mediated antiviral immune responses. ***Elife***, 6(8); 6. pii: e24425
3. Y-H Bi, Q Xie, S Zhang, Y Li, H-X Xiao, T Jing, WN Zheng, J Li, X-J Jia, L Sun, J-H Liu, C Qin, George F Gao, **W-J Liu***. 2014. Assessment of the internal genes of influenza A (H7N9) virus contributing to the high pathogenicity in mice. ***Journal of Virology***. doi:10.1128/JVI.02390-14
4. W-N Zheng, J Li, S-S Wang, S Cao, J-W Jiang, C Chen, C Ding, C Qin, X Ye, George Fu Gao, **W-J Liu***. 2015. Phosphorylation controls the nuclear-cytoplasmic shuttling of influenza A virus nucleoprotein. ***Journal of Virology***. 3(18). pii: JVI.00015-15.

5. Y-P Sun, J-W Jiang, P Tien, **W-J Liu** *, J Li*. 2018. IFN-ë: A new spotlight in innate immunity against influenza virus infection. ***Protein & Cell.*** doi: 10.1007/s13238-017-0503-6

(ii) other significant publications/products, whether or not related to the proposed project

1. J-W Jiang, J Li*, W-H Fan, W-N Zheng, M Yu, C Chen, L Sun, Y-H Bi, C Ding, George Fu Gao, **W-J Liu***. 2016. Robust Lys 63-linked Ubiquitination of RIG-I Promotes Cytokine Eruption in Early Influenza B Virus Infection. ***Journal of Virology***. pii: JVI.00549-16.
2. Sh Cao#, J-W Jiang#, J Li, Y Li, L-M Yang, Sh-Sh Wang, J-H Yan, George F Gao, **W-J Liu***. 2014. Characterization of The Nucleocytoplasmic Shuttle of The Matrix Protein of Influenza B Virus. ***Journal of Virology***.88 (13):7464-7473
3. Sh-Y Gao, Sh-Sh Wang, Sh Cao, L Sun, J Li, Y-H Bi, George F Gao, **W-J Liu***. 2014. The characteristics of nucleocytoplasmic transport of H1N1 influenza A viruses nuclear export protein (NEP). ***Journal of Virology***. 88 (13):7455-7463
4. S-S Wang, Zh-D Zhao, Y-H Bi, L Sun, X-L Liu*, **W-J Liu***.2013. Tyrosine 132 phosphorylation of influenza A virus M1 protein is crucial for virus replication by controlling its nuclear import. ***Journal of Virology***, 87(11):6182-91
5. Sh Cao, Yi Shi, Sh-G Tan, H Song, George F. Gao*, **W-J Liu***. 2012. Reply to "Nuclear Export Signal and Immunodominant CD8+ T Cell Epitope in Influenza A Virus Matrix Protein 1"--Sequence Sharing Between Viral Nuclear Export Signals (NES) and CD8+ T Cell Epitopes. ***Journal of Virology***, 86(18):10259-10260

Synergistic Activities

International Research Prof Wenjun Liu focuses on the molecular biology of viruses, the interactions of viruses with host cells, the pathogenesis of viral diseases, the post-translational modification of viral proteins, and mechanisms of host defense. The research works are designed to increase fundamental knowledge as well as to facilitate the development of new approaches to control of viral infection. Funding includes awards from NSFC, CAS, Ministry of Science and Technology of China and Ministry of Agriculture and Rural Affairs of China.

Editorial commitments Prof Wenjun Liu is the Chief Editor of the major reference book *'the principles of virology'* (translated, 3rd Edition 2014), and serves as an academic editor for General overview and Immunology and 'The influenza virus' chapters.

Teaching activities Prof Wenjun Liu is lecturing at the UCAS; Masters Medical virology, training of UCAS and UCAS graduate and postgraduate students supporting their laboratory and PhD projects. He has supervised 40 PhD students and postdoctoral researchers.

International board memberships Prof Wenjun Liu was a Scientific Board member of International cooperation and exchange program of NSFC (2015) and organized a workshop on Workshop on swine and poultry research initiative partnering panel. He co-organised US-China Workshop on Frontiers in Ecology and Evolution of Infectious Diseases (2018, 2019).

