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**SUMMER RESEARCH
TRAINING PROGRAM AWARDS
2009**

**TUFTS UNIVERSITY
CUMMINGS SCHOOL OF
VETERINARY MEDICINE**



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2009 Summer Research Training Program Awards

<u>Awardee</u>	<u>Award Type</u>	<u>Title of Research Project</u>
Mehnaz Aziz V'12	Morris	Feasibility Study on Using Non-Surgical Sterilization as a Means of Street Dog Population Control in Kathmandu, Nepal
Colin Basler V'12	US Army	Assessing the Effectiveness of the Dog Sterilization and Rabies Control Program at IAAS, Rampur, Nepal
Laurel Bifano V'12	Merck	Methicillin Resistant Staphylococcus Intermedius: A Growing Concern? A Multiperspective Evaluation of Its Frequency of Occurrence in the State of Massachusetts
Michael Campagna V'11	NIH	Effects of an X-linked gene, Jarid1c, on Development of the Prefrontal Cortex, and its Influence on Behavior
Ashley Case V'12	US Army	Rabies Antibody Seroprevalence Among Mexican Bats
Emily Clore V'12	NIH	Retrospective Evaluation of Parenteral Nutrition in Alpacas
Rebecca Foelber V'11	US Army	High Risk Practices in the Production and Marketing of Muscovy Ducks for Transmission of Highly Pathogenic Avian Influenza in Indonesia
Matthew Gordon V'12	US Army	Juvenile Survival and Long Term Health of a Translocated Population of Gopher Tortoises
Stacy Green V'12	NIH	Endocrine Regulation of Neural Prolactin in Lactating Rats
Katherine Haman V'12	US Army	Health Assessments and Antibiotic Resistance of Free-Ranging Atlantic Sharpnose (<i>Rhizoprionodon terraenovae</i>) and Bonnethead (<i>Sphyrna tiburo</i>) Sharks off the Coast of Florida and Georgia
Susan Hayhurst V'11	US Army	Investigating Antibiotic Resistance and Treatment Effectiveness in Avian Patients in a New England Wildlife Rehabilitation Clinic
Jessica Hekman V'11	NIH	A Model for Identification and Quantification of Stress in Hospitalized Dogs
Erin Jackson V'12	NIH	The Virulence of <i>S. sonnei</i> WRSs3 in Neonatal Pigs
Rita Jou V'12	NIH	Morphological Alterations In Gray matter in Doberman Pinschers with Canine Obsessive- Compulsive Disorder: A Voxel-Based Morphometry Analysis
Michelle Kneeland V'12	NIH	Evaluating Village Chicken Newcastle Disease Vaccination Campaigns in Chifunda, Zambia: Retrospective Analysis and Participatory Rural Appraisal

<u>Awardee</u>	<u>Award Type</u>	<u>Title of Research Project</u>
Michelle Lamond V'12	NIH	Potentially Preventable Hospitalization at the FHSA
Jamie Lovejoy V'12	US Army	Economic Evaluation of Rabies Treatment and Prevention in Freetown, Sierra Leone
Jennifer Mahon V'12	NIH	Evaluation of Endothelin Expression in Dogs with Five Naturally Occurring Diseases: A Promising New Therapeutic Target
Katherine Megquier V'11	NIH	Expression Profiling of Canine Hemangiosarcoma
Catherine Newman V'11	NIH	Effects of Neonatal Exposure to Novel Odors on Adult Repetitive Grooming
Lauren O'Connell V'11	NIH	Estrogen Receptor Alpha and Activation of the Amygdala Following Reproductive Experience
Sarah Raabis V'12	US Army	Sustainable Food Security and Rural Family Livelihoods: A Descriptive Evaluation of Small-Scale Livestock Production in the Limpopo National Park Support Zone
Lydia Scheidler V'11	US Army	Risk Factors Associated with the Transmission of Tuberculosis in Captive Elephants in Nepal
Annie Shea V'11	NIH	Antibiotic Use in Dogs at Small Animal Hospitals: A Case Study at the Foster Hospital for Small Animals at Tufts University
Rebecca Swimmer V'11	NIH	Validation of the 6-Minute Walk Test in Dogs
Samantha Swisher V'12	US Army	Potential Impact of Improved Poultry Yields on Bushmeat Hunting in Limpopo National Park, Mozambique
Hannah Tadros V'11	US Army	Variety, Frequency of Use, and Medicinal Efficacy of Indigenous Medicinal Treatments Used by Donkey Owners in Giza, Egypt to Prevent and Treat Disease in Their Working Animals
Jana Thomas V'12	NIH	Prevalence of Two Genes Encoding Antibiotic Resistance in Cloacal Contents of Juvenile and Adult Herring Gulls (<i>Larus argentatus</i>).
Deborah Thomson V'12	US Army	Assessment of the Impact of Animal Husbandry Education Heifer International-Donated Water Buffalo
Amy Vlazny V'11	US Army	Survey of Tzeltal Maya Farmers' Knowledge of Swine Health and Husbandry Systems

Awardee: Mehnaz Aziz V'12

Mentor: Dr. Gretchen Kaufman

Award Type: Morris Foundation

Research Project Feasibility Study on Using Non-Surgical Sterilization as a Means of Street Dog Population Control in Kathmandu, Nepal

Summary: Rabies is a major public health concern in many parts of the developing world. Worldwide the virus is most commonly transmitted to people from the domestic dog. In Nepal, where rabies is endemic, an average of 25,000 people receive post-exposure treatment for rabies and more than 100 people die from rabies each year.

One of the basic components of rabies control, according to World Health Organization guidelines, is control of the street dog population. Municipality officials in Kathmandu, Nepal have used strychnine poisoning in attempts to reduce the street dog population; however, due to efficacy and welfare concerns regarding this method, surgical sterilization is now used to manage the street dog population. In this study, I will work with the Kathmandu Animal Treatment Centre in Nepal to analyze the feasibility of using an alternative population control method, non-surgical sterilization. Through efficacy, economic, and social parameters, I will test my hypothesis that non-surgical sterilization is an equally efficacious but more economically effective and more socially acceptable method for street dog population control than other methods employed in Kathmandu. I will research the effectiveness of achieving successful canine sterilization for both surgical and non-surgical population control methods. I will gather costs involved in using surgical sterilization in Kathmandu and compare these to the cost of using non-surgical sterilants. I will conduct surveys of the public and veterinary Kathmandu population concerning the different street dog population control methods to garner opinion on the social acceptability of each method.

If non-surgical sterilization proves to be a more efficacious, more economically effective, and more socially acceptable method of population control, then this study will facilitate future implementation of non-surgical sterilization in Kathmandu. It may also serve as a model for potential implementation of non-surgical methods in other developing countries.

Awardee: Colin Basler V'12

Mentor: Dr. Gretchen Kaufman

Award Type: US Army

Research Project: Assessing the Effectiveness of the Dog Sterilization and Rabies Control Program at IAAS, Rampur, Nepal

Summary: Rabies continues to pose a serious threat in many parts of the developing world, including Nepal. In the recent past, a dog sterilization and vaccination program has been implemented in the Chitwan district of Nepal in order to reduce the incidence of rabies and increase the capacity to implement rabies prevention programs within the country. My goal is to determine the effectiveness of the sterilization and vaccination program. In order to determine the program's effectiveness, the residents of four communities where the sterilization/vaccination program has been operating will be interviewed in order to determine their level of knowledge of rabies as well as their attitudes and behaviors that impact rabies prevention. The results of the survey will be compared to results from four similar communities which the sterilization/vaccination program has not yet reached. In addition to the survey, a census of the dog population will be taken in each village in order to determine the proportion of dogs that have been sterilized by the program. This information will help determine the effectiveness of the sterilization/vaccination program and will also give baseline data for the four communities which have not been involved in the program.

Awardee: Laurel Bifano V'12

Mentor: Dr. Joann Lindenmayer

Award Type: Merck Merial

Research Project: Methicillin Resistant Staphylococcus Intermedius: A Growing Concern? A Multiperspective Evaluation of Its Frequency of Occurrence in the State of Massachusetts

Methicillin Resistant Staphylococcus aureus (MRSA) is an increasing problem among human and animal populations in recent years. While originally identified as a nosocomial infection associated with prolonged hospital stays (hospital acquired MRSA or HA), beginning in the early 1990's, it began to be found in the community amongst people with no specific risk factors. Recent anecdotal evidence from clinicians suggests that the frequency of a different strain of resistant Staph, Methicillin resistant Staphylococcus intermedius (MRSI) may be increasing in the animal population. Currently, there is little

data documenting the frequency of occurrence of MRSI. The goal of this study is threefold: determine if MRSI is increasingly being diagnosed, determine if clinicians are testing more frequently for resistant Staph species and document clinicians' concerns about antibiotic-resistant strains of Staphylococcus.

The first goal will utilize the FIRST database at the Foster Small Animal Hospital to document the number of diagnoses of MRSI during each of the past 5 years. Second, we will work with Idexx laboratories to quantify the number of Staph spp. cultures being sent in for evaluation, how many were speciated and cultured, and of those how many were MRSI or MRSA. The final component of the study will involve using the Epi Info U 3.5.2 system to develop and distribute surveys to Massachusetts Veterinary Medical Association members to document veterinarians' subjective impressions about the frequency of occurrence of Staph spp. in their practices.

This combination of information will help us determine whether MRSI is becoming of greater clinical importance and will provide us with a baseline for future evaluation.

Awardee: Michael Campagna V'11

Mentor: Dr. Jun Xu

Award Type: NIH

Research Project: Effects of an X-linked gene, Jarid1c, on Development of the Prefrontal Cortex, and its Influence on Behavior

Summary: Jarid1c is an X-linked gene important for neurological development. It encodes a histone demethylase, which acts to repress transcription, and leads to normal neuronal differentiation, cell death, and dendritic growth. Mutations in this gene are known to cause mental retardation, increased aggression, and autistic behaviors in humans.

Our first hypothesis is that individuals with decreased Jarid1c action in specific brain regions will show a decrease in histone demethylation and a reduction in gene repression, causing deficits in cognitive and social behavior. To test this hypothesis, adult mice will be treated with small interference RNA (siRNA) against Jarid1c. Certain genes will be expected to have a higher expression in these treated mice which will behave differently in social preference and recognition tests, when compared to controls. Jarid1c will be silenced in the pre-frontal cortex with siRNA injections, as this region has been proven to show morphological changes in individuals with social and cognitive dysfunction such as autism and retardation.

Our second hypothesis is that the sexually dimorphic expression of Jarid1c may be responsible for differences in social behaviors between males and females. Since Jarid1c does not undergo X-inactivation in females, it is seen to be more highly expressed in XX individuals than in XY, i.e. it should normally be present to a greater extent in normal females when compared to males. To test this dosage

effect on Jarid1c expression, a four core mouse model will be used in which phenotypic females (with ovaries) and males (with testes) can have either an XX, or XY genotype. We predict XX mice, with ovaries or testes, will behave differently and have a different gene expression profile from XY mice, irrespective of their gonadal status.

This experiment should give us a better understanding of the genetic processes, and behavioral phenotypes involved in the development of some gender-specific neurological diseases that affect the human population.

Awardee: Ashley Case V'12

Mentor: Dr. Peter Daszak, Dr. Jon Epstein, and Dr. Joann Lindenmayer

Award Type: US Army

Research Project: Rabies Antibody Seroprevalence Among Mexican Bats

Summary: In recent years, the emergence of novel diseases and the re-emergence of many others has become a global problem. Disease outbreaks not only carry a huge toll on morbidity and mortality but also they cost societies billions of dollars. The majority of emerging diseases are zoonotic and the majority of these zoonotic diseases arise from wildlife. Moreover, many of the disease that have emerged in the last several years including Nipah, Hendra virus and SARS have had origins in various bat species. Previous studies have indicated that anthropomorphic change drives disease emergence and outbreaks in both human and wildlife populations. Some of these anthropogenic changes include deforestation, agricultural encroachment, and road and dam building. Changes to the environment such as these create new selection pressures that alter the relationship between hosts and pathogens allowing pathogens to thrive in these new environments. Rabies is considered a re-emerging disease throughout much of the world and is a priority disease for control according to the World Health Organization. In recent years, bat borne rabies has become an increasing public health problem in both Europe and the Americas. The aim of this study is to better understand the impact that anthropogenic change has on the rabies antibody titer of bats living in environments impacted by human-induced ecological change and bats living in environments that are not impacted by such change. The study will be conducted by collecting blood samples from two populations of Mexican bats, one population will be from an area that has been impacted by human-induced ecological change and the other will be from an undisturbed area. The rabies antibody titer of the bats will be determined using an Enzyme-linked ImmunoSorbent Assay (ELISA), specifically the The ELISA PLATELIA™ RABIES II, Bio-Rad assay will be used. The total number of positive and negative titers for each species at each site will be counted. The mean, standard deviations and confidence intervals will be determined. To determine whether the difference between the means is statistically significant, statistical tests of significance such as a T-test will be performed.

Awardee: Emily Clore V'12

Mentor: Dr. Lisa Freeman

Award Type: NIH

Research Project: Retrospective Evaluation of Parenteral Nutrition in Alpacas

Summary: Little is known about the use of intravenous or parenteral nutrition (PN) in alpacas, a species with unique anatomical and metabolic characteristics. PN can be a lifesaving means for providing nutritional support in animals that have impaired gastrointestinal function. Published case studies have established that PN is feasible in camelids, but do not examine ideal nutrient formulas nor common complications observed. According to pedigree registries, alpaca populations in the United States have doubled over the last decade.¹¹ The increasing popularity of this domestic species for breeding and exhibition in the US means that more veterinary hospitals are admitting critically ill crias and adult alpacas. Clinicians are at a disadvantage when treating these patients without clear definitions of effective formula or risks of treatment. The long term goal of our research is to prospectively develop optimal parenteral nutrition formulas for alpacas. The purpose of the proposed study is to retrospectively evaluate the use of PN in alpacas, to determine the formulations used, and evaluate potential complications related to formulation.

Alpacas receiving PN while hospitalized from 1999 to 2008 will be included in this study. Cases will be selected based on medical records, pharmacy logs and nutritional support logs of alpacas receiving PN. Information will be reviewed using a standardized data sheet. Data collected will include: signalment; body weight; underlying medical condition(s); hospitalization duration before, during and after PN administration; resting energy requirements (RER); illness factor used; specific PN formulation; catheter type; biochemical data; frequency and type of complications; and outcome (i.e., survival, death, or euthanasia). The goal of this retrospective evaluation is to understand the recent efficacy of PN treatment in alpacas. This will provide the basis upon which we can develop prospective research to develop optimal parenteral nutrition practices for this increasingly common domestic animal.

Awardee: Rebecca Foelber V'11

Mentor: Dr. Stacie Lawson

Award Type: US Army

Research Project: High Risk Practices in the Production and Marketing of Muscovy Ducks for Transmission of Highly Pathogenic Avian Influenza in Indonesia

Summary: Given that Indonesia is the country with the most human infections of highly pathogenic avian influenza (HPAI) H5N1, it is important to understand the epidemiology of the disease, including common reservoirs and modes of virus transmission. Many scientists have proposed that waterfowl are a reservoir for HPAI, but more studies are needed to examine the exact role domestic waterfowl play in virus transmission in Indonesia. Research on domestic waterfowl has focused on Pekin ducks and Indian runner ducks, while little is known about the rarer Muscovy ducks. However, Indonesian livestock officials have recognized that Muscovy ducks are raised differently than other ducks, in that Muscovy ducks are raised in small flocks in a free-range setting while others are managed more intensively. It is important to understand the husbandry styles of these birds, since the risk of HPAI infection of poultry depends on several factors, including the manner in which birds are raised on farms. Additionally, the WHO and FAO have discovered that, of many types of birds sold at markets, Muscovy ducks are the highest risk factor for environmental contamination. Thus, a study that focuses on the production system and market chain of Muscovