Consortium on Law and Values
in Health, Environment & the Life Sciences
2015-16 Student Proposal Cover Page

Applicant Information

Applicant name:	George Omondi	Email:	paulx176@umn.edu
Project title:	**Optimizing novel diagnostic protocols for management of tuberculosis in a community-driven chimpanzee sanctuary in Africa: Mitigating disease transmission between great apes and humans.**		
Department:	Veterinary Population Medicine	College:	College of Veterinary Medicine
Degree program:	Ph.D. (VMED)	Faculty advisor Name & email:	Dominic Travis datravis@umn.edu ☐ NA
Dept. Head:	Thomas Molitor	Dept. Head's email:	molit001@umn.edu
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How did you hear about this funding opportunity?
☐ Consortium e-mail ☐ The Brief ☐ Advisor ☒ Dept. email/newsletter ☒ Consortium website ☐ Other

Funding

Total amount of funding requested: **$ 7,000**

Executive summary (maximum 200 words)

Wildlife sanctuaries within Africa are critical for great ape conservation and provide a platform for communities to raise awareness through conservation education, and create direct and indirect employment through ecotourism. Unfortunately, close interaction between humans and great apes has led to an increase in disease transmission, threatening both conservation efforts and the goodwill from local communities. Lwiro Chimpanzee Sanctuary is a unique sanctuary located in the Democratic Republic of Congo with a history of tuberculosis and measles, which spread from great apes to their human caregivers and to the community. To maintain great apes health and enhance local community goodwill and involvement in their conservation, a better understanding of the pathways of disease transmission, especially tuberculosis, is essential. In this study, I am evaluating the efficacy of two established tests and validating two novel diagnostic tests for the detection of tuberculosis in great apes, with the potential for noninvasive application to monitor health of free-ranging great ape populations. In combination with available sanctuary clinical records, we aim to develop locally acceptable risk-based tuberculosis surveillance and management strategies, allowing for evidence-based decision making in reducing risk of disease transmission between human and wild ape populations.

Approvals

Check all appropriate approvals required for your proposal. Approvals must be obtained prior to receipt of funding. If you have applied for approval but have not yet received it, indicate that below.

IRB ☐ Yes ☐ No ☒ NA ☐ Application pending

Other ☒ Yes ☐ No ☐ NA ☐ Application pending Specify: IACUC # 1504-32510A

Checklist—for reviewer use

☒ The proposal is 1000 words or less excluding budget, biographies, references and citations.

☒ The proposal includes a work plan with a specific timeline using months or quarters to identify work to be done and completion dates.

☒ The proposal includes a 1-2 paragraph biography of the applicant and all co-investigators.

☒ The budget form is complete including the funds sought for this project, other pending applications for this project, and the amount/source of matching or other funds.

☒ The applicant's faculty advisor is copied on the application email. Professional students w/o advisors check NA.

☒ All necessary approvals are pending or received.

Background

Wildlife sanctuaries within Africa are critical for great ape conservation[1] and provide a platform for communities to raise awareness through conservation education, and create employment through ecotourism. Unfortunately, increasing contact between great apes and humans poses a public and animal health challenge[2]. Lwiro Chimpanzee Sanctuary, Democratic Republic of Congo, has had challenges with tuberculosis (TB) and measles outbreaks, both of which spread to animal keepers and to the community. There were nine confirmed TB cases and 50 chimpanzees underwent treatment, but for a shorter period than prescribed. Two caregivers and the wife of a caregiver tested positive; they were treated for 4 months, a significantly shorter period than advised by the WHO. No testing or follow-up investigations were performed. Given that this sanctuary is situated in a UNESCO ecosystem, houses over 55 chimpanzees and 75 monkeys from ten distinct species, and is working towards reintroducing chimpanzees back to the wild, this is a potentially explosive situation for ape health, human health and livelihoods.

Respiratory diseases and TB, in particular, have caused illness and death in many great ape populations in contact with humans[3, 4,5,6,7], threatening both conservation and goodwill from local communities. In captivity, recurrent outbreaks often coincide with outbreaks in human populations[8, 9]. To maintain great ape health and enhance local community goodwill and involvement in their conservation, we need better tools to diagnose TB in order to understand and mitigate transmission between great apes and humans. This study will allow for the development of effective TB surveillance, thus enhancing animal welfare, while maintaining human health and livelihoods.

Human populations in Africa have a high prevalence of TB[10], and transmission to nonhuman primates increases in areas with high human densities and TB prevalence[11, 12, 13.] Local communities provide the workforce to sanctuaries, creating a bridge between human and captive ape populations. Animal keepers have the highest contact with apes and pose a risk to the animals and human communities if they are infected. However, due to the lack of reliable TB diagnostics, it is difficult to screen animals prior to their arrival at sanctuaries, determine if animals become infected from keepers, or monitor their health prior to reintroduction to the wild. In an internal survey conducted by the Pan-African Sanctuary Alliance (PASA), an association of 22 great ape sanctuaries in Africa, all sanctuaries reported using tuberculin skin tests (TST) as the primary TB surveillance tool for primates, even though the test has poor sensitivity. 30% reported having at least one tuberculosis positive animal while 77% had false positive/negative test results[14]. In four PASA sanctuaries, tuberculosis has been diagnosed in chimpanzees and other primates using alternative tests; all of these animals were negative using TST[14, 15, 16].

Alternative tests to the standard TST exist, but their efficacy in great apes has not been demonstrated. This inability to reliably identify the status of an animal negates the community's conservation efforts and places both wild species and human communities at risk. In addition, noninvasive tests are needed for monitoring of free-ranging populations; allowing for post-reintroduction monitoring of health, and mitigating against disease introduction to wild populations and potentially human communities. Thus, in order to understand the epidemiology of TB in great apes, novel non-invasive and reliable diagnostic tools are needed.

Objective and Significance

The need for sanctuaries in great ape conservation and in the employment and environmental education of local communities cannot be overstated; however disease risks need to be addressed. **The objective of this research is to evaluate and validate the use of four diagnostic tests in the identification of tuberculosis-positive chimpanzees in African sanctuaries and develop a risk-based management strategy for its control.** My work involves validating two novel diagnostic protocols to screen for tuberculosis through detection of mycobacterial DNA in feces and identification of mycobacterial specific-biomarkers produced during an infection (Table 1). I will also evaluate the efficacy of two currently used immune-based diagnostic tests: tuberculin skin tests and interferon gamma test. The results of this study have direct applications to the health of the chimpanzees, other nonhuman primates, and local communities by allowing for risk analysis and evidence-based decision making.

Methods and approaches

This research focuses on Lwiro Chimpanzee Sanctuary because of the need to establish a baseline for health monitoring and the recurrent tuberculosis challenges faced by this unique community-driven sanctuary. Fecal and blood sample will be collected during scheduled health examinations, which will be conducted by myself at the request of the sanctuary management as they do not have a resident veterinarian. We aim to sample 55 resident chimpanzees and any sympatric wild species during the examinations. All samples will be screened using four different TB tests (Table 1). These diagnostic tests results will be triangulated with available sanctuary records to develop effective risk-based surveillance and management plans for tuberculosis control.

Table 1

Test	**Sample collected**	**Mechanism**	**Novelty**	**Citation**
Tuberculin Skin Test	None	- Measures cell-mediated immune response to TB - Bovine and avian purified TB protein derivative injected in to the eye palpebra	- Current diagnostic standard	17
Interferon Gamma Test	Whole blood (3mL) per animal – incubated for 24hrs in a QuantiFERON tube	-Interferon gamma produced following stimulation of T-cells by antigens specific to *M. tuberculosis* and concentration measured using an ELISA kit; results interpreted based on selected cut-off points.	-Diagnosis of latent tuberculosis. -Not affected by Tuberculosis vaccination status	18
Mycobacterial biomarkers	Serum (1ml)	-During TB infection, three proteins are secreted (MB1895c, MB2515c and PKs5) -These can be measured to indicate presence of a TB infection using a high resolution proteomic approach (iTRAQ).	- Able to identify both active and latent infections.	19, 20
Fecal DNA detection	Feces	An insertion element *IS6110* is used to detect the presence of mycobacterial DNA in feces	-Potential for non-invasive diagnosis of tuberculosis in both captive and wild ape populations	16

Timeline: Table 2

Activities	Jun – Jul 2016	Jul - Aug - 2016	Sept – Dec 2016	Jan – Mar 2017
Sampling and Testing	X			
Collation of Sanctuary Records		X		
Laboratory Analysis			X	
Data Analysis and Writing				X

Biography

George Omondi is a wildlife veterinarian and a PhD student in the Veterinary Medicine program in the College of Veterinary Medicine. George obtained his DVM degree in 2009 from the University of Nairobi in Kenya, and has gained extensive experience as a wildlife and primate veterinarian, and manager of wildlife sanctuaries. He was employed by the Kenya Wildlife Service, and then served as Deputy Manager and Head Veterinarian of Sweetwaters Chimpanzee Sanctuary – the only chimpanzee sanctuary in Kenya and a model sanctuary in the Pan-Africa Sanctuary Alliance. At the same time, George served as the Head Veterinarian for Ol Pejeta Conservancy – a unique operation integrating mixed grazing of wildlife and cattle, and community development. George's research interests include understanding the epidemiology and control of infectious diseases, specifically their dynamics at the wildlife-livestock-human interface with a view to ecosystem health preservation, sustainable use and human development. This study is part of his PhD study encompassing multiple PASA sanctuaries.

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Budget for Student Proposals

Project Title: **Optimizing novel diagnostic protocols for management of tuberculosis in a community-driven chimpanzee sanctuary in Africa: Mitigating disease transmission between great apes and humans.**

Instructions: Provide justification along with costs.

			Requested funding	Matching/other funding	
	Category	**Description & justification**	**Amount**	**Amount**	**Source**
1	Your stipend	*What is hourly wage & fringe based on--departmental, community or other rate?*			
2	Speaker honoraria	___ speakers x $ _____ honorarium			
3	Supplies & Services	**Sampling consumables:** $1,800 - for syringes, needles, anesthetic agents, gauze, blood collection tubes and fecal collection pots. **Sanctuary support:** $200 for participating in the study. **Testing consumables:** $15 each for 60 doses of avian and bovine purified protein derivative; $1200 for QuantiFERON - Gold tubes (Nil, Mitigen and TB); Fecal extraction and assays - $45 each for 55 samples; Biomarkers analysis - each for $35 each for 55 samples. **Laboratory consumables:** $1,800	$4,500	$5,800	We have applied for a Morris Animal Foundation Research Grant as part of the larger study, including Sweetwaters in kenya and Ngamba in Uganda to supplement the supplies and expenses, sample storage and subsequent shipping and research and other permits fees (total of $114392- including tuition support for Phd) for Democratic Repubic of Congo.
4	Equipment				
5	Travel	**Air travel:** $2,500 international flight between MSP-NBO-DRC. **Local transportation:** $ 300 **Accomodation and Meals:** $100 per night for 20days.	$2,500	$2,300	
		Subtotal research expenses (2-6)	**$7,000**	**$8,100**	
	TOTAL BUDGET		$7,000	$8,100	$15,100

Budget Guidelines

1. Stipend justification. You must justify the amount of stipend you are requesting by identifying the number of hours you plan to work on the project and the hourly wage used for research assistants in your department. Include fringe benefits.
2. For colloquia, identify the number of speakers and the amount of honoraria you will provide.
3. Supplies and services. List out all supplies and their estimated costs. Explain in line 7 or in the body of your proposal what the supplies will be used for.
4. Equipment costs are allowable only if the justification clearly shows that the equipment is necessary for the project. Include explanation of what will happen to equipment at completion of project.
5. Travel costs must include a description of the purpose of the travel, start and stop dates of travel, transportation costs, housing costs, and allowable per diem (use University rates found at http:// travel/umn.edu).