Current and Pending Support – Dr Wenjun Liu

Current:

Project / Proposal Title: Regulation of the influenza A virus replication by NP phosphorylation
Source of Support: NSFC
Total Award Amount: 640,000 yuan
Total Award Period Covered: 1/1/2016 – 12/31/2019
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Project / Proposal Title: Nuclear-cytoplasmic shuttling of influenza A virus and its effect on viral replication
Source of Support: NSFC
Total Award Amount: 2,750,000 yuan
Total Award Period Covered: 1/1/2017 – 12/31/2021
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Project / Proposal Title: The interaction mechanism between animal influenza virus and host RNA
Source of Support: Ministry of science and technology – National key research and development plan
Total Award Amount: 2,800,000 yuan
Total Award Period Covered: 1/1/2016 – 12/31/2020
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Project / Proposal Title: New oral vaccine for livestock and poultry diseases induced mucosal immunity
Source of Support: Ministry of science and technology – National key research and development plan
Total Award Amount: 900,000 yuan
Total Award Period Covered: 1/1/2017 – 12/31/2020
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Project / Proposal Title: Pathogen host adaptation and immune intervention
Source of Support: The Strategic Priority Research Program
Total Award Amount: 800,000 yuan
Total Award Period Covered: 1/1/2018 – 12/31/2021
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Pending:

Project / Proposal Title: The Regulation of Influenza B Virus Replication by Autophagy
Source of Support: NSFC
Total Award Amount: 560,000 yuan
Total Award Period Covered: 1/1/2020 – 12/31/2023
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

Project / Proposal Title: Mechanisms of influenza virus-induced secondary bacterial infection in respiratory tract regulated by CypA
Source of Support: NSFC
Total Award Amount: 570,000 yuan
Total Award Period Covered: 1/1/2020 – 12/31/2023
Location of Project: Institute of Microbiology, Chinese Academy of Sciences

The following information regarding collaborators and other affiliations (COA) must be separately provided for each individual identified as senior project personnel. The COA information must be provided through use of this COA template.

Please complete this template (e.g., Excel, Google Sheets, LibreOffice), save as .xlsx or .xls, and upload directly as a Fastlane Collaborators and Other Affiliations single copy doc. Do not upload .pdf.

Please note that some information requested in prior versions of the PAPPG is no longer requested. THIS IS PURPOSEFUL AND WE NO LONGER REQUIRE THIS INFORMATION TO BE REPORTED. Certain relationships will be reported in other sections (i.e., the names of postdoctoral scholar sponsors should not be reported, however if the individual collaborated on research with their postdoctoral scholar sponsor, then they would be reported as a collaborator). The information in the tables is not required to be sorted, alphabetically or otherwise.

There are five separate categories of information which correspond to the five tables in the COA template:

COA template Table 1:
List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

COA template Table 2:
List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

COA template Table 3:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **The individual's Ph.D. advisors; and**
- **All of the individual's Ph.D. thesis advisees.**

COA template Table 4:
List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:
- **Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and**
- **Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.**

COA template Table 5:
List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief must list the entire editorial board.
- **Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and**
- **Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.**

The template has been developed to be fillable, however, the content and format requirements must not be altered by the user. This template must be saved in .xlsx or .xls format, and directly uploaded into FastLane as a Collaborators and Other Affiliations Single Copy Document. Using the .xlsx or .xls format will enable preservation of searchable text that otherwise would be lost. It is therefore imperative that this document be uploaded in .xlsx or .xls only. Uploading a document in any format other than .xlsx or .xls may delay the timely processing and review of the proposal.

This information is used to manage reviewer selection. See Exhibit II-2 for additional information on potential reviewer conflicts.

1 Note that graduate advisors are no longer required to be reported.
2 Editorial Board does not include Editorial Advisory Board, International Advisory Board, Scientific Editorial Board, or any other subcategory of Editorial Board. It is limited to those individuals who perform editing duties or manage the editing process (i.e., editor in chief).

List names as Last Name, First Name, Middle Initial. Additionally, provide email, organization, and department (optional) to
Fixed column widths keep this sheet one page wide; if you cut and paste text, set font size at 10pt or smaller, and
To insert *n* blank rows, select *n* row numbers to move down, right click, and choose Insert from the menu.
You may fill-down (crtl-D) to mark a sequence of collaborators, or copy affiliations. Excel has arrows that enable sorting.
For "Last Active Date" and "Last Active" columns dates are optional, but will help NSF staff easily determine which information remains relevant for reviewer selection.
"Last Active Date" and "Last Active" columns may be left blank for ongoing or current affiliations.

Table 1: List the individual's last name, first name, middle initial, and organizational affiliation in the last 12 months.

1	Your Name:	Your Organizational Affiliation(s), last 12 mo	Last Active Date
	Wenjun Liu	CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences, Beijing , China	12-Nov-19

Table 2: List names as last name, first name, middle initial, for whom a personal, family, or business relationship would otherwise preclude their service as a reviewer.

R: Additional names for whom some relationship would otherwise preclude their service as a reviewer.

to disambiguate common names

2	Name:	Type of Relationship	Optional (email, Departmer	Last Active
R:		(none applicable)		

Table 3: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following.

G: The individual's Ph.D. advisors; and
T: All of the individual's Ph.D. thesis advisees.

to disambiguate common names

3	Advisor/Advisee Name:	Organizational Affiliation	Optional (email, Department)
G:	Peter Hansen	University of Florida	Molecular and Cell Biology (Emeritus Professor)
T:	Xiaoling Liu	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Zengfu Wang	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Xueqing Hua	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Shanshan Meng	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Maorong Yu	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Chongfeng Xu	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Shuai Cao	University of Chinese Academy of Sciences	Institute of Microbiology

T:	Ke Zhang	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Caiwei Chen	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Shanshan Wang	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Shengyan Gao	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Hongren Qv	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Zhengdong Zhao	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Zhengwei Nan	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Can Chen	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Wei Liu	University of Chinese Academy of Sciences	Institute of Microbiology
T:	Liang Cui	University of Chinese Academy of Sciences	Institute of Microbiology

Table 4: List names as last name, first name, middle initial, and provide organizational affiliations, if known, for the following:

A: Co-authors on any book, article, report, abstract or paper with collaboration in the last 48 months (publication date may be later); and

C: Collaborators on projects, such as funded grants, graduate research or others in the last 48 months.

to disambiguate common names

4	Name:	Organizational Affiliation	Optional (email, Departmer	Last Active
A:	Bing Xu	BNU; Beijing Normal University China		2018
A:	Bo Li	SCAU ;South China Agricultural University China		2018
A:	Chen J	CAS; Chinese Academy of Sciences China		2017
A:	Chen Q	CAS; Chinese Academy of Sciences China		2017
A:	Cheng Zhang	CASCIRE Center for Influenza Research and Early-Warning China		2019
A:	Chenggang Xu	SCAU ;South China Agricultural University China		2018
A:	Chuan Qin	CAMC Chinese Academy of Medical Sciences & PUMC Peking Union Medical Collage		2019
A:	Chuansong Quan	China CDC Chinese Center for Disease Control and Prevention China		2019
A:	Dai L	CAS; Chinese Academy of Sciences China		2017
A:	Di Liu	CASCIRE Center for Influenza Research and Early-Warning China		2018
A:	Edward C. Holmes	UoS; University of Sydney Australia		2018
A:	Fei Liu	CASCIRE Center for Influenza Research and Early-Warning China		2019
A:	Fengdi Li	CAMC Chinese Academy of Medical Sciences & PUMC Peking Union Medical Collage		2019
A:	Fu G	FAAS Fujian Academy of Agricultural Sciences China		2017
A:	Fuchun Zhang	GMU; guangzhou medical university China		2018
A:	Gary Wong	SUSTC Southern University of Science and Technology China		2019
A:	George F. Gao	CASCIRE Center for Influenza Research and Early-Warning China		2018
A:	Guangjie Lao	SCAU ;South China Agricultural University China		2018
A:	Guanming Su	SCAU ;South China Agricultural University China		2018
A:	Guihong Zhang	SCAU ;South China Agricultural University China		2018
A:	He S	NXU ningxia university China		2017
A:	Huaiyu Tian	BNU; Beijing Normal University China		2018
A:	Huanan Li	SCAU ;South China Agricultural University China		2018
A:	Jiahao Zhang,	SCAU ;South China Agricultural University China		2018
A:	Jie Cui	CAS; Chinese Academy of Sciences China		2018
A:	Jing Li	CAS; Chinese Academy of Sciences China		2018
A:	John-Sebastian Eden	UoS; University of Sydney Australia		2018
A:	Lei F	CAS; Chinese Academy of Sciences China		2017
A:	Li H	Yunnan CDC Yunnan Center for Disease Control and Prevention China		2017
A:	Li L	CAS; Chinese Academy of Sciences China		2017
A:	Li X	NVC National Research Center for Veterinary Medicine China		2017
A:	Li X	CASCIRE Center for Influenza Research and Early-Warning China		2017
A:	Li Xing	SCAU ;South China Agricultural University China		2018
A:	Liang Wang	CASCIRE Center for Influenza Research and Early-Warning China		2019
A:	Linlin Bao	CAMC Chinese Academy of Medical Sciences & PUMC Peking Union Medical Collage		2019
A:	Liu W	CASCIRE Center for Influenza Research and Early-Warning China		2017
A:	Liu Y	Shenzhen Third People's Hospital China		2017

