The University of Georgia

University Council
Athens, Georgia 30602

October 2, 2015

UNIVERSITY CURRICULUM COMMITTEE – 2015-2016
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Dear Colleagues:

The attached proposal for a new Center for Vaccines and Immunology will be an agenda item for the October 9, 2015, Full University Curriculum Committee meeting.

Sincerely,

William K. Vencill

William K. Vencill, Chair
University Curriculum Committee

cc: Provost Pamela S. Whitten
Dr. Rahul Shrivastav

Center for Vaccines and Immunology
at
The University of Georgia

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1 Narrative statement

1.1 Introduction

Dramatic increases in average life expectancies in the U.S. and around the world over the last 160 years have been accomplished due to the prevention and treatment of infectious diseases. Key drivers have been the use of sanitation, antibiotics, and vaccines. According to the World Health Organization, vaccines are currently available for 26 infectious diseases in humans. Many more vaccines used in veterinary medicine protect human health by reducing the sources of zoonotic diseases. While immunization saves more than 3 million lives every year, infectious diseases still remain the leading cause of deaths worldwide. As globalization and other environmental changes alter the dynamics of disease spread, emerging, re-emerging and zoonotic diseases pose an increasing risk to global public health, animal health, and global security.

To meet the increasing need for new vaccines, we propose the establishment of a Center for Vaccines and Immunology (CVI) at the University of Georgia. The CVI will facilitate basic and translational research that addresses the "Science of Vaccines" and the critical need for new and improved vaccines and associated technologies for both existing and emerging infectious disease threats. The CVI will work closely with industrial, public health and academic partners on the control and eradication of pathogens deemed to be a high priority by international public health organizations. Vaccines against several of these diseases are already under development and testing by UGA investigators, and the establishment of a vaccine center will facilitate these efforts while promoting the creation of additional innovative prevention strategies.

Infectious disease prevention and vaccination strategies require the collaborative efforts of experts in multiple scientific fields ranging from immunology and virology to epidemiology and ecology to mathematical modeling and engineering. UGA researchers engaged in vaccine studies are currently spread out across different departments, schools and colleges on campus. The establishment of a Center for Vaccines and Immunology will provide a venue for interdisciplinary collaboration and give research support, mentoring and training for scientists with the common goal of preventing infectious diseases. The unification of researchers and the focused mission of the CVI will facilitate the procurement of training grants to support talented trainees. In addition to CVI-associated researchers from across campus, a core of experts based in the CVI will engage in vaccine-focused research in collaboration with individuals from business, academia and government agencies to create an atmosphere in which students, research scientists, and faculty contribute to the development of vaccines.

The University of Georgia is uniquely qualified to accommodate a Center for Vaccine Research because it currently has diverse, world-renowned expertise within the areas of infectious disease, veterinary medicine, ecology and public health. By engaging the world-class biocontainment resources at the University of Georgia and the expertise of surrounding institutions, the CVI can focus on emerging and re-emerging zoonotic infections, including biodefense agents. The CVI will actively partner with researchers at neighboring institutions including the CDC, USDA Southeast Poultry and Russell Research Laboratories, as well as global and local companies, such as Sanofi-Pasteur and Merial Ltd, to explore, invest, and expand the reach of the UGA CVI to develop an active vaccine development community. In addition, the CVI will proactively reach

out to vaccine colleagues at the Emory Vaccine Center to build on the collaborative efforts of the researchers on both campuses and expand the vaccine footprint in the state of Georgia. Collaborations will extend internationally to place our research teams in areas at the highest risk for emerging and re-emerging infectious diseases. To this end the CVI will promote and build upon already established relationships with researchers in Brazil, the Caribbean, Africa and Southeast Asia.

1.2 Mission and Functions

The mission of the proposed CVI is to bring together vaccine researchers at the University of Georgia and help them identify opportunities for collaboration, and provide an intellectual environment for discovery. The CVI will become a world-class center for basic and translational research by: (1) coalescing the existing vaccine-related expertise at UGA; (2) recruiting new expertise; (3) developing regional, national, and international partnerships; 5) strengthening ties to corporate partners; and (6) providing education and training in the science of vaccines, and thus helping to ensure a pipeline of future researchers for academic, public health and industrial vaccine programs.

The CVI will be comprised of a 27,500 square foot physical space within the College of Veterinary Medicine where the Small Animal Veterinary Teaching Hospital was formerly housed. Repurposing of this space was approved by the Provost's UGA space allocation committee. The CVI will house 10 research labs for core faculty as well as three shared research labs that will provide equipment and resources for researchers across campus. Additional CVI-associated faculty will be housed within their home departments across campus.

The CVI will have three functional core facilities, namely: the Immunology Core, the Biomarker Core, and Translational Medicine Core. The Immunology Core will provide laboratory analyses of innate and adaptive immune function for assessment of pre-clinical and clinical vaccine efficacy. The Biomarker Core will provide services to identify biomarkers for vaccine efficacy and microbial virulence. The Translational Medicine Core will provide all epidemiological and clinical services during clinical trials.

An important function of the CVI faculty will be to provide instruction, mentoring and training for undergraduates, graduate students, post-docs and other trainees. Training grants acquired and supported by the CVI will serve to recruit and retain the most competitive trainees.

1.3 Center Development Plan

A three-phase plan is proposed to establish the infrastructure, faculty and personnel necessary to carry out the above mentioned functions and to pursue the CVI mission. Dr. Ted Ross, a recent Georgia Research Alliance Eminent Scholar hire and one of the primary core faculty for the CVI, has been selected as the first CVI Director. Dr. Ross reports to Dr. Fred Quinn, Department Chair of Infectious Disease at the College of Veterinary Medicine and Dr. Sheila Allen, Dean of the College of Veterinary Medicine.

Phase 1: Infrastructure: Renovate facility and laboratories, hire new faculty, develop core CVI capabilities and programs to coordinate and enhance new vaccine research on the UGA campus

Phase 2: Support: Extend support to ongoing research activities in vaccine research at UGA

Phase 3: Expansion and training: Coordinate the development, submission and performance of multi-institutional projects and training programs particularly targeting students, instructors and postdoctoral scholars in vaccine research, immunology, and infectious disease pathogenesis and modeling.

Phase 1. Infrastructure (1-2 years, 4-5 years for faculty hires)

The following bullet points indicate key items in the phase 1 of the development plan.

- **Primary faculty.** Primary faculty members will focus on various aspects of immunology and vaccines and their labs will be housed in the CVI. Three primary faculty members are already established at UGA (Biao He, Fred Quinn and Ted M. Ross) and 1 primary faculty has recently been recruited and is in transition to UGA (Eric Harvill). Four additional primary faculty members will be recruited within the next 5 years.

- **Facility construction.** The CVI will be housed in a 27,500 square foot facility in the former small animal veterinary hospital. The facility will support approximately 100 scientific staff in ten laboratories and three core facilities.

- **Core Facilities.** Immunology, Biomarker and Translational Core facilities will be housed in the CVI. Donald Carter has been hired as the Research Director and he will oversee all Research and Core activities in the CVI. Two senior and two junior researchers will be hired to manage and provide service in the core facilities.

- **Seminar program.** The seminar program will be initiated to invite leading vaccine and immunology researchers to present their work and to engage with the University of Georgia community.

- **Annual Symposia.** The UGA CVI director, Dr. Ted Ross and the Emory Vaccine Center director, Dr. Rafi Ahmed, have agreed to hold an annual symposium that will rotate between the two institutions. Local, national and international leaders in vaccine research will be invited to present their research, meet with UGA scientists and leaders, and establish collaborations with investigators across the UGA campus.

- **Undergraduate and graduate student instruction.** The CVI will support its faculty in the development and delivery of materials to teach vaccinology in undergraduate and graduate courses. Further, the center will actively seek to strengthen connections in course instruction among the College of Veterinary Medicine, College of Public Health, other schools and colleges at UGA, and the Georgia Health Sciences University/University of Georgia Medical Partnership education programs. Competitive research fellowships from extramural training grants will be used to recruit the best and brightest graduate student trainees in the vaccine field.

- **Grant-writing support.** The UGA CVI will support grant applications of participating faculty by providing access to data, programming support to perform preliminary analyses, structured feedback on study design and proposal writing, and narrative description of research capabilities. The CVI will provide support in the form of intellectual, administrative and scientific resources. The following program proposals are planned for submission to NIH: (1) a proposal for research on Vaccines and Infectious Diseases; (2) a proposal for a graduate training program in Vaccines and Infectious Diseases Pathogenesis and Modeling (3) a collaborative proposal on emerging and re-emerging transmission of infectious diseases.

- **Promotion of CVI research.** The CVI will further advance the international reputation of the University of Georgia in the area of vaccine research and immunology. To advance this reputation, travel support will be provided for Center scientists and faculty to visit researchers or represent the University of Georgia at national and international scientific gatherings. Funding will be provided from research and training grants administered through the CVI.

Phase 2. Support (2-3 years)

The following initiatives will be added within the first three years to further support and promote current vaccine-related research within the UGA community. Financial support for these activities will be provided from CVI research and training grants.

- **Research support.** The CVI will provide vaccine research support that will complement and enhance equipment and staff resources currently provided on campus for students, research scientists, and faculty working on problems in infectious disease pathogenesis and immunology. Initially, the CVI will provide this additional support service through the expertise of its faculty. Support for a full time staff position will be provided from indirect cost returns to the CVI.

- **Professional development**. The Center will establish a program to enhance the professional development of researchers, particularly postdoctoral associates, research scientists and graduate students. Activities will include the sharing of information and the development of materials pertaining to best practices for research in vaccinology and career opportunities. The CVI will provide access to workshops and opportunities to develop public speaking and interviewing skills as well as technical- and grant-writing skills and curriculum vitae development.

- **Technical support**. The CVI will support the training of technical personnel who will contribute to the pool of talent at the University of Georgia. The Center will also seek to hire technical staff, contributing to job creation in the state. These hires will begin in Phase I and will be completed in Phase II.

- **Annual retreat**. An annual retreat will be initiated to provide CVI scientists and faculty with access to the best and most current vaccine research taking place at UGA. The retreat will allow for the free-flow of scientific information as well as administrative information among the faculty and the CVI administration. Lectures will be organized in such a way that students and other early career scientists will be provided special opportunities to engage with CVI faculty about their own studies.

Phase 3. Expansion and Training (3-7 years)

Upon further development of the CVI and the procurement of additional funds from competitive grants, the CVI will pursue additional projects specific to the training of young scientists.

- **Competitive postdoctoral fellows program.** While incredibly productive, the postdoctoral stage is short (1-3 years) and results in high turnover and a continuously refreshing pool of talent at research institutes. For these reasons, the development of a revolving coterie of talented and productive postdocs will be one of the most effective ways to advance the aims of the CVI. This can be achieved with the establishment of a competitive fellowship program. Postdoctoral scholars are most productive when they are permitted to carry out a research program of their own design and often are best recruited through a competitive mechanism, the winners of which are provided with salary and research support.

- **Recruitment of graduate students and development of graduate student fellowships.** By providing a visible concentration of expertise, sponsoring recruitment activities, and supporting training grants, the CVI will assist faculty in recruiting highly talented graduate students. To emphasize the importance of novel methodological advancements in vaccine research, the CVI will provide fellowships, to be treated as "dissertation improvement grants". These fellowships will provide stipend support to enable doctoral students to focus on developing and disseminating novel methodology.

- **Research experiences for undergraduates.** The UGA CVI will aim to support 8-10 undergraduate researchers each year, either as research assistants or as researchers conducting independent projects.

- **Research experience for high school teachers and students**. Engagement with high school teachers and students during summer recess provides an opportunity to support the local community and to advance the reputation of the University of Georgia throughout the state. The program will provide summer employment and enrichment activities and will promote interest in science and vaccine research among high school students. The UGA CVI will maintain a fund derived from indirect cost returns to support affiliated faculty who wish to participate in such programs by contributing to program fees or participant wages.

1.4 Timeline and measurable outcomes

Success will be evaluated by completion of the following objectives, some of which are underway or completed:

- **Within one year**
  - Establish leadership: The Director of the Center for Vaccines and Immunology has been chosen. Dr. Ted M. Ross became a faculty member of UGA on June 1, 2015 in the Department of Infectious Diseases and CVM and has been leading the development of the CVI.
  - Establish national and international collaborations for clinical trials: Dr. Ross has established collaborations and human clinical cohorts in the U.S. (Pittsburgh, PA and Stuart, FL), as well as internationally in Brazil, Trinidad, Dominica, St. Kitts, Vietnam, and India.

- Complete renovations and establish a stable financial environment: A draft budget for CVI has been established based upon the indirect return dollars from a full complement of 8 core CVI faculty.
- Hire the first of 4 new faculty: Dr. Eric Harvill has been hired as the first CVI recruited faculty and will be housed in the renovated space.
- Begin seminars and workshops designed to bring leading external vaccine and immunological researchers to UGA and to develop competence among our cohort of early career scientists.

- **Within two years**
  - Hire the second of 4 new faculty.
  - Transfer two current UGA faculty from their present location to the new CVI location.
  - Establish a collaborative agreement with companies, academic centers and government agencies interested in vaccines and infectious diseases. UGA has established collaborative research agreements with Sanofi-Pasteur, the largest influenza vaccine manufacturer in the world and will seek collaboration with Merial Ltd as well. Dr. Ross has an established collaborative relationship with Dr. Rafi Ahmed, Director of the Emory Vaccine Center and Dr. Julia Hilliard, Director and Chair of the Department of Microbiology at Georgia State University and the BSL4 facility.
- **Within three years**
  - Collectively publish multiple peer-reviewed scientific publications in high impact journals in vaccinology, immunology, or infectious disease pathogenesis and modeling.
  - Submit three new major grant applications from CVI faculty.
- **Within four years**
  - Hire the third of 4 new faculty.
  - Submit two large collaborative grant applications. One grant with primarily CVI research faculty and the second with collaborative scientists both at UGA and at outside institutions.
- **Within five years**
  - Complete hiring of new external faculty
  - Make the University of Georgia a destination for post-doctoral scientists and graduate students in the study of vaccines, immunology and infectious disease pathogenesis and modeling. Achievement of this objective will be evaluated according to attendance at workshops and seminars, publication of peer-reviewed articles and other technical publications, and self-reporting by graduate students.

1.5 Benefits to UGA and state of Georgia Communities

UGA

- A state-of-the-Art facility for Vaccines and Immunology in the former Small Animal Research Hospital.
- Establishment of long-term partnerships for collaborations, funding and vaccine development with pharmaceutical companies and government agencies.
- Develop and license vaccines in the CVI.
- Spin off of companies from the vaccines and products developed in the CVI.

- University-based instruction and development of the next generation of scientists, business and industrial leaders.
- Training grants for the recruitment and retention of top trainees in the field.

State of Georgia

- Development of talent/technical training for scientists at an early career stage for jobs in the state of Georgia.
- Creation of affiliated technical and non-technical jobs
- Spin off companies in Georgia based upon research and products developed at the CVI.
- Improved prevention, detection and therapeutic options for infectious disease and public health problems affecting residents and animals of the state. Examples include:
    - Development of novel vaccines for influenza, veterinary diseases, arboviruses, and biodefense pathogens, as well as zoonotic diseases affecting humans and other animals.
    - Studies of the environmental causes of viral diseases found throughout the state including those that affect humans, pets and livestock.

2 Operating procedures and policies

2.1 Organization and Administration

In keeping with the UGA policy to prefer the most decentralized administrative level consistent with meeting the center mission, the UGA CVI will be organized within the College of Veterinary Medicine and involve minimal additional administrative structure. Specifically, it will consist of a Director (to be appointed by the Office of the Vice President of Research and Dean of the College of Veterinary Medicine) and associated faculty members of the Department of Infectious Diseases, including postdoctoral associates; and student/staff members. Although the UGA CVI will be physically located and organized within the College of Veterinary Medicine, any interested faculty (including adjunct appointments), staff person, or student associated with the University of Georgia will be eligible to apply for membership. An advisory committee comprised of four elected members of the CVI will meet annually to evaluate Center objectives. Membership in the Center will be determined by majority vote of this committee plus the Director and will be contingent on regular participation in the UGA CVI faculty meetings. An annual retreat of all Center scientists will be sponsored for the purposes of event planning, to receive critical feedback from participants on Center activities and opportunities, and to conduct other Center business. The College of Veterinary Medicine will serve as the administrative unit of the Center. A comprehensive review of the Center will be performed every five years, beginning in Spring 2016, by a committee appointed by the Dean of the College of Veterinary Medicine.

2.2 Amounts and Sources of Anticipated Income

To undertake its activities, the UGA CVI will adopt a two-pronged business model: (1) core and continuing Center activities will be supported by an annual operating budget derived from indirect

cost returns from CVI faculty and core facility fees (2) other activities will be designated as projects and will be supported by funds raised for each project, typically by applications to granting agencies and institutions (*e.g.,* NIH). These two sources will maintain the financial stability of a fully running CVI. The tables below outline a pro-forma budget for the operating expenditures and revenues for the first three years of the CVI. Indirect cost returns brought into the University by CVI faculty will be directed toward the CVI operating expenses, anticipated amounts are indicated in the table below. Additional overhead facility and administrative aspects will be supported by the College of Veterinary Medicine.

CVI Anticipated Operating Costs

Expense Category	FY17	FY18	FY19
Staff salary	$125,000	$290,000	$450,000
Core Facility Maintenance Contracts and Supplies	$150,000	$150,000	$150,000
Seminar series	$5,000	$5,000	$5,000
Travel funds	$10,000	$10,000	$10,000
Annual Symposia	$15,000	$15,000	$15,000
Annual Retreat	$7,000	$7,000	$7,000
Total Expenditures	$312,000	$477,000	$637,000

CVI Anticipated Revenue

Revenue Source	FY17	FY18	FY19
Indirect Cost Returns	$200,000	$300,000	$400,000
Core Facility User Fees	$50,000	$100,000	$100,000
CVM	$50,000	$50,000	$50,000
OVPR	$12,000	$27,000	$87,000
Total Revenue	$312,000	$477,000	$637,000

Additional funds from the College of Veterinary Medicine ($1M), the Office of the Vice President for Research ($1M), the Office of the Senior Vice President for Academic Affairs and Provost ($1M) and The Georgia Research Alliance ($1M) will support the renovations of the CVI space at the site of the former Veterinary Teaching Hospital. The estimated cost for renovations is $4M for the first phase of construction. Additional funds for renovations are anticipated from healthcare industry sponsorships currently under negotiations. Equipment expenditures to establish the Core Facilities ($2M) will be supported by faculty start-up funds and sponsored projects. As part of the recruitment of the GRA Eminent Scholar in Infectious Diseases, agreements between the Office of the Senior Vice President for Academic Affairs and Provost and the College of Veterinary Medicine have been made to provide support for the start-up packages and salaries for new faculty hires for the CVI.

3 Responsibilities of participating units

The CVI will receive oversight, review, administrative support and support for development from the College of Veterinary Medicine and Department of Infectious Diseases. The director of the center will report to the Chair of the Department of Infectious Diseases and Dean of the College of Veterinary Medicine.

All participating faculty will retain their appointments in their home units. Promotion, tenure, and salary decisions will be made in the home unit according to unit criteria in consultation with the Director of the CVI. All non-tenure track CVI personnel are expected to draw salary from its budget.

4 Physical resources

Research staff associated with the CVI will be housed in the research groups of their faculty mentors. Lecture, computer lab, core scientific laboratories, core facilities, and meeting spaces will be provided in the CVI facilities that will be located in the newly renovated former CVM Small Animal Teaching Hospital.

5 Faculty and staff necessary for initial three years

Initiation of center programs and maintenance of core center activities for the first three years will be performed by UGA faculty, research staff and students in the course of their normal scholarly activities (see section 6 for list of participating faculty). Administrative support will initially be provided by the staff of the College of Veterinary Medicine, Department of Infectious Diseases.

6 List of Participating Faculty

6.1 Primary Recruited Faculty

Once fully recruited, the 8 primary core CVI faculty and their teams will work closely with CVI-affiliated faculty in pursuit of the Center mission. The first 4 core CVI faculty are established at UGA (see section 6.2), including the proposed CVI director, Dr. Ted M. Ross. The remaining 4 positions will be filled with recruited faculty who will fill or expand key expertise or skill sets to firmly establish the capabilities of the Center. The critical areas of expertise include:

- Vaccine design and development
- B and T cell immunology
- Innate immunology, dendritic cells, and/or TLR mechanisms
- Adjuvant biochemistry
- Virology

- Translational Medicine

6.2 Primary Existing Faculty

Core faculty who are already established at UGA and will join the CVI and be housed within the CVI include:

Ted M. Ross: Influenza vaccinology using ferret models, vaccine design for emerging viral pathogens, such as Dengue, Chikungunya, and alphaviruses and respiratory viruses such as respiratory syncytial virus. Virus-host immune intereactions during infection for respiratory, arboviral, and HIV. Biomarker assessment to infection and vaccination in pre-clinical and human studies
Fred Quinn: Tuberculosis vaccines and animal models of transmission
Eric Harvill: *Bordetella pertussis* and *B. bronchiseptica* vaccines; novel animal models; lung microbiome studies
Biao He: Influenza; Rabies; Mumps; tuberculosis; *Burkholderia*; HIV; Ebola and RSV vaccines.

6.3 Secondary Existing Faculty

CVI core faculty housed in their home departments who are already established at UGA and will join the CVI include:

Stephen Trent: Adjuvants, Bacterial vaccines and carbohydrate immunology
Eric Lafontaine: *Burkholderia*; *Moraxella catarrhalis* vaccines; novel animal models
Daniel Perez: Influenza virology and animal poultry vaccinology
Jeff Hogan: *Burkholderia* and Chikungunya virus vaccine development
Courtney Murdock: Malaria and Chikungunya virus vaccine development; insect vector biology; vaccine modeling

6.4 Affiliated Faculty

CVI faculty will benefit from interactions with a large community of UGA faculty researchers who have overlapping interests. These include, by area of expertise:

Viral:
Ralph Tripp: Influenza, RSV, Polio, Norovirus, Rotavirus, and MERS vaccine enhancement; immunotherapeutic testing
David Stallknecht: Influenza vaccines; surveillance in wildlife
Maricarmen García: Poultry vaccines
Holly Sellers: Poultry vaccines
Mark Tompkins: Influenza and Dengue virus vaccine development; transmission in animal models
Scott Pegan: Crimean-Congo Hemorrhagic Fever virus vaccines; innate immunology
Mark Jackwood: Poultry viral vaccines

Kim Klonowski: Influenza vaccines; immunology
Danny Mead: Vector borne viral disease vaccine development

Bacterial:

Mary Hondalus: Tuberculosis and *Rhodococcus* vaccines; animal model development

Parasitic:

Rick Tarleton: Trypanosomiasis vaccines; immunology
Julie Moore: Malaria vaccines; therapeutics
Harry Dickerson: teleost vaccinology, comparative immunology, T and B cell repertoire analysis

Mixed:

Don Harn: Schistosomiasis and HIV vaccines; novel adjuvant development
David Hurley: Large food animal vaccines and adjuvants

Adjuvants:

Fikri Avci: Bacterial vaccines and carbohydrate immunology

Vaccine Modeling:

Andrew Park: Influenza, malaria and insect vector models
Vanessa Ezenwa: Tuberculosis vaccines and transmission models in animals
Pej Rohani: Pertussis and other respiratory vaccine models
John Drake: Ebola and other zoonotic vaccine models

Epidemiology:

Chris Whalen: Tuberculosis and HIV
Andreas Handel: Tuberculosis, Norovirus and influenza

Carbohydrate chemistry –

Gert Jan-Boons: carbohydrate chemistry; cancer vaccines
Christine Szymanski: glycans, host-pathogen interactions, virulence

7 Recommendations for the creation of courses or degrees

This proposal makes no recommendations for creation of courses or degrees.

8 Degree Programs

The UGA CVI will not offer a degree program.

9 Letters of Support

See attached documents

10 Appendix : Biographical Summaries of Core CVI Faculty

See attached documents

The University of Georgia

Office of the Dean

College of Veterinary Medicine

Athens, Georgia 30602-7371
Telephone 706-542-3461
Fax 706-542-8254

September 8, 2015

Proposal: Center for Vaccines and Immunology at the University of Georgia

Dear Dr. Whitten and members of the University Curriculum Committee:

I am writing in support of the proposal for the establishment of a "Center for Vaccines and Immunology" at the University of Georgia, submitted by Dr. Fred Quinn and Dr. Ted Ross of the College of Veterinary Medicine. The veterinary profession is devoted to the improvement of both animal and human health and recognizes the critical and global need for new and improved infectious disease prevention strategies.

A Center for Vaccines and Immunology will unify scientists involved in vaccine-related research already present at UGA, and will bring in new research talent to create a rich and supportive environment in which basic and translational research inquiries can flourish, and novel approaches to infectious disease prevention can be designed and tested. The Center will promote collaborations not just across campus but also with other academic partners, pharmaceutical corporations, and governmental agencies. Support for the Center at UGA is evidenced by the commitments made by the College of Veterinary Medicine, the Office of the Vice President for Research, and the Office of the Senior Vice President for Academic Affairs and Provost, as well as the Georgia Research Alliance. Further, the College of Veterinary Medicine is currently negotiating corporate sponsorship for the center with two international healthcare industry leaders.

The Center will be located on the campus of the College of Veterinary Medicine and renovation plans have been approved by UGA architects. As Dean of the College of Veterinary Medicine I will provide administrative oversight of the Center along with Dr. Fred Quinn, Head of the Department of Infectious Disease at the College of Veterinary Medicine. The center will be under the direction of Dr. Ted Ross, a recently appointed College of Veterinary Medicine Professor and GRA Eminent Scholar who is an internationally known expert in vaccine design for influenza and emerging viral pathogens, and whose research spans basic and pre-clinical research through human trials. Under Dr. Ross' leadership, and with the diversity of current and future research expertise across the university, I am confident that the Center for Vaccines and Immunology will provide the intellectual platform necessary to support and advance collaborative, interdisciplinary approaches for the prevention and eradication of infectious diseases and the enhancement of public health.

In summary, as infectious diseases continue to pose a threat to the public health, new vaccine strategies are critically needed. I strongly believe that a Center for Vaccines and Immunology at the University of Georgia will help meet this need and will position UGA as world leader in vaccine research.

Sincerely,

Sheila W. Allen, DVM, MS
Dean

The University of Georgia

Office of the Vice President for Research

September 17, 2015

Dr. Pamela S. Whitten
Senior Vice President for Academic Affairs
and Provost
206 Administration Building
Campus

Dear Provost Whitten and Members of the University Curriculum Committee –

I write to most enthusiastically support the establishment of the proposed Center for Vaccines and Immunology, led by Georgia Research Alliance Eminent Scholar Ted Ross. The University, with support from my office, has been engaged in a multi-year, cross-campus initiative to build an outstanding, broadly-focused infectious disease program. This infectious disease initiative is centered in the Department of Infectious Diseases in the College of Veterinary Medicine (CVM) but includes key programmatic elements in several other colleges, schools and centers. It leverages the CVM's expertise in animal and (increasingly) human health, with biomedical, human/public health, and ecological (disease modeling) expertise in other units. It also leverages UGA's investments in remarkable infrastructure (e.g. the Animal Health Research Center) that allows studies of serious disease pathogens as well as candidate vaccines and therapeutics. The end result is that the University is poised to be a national leader in the field of One Health, a unifying concept that underscores the connectedness of human, animal and environmental health. The value of this infectious disease initiative is evident in the fact that it has emerged as one of the most productive areas on campus from the perspective of external funding that includes some very large awards supporting important partnerships with other institutions in Georgia (Emory, The Centers for Disease Control and Prevention, etc.) and elsewhere.

A significant development in the continued build-out of the infectious disease program was the recent recruitment of Dr. Ted Ross as the University's latest GRA Eminent Scholar. Dr. Ross is a notable scholar whose work in the area of vaccines, particularly influenza vaccines, is exceptionally well funded by the pharmaceutical industry. His recruitment, along with several other recent faculty recruitments, adds significantly to our existing strength in vaccine development and improvement, and makes this the ideal time to create the proposed Center for Vaccines and Immunology. This Center, administratively headquartered in the CVM, will add important value by increasing collaborations across campus as well as with other academic partners, pharmaceutical corporations and government agencies. Dr. Ross has already engaged in extended discussions with the leadership of the Emory Vaccine Center and the CDC, as well as with the Sanofi Pasteur and Merial corporations, the world's largest producers of human and animal vaccines, respectively. In so doing, he not only has the enthusiastic support of my office but also the Georgia Research Alliance. Lastly, although the proposed Center will focus on research and will not have any formal curricular elements, its creation will nevertheless have a major impact on student education and training, and thus help to ensure a continuing pipeline of future talent to work on vaccines and infectious diseases in academic, private and government sectors.

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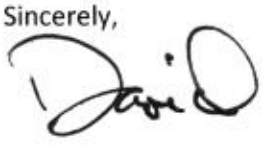
To repeat, I am strongly supportive of this proposal to establish the Center for Vaccines and Immunology. I believe it is an important next step as we continue to make UGA a go-to institution for research on infectious diseases and vaccines. To that end, I believe it will encourage important interactions with industry and other research entities. And, having worked closely with Dr. Ross in recent months, I am confident he will provide the necessary leadership and vision, and in this regard will be well supported by the CVM, OVPR and the Georgia Research Alliance.

Sincerely,



David Lee
Vice President for Research

College of Veterinary Medicine
Department of Infectious Diseases

September 8, 2015

Proposal: Center for Vaccines and Immunology at the University of Georgia

Dear Provost Whitten and members of the University Curriculum Committee:

I am writing in support of the proposal for the establishment of a "Center for Vaccines and Immunology" (CVI) at the University of Georgia. Developing Vaccines for One World will be the mission for the research endeavors at the CVI. The scientific acumen represented at the CVI will position our scientists to participate in the therapeutic revolution of harnessing the power of the immune system to develop or improve vaccines for infectious agents that pose risks to human and animal health.

Personalized immunotherapy and vaccine adoption is dependent on scientists' ability to manipulate the therapeutic outcomes using the immune system. The scientists at the CVI will have diverse areas of scientific focus, but all will collaborate to solve infectious disease challenges by developing, testing, and licensing the cutting-edge vaccines of the future -- for emerging and non-emerging infectious diseases that affect humans and animals in the United States and the world. The CVI will develop a new and innovative research center to enhance both the basic and translational scientific research already ongoing at UGA.

CVI researchers will possess an in-depth knowledge of vaccine design, therapeutics, adjuvants, immunology, pathogenesis, genetics, and infectious disease. To broaden the application of their understanding of the immune system, the Center will actively recruit medical and veterinary scientists working on infectious disease, immunology, and vaccinology. The CVI will also work with local and state communities with expertise in infectious diseases that claim millions of human lives and numerous lives of domesticated and wild animals each year. The CVI will actively partner with researchers at the USDA and the Southeast Poultry Research Laboratory, the Emory Vaccine Center, the CDC, and local companies to explore, invest, and expand development of an active vaccine community. Lastly, the CVI will promote student education and training and will coordinate training grant programs in the science of vaccines, thus helping to ensure a pipeline of future researchers for academic, public health and industrial vaccine programs.

In summary, as infectious diseases continue to pose a threat to animal and public health, new vaccine strategies are critically needed. Under Dr. Ross' leadership, and with the diversity of current and future research expertise at UGA, I am confident that the CVI will provide the intellectual platform necessary to support and advance collaborative, interdisciplinary approaches to the prevention and eradication of infectious diseases and the enhancement of public health.

Sincerely,

Frederick D. Quinn, Ph.D.
Athletic Association Professor of Infectious Diseases and Head
Telephone (706) 542-3473 • Fax (706) 542-5771 • Athens, GA 30602-7387 • website: www.vet.uga.edu/ID

The University of Georgia

College of Public Health
Epidemiology and Biostatistics

October 9, 2015

Proposal: Center for Vaccines and Immunology at the University of Georgia

Dear Dr. Whitten and members of the University Curriculum Committee:

We are writing in support of the proposal for the establishment of a "Center for Vaccines and Immunology" at the University of Georgia, submitted by Dr. Fred Quinn and Dr. Ted Ross of the College of Veterinary Medicine. We are aware of the critical and global need for new and improved infectious disease prevention through vaccination strategies.

As described in the proposal, the Center for Vaccines and Immunology plans to unify scientists involved in vaccine-related research already ongoing at UGA and will bring in new research talent to create a critical and dynamic mass for basic and translational research into novel vaccine approaches to infectious disease prevention.

As we understand it, the Center will promote collaborations across campus, including the UGA College of Public Health. The center will be under the direction of Dr. Ted Ross, a recently appointed College of Veterinary Medicine Professor who is an internationally known expert in vaccine design for influenza and emerging viral pathogens and whose research spans basic and pre-clinical research through human trials. Under Dr. Ross' leadership, and with the diversity of current and future research expertise across the university, we are confident that the Center for Vaccines and Immunology will provide the community and resources necessary to support and advance collaborative, interdisciplinary approaches to the prevention and eradication of infectious diseases and the enhancement of public health.

In summary, as infectious diseases continue to pose a threat to the public health, new vaccine strategies are in critical need. We strongly believe that a Center for Vaccines and Immunology at the University of Georgia will help meet this need and will position UGA as world leader in vaccine research.

Sincerely,

Phillip Williams, Ph.D.
Dean, and Georgia Power Professor
College of Public Health

Christopher Whalen, M.D., M.S.
Ernest Corn Professor of Infectious
Disease Epidemiology

101 Buck Road • B.S. Miller Hall • Health Sciences Campus • Athens, Georgia 30602
Telephone 706-542-7480

Appendix: Biographical Summaries of Core CVI Faculty

BIOGRAPHICAL SKETCH

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

NAME: Ted M. Ross

eRA COMMONS USER NAME (credential, e.g., agency login):TEDROSS

POSITION TITLE: Professor and GRA Eminent Scholar

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

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Arkansas, Fayetteville, AR	B.S., M.S.	1986, 1989	Zoology, Microbiology
Vanderbilt University, Nashville, TN	Ph.D.	1996	Microbiology
Duke University, Durham, NC	Post-Doc	1996-1998	Genetics-HIV Biology
Emory University, Atlanta, GA	Senior Res Associate	1998-2000	Emory Vaccine Center-

A. Personal Statement

The PI is a highly motivated, creative, and skilled scientist with experience in the fields of virology, vaccines, immunology, and microbiology. Dr. Ross is the senior investigator that developed computationally-optimized broadly reactive antigen (COBRA) technology for the rational design of vaccine candidates for influenza viruses [1-2], dengue viruses (4), and HIV. He was the lead investigator for development of DNA, recombinant protein and virus-like particle (VLP) vaccines for pandemic (1-2) and seasonal influenza, HIV/SIV/SHIV, dengue virus (4-5), West Nile virus (3), as well as several vaccine candidates under investigator for chikungunya virus, ebola virus, and respiratory syncytial virus (RSV). Using VLP vaccine technologies developed in the Ross laboratory, respiratory syncytial virus (RSV) VLP vaccines, which are proposed in this application, have been tested in adult and pregnant mouse models. His work possesses a unique vision and he is passionate about utilizing novel gene product designs to elicit high-titer protective immune responses for both adults and juveniles. He has multiple high impact publications in pre-clinical vaccine assessment in mice, ferrets, and non-human primates, is the primary investigator on externally funded research projects, and has project management skills in mulit-investigator UO1 and PO1 projects.

1. Giles BM and **Ross TM**. Development of a computationally optimized broadly reactive (COBRA) hemagglutinin for elicitation of protective antibodies against multiple clades of H5N1. 2011. Vaccine. 29:3043-54.

2. Giles BM, Crevar CJ, Carter DM, Bissel SM, Schultz-Cherry S, Khurana S, Golding H, Wiley CA, and **Ross TM**. Computationally-Optimized Hemagglutinin Expressed on a Virus-like Particle Vaccine Elicits Broadly-Reactive Antibodies that Protect Non-human Primates from H5N1 clade 2 Influenza Infection. 2012. J. Inf. Dis. 205:1562-70.

3. Dunn MD, Rossi SL, Carter DM, Vogt MR, Mehlhop E, Diamond MS, **Ross TM**. Fusion of the C3d derivative P28 to West Nile virus E or domain III augments protective antibody responses in mice. 2010. Virology J. 7:95-106.

4. **Ross TM**, Tang XC, Lu HR, Olagnier D, Kirchenbaum GA, Evans JD. COBRA-Based Dengue Tetravalent

Vaccine Elicits Neutralizing Antibodies Against All Four Dengue Serotypes. 2015. J. Vacc Immunotech

5. Chiang C, Beljanski V, Yin K, Olagnier D, Ben Yebdri F, Steel C, Goulet ML, DeFilippis VR, Streblow DN, Haddad EK, Trautmann L, **Ross T**, Lin R, Hiscott J. Sequence-specific modifcations enhance the broad spectrum antiviral response activated by RIG-I agonists. 2015. J Virol. In press.

B. Positions and Honors

2015-present	Professor Department of Infectious Diseases, University of Georgia
2015-Present	Eminent Scholar, Georgia Research Alliance
2013-2015	Professor (Full Member), Vaccine and Gene Therapy Institute (VGTI) of Florida, Director of the Vaccine and Infectious Diseases Division
2009-2013	Associate Professor (w/Tenure), Univ. of Pittsburgh, Molecular Genetics & Biochemistry
2006-present	Investigator, University of Pittsburgh, Center for Vaccine Research,
2003-2009	Assistant Professor, University of Pittsburgh, Dept. of Molecular Genetics & Biochemistry,
2003-2007	Assistant Professor, University of Pittsburgh, Division of Infectious Diseases,
2001-2010	Editor-in-Chief, *Current HIV Research*.
2000-2003	Assistant Professor, East Carolina University, Dept. of Microbiology and Immunology.

Honors/Awards

1989	Graduate Student Research Award, University of Arkansas.
1993	National Research Service Award, National Cancer Institute, Vanderbilt University.
1996	Sidney P. Colowick Award - Outstanding Graduate Achievement, Vanderbilt University
1997-1998	Duke Interdisciplinary Research Training Program in AIDS Award, Duke University.
2003	Appreciation of Outstanding Medical Student Teaching, East Carolina University.
2008	Pittsburgh Life Sciences Greenhouse Award
2012-present	Treasurer, International Society for Vaccines
2013-present	Fellow, International Society for Vaccines
2015-present	Georgia Research Alliance Eminent Scholar

Patents

DNA expression vectors and methods of use. US 7,795,017. Assignees: Emory University Inventors Harriet L. Robinson, Rama R. Amara, Ted M. Ross, Rick A. Bright. Filing Date 2004-12-09; Issue Date 2010-09-14

DNA expression vectors and methods of use. US 20020106798. Assignees: Emory University Inventors Harriet L. Robinson, James M. Smith, Ted M. Ross, Rick Arthur Bright, Jian Hua, Dennis Ellenberger, Donald G. Hildebrand. Filing Date 2001-03-02; Issue Date Unknown

Tetravalent influenza vaccine and use thereof. US 8,513,006. Assignees: University of Pittsburgh—Of the Commonwealth System of Higher Education. Inventors Ted M. Ross, Xianchun Tang, Hairong Lu. Filing Date 2011-09-12; Issue Date 2013-08-20

COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR INFLUENZA. US 20130183342. Assignees: University of Pittsburgh—Of the Commonwealth System of Higher Education. Inventors Ted M. Ross, Brendan M. Giles. Filing Date 2011-09-09; Issue Date Unknown

UNIVERSAL DENGUE VIRUS SEQUENCES AND METHODS OF USE. US 20130071419. Assignees University of Pittsburgh - Of the Commonwealth System of Higher Education. Inventors Ted M. Ross, Nikolaos Vasilakis. Filing Date 2011-05-23; Issue Date Unknown

COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR H5N1 AND H1N1 INFLUENZA VIRUSES. Provisional Patent Application No. 61/617,815. Pitt Ref. No. 02631. Klarquist Ref. No. 8123-88529-01. Assignees University of Pittsburgh - Of the Commonwealth System of Higher Education. Filed March 30, 2012; Country: United States of America

COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR H3N2, H2N2, AND B INFLUENZA VIRUSES. Application No. 61/596,014. Pitt Ref. No. 02525. Klarquist Ref. No. 8123-88294-01.

Assignees University of Pittsburgh - Of the Commonwealth System of Higher Education. Filed February 7, 2012**.** Country: United States of America

COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR H1N1 INFLUENZA. Application No. 61/498,800. Pitt Ref. No. 02456. Klarquist Ref. No. 8123-87208-01. Assignees University of Pittsburgh - Of the Commonwealth System of Higher Education. Filed June 20, 2011. Country: United States of America

COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR HUMAN AND AVIAN H5N1 INFLUENZA. Provisional Patent Application No. 61/597,998, Pitt Ref. No. 02464. Klarquist Ref. No. 8123-88295-01. Assignees University of Pittsburgh - Of the Commonwealth System of Higher Education. Filed February 13, 2012. Country: United States of America

SYNERGISTIC CO-ADMINISTRATION OF COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR HUMAN AND AVIAN H5N1 INFLUENZA. U.S. Provisional Patent Application No.: 62/094,795. Our Ref.: 0171.0006-PRO. Assignees – VGTI Florida. Filed: 19 December 2014

SYNERGISTIC CO-ADMINISTRATION OF COMPUTATIONALLY OPTIMIZED BROADLY REACTIVE ANTIGENS FOR H1N1 INFLUENZA. U.S. Provisional Patent Application No.: 62/094,772. Our Ref.: 0171.0005-PRO. Assignees – VGTI Florida. Filed: 19 December 2014

C. Contributions to Science

Dr. Ross has contributed to science in several important ways.

1. C3d as a DNA vaccine adjuvant. Dr. Ross pioneered the use of C3d, a component of the innate immune system, as a molecule adjuvant for DNA vaccine produced adjuvants (Ross et al. 2000. Nat. Immunol). His work has been cited 100s of times. The fusion of C3d to an antigen reduces the amount of antigen needed to stimulate an immune response from a DNA vaccine by 1000 fold.

Bhardwaj N, Pierce BR, **Ross TM.** Immunization with DNA vaccine Expressing Gn Coupled to C3d prevents clinical signs of infection and protects mice against an aerosol Rift Valley fever virus infection. 2012. J. Bioterror. Biodef. S3:006.

Dunn MD, Rossi SL, Carter DM, Vogt MR, Mehlhop E, Diamond MS, **Ross TM**. Fusion of the C3d derivative P28 to West Nile virus E or domain III augments protective antibody responses in mice. 2010. Virology J. 7:95-106.

Bower JF, Yang X, Sodroski J, **Ross TM**. Elicitation of Neutralizing Antibodies with DNA Vaccines Expressing Soluble Stabilized Human Immunodeficiency Virus Type 1 Envelope Glycoprotein Trimers Conjugated to C3d. J Virol. 2004. 78: 4710–4719.

Mitchell JA, Green TD, Bright RA, **Ross TM**. Induction of heterosubtypic immunity to influenza A virus using a DNA vaccine expressing hemagglutinin-C3d fusion proteins. Vaccine. 2003. 21:902-914.

Green TD, Montefiori DC, **Ross TM**. Enhancement of antibodies to the human immunodeficiency virus type 1 envelope by using the molecular adjuvant C3d. J Virol. 2003. 77:2046-2055.

2. Virus-like particle vaccines for seasonal H1N1 and H3N2, and pandemic H5N1 influenza. Virus-like particles are effective vaccine delivery mechanisms that provide the immune system antigens in the correct 3-dimensional structure. Immune epitopes are presented in their correct conformations. VLPs are more effective than single antigens at stimulating the immune response.

Giles BM, Bissel SJ, DeAlmeida DR, Wiley CA, Tumpey TM, and **Ross TM**. A 1918 influenza virus-like particle elicits long-lasting protective immune responses to 2009 pandemic H1N1 virus. 2011. J. Virol. 86:1500-1513.

Ross TM, Mahmood K, Crevar CJ, Schneider-Ohrum K, Heaton PM, Bright, RA. A trivalent virus-like particle vaccine elicits protective immune responses against seasonal influenza strains in mice and ferrets. Seasonal

trivalent influenza VLP vaccines elicit broader immune responses than an inactivated split influenza vaccine. 2009. PLoS One. 4:e6032.

Mahmood K, Bright RA, Mytle N, Carter DM, Crevar CJ, Achenbach JE, Heaton PM, Tumpey TM, **Ross TM**. H5N1 VLP vaccine induced protection in ferrets against lethal challenge with highly pathogenic H5N1 influenza viruses. Vaccine. 2008. 26:5393-5393.

Bright RA, Carter DM, Crevar CJ, Toapanta FR, Steckbeck JD, Cole KS, Kumar N, Pushko P, Smith G, **Ross TM**. Cross-clade protective immune responses to influenza viruses with H5N1 HA and NA elicited by an influenza virus-like particle. PLoS One. 2008. 3(1) e1501.

Bright RA, Carter DM, Daniluk S, Toapanta FR, Ahmad A, Gavrilov V, Massare M, Pushko P, Mytle N, Rowe T, Smith G, **Ross TM**. Influenza virus-like particles elicit broader immune responses than whole virion inactivated influenza virus or recombinant hemagglutinin. Vaccine. 2007. 25:3871-3878.

3. COBRA H5N1 influenza VLP vaccine development. The development of a broadly-reactive antigen to stimulate immune responses against a panel of influenza strains that lead to a Universal influenza vaccine is critical for the future of influenza vaccine development. COBRA elicits responses against panels of H5N1 influenza viruses. This technology has been applied for H1N1, H3N2, H7N9, H2N2, and B influenza strains.

Giles BM and **Ross TM**. Development of a computationally optimized broadly reactive (COBRA) hemagglutinin for elicitation of protective antibodies against multiple clades of H5N1. 2011. Vaccine. 29:3043-54.

Giles BM, Bissel SJ, DeAlmeida DR, Wiley CA, and **Ross TM**. Antibody Breadth and protective efficacy is Increased by Vaccination with Computationally Optimized Hemagglutinin but not with Polyvalent Hemagglutinin base H5N1 VLP Vaccines. 2012. Clin Vacc Immunol. 19:128-39.

Bissel SJ, Giles BM, Wang G, Olevian DC, **Ross TM**, Wiley CA. Acute Murine H5N1 Influenza A Encephalitis. 2012. Brain Path. 22(2):150-158.

Crever CJ, Carter DM, Lee KY, Ross TM. Cocktail of H5N1 COBRA HA vaccines elicit protective antibodies against H5N1 viruses from multiple clades. 2015. Hum Vacc Immunother. 11:572-583.

4. COBRA influenza vaccine protection of non-human primates against H5N1 challenge. The first demonstration of protection against H5N1 challenge using VLP vaccines expressing a COBRA HA.

Bissel SJ, Wang G, Carter DM, Crevar CJ, **Ross TM**, Wiley CA. H1N1, but not H3N2, influenza A virus infection protects ferrets from H5N1 encephalitis. 2014. J. Virol. 88(6):3077-91.

Giles BM, Crevar CJ, Carter DM, Bissel SM, Schultz-Cherry S, Khurana S, Golding H, Wiley CA, and **Ross TM**. Computationally-Optimized Hemagglutinin Expressed on a Virus-like Particle Vaccine Elicits Broadly-Reactive Antibodies that Protect Non-human Primates from H5N1 clade 2 Influenza Infection. 2012. J. Inf. Dis. 205:1562-70.

5. Sequential infection of seasonal influenza viruses elicit antibodies to pandemic influenza strains. Understanding why older, middle-aged, and younger individuals are protected against emerging influenza virus strains is a fundamental question in the influenza field and for influenza vaccine development. Pre-existing immunity is critical of the effective function of a seasonal or universal influenza vaccine. This study demonstrated that ferrets infected with different combination of seasonal H1N1 strains over a 12 month period, developed protection against pandemic CA/09 influenza strain, even though the animals had never been exposed to CA/09 influenza virus.

Crevar CJ, Carter DM, Lee KYJ, and **Ross TM**. Cocktail of H5N1 COBRA HA Vaccines Elicit Antibodies against H5N1 Viruses from Multiple Clades. 2015. Human Vacc Immunother. 11(3):572-83.

Carter DM, Bloom CE, Nascimento EJ, Marques ETA, Craigo JK, Cherry JL, Lipman DJ, **Ross TM**. Sequential Ferret H1N1 influenza infection in ferrets elicits neutralizing antibodies to emerging H1N1 isolates. 2013. J Virol. 87(2). 1400-1410.

Carter DM, Giles BM, Lu H-R, Crevar CJ, Bloom CE, Cherry JL, Lipham DJ, **Ross TM.** Human Antisera Cross-Reactivity to Novel H1N1 influenza Correlates with Hemagglutination-Inhibition Activity Against Multiple Seasonal H1N1 Viruses. 2012. PLoS One. 7:e39435.

All the COBRA-related studies have directly led to Phase I clinical trials in humans and will be assessed through Collaborative Research Agreements between Sanofi-Pasteur.

C. Research Support

Ongoing Research Support

NIH/NIAID 1U01AI111598-010 (PI: Ghedin) **Period Covered:** 09/13-03/14
Role: Co-Investigator
Title: Omics-Based Predictive Modeling of Age-Dependent Outcome to Influenza Infection
Our main goal is to infect ferrets with novel H1N1 influenza and collect RNA and other samples for analysis with OMICS technologies for transcriptomics, proteomics, lipidomics, and other analyses. Three different age groups will be infected: adults, aged, and neonatal ferrets.

Sanofi-Pasteur Collaborative Research Agreement (PI: Ross) **Period Covered:** 04/13-06/17
Role: PI
Title: COBRA Based Influenza Vaccines for Seasonal Influenza
The goal is to develop broadly reactive COBRA immunogens for H1N1, H3N2, and B Influenza viruses in order to elicit protective immunity against current and future emerging viral isolates. COBRA immunogens are being designed to assess three objectives: 1) Determine role of glycosylation on elicitation of broadly reactive immunity 2) Determine the ability to protect against 30 years of influenza viruses in mice and ferret models, 3) Develop clinical material for Phase I clinical trials and test efficacy in humans.

Sanofi-Pasteur Master Service Agreement (PI: Ross) **Period Covered:** 04/13-06/18
Role: PI
Title: B cell profiling of plasmablasts & memory cells following vaccination with TIV/QIV split vaccine.
The goal is to understand the effect of pre-existing immunity on elicitation of nascent B cells and recall of memory B cells following vaccination with current commercial inactivated split influenza vaccines (Fluzone). The same volunteers will be vaccinated for 6 straight influenza seasons and the measurement of immune responses will be compared between current vaccines and experimental universal vaccines. Profiling B cells by deep sequencing of VH and VL chains and generation of monoclonal antibodies for epitope mapping of site on the HA protein will be performed.

NIH/NIAID FP00005864 IDIQ Contract (PI: Kelvin) **Period Covered:** 09/15-03/17
Role: Co-PI
Title: Pre-Immune Ferret Model for the Evaluation of Influenza Vaccines and Vaccination Strategies.
The purpose of this study is to generate a ferret model that has pre-immunity to various H1N1 and H3N2 strains of influenza to test universal vaccines against seasonal and pandemic influenza viruses.

ABRIDGED CURRICULUM VITA
ERIC T. HARVILL

EDUCATION

1995-2000 **Post Doc, Microbiology and Immunology**
University of California, Los Angeles
Department of Microbiology and Immunology
Advisor: Dr. Jeffrey F. Miller

1990-1995 **Ph.D., Microbiology and Molecular Genetics**
University of California, Los Angeles
Department of Microbiology and Molecular Genetics
Advisor: Dr. Sherie L. Morrison

1989 **B.S., with Honors in Molecular and Cell Biology**
The Pennsylvania State University
Schreyer's Honors College
Advisor: Dr. Wallace Snipes

PROFESSIONAL EXPERIENCE

2015-Present **Distinguished Professor of Microbiology and Infectious Disease**
Department of Veterinary and Biomedical Science,
The Pennsylvania State University, University Park, PA

2013-Present **Visiting Professor**
Lee Kong Chian Medical School,
Nanyang Technological University, Singapore

2012-Present **Professor of Microbiology and Infectious Disease**
Department of Veterinary and Biomedical Science,
The Pennsylvania State University, University Park, PA

2006-2012 **Associate Professor of Microbiology and Infectious Disease**
Department of Veterinary and Biomedical Science,
The Pennsylvania State University, University Park, PA

2007-2008 **Visiting Professor (Sabbatical**)
Department of Veterinary Medicine,
University of Cambridge, United Kingdom

2000-2006 **Assistant Professor of Microbiology and Infectious Disease**
Department of Veterinary and Biomedical Science,
The Pennsylvania State University, University Park, PA

1996-2000 **Postdoctoral Fellow**
Department of Microbiology and Immunology,
University of California, Los Angeles, CA

SELECTED HONORS AND AWARDS

2004-Present Member (ad hoc) of six different NIH study sections

2002-Present Scientific review for DTRA, USDA and other national and international funding agencies

2005-Present Editorial Board, Infection and Immunity

2005 Participant, **National Academy of Science**'s NRC Committee - Animal Models for Testing Interventions Against Aerosolized Bioterrorism Agents

2006-2008 Member, **National Academy of Science**'s NRC Committee on Bioterrorism Risk

2008- SECRET level clearance by US government

2008-2010 Member, **National Academy of Science**'s NRC Committee on Biosquare II

2008-2009 Visiting Professor - Cambridge University

2008-2009 Cambridge University Perkin Elmer Distinguished Visiting Fellow

2008-2009 Queens' College, Distinguished Academic Fellow

2010-2013 Board of Directors, Centre Soccer Association

2011-Present Editorial Board, PLoS ONE

2012- Present Associate Editor, Ad hoc, PLoS Pathogens

2013- Present Member of NIH study section Genetic Variation and Evolution (GVE)

2013- Present Editorial Board, Clinical and Vaccine Immunology

2013- Present Visiting Professor, Lee Kong Chian School of Medicine, Nanyang Technological University

2015-Present Distinguished Professor of Microbiology and Infectious Disease, Penn State

2015-Present Advisory Board for "Microbiome R&D and Business Collaboration Forum"

GRANTS AND CONTRACTS

Previous Research Support

Over $5,000,000 in prior support direct to Harvill lab.

Recent Research Support:

2005-2011 "EID: Parasite Induced Susceptibility and Transmission in a Seasonal Environment: Micro-Macro interaction and the Dynamics of the Parasite Community of Mice" National Science Foundation. PI: Hudson $250,000.

2009-2011 "ARRA: Evolution of the *Bordetella*e from Commensals to Pathogens" National Institute of General Medical Sciences. PI: Harvill $384,000.

2010-2011 "University Strategic Partnership Applied Sciences II" Defense Threat Reduction Agency, PI: Miller $1,057,000.

2010-2011 "The Role of Fimbriae in *Bordetella pertussis* Colonization and Host Response" Sanofi Pasteur Inc. PI: Harvill $169,000.

2010-2012 "ARRA: Expanding Data Collection Via High-Throughput DNA Sequencing" National Center for Research Resources, PI: Schuster $500,000.

2010-2012 "Natural Killer T Cells in *Bordetella pertussis* Immunity (Predoctoral Fellowship for Alexia Karanikas)" American Heart Association, PI: Harvill $46,000.

2010-2013 "ARRA: Penn State: ABSL-3 Facility Construction" National Center for Research Resources, PI: Kennett $14,830,000.

2008-2013 "Evolution of the *Bordetella*e from Commensals to Pathogens" National Institute of General Medical Sciences. PI: Harvill $2,200,000.

2010-2014 "Education in Genomics-Based Microbial Forensics" USDA National Institute of Food and Agriculture, PI: Kang $1,000,000.

2011-2014 "Spatial Ecology and Epidemiology of Soil Borne Human and Animal Bacterial Pathogens and Its Public Health Significance in Pakistan" Defense Threat Reduction Agency, PI: Jayarao $842,000.

Current Research Support:

2015-2020 "Microbiota-Pathogen Competition" NIH, NIGMS. PI: Harvill $1,868,750.

2014-2015 "*Bordetella* vs. Microbiota" NIH, NIAID. PI: Harvill $357,000.

2011-2015 "A Metagenomic Approach to Unbiased Identification of Pathogens Endemic to Pakistan" Defense Threat Reduction Agency, PI: Harvill $1,892,000.

2014-2018 "Manipulation of Innate Immune Response by Mucosal Bacterial Pathogens" Singapore Ministry of Education, PI: Kline/Harvill S$1,000,000

2013-2015 "Research on Bordetella pertussis" unrestricted gift from Sanofi-Pasteur. PI: Harvill $129,000.

2013-2015 "Research on Respiratory Infection" Lee Kong Chian School of Medicine, Nanyang Technological University. PI: Harvill S$80,000.

2014-2019 "Air Microbiome" Singapore Ministry of Education, PI: Kjelleberg S$25,000,000

2015-2017 "*Bordetella pertussis* Acellular Vaccine Enhancement" CDC, PI: Harvill $300,000 direct

2015-2017 "*Bordetella pertussis* Molecular Mechanisms of Transmission" CDC, PI: Harvill $300,000 direct

SELECTED PUBLICATIONS

1. Hester SE, Goodfield LL, Park J, Feaga JA, Ivanov Y, Bendor L, Taylor DL,**Harvill ET**. Host specificity of ovine Bordetella parapertussis and the role of complement. PLoS ONE; 2015 Jul 9;10(7):e0130964. doi: 10.1371/journal.pone.0130964. eCollection 2015.
2. Register KB, Ivanov YV, **Harvill ET**, Brinkac L, Kim M, Losada L. (2015) Draft genome sequences of six Bordetella hinzii isoletes acquired from avian and mammalian hosts. *Genome Announcements*; 3(2). DOI:10.1128/genomeA.00081-1.

3. Register KB, Ivanov YV, Jacobs N, Meyer JA, Goodfield LA, Muse SJ, Smallridge WE, Brinkac L, Kim M, Sanka R, **Harvill ET**, Losada L. (2015) Draft genome sequences of 53 genetically distinct isolates of Bordetella bronchiseptica representing 11 terrestrial and aquatic hosts. *Genome Announcements*; 3(2). DOI:10.1128/genomeA.00152-15.
4. Malys T, Linz B, Ivanov Y, Shabbir MZ, Rabbani M, Ahmad H, Shabbir MAB, Raygoza Garay JA, Mwangi MM, Yaqub T, Ahmad A, **Harvill ET**. (2014) The microbiome of the lower respiratory tract of healthy and diseased chickens from Pakistan. PLoS ONE.
5. Gorgojo J, **Harvill ET**, Rodriguez ME. (2014) Bordetella parapertussis survives inside human pacrophages in lipid raft enriched phagosomes. *Infection and Immunity*; 2014 Dec;82(12):5175-84. doi: 10.1128/IAI.02553-14. Epub 2014 Sep 29.
6. Place DE, Muse SJ, Kirimanjeswara GS,**Harvill ET**. (2014) Caspase-1-independent interleukin-1β is required for clearance of Bordetella pertussis infections and whole-cell vaccine-mediated immunity. (2014) PLoS ONE; 9(9):e107188. DOI:10.1371/journal.pone.0107188.
7. **Harvill ET**, Goodfiel LL, Ivanov Y, Smalldrige WE, Meyer JA, Cassiday PK, Tondella ML, Brinkac L,Sanka R, Kim N, Losada L. (2014) Genome sequences of nine Bordetella holmesii strains isolated in the United States. *Genome Announcements*; 2(3). DOI:10.1128/genomeA.00438-1.
8. Hewlett EK, Burns DK, Cotter PA, **Harvill ET**, Merkel TJ, Quinn CO, Stibitz ES. (2014) Pertussis pathogenesis - what we know and what we don't know. *The Journal of Infectious Diseases*; 209(7):982-5. DOI:10.1093/infdis/jit639.
9. Bart MJ, Harris SR, Advani A, Arakawa Y, Bottero D, Bouchez V, Cassiday PK, Chiang C-S, Dalby T, Fry NK, Gaillard ME, van Gent M, Guiso N, Hallander HO,**Harvill ET**, He Q, van der Heide H, Keuvelman K, Hozbor D, Kamachi K, Karataev GI, Lan R, Lutylska A, Maharjan RP, Mertsola J, Miyamura T, Octavia S, Preston A, Quail MA, Sintchenko V, Stefanelli P, Tondella ML, Tsang RSW, Xu Y, Yao S-M, Zhang S, Parhill J, Mooi F. (2014) Global population structure and volution of Bordetella pertussis and their relationship with vaccination. *mBio*; 5(2). DOI:10.1128/mBio.01074-14.
10. Rolin O, Muse SJ, Chetan S, Shokrollah E, Gerdts V, Hittle LE, Ernst RK, **Harvill ET**, Preston A. (2014) Enzymatic modification of lipid A by ArnT protects Bordetella bronchiseptica against cationic peptides and is required for transmission. I*nfection and immunity*; 82(2):491-9. DOI:10.1128/IAI.01260-12.
11. Smallridge WE, Rolin OY, Jabocs NT,**Harvill ET**. (2014) Different effects of whole-cell and acellular vaccines on Bordetella transmission. *The Journal of Infectious Disease*; 2014 Jun 15;209(12):1981-8. doi: 10.1093/infdis/jiu030. Epub 2014 Jan 16.
12. Rolin O, Smallridge W, Henry M, Goodfield L, Place D, **Harvill ET**. (2014) Toll-like receptor 4 limits transmission of Bordetella bronchiseptica. PLoS ONE; 9(1):e85229. DOI:10.1371/journal.pone.0085229.
13. Weyrick LS, Feaga HA, Park J, Muse SJ, Chetan YS, Rolin OY, Young SE, **Harvil ET**. (2013) Resident microbiota affect Bordetella pertussis infectious dose and host specificity. *The Journal of Infectious Diseases*; 2014 Mar;209(6):913-21. doi: 10.1093/infdis/jit597. Epub 2013 Nov 13.
14. **Harvill ET**, Goodfiel, LL, Ivanov Y, Meyer JA, Newth C, Cassiday P, Tondella MK, Liao P, Zimmermann J, Meert K, Wessel D, Berger J, Dean JM, Holubkov R, Burr J, Liu T, Brinkac L, Kim M, Losada L. (2013) Genome sequences of 28 Bordetella pertussis U.S. outbreak strains dating from 2010 to 2012. *Genome Announcements*; 1(6). DOI:10.1128/genomeA.01075-13.
15. Hester SE, Park J, Goodfield LL, Feaga HA, Preston A, **Harvill ET**. (2013) Horizontally acquired divergent O-antigen contributes to escape from cross-immunity in the classical bordetellae. *BMC Evolutionary Biology*; 13(1):209. DOI:10.1186/1471-2148-13-209.

16. Pinkerton M, Chinchilli V, Banta E, Craig T, August A, Bascom R, Cantorna M,**Harvill ET**, Ishmael FT. (2013) Differential expression of microRNAs in exhaled breath condensates of patients with asthma, patients with chronic obstructive pulmonary disease and healthy adults. *The Journal of allergy and clinical immunology*; 132(1). DOI:10.1016/j.jaci.2013.03.006.
17. Berger JT, Carcillo JA, Shanley TP, Wessel DL, Clark A, Holubkov R, Meert KL, Newth CJL, Berg RA, Heidemann S, Pollac M, Dalton H, **Harvill ET**, Karanikas A, Liu T, Burr JS, Doctor A, Dean JM, Jenkins TL, Nicholson CE (2013) Critical pertussis illness in children: a multicenter prospective cohort study. *Pediatric Critical Care Medicine*; DOI:10.1097/PCC.0b013e31828a70fe.
18. Lass S, Hudson PJ, Thakar J, Saric J,**Harvill ET**, Albert R, Perkins SE. Generating super-shedders: co-infection increases bacterial load and egg production of a gastrointestinal helminth. (2013) *Journal of The Royal Society Interface*; 10(80):20120588. DOI:10.1098/rsif.2012.0588.
19. **Harvill ET**. (2013) "Cultivating Our Frienemies: Viewing Immunity As Microbiome Management" *mBio*. 2013 Mar 26;4(2).
20. Weyrich SL, Feaga HA, Park J, Muse SJ, Safi CY, Rolin OY, Young SE, Harvill ET(2013) "Resident Microbiota Affect Bordetella pertussis Infectious Dose and Host Specificity" *Journal of Infectious Diseases*, accepted September 23, 2013.
21. Hester SE, Park J, Goodfield LL, Feaga HA, Preston A and **Harvill ET** (2013) "Horizontally Acquired Divergent O-antigen Contributes to Escape from Cross-Immunity in the Classical Bordetellae" *BMC Evolutionary Biology*, in press.
22. Lass S, Hudson PJ, Thakar J, Saric J,**Harvill ET**, Albert R, Perkins SE. (2013) "Generating super-shedders: co-infection increases bacterial load and egg production of a gastrointestinal helminth". J R Soc Interface. 2012 Dec 19;10(80):20120588.
23. Weyrich LS, **Harvill ET** (2013) "Teaching Ethical Aptitude to Graduate Student Researchers" Accountability in Research, 2013;20(1):5-12.
24. Park J, Zhang Y, Buboltz AM, Zhang X, Schuster SC, Ahuja U, Liu M, Miller JF, Sebaihia M, Bentley SD, Parkhill J,**Harvill ET**. (2012) Comparative genomics of the classical Bordetella subspecies: the evolution and exchange of virulence-associated diversity amongst closely related pathogens. BMC Genomics. 13(1):545.
25. Weyrich LS, Rolin OY, Muse SJ, Park J, Spidale N, Kennett MJ, Hester SE, Chen C, Dudley EG, and **Harvill ET**. (2012) "A Type VI Secretion System Encoding Locus is Required for Bordetella bronchiseptica Immunomodulation and Persistence In Vivo" PLoS ONE, 2012;7(10):e45892.
26. Gorgojo J, Lamberti Y, Valdez H, **Harvill ET**, Rodríguez ME. (2012) "Bordetella parapertussis survives the innate interaction with human neutrophils by impairing bactericidal trafficking inside the cell through a lipid raft-dependent mechanism mediated by the lipopolysaccharide O antigen." Infect Immun. 2012 Oct 1.
27. Ahuja U, Liu M, Tomida S, Park J, Souda P, Whitelegge J, Li H, **Harvill ET**, Parkhill J, Miller JF. (2012) "Phenotypic and Genomic Analysis of Hypervirulent Human-associated Bordetella bronchiseptica." BMC Microbiol. 2012 Aug 6;12:167.
28. Zhang X, Weyrich LS, Lavine JS, Karanikas AT, **Harvill ET**. (2012)"Lack of Cross-protection against Bordetella holmesii after Pertussis Vaccination." Emerg Infect Dis. 2012 Nov;18(11):1771-9.
29. Hester SE, Lui M, Nicholson T, Nowacki D, and **Harvill ET**, (2012)"Identification of a CO2 responsive regulon in Bordetella" PLoS ONE, 2012;7(10):e47635.
30. Barchinger SE, Zhang X, Hester SE, Rodriguez ME, **Harvill ET**, Ades SE. (2012) "sigE facilitates the adaptation of Bordetella bronchiseptica to stress conditions and lethal infection in immunocompromised mice." BMC Microbiol. 2012 Aug 16;12(1):179.

BIOGRAPHICAL SKETCH

NAME Biao He	POSITION TITLE Professor and GRA-Distinguished Investigator Fred C. Davison Distinguished University Chair
eRA COMMONS USER NAME biaohe	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Wuhan University, Wuhan, China	B.S.	1987	Virology
State University of New York Downstate Brooklyn, NY	Ph.D.	1996	Molecular Biology
Howard Hughes Medical Institute Northwestern University, Evanston, IL		1996-2001	Molecular Virology

A. PERSONAL STATEMENT

For past 19 years, I have been working with paramyxoviruses, including PIV5, mumps virus (MuV) and J paramyxovirus (JPV). My research has been focused on examining virus and host interaction at molecular level as well as at organism level (i.e., infection of animals: chicken, mouse, hamster, ferret, dog, swine and monkey). My lab has defined functions of the small hydrophobic (SH) protein (1). In addition, we are the first to identify a viral mRNA that activates MDA5-dependent interferon-β expression (2). My lab has generated recombinant viruses for PIV5, mumps and J paramyxovirus (3 and 4). Taking advantage of our expertise, we have expanded our work into developing vaccines using these viruses as vectors. We have developed vaccine candidates for influenza virus, rabies virus, RSV, Nipah virus, Ebola virus, HIV, *Mycobacteria tuberculosis* and malaria using these viruses as vectors (5). We have published 56 papers and in 2015, we have published 6 papers (4 JVI, 1 PLOS one and 1 PNAS), 2 manuscripts in revision and 1 under review.

This proposal is a team effort. Drs. He and Fu have been working together on developing a rabies vaccine for animals and humans based on PIV5 (Chen et al, 2013, 1c) as well as on developing a therapy for rabies diseases (Huang et al, 2015). Dr. He has developed the PIV5-based vaccine system. Dr. Fu is an expert on rabies and rabies vaccine development. Dr. Kaori Sakamoto is a board certified animal pathologist and has been working with Dr. He for over six years. Drs. Sakamoto and He have been published three papers together and one is under revision. Dr. Marc Kent is a neurosurgeon and specializes on treating dogs with brain tumors. All members are on the faculty of veterinary medicine on the campus of University of Georgia.

1. Wilson, R.L., Fuentes, S. and **He, B.** (2006) Functions of Small Hydrophobic Proteins of Paramyxovirus ***J. Virol.*** *80 (4): 1700-9*
2. Luthra, P, Sun, D., Silverman, R. H. and **He, B.** (2011) Activation of IFN expression by a viral mRNA through a MDA 5/RNase L pathway. ***Proc. Natl. Acad. Sci.*** *108:2118-2*
3. Xu, P, Li, Z., Sun, D., Lin, Y., Wu, J., Rota, P.A. and **He, B.** (2011) Rescue of Wild-type Mumps Virus from a Strain Associated with Recent Outbreaks Helps to Define the Role of the SH ORF in the Pathogenesis of Mumps Virus ***Virology*** *15;417(1):126-36*
4. Li Z, Xu J, Chen Z, Gao X, Wang LF, Basler C, Sakamoto K, **He B.** (2013) The L gene of J paramyxovirus plays a critical role in viral pathogenesis ***J Virol.*** *87(23):12990-8.*
5. Phan S., Chen Z., Xu P., Li Z., Gao X., Foster S., Teng M.N., Tripp, R.A., Sakamoto K. and **He B.** (2014) A respiratory syncytial virus (RSV) vaccine based on parainfluenza virus 5 (PIV5) ***Vaccine*** *32(25):3050-7.*

B. POSITIONS AND HONORS

Positions and Employment

1987-1989	Research Fellow, National Institute of Vaccine and Serum, Beijing, P. R. China
1996-2001	Associate, HHMI, Department of Biochemistry, Molecular Biology and Cell Biology, Northwestern University, Evanston, IL
2001-2007	Assistant Professor, Pennsylvania State University, University Park, PA
2002-	Visiting Professor, Wuhan University, P. R. China
2007-2009	Associate Professor, Pennsylvania State University, University Park, PA
2009-2011	Associate Professor and GRA-Distinguished Investigator, Department of Infectious Diseases, University of Georgia, Athens, GA
2010-	Founder and President, Cyan Bio Inc., Athens, GA
2011-	Professor and GRA-Distinguished Investigator, Department of Infectious Diseases, University of Georgia, Athens, GA
2014-	Fred C. Davison Distinguished University Chair, University of Georgia, Athens, GA

Honors

2002	Young Scientist Travel Award, American Society for Virology
2002-04	Joan Luerssen Faculty Enhancement Fund, Pennsylvania State University
2002-06	Scientist Development Award, American Heart Association
2005-07	Young Investigator Award, Alliance for Cancer Gene Therapy
2009-	Georgia Research Alliance (GRA) Distinguished Investigator

C. CONTRIBUTION TO SCIENCE

1. DEVELOPING PARAINFLUENZA VIRUS 5 (PIV5) AS A VACCINE VECTOR

I started my research on PIV5 as a post-doctoral fellow in Dr. Robert A Lamb's lab in 1996. At the time, there was not a reverse genetics system for PIV5, a negative stranded non-segmented RNA virus, to allow genetic manipulation of PIV5 genome. I generated a reverse genetics system for PIV5, thus, allowing modification of PIV5 genome through its cDNA(a). The system was used for studies of PIV5 viral proteins as well as a platform for expressing foreign genes. While I believe PIV5 has many advantages over an adenovirus (AdV)-based vector, the field of viral vectored vaccines development was dominated by AdV. It was difficult to convince people and even harder to obtain funding for developing PIV5 as a vector. It took me 10 years to publish our first paper on using PIV5 as a vaccine vector in 2007 (b). Recently, we have demonstrated that PIV5 is effective as a vaccine vector for influenza A viruses H5N1 and H7N9, rabies virus and respiratory syncytial virus in animals (c and d). I am the inventor of the patent "PIV5 based vaccines" (PCT/US2013/022962). This patent has been licensed to a Fortunate 100 company and others for vaccine development. At present, NIH is supporting the development of HIV and malaria vaccines based on PIV5.

a. **He, B.,** Paterson, R. G., Ward, C. D. and Lamb, R. A. (1997) Recovery of infectious SV5 from cloned DNA and expression of a foreign gene ***Virology*** 237, 249-260.

b. Tompkins, S.M., Lin, Y., Leser, G.P., Kramer, K.A., Haas, D.L., Durbin, R.K., Durbin, J.E., Tripp, R., Lamb, R.A. and **He, B.** (2007) Recombinant parainfluenza virus 5 (PIV5) expressing the influenza A virus hemagglutinin provides immunity in mice to influenza A virus challenge ***Virology,*** *362(1): 139-150*

c. Chen, Z., Zhou, M., Gao, X., Zhang, G., Ren, G, Fu, Z.F. and **He, B.** (2013) A novel rabies vaccine based on a recombinant parainfluenza virus 5 expressing rabies virus glycoprotein ***J. Virol.*** *87(6):2986-93*

d. Phan S., Chen Z., Xu P., Li Z., Gao X., Foster S., Teng M.N., Tripp, R.A., Sakamoto K. and **He B.** (2014) A respiratory syncytial virus (RSV) vaccine based on parainfluenza virus 5 (PIV5) ***Vaccine*** *32(25):3050-7*.

2. DEVELOPING A NOVEL MUMPS VACCINE

MuV, a paramyxovirus, causes acute inflammatory infections in humans involving most organ systems. MuV is most notable as a highly neurotropic and neurovirulent agent causing a number of central nervous system manifestations ranging from mild meningitis to severe, and occasionally fatal, encephalitis. MuV infection was the most common cause of viral meningitis and encephalitis before the use of MuV vaccine. MuV vaccine (Jeryl Lynn strain, JL), a live attenuated virus, was first licensed in 1967. MuV vaccination is a part of 2-dose MMR (mumps, measles and rubella) vaccine regimen that is administrated to children at 1 and 5 years of age. Annual reported cases of mumps reduced from 150,000 in pre-vaccination era to about 350 nationwide between 2000 and 2005. A goal of eliminating MuV in US by 2010 was set by the US Department of Health and Human Services in 2000. However, I felt that the 2010 elimination date in the US was unlikely. There were large outbreaks in the UK. MuV vaccination rate in the UK was at its peak at 92% in 2-year old with 1-dose MMR in 1995 and dropped to 82% in 2005. The outbreaks occurred in the UK and the outbreaks implied that the vaccine did not work as well as it should have. Soon after I established my own lab in 2001, I started working on mumps virus. In 2004, I submitted my first grant on studies of mumps virus pathogenesis after investing my time, effort and resources from my limited startup fund to obtain sufficient preliminary data. My grants received decent scores but were just beyond the payline. Reservation from review committees was understandable. On the one hand there was the medical establishment in the US who saw the elimination of mumps in the US in sight and did not see a need to invest limited resources in mumps virus research; On the other hand, it was me, a newly independent scientist, who tried to convince establishment the need to study mumps virus. In 2006, the US experienced the largest mumps epidemic in nearly 20 years. Over 6,500 mumps cases were reported. The 2006 outbreak is considered first two-dose MuV vaccine failure. Interestingly, the particular virus responsible for the US epidemic is of the same genotype that has caused the massive epidemic in the UK where over 56,000 cases were reported in the 2004/2005 season. The 2006 outbreak made big news in mainstream news media, including the *Washington Post*. I took the lengthy article in the *Washington Post* and sent it to a program officer in NIH. Within 24 hours, a commitment was made by NIH to fund my grant that was just beyond the payline. At the time, there was not a single grant funded by NIH to study mumps virus. Since the 2006 outbreak, a large outbreak occurred in New York and New Jersey with 1,521 reported cases in Feb. 2010 before the outbreak was over.

The cause of the outbreaks is not clear at this time; however, it is possible that a new MuV emerged and/or the vaccine is not effective against this new strain of MuV. A new mumps vaccine will be ideal to deal with these problems. Since I have been funded in 2006, we have determined the entire sequence of the MuV in the 2006 outbreak. We have generated reverse genetics system for the 2006 isolate (a). Using the reverse genetics system, we have generated a recombinant MuV lacking the V protein. The most important thing is that this virus is attenuated *in vivo* (rMuVΔV). In neurotoxicity tests performed by Dr. Steve Rubin, the most prominent safety expert on mumps virus at FDA, rMuVΔV had lower neurotoxicity than current vaccine JL, the gold standard of a safe vaccine (b). Furthermore, we have found that rMuVΔV is as immunogenic as wild type virus and grows as well as wild type in Vero cells that are FDA-approved for vaccine production (c). Our grant on developing a new mumps vaccine was given a perfect score and has been funded by the NIH. We have now developed animal models to test efficacy of new MuV vaccine (d).

I took a calculated risk in investing my future research program against the prevailing thought of the time and persisted to have survived. While I am proud of my scientific accomplishment of developing a potential vaccine for mumps virus using a novel approach, I also felt that I have been very lucky. Had the outbreak of mumps not happened in 2006, I doubt that my mumps research would have gone this far. I have also been fortunate that many people had helped me with my beginning the mumps virus work. Dr. Paul Rota in the CDC helped me with getting the isolate from 2006 outbreak. Dr. Steve Rubin at FDA helped with neurotoxicity tests and allowed me to stay in his lab in FDA to learn about mumps virus. I enjoy working with others.

a. Xu, P, Li, Z., Sun, D., Lin, Y., Wu, J., Rota, P.A. and **He, B.** (2011) Rescue of Wild-type Mumps Virus from a Strain Associated with Recent Outbreaks Helps to Define the Role of the SH ORF in the Pathogenesis of Mumps Virus ***Virology*** *15;417(1):126-36*
b. Xu, P., Luthra, P., Li, Z., Fuentes, S., D'andrea, J.A., Wu, J., Rubin, S., Rota, P.A. And **He, B**. (2012) The V Protein Of Mumps Virus Plays A Critical Role In Pathogenesis ***J. Virol.*** *86(3):1768-76*
c. Xu P, Chen Z, Phan. S, Pickar A. and **He B.** (2014) Immunogenicity of novel mumps vaccine candidates generated by genetic modification ***J Virol.*** *88(5):2600-10*
d. Xu P, Huang Z, Gao X, Michel FJ, Hirsch G, Hogan RJ, Sakamoto K, Ho W, Wu J and **He B.** (2013) Infection of mice, ferrets, and rhesus macaques with a clinical mumps virus isolate. ***J. Virol.*** *87(14):8158-68*

3. DEFINING FUNCTIONS OF SH

SH proteins are encoded by paramyxoviruses PIV5, MuV, RSV and JPV. The functions of SH proteins were not known. My lab first reported that they play a role in inhibiting TNF-α signaling *in vitro* (a, b and c).

While the roles of the SH proteins in viral pathogenesis were studied using tissue culture systems, their roles *in vivo* are not clear due to the lack of appropriate animal model systems. We plan to study the roles of SH in animals in this proposal. JPV naturally infects rodents, the SH of JPV is the only feasible model to understand the functions of the SH protein *in vitro* as well as *in vivo*.

a. Lin, Y., Bright, A.C., Rothermel, T.A. and **He, B.** (2003) Induction of apoptosis by paramyxovirus simian virus 5 lacking small hydrophobic gene. ***J. Virol.*** *77(6): 3371-83*
b. Wilson, R.L., Fuentes, S. and **He, B.** (2006) Functions of Small Hydrophobic Proteins of Paramyxovirus ***J. Virol.*** *80 (4): 1700-9*
c. Fuentes, S., Tran, K.C., Teng, M.N. and **He, B.** (2007) Function of the respiratory syncytial virus small hydrophobic protein ***J. Virol.*** *81(15): 8361-6* **(selected as the spotlight for the August 15th issue)**

4. ACTIVIATION AND INHIBITON OF INNATE IMMUNITY BY PARAMYXOVIRUS

Innate immune responses are critical in host defense against infections. Interferon (IFN) plays the most critical role in innate immune responses against viral infections. In addition, IFN plays an important role in adaptive immune responses as well as in cancer. Viral infection triggers the expression of IFN-β in infected cells. Retinoic acid-inducible gene-I (RIG-I) and melanoma differentiation associated gene-5 (MDA5) are two RNA helicases that are involved in cytoplasmic sensing of pathogen-associated molecule patterns (PAMPs) during viral infection, leading to activation of IFN expression. It is well established that RIG-I recognizes 5' triphosphate RNA generated during viral infection, which is different from host RNA. What PAMP MDA5 recognizes and how it differentiates PAMP from self-RNA are not clear. It has been reported that stable, long, double-stranded (ds) RNA structures greater than 2 kilobase (kb) pairs in size, presumably with 5'-triphosphates generated during virus infection (not typical of self RNA), may serve as a distinguishing factor for MDA5-specific recognition.

Parainfluenza virus 5 (PIV5) is a prototypical paramyxovirus. The V protein of PIV5 is known to block IFN activation. In our studies, infection of a mutant PIV5 lacking the cysteine-rich C-terminus of the V protein (rPIV5VΔC) produced large amount of IFN-β (a). Using this virus as a model inducer of IFN-β expression, we have identified the L gene of PIV5 being responsible for activating IFN-β expression (b). Interestingly, the mRNA of L, not the protein, is capable of activating IFN-β expression through a MDA5-dependent pathway (c). We, for the first time, have identified a natural ssRNA trigger for MDA5 in our studies. This work has not only led to identification of novel triggers for MDA5, but also may lead to discovery of small RNA molecules capable of activating expression of interferon expression, which might be used as a broad anti-viral drug and adjuvant.

a. **He, B.,** Paterson, R.G., Stock, N., Durbin, J.E., Durbin, R. K., Goodbourn, S., Randall, R.E. and Lamb, R.A. (2002) Recovery of paramyxovirus simian virus 5 with a V protein lacking the conserved cysteine-rich domain: The multifunctional V protein blocks both interferon-β induction and interferon signaling. ***Virology,*** 303, 15–32
b. Luthra, P., Sun, D., Wolfgang**,** M., and **He, B. (**2008) Activation of NF-κB Through an AKT1-dependent Pathway by the L protein of parainfluenza virus 5 (PIV5) ***J. Virol.*** *82:10887-95*
c. Luthra, P, Sun, D., Silverman, R. H. and **He, B.** (2011) Activation of IFN expression by a viral mRNA through a MDA 5/RNase L pathway. ***Proc. Natl. Acad. Sci.*** *108:2118-2*

5. UNDERSTANDING PATHOGENESIS OF J PARAMYXOVIRUS

J paramyxovirus (JPV) was first isolated from rodents in the early 1970s in Australia. It was identified as a paramyxovirus based on morphological studies. In 2005, its genome structure was determined. The JPV genome has eight genes in the order of 3'-N-P/V/C-M-F-SH-TM-G-L-5'. JPV encodes a TM (transmembrane) protein that has no homology to any known proteins and does not exist in any other classified paramyxoviruses. Phylogenetic analysis of the genome of JPV indicates that *Henipavirus,* an emerging paramyxovirus genus, is evolutionally the closest to JPV. Incidentally, Hendra virus, a *Henipavirus*, was first isolated in Australia as well.

In 2011, we established the first reverse genetics system for JPV and generated the largest non-segmented negative stranded RNA virus (a). In 2013, we identified an isolate of JPV that causes disease in laboratory mice and found that the L gene plays critical in JPV pathogenesis (b).

a. Li Z, Xu J, Patel J, Fuentes S, Lin Y, Anderson D, Sakamoto K, Wang LF, and **He, B.** (2011) Function of the small hydrophobic protein of J paramyxovirus ***J. Virol.*** *85:32-42.*
b. Li Z, Xu J, Chen Z, Gao X, Wang LF, Basler C, Sakamoto K, **He B.** (2013) The L gene of J paramyxovirus plays a critical role in viral pathogenesis ***J Virol.*** *87(23):12990-8.*

D. RESEARCH SUPPORT

Active

1R01AI097368-02 (He, PI) 5/10/2012 – 4/30/2017
NIH/NIAID
Developing A Novel Mumps Virus Vaccine
The major goal of this project is to develop novel mumps virus vaccine.

1R01AI106307-01 (Luo and He, MPI) 8/1/2013 – 7/31/2017
NIH/NIAID
Mechanism of Paramyxovirus Replication
The major goal of this project is to investigate mechanism of mumps virus RNA synthesis using structural and functional approaches.

1R01AI111863-01 (Spearman and He, MPI) 4/10/2014-11/30/2018
NIH/NIAID
Mucosal Protection Against HIV Generated by PIV5 Priming and VLP Boosting
The major goal of this project is to test feasibility of using PIV5 as a vector for HIV vaccine development.

1R21AI110849-01A1 (He, PI) 4/7/2015 – 3/31/2017
NIH/NIAID
Developing A Novel Viral Vector For A Human Malaria Vaccine
The major goal of this project is to test feasibility of using PIV5 as a vector for malaria vaccine development.
A Novel Approach for *Mycobacterium Tuberculosis* Vaccine Development

BIOGRAPHICAL SKETCH

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

NAME: Frederick D. Quinn

eRA COMMONS USER NAME (credential, e.g., agency login): fquinn

POSITION TITLE: Professor and Department Head – UGA; Founder – Pathens, Inc.

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

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Marquette University, Milwaukee, WI	B.S.	05/1980	Biology/Chemistry
Indiana University, Bloomington, IN	M.A.	05/1982	Microbiology
Indiana University, Bloomington, IN	Ph.D.	08/1985	Microbiology
University of Tennessee, Memphis, TN	Postdoctoral	04/1986	Molecular Biology
Stanford University, Stanford, CA	Postdoctoral	09/1989	Cellular Microbiology

A. Personal Statement

The BCG vaccine, developed nearly a century ago, offers variable protection against pulmonary tuberculosis. This proposal is designed around the concept that the continuing spread of tuberculosis cannot be halted without the development of a new far more effective vaccine to replace BCG. My research program over the past decade at the Centers for Disease Control and Prevention and now at the University of Georgia has focused on identifying and studying genetic mechanisms of mycobacterial (particularly *M. tuberculosis*) pathogenesis, and using these factors as therapeutic, diagnostic and vaccine targets. My laboratory has developed and routinely used new and pre-existing *in vitro* (tissue culture), *ex vivo* (organ culture) and *in vivo* (animal) model systems to achieve our goals. Most recently, in a STTR Phase I award to Pathens, Inc., we developed and demonstrated protective efficacy of a PathVec-based antigen 85B-expressing intranasal vaccine in *Mycobacterium tuberculosis* aerosol-challenged guinea pigs. This proposed Phase II project is a logical extension of that work, and I am looking forward to the challenges and rewards it will bring. My contributions to this proposed project will include participation in the vaccine safety and immune response analyses, general oversight of all project aims, writing and submitting manuscripts, and communicating with the funding agency.

B. Positions and Honors

Positions and Employment

Centers for Disease Control and Prevention
1989-1993; Supervisory Microbiologist, Division of Bacterial Diseases
1994-1996; Chief, Pathogenesis Laboratory, Division of Bacterial and Mycotic Diseases
1996-2001; Chief, Pathogenesis Laboratory, Division of AIDS, STD, and TB Laboratory Research
Emory University
1993-2001; Microbiology Instructor, School of Nursing
2003-present; Adjunct Assistant Professor, School of Medicine
University of Georgia
2002-present; Professor and Head, Department of Infectious Diseases
2002-2006; Chair, Division of Infectious Diseases, Biomedical and Health Sciences Institute
Pathens, Inc.
2006 Founder
2009-2015; CEO

Other Experience and Professional Memberships

1982-present; Member, American Society for Microbiology
1989, 1997, 2002; Member, Veterans Administration Study Section
1990-present; Editorial Board, *Current Microbiology*
1991-1999; Member, CDC Extramural Study Section
1992-1995, 1998-2005; *ad hoc* member, USDA Study Section
1993-1996; Member, WHO Vaccine Grants Section
1993-present; Editorial Board, *Applied Biochemistry and Biotechnology*
2005-present; Editorial Board, *The Veterinary Journal*
2005-2009, 2015; *ad hoc* member, NIH IBD Study Section
2011-NIH Partnerships for Development of Vaccine Technologies Study Section
2012-present Panel Member, AAAS Research Competitiveness Program
2012, 2014-Member NIH Special Emphasis Panel on Infectious Diseases and Aging

Honors

1992; Director's Award, Centers for Disease Control
1994; Secretary's Award, U.S. Department of Health and Human Services
1995; James K. Nakano Citation, Centers for Disease Control and Prevention
1996; Trudeau Outstanding Young Investigator Award, American Lung Association
1999; Fulbright Scholar
2001; Honor Award, National Center for Infectious Diseases
2010; Athletic Department Endowed Professorship in Infectious Diseases, University of Georgia

C. Contributions to Science

1. Early publications from my graduate, postdoctoral and early CDC years, described studies that defined genetic virulence mechanisms for a number of bacterial pathogens including *Legionella pneumophila, Listeria monocytogens, Haemophilus influenzae* biogroup *aegyptius*, *Capnocytophaga canimorsus Neisseria meningitidis, Afipia felis, Mycobacterium ulcerans,* and ultimately *Mycobacterium tuberculosis*. CDC efforts in particular were focused on coordinating efforts to control new and re-emerging US and international bacterial diseases. With *H. influenzae* biogroup *aegyptius*, *C. canimorsus*, *A. felis,* and *M. ulcerans*, few studies other than ours have been published defining basic virulence traits associated with these pathogens. In addition to CDC discretionary funds, many of these studies were funded by WHO and private foundation awards such as American Lung Association. I served as the primary investigator or co-investigator in all of these studies.
    a. Hoffman, P.S., C.A. Butler, and **F.D. Quinn**. 1989. Cloning and temperature-dependent expression in *Escherichia coli* of a *Legionella pneumophila* gene encoding a genus-common 60 kilodalton antigen. Infect. Immun. **57**: 1731-1739.
    b. Weyant, R.A., F.D. Quinn, M.J. Worley, V.G. George, E.H. White and E.A. Utt. 1994. Tissue culture assay that differentiates virulent from avirulent strains of *Haemophilus influenzae*, biogroup aegyptius. J. Infect. Dis. **169**: 430-433.
    c. Utt, E.A., J.P. Brousal, L.C. Kikuta-Oshima and **F.D. Quinn**. 1995. The identification of bacterial gene expression differences using mRNA-based isothermal subtractive hybridization. Can. J. Microbiol. **41**:152-156.
    d. Posey, J.E., T.M. Shinnick and **F.D. Quinn**. 2006. Characterization of the twin arginine translocase (TAT) secretion system of *Mycobacterium smegmatis*. J. Bacteriol. 188: 1332-1340.

2. The final two CDC programs that I supervised were the Emerging Bacterial Diseases Laboratory and the TB Pathogenesis Laboratory. The unit mandates permitted the development of *in vitro* and *in vivo* models to complement the molecular genetic methods for examining bacterial virulence.
    a. Fischer, L.J., R.S. Weyant, E.H. White, and **F.D. Quinn**. 1995. Invasion, intracellular multiplication, and toxic destruction of cultured macrophages by *Capnocytophaga canimorsus*. Infect. Immun. **63**: 402-409.
    b. **Quinn, F.D.**, R.S. Weyant, M. J. Worley, E.H. White, E.A. Utt, and E.A. Ades. 1995. Human microvascular endothelial tissue culture cell model for studying the pathogenesis of Brazilian purpuric fever. Infect. Immun. **63**:2317-2322

c. Steinert, M., K. Birkness, E. White, B. Fields, and **F. Quinn**. 1998. *Mycobacterium avium* bacilli grow saprozoically in coculture with *Acanthamoeba polyphaga* and survive within cyst walls. Appl. Environ. Microbiol. **64**:2256-2261.
d. Birkness, K.A., M. Deslauriers, J.H. Bartlett, E.H. White, C.H. King, and **F.D. Quinn**. 1999. An *in vitro* tissue culture bilayer model to examine early events in *Mycobacterium tuberculosis* infection, Infect. Immun. **67**:653-658.
e. Birkness, K.A., J. Guarner, S.B. Sable, R.A. Tripp, K.L. Kellar, J. Bartlett, and **F.D. Quinn.** 2006. An i*n vitro* model of the leukocyte interactions associated with granuloma formation in *M. tuberculosis* infection. Immunol. Cell Biol. 85:160-168.

3. In early 2002, I left CDC to become Professor and Head of the Department of Infectious Diseases at the University of Georgia. In addition to helping build the program, the veterinary environment provided facilities and expertise to develop more appropriate animal models, and vehicles for testing vaccine candidates, diagnostic tests and novel therapies for *M. tuberculosis* (and other zoonotic pathogens). The program-building phase took longer than expected and slowed the research program. Nonetheless, progress is being made.
    a. Gupta, T., K. Fine, R. Karls, and **F. Quinn**. 2013. Infection of *Acanthamoeba polyphaga* by *Mycobacterium shottsii* and *M. pseudoshottsii*. Can. J. Microbiol. 59:570-576.
    b. Jelesijevic, T., S.M. Zimmerman, S.B. Harvey, D.G. Mead, T.L. Shaffer, D.M. Estes, F. Michel, **F.D. Quinn**, R.J. Hogan, and Eric R. Lafontaine. 2015. Use of the Common Marmoset to study *Burkholderia mallei* Infection. PLoS One. 10(4):e0124181. doi: 10.1371/journal.pone.0124181.
    c. Chen, Z., T. Gupta, P. Xu, S. Phan, A. Pickar, W. Yau, R.K. Karls, **F.D. Quinn**, K. Sakamoto, and B. He. 2015. Efficacy of parainfluenza virus 5 (PIV5)-based tuberculosis vaccines in mice. Submitted.

4. Current laboratory research focuses on understanding the pathogenesis of *M. tuberculosis*, with the ultimate goal of developing improved vaccines and diagnostic tests for TB and other respiratory bacterial infectious diseases. Current activities include TB vaccine animal efficacy testing, animal model development for transmission studies, social network transmission studies in Uganda, and zoonotic field studies being organized in Mexico, Egypt, Morocco and Uganda. These studies also demonstrate the policy and commercial implications associated with these findings.
    a. Castro-Garza, J., W. E. Swords, R. K. Karls and **F. D. Quinn**. Dual mechanism for *Mycobacterium tuberculosis* cytotoxicity on lung epithelial cells. 2012. Can. J. Microbiol. 58:909-916.
    b. Fine, K.L., M. Metcalfe, E. White, M. Virji, R.K. Karls, and **F.D. Quinn**. 2012. Involvement of the autophagy pathway in trafficking of *Mycobacterium tuberculosis* bacilli in alveolar epithelial cells. Cell. Microbiol. doi: 10.1111/j.1462-5822.2012.01804.x.
    c. Fine-Coulson, K., S. Giguère, **F.D. Quinn**, and B.J. Reaves. 2015. Infection of A549 human type II epithelial cells with *Mycobacterium tuberculosis* induces changes in mitochondrial morphology, distribution and mass that are dependent on the early secreted antigen, ESAT-6. Microbes Infect. pii: S1286-4579(15)00112-4. doi: 10.1016/j.micinf.2015.06.003.
    d. Chen, X., K. Sakamoto, **F.D. Quinn**, C. Huanchun, and Z.F. Fu. 2015. Persistence of *Mycobacterium tuberculosis* and *M. bovis* Bacille Calmette-Guérin in murine brain microvascular endothelial cells. Submitted.

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/1XQdcr9ShjHQZ/bibliography/48578555/public/?sort=date&direction=ascending.

D. Research Support (last 3 years)
Ongoing Research Support:

FAIN-1458766 8/15/15-7/31/18
NSF/DBI
Design and implement a high-throughput, large-scale computational pipeline to detect changes in organellar morphology of cells infected with bacterial pathogens.

Role: Co-Investigator

1 R21 AI113478-01 (Manley) 7/1/14–6/30/16
NIH/NIAID
Mouse models for TB infection across the lifespan. The focus of this project is to use the unique mouse genetic resources developed in the Manley lab to identify and test specific T cell based mechanisms that may contribute to decreased immune responses to *M. tuberculosis* in the elderly.
Role: Co-PI

1 R01 AI093856-01A1 (Whalen) 4/1/12-3/31/17
NIH/NIAID
Community transmission of tuberculosis in urban Africa. The scientific goal of this project is to understand transmission of *M. tuberculosis* in an urban African setting. The extended, applied goal is to add cost-effective strategies aimed at interrupting transmission of *M. tuberculosis* to current global approaches to tuberculosis control.
Role: Co-Investigator

1 R25GM109435-01 (Moore) 3/1/14–12/31/19
NIH/NIAID
Postbaccalaureate training in infectious diseases.This program will draw on the remarkable strength UGA has in this area and set us apart from other programs. A diverse representation of faculty, research programs and departments is valued by the NIH and included in this program.
Co-Investigator

GRAVL14D5 (Quinn) 10/1/14–12/31/15
Georgia Research Alliance
A novel live intranasal TB vaccine – phase II. The major goal of this study is to facilitate completion of the NIH R41 STTR Phase I aim examining TBVac85 in a long-term vaccination/challenge study.
Role: Co-PI

IPD program (Quinn) 7/1/14-6/30/16
UGA
The ferret as a model of tuberculosis transmission. There currently is no animal model for the study of tuberculosis transmission. The ferret is a good transmission model for influenza. This program of study will determine whether ferrets with acute disease can transmit *Mtb* bacilli to naïve contacts.
Role: Co-PI

Recently Completed Research Support (last 3 years)

1 R41 AI100457-01 (Quinn) 7/1/12-6/30/15
NIH/NIAID
A novel live intranasal TB vaccine. The major goal of this project is to evaluate the protective efficacy of TBVac85 against *Mycobacterium tuberculosis* in a guinea pig intranasal infection model system.
Role: PI

1 U18FD004037-01 (Quinn) 10/1/2010-1/31/15
US Dept of Health & Human Services
Phase II analysis of the alpha-crystallin protein as a diagnostic test for latent tuberculosis. A large number of serum and urine samples from high risk and control groups are being collected and analyzed using a novel latency diagnostic test.
Role: PI

1 R21 AI103575-01A1 (He) 5/15/13-4/30/15
NIH/NIAID
A novel approach for *Mycobacterium tuberculosis* vaccine development. This project examined the efficacy of a parainfluenza virus 5 (PIV5) based *Mycobacterium tuberculosis* vaccine using the mouse aerosol model of infection and protection.