A:	Luo Y	SFA State Forestry Administration China		2017
A:	Ma Z	xju ; Xinjiang University China		2017
A:	Ming Liao	SCAU ;South China Agricultural University China		2018
A:	Pan Z	Xizang Agriculture and Animal Husbandry CollegeChina		2017
A:	Qi Lv	CAMC Chinese Academy of Medical Sciences & PUMC Peking Union Medical Collage		2019
A:	Quan C	China CDC Chinese Center for Disease Control and Prevention China		2017
A:	Sharshov K	NSU Novosibirsk State University Russia		2017
A:	Shestopalov A	NSU Novosibirsk State University Russia		2017
A:	Shi W	TMSU;Taishan Medical College;China		2017
A:	Shi Y	CASCIRE Center for Influenza Research and Early-Warning China		2017
A:	Shumin Xie	SCAU ;South China Agricultural University China		2018
A:	Tao Hu	TMSU;Taishan Medical College;China		2018
A:	Tao Ren	SCAU ;South China Agricultural University China		2018
A:	Tian W	SXAU Shanxi Agricultural University China		2017
A:	Wang L	Hainmc Hainan Medical University China		2017
A:	Wang Q	FUDAN fudan university China		2017
A:	Wei Li	CAS; Chinese Academy of Sciences China		2018
A:	Weifeng Shi	TMSU;Taishan Medical College;China		2018
A:	Weixin Jia	SCAU ;South China Agricultural University China		2018
A:	Wenbao Qi	SCAU ;South China Agricultural University China		2018
A:	William J. Liu	China CDC Chinese Center for Disease Control and Prevention China		2019
A:	Wong G	Shenzhen Third People's Hospital China		2017
A:	Xia Q	Hainmc Hainan Medical University China		2017
A:	Xiao H	CAS; Chinese Academy of Sciences China		2017
A:	Xiaoman Wei	CAS; Chinese Academy of Sciences China		2018
A:	Xu W	Yunnan CDC Yunnan Center for Disease Control and Prevention China		2017
A:	Yan J	CASCIRE Center for Influenza Research and Early-Warning China		2017
A:	Yang Yang	SUSTC Southern University of Science and Technology China		2019
A:	Yin R	JLU jilin university China		2017
A:	Yingxia Liu	SUSTC Southern University of Science and Technology China		2019
A:	Yingying Du	CAS; Chinese Academy of Sciences China		2018
A:	Yuhai Bi	CASCIRE Center for Influenza Research and Early-Warning China		2018
A:	Zeng H	CMU Capital Medical University China		2017

Table 5: List editorial board, editor-in chief and co-editors with whom the individual interacts. An editor-in-chief

B: Editorial Board: List name(s) of editor-in-chief and journal in the past 24 months; and

E: Other co-Editors of journal or collections with whom the individual has directly interacted in the last 24 months.

to disambiguate common names

5	Name:	Organizational Affiliation	Journal/Collection	Last Active
E:	Gong Cheng	Tsinghua-Peking Center for Life Sciences, School of Medicine, Tsinghua University, Beijing , China	Frontiers in Cellular and Infection Microbiology	11/6/19
E:	Xinwen Chen	Guangzhou Institute of Biomedicine and Health, Chinese Academy of Sciences, Guangzhou, China	Virologica Sinica	11/6/19
B:	Zhengli Shi	CAS Key Laboratory of Special Pathogens and Biosafety, Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, China	Virologica Sinica	11/6/19
E:	Cuihua Liu	CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences, Beijing , China	Scientific Reports	11/6/19

RESEARCH & RELATED BUDGET - Budget Period 1

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

ORGANIZATIONAL DUNS: 0645396120000 **Enter name of Organization:** USDA-ARS-South Atlantic Area

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period:** 1 **Start Date:** 06/01/2020 **End Date:** 05/31/2021

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Darrell	R	Kapczynski		0.00	12.00			0.00	0.00	0.00

Project Role: PD/PI

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

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

Total Senior/Key Person: 0.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
1	Post Doctoral Associates	12.00			65,448.00	22,906.80	88,354.80
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
1	**Total Number Other Personnel**					**Total Other Personnel**	88,354.80

Total Salary, Wages and Fringe Benefits (A+B): 88,354.80

C. Equipment Description

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

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment | Delete Attachment | View Attachment

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

Total Equipment:

D. Travel

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

E. Participant/Trainee Support Costs

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

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	17,700.00
2.	Publication Costs	0.00
3.	Consultant Services	0.00
4.	ADP/Computer Services	0.00
5.	Subawards/Consortium/Contractual Costs	69,646.00
6.	Equipment or Facility Rental/User Fees	0.00
7.	Alterations and Renovations	0.00
8.	One time Post doc BSL2 Clearance	1,500.00
9.	One time post doc background check	132.00
10.		
	Total Other Direct Costs	88,978.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	179,332.80

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
USDA	11.11		12,187.42
		Total Indirect Costs	12,187.42

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

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	191,520.22

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	191,520.22

L. Budget Justification

(Only attach one file.) Budgetjustification KapczynskiPerez.pd [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED BUDGET - Budget Period 2

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

ORGANIZATIONAL DUNS: 0645396120000 **Enter name of Organization:** USDA-ARS-South Atlantic Area

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period:** 2 **Start Date:** 06/01/2021 **End Date:** 05/31/2022

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Darrell	R	Kapczynski		0.00	12.00			0.00	0.00	0.00

Project Role: PD/PI

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

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

Total Senior/Key Person: 0.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
1	Post Doctoral Associates	12.00			66,756.96	23,364.94	90,121.90
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
1	**Total Number Other Personnel**					**Total Other Personnel**	90,121.90

Total Salary, Wages and Fringe Benefits (A+B): 90,121.90

C. Equipment Description

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

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment | Delete Attachment | View Attachment

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

Total Equipment:

D. Travel

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

E. Participant/Trainee Support Costs

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

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	17,700.00
2.	Publication Costs	2,500.00
3.	Consultant Services	0.00
4.	ADP/Computer Services	0.00
5.	Subawards/Consortium/Contractual Costs	73,877.00
6.	Equipment or Facility Rental/User Fees	0.00
7.	Alterations and Renovations	0.00
8.		
9.		
10.		
	Total Other Direct Costs	94,077.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	187,198.90

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
USDA	11.11		12,591.32
		Total Indirect Costs	12,591.32

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

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	199,790.22

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	199,790.22

L. Budget Justification

(Only attach one file.) Budgetjustification KapczynskiPerez.pd [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED BUDGET - Budget Period 3

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

ORGANIZATIONAL DUNS: 0645396120000 **Enter name of Organization:** USDA-ARS-South Atlantic Area

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period:** 3 **Start Date:** 06/01/2022 **End Date:** 05/31/2023

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Darrell	R	Kapczynski		0.00	12.00			0.00	0.00	0.00

Project Role: PD/PI

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

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

Total Senior/Key Person: 0.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
1	Post Doctoral Associates	12.00			68,092.10	23,832.23	91,924.33
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
1	**Total Number Other Personnel**					**Total Other Personnel**	91,924.33

Total Salary, Wages and Fringe Benefits (A+B): 91,924.33

C. Equipment Description

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

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment | Delete Attachment | View Attachment

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

Total Equipment:

D. Travel

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

E. Participant/Trainee Support Costs

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

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	17,700.00
2.	Publication Costs	2,500.00
3.	Consultant Services	0.00
4.	ADP/Computer Services	0.00
5.	Subawards/Consortium/Contractual Costs	86,814.00
6.	Equipment or Facility Rental/User Fees	0.00
7.	Alterations and Renovations	0.00
8.		
9.		
10.		
	Total Other Direct Costs	107,014.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	201,938.33

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
USDA	11.11		12,791.59
		Total Indirect Costs	12,791.59

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

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	214,729.92

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	214,729.92

L. Budget Justification

(Only attach one file.) Budgetjustification KapczynskiPerez.pd [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED BUDGET - Budget Period 4

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

ORGANIZATIONAL DUNS: 0645396120000 **Enter name of Organization:** USDA-ARS-South Atlantic Area

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period:** 4 **Start Date:** 06/01/2023 **End Date:** 05/31/2024

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Darrell	R	Kapczynski		0.00	12.00			0.00	0.00	0.00

Project Role: PD/PI

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

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

Total Senior/Key Person: 0.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
1	Post Doctoral Associates	12.00			69,453.94	24,308.88	93,762.82
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
1	**Total Number Other Personnel**					**Total Other Personnel**	93,762.82

Total Salary, Wages and Fringe Benefits (A+B): 93,762.82

C. Equipment Description

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

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment | Delete Attachment | View Attachment

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

Total Equipment:

D. Travel

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

E. Participant/Trainee Support Costs

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

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	8,450.00
2.	Publication Costs	2,500.00
3.	Consultant Services	0.00
4.	ADP/Computer Services	0.00
5.	Subawards/Consortium/Contractual Costs	75,615.00
6.	Equipment or Facility Rental/User Fees	0.00
7.	Alterations and Renovations	0.00
8.		
9.		
10.		
	Total Other Direct Costs	86,565.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	183,327.82

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
USDA	11.11		11,968.09
		Total Indirect Costs	11,968.09

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

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	195,295.91

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	195,295.91

L. Budget Justification

(Only attach one file.) Budgetjustification KapczynskiPerez.pd [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED BUDGET - Budget Period 5

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

ORGANIZATIONAL DUNS: 0645396120000 **Enter name of Organization:** USDA-ARS-South Atlantic Area

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period:** 5 **Start Date:** 06/01/2024 **End Date:** 05/31/2025

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Darrell	R	Kapczynski		0.00	12.00			0.00	0.00	0.00

Project Role: PD/PI

Additional Senior Key Persons: Add Attachment | Delete Attachment | View Attachment

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

Total Senior/Key Person 0.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
1	Post Doctoral Associates	12.00			70,843.02	24,795.06	95,638.08
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						

1 **Total Number Other Personnel**

Total Other Personnel 95,638.08

Total Salary, Wages and Fringe Benefits (A+B) 95,638.08

C. Equipment Description

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

Equipment item **Funds Requested ($)**

Additional Equipment: Add Attachment | Delete Attachment | View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

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

E. Participant/Trainee Support Costs

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

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	8,450.00
2.	Publication Costs	2,500.00
3.	Consultant Services	0.00
4.	ADP/Computer Services	0.00
5.	Subawards/Consortium/Contractual Costs	76,900.00
6.	Equipment or Facility Rental/User Fees	0.00
7.	Alterations and Renovations	0.00
8.		
9.		
10.		
	Total Other Direct Costs	87,850.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	186,488.08

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
USDA	11.11		12,176.45
	Total Indirect Costs		12,176.45

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

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	198,664.53

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	198,664.53

L. Budget Justification

(Only attach one file.) Budgetjustification KapczynskiPerez.pd [Add Attachment] [Delete Attachment] [View Attachment]

RESEARCH & RELATED BUDGET - Cumulative Budget

		Totals ($)
Section A, Senior/Key Person		0.00
Section B, Other Personnel		459,801.93
Total Number Other Personnel	5	
Total Salary, Wages and Fringe Benefits (A+B)		459,801.93
Section C, Equipment		
Section D, Travel		14,000.00
1. Domestic	6,000.00	
2. Foreign	8,000.00	
Section E, Participant/Trainee Support Costs		0.00
1. Tuition/Fees/Health Insurance	0.00	
2. Stipends	0.00	
3. Travel	0.00	
4. Subsistence	0.00	
5. Other		
6. Number of Participants/Trainees		
Section F, Other Direct Costs		464,484.00
1. Materials and Supplies	70,000.00	
2. Publication Costs	10,000.00	
3. Consultant Services	0.00	
4. ADP/Computer Services	0.00	
5. Subawards/Consortium/Contractual Costs	382,852.00	
6. Equipment or Facility Rental/User Fees	0.00	
7. Alterations and Renovations	0.00	
8. Other 1	1,500.00	
9. Other 2	132.00	
10. Other 3		
Section G, Direct Costs (A thru F)		938,285.93
Section H, Indirect Costs		61,714.87
Section I, Total Direct and Indirect Costs (G + H)		1,000,000.80
Section J, Fee		
Section K, Total Costs and Fee (I + J)		1,000,000.80

BUDGET JUSTIFICATION

A) Senior/Key Personnel:

Dr. Darrell R. Kapczynski (2% effort, no salary requested) is Project Director and Co-PI and a Research Microbiologist at USDA-ARS-Southeast Poultry Research Laboratory. Dr. Kapczynski is avian influenza expert who specializes in avian immunology and vaccine research. He has extensive experience working with poultry and wild birds. He will design and supervise the in vivo studies in WP2 and will oversee the entire project. He will work closely with Dr. Perez in the analysis of the data and manuscript preparation.

B) Other Personnel:

TBD Post-doc (100%) The incumbent is experienced in molecular biology as well as NGS sequencing technologies and sequence assembly/curation. He/she will work and help with the training of the Graduate Student in all aspects related to sequencing analysis, data preparation, interpretation and preparation of manuscripts.

Fringe Benefits

Fringe benefits for USDA Post docs is calculated at 35% for all years of the project.

C) Equipment - None

D) Travel

Domestic and international travel funds are requested. This includes 1 trip per year in years 1-5 for the Post-doc and/or the PI to attend a professional conference (e.g., ASV, AAAP, AASV, CRWAD) to present findings from this research. In addition meetings of the PDs from UK and China, as needed, will be decided on a regular basis. The cost of travel is calculated for 5 days and includes airfare, lodging, per diem, and ground transportation. The cost of airfare and ground transportation is based on estimated costs. Lodging and per diem costs are based on GSA lodging and per diem rates.

E) Participant/Trainee Support Costs - None

F) Other Direct Costs

F.1) Materials and Supplies

Expendable Materials and Supplies detailed within the budget including consumables, lab supplies, chemicals, animals and per diems are requested per year as follows:

Supplies							
Disposible plastics and media	$ 2,000.00	$ 2,000.00	$ 2,000.00	$ 1,000.00	$ 1,000.00	$ 8,000.00
Molecular Biology reagents	$ 6,000.00	$ 6,000.00	$ 6,000.00	$ 3,000.00	$ 3,000.00	$ 24,000.00
Animal costs and per diem	$ 9,000.00	$ 9,000.00	$ 9,000.00	$ 4,100.00	$ 4,100.00	$ 35,200.00
Serology/Histopathology	$ 700.00	$ 700.00	$ 700.00	$ 350.00	$ 350.00	$ 2,800.00
Total Supplies	**$ 17,700.00**	**$ 17,700.00**	**$ 17,700.00**	**$ 8,450.00**	**$ 8,450.00**	**$ 70,000.00**

F.2) Publication Costs

Funds are requested for publication costs 1 manuscript/year (years 2-5) in a peer reviewed journal for a total of $10,000.

H) Indirect Costs

Indirect costs are calculated at the federally negotiated rate of 51% MTDC for on-campus research projects per the F&A rate agreement negotiated with the Department of Health and Human Services dated May 31, 2018.

BUDGET JUSTIFICATION

A) Senior/Key Personnel:

Daniel R. Perez, PhD, Principal Investigator (2% summer effort) is a Georgia Research Alliance Distinguished Investigator and Caswell S Eidson Chair in Poultry Medicine, Department of Population Health, Poultry Diagnostic and Research Center in the College of Veterinary Medicine at the University of Georgia. PI Perez has extensive experience with reverse genetics systems for artificial generation of influenza viruses and virus sequencing and evolution. Dr. Perez was one of the first to take a closer look at the susceptibility and relevance of quail and other minor poultry species for the emergence of influenza viruses with expanded host range. He will design and supervise the sustained transmission studies and the fitness model testing proposed in this application and will oversee the entire project. He will work closely with Dr. Kapczynski in the analysis of the data and manuscript preparation.

B) Other Personnel:

Daniela Rajao, DVM, MSc, PhD, (2% summer effort) is an Assistant Professor in the Department of Population Health at UGA. She has extensive experience working with the pathogenesis and immune response of influenza A viruses, particularly in swine and avian species. Dr. Rajao and Perez share the same lab space and work together on various research projects of common interest. Dr. Rajao will assist with the supervision of lab personnel and overall coordination of the animal studies in this application. In addition, she will assist with data analyses, interpret results, coordinate and assist in manuscript preparation.

TBD Graduate Research Assistant, DVM (50% effort) will work with Dr. Perez to perform the sustained transmission studies, collect and process samples as detailed in the application. This individual will share responsibility with the Postdoc in terms of performing the animal studies and generating and interpreting the data.

TBD Post-doc (19.5%) The incumbent is experienced in molecular biology as well as NGS sequencing technologies and sequence assembly/curation. He/she will work and help with the training of the Graduate Student in all aspects related to sequencing analysis, data preparation, interpretation and preparation of manuscripts.

Fringe Benefits

Fringe benefits for University of Georgia personnel are budgeted based on the University of Georgia current estimates. For Drs. Rajao and Perez they are calculated at 24.37% for summer salary. For the Graduate Research Assistant, they are calculated at 5%. For the Post-doc, they are calculated at 49%. The benefits will be expended as per the actual rates at the time of expenditure.

C) Equipment - None

D) Travel

Domestic travel funds are requested. This includes 1 trip per year in years 2-5 for the Graduate Research Assistant and/or Post-doc to attend a professional conference (e.g., ASV, AASV, CRWAD) to present findings from this research. The cost of travel is calculated for 5 days and includes airfare, lodging, per diem, and ground transportation. The cost of airfare and ground

transportation is based on estimated costs. Lodging and per diem costs are based on GSA lodging and per diem rates.

E) Participant/Trainee Support Costs - None

F) Other Direct Costs

F.1) Materials and Supplies

Expendable Materials and Supplies detailed within the budget including consumables, lab supplies, chemicals, animals and per diems are requested per year as follows:

Supplies						
Disposible plastics and media	$ 500.00	$ 500.00	$ 500.00	$ 500.00	$ 500.00	$ 2,500.00
Molecular Biology reagents	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 2,000.00	$ 2,000.00	$ 19,000.00
Animal costs and per diem	$ 150.00	$ 150.00	$ 5,400.00	$ 150.00	$ 150.00	$ 6,000.00
Serology/Histopathology	$ 400.00	$ 400.00	$ 400.00	$ 400.00	$ 400.00	$ 2,000.00
Total	**$ 6,050.00**	**$ 6,050.00**	**$ 11,300.00**	**$ 3,050.00**	**$ 3,050.00**	**$ 29,500.00**

F.2) Publication Costs

Funds are requested for publication costs 1 manuscript/year (years 3-5) in a peer reviewed journal for a total of $7,500.

H) Indirect Costs

Indirect costs are calculated at the federally negotiated rate of 51% MTDC for on-campus research projects per the F&A rate agreement negotiated with the Department of Health and Human Services dated May 31, 2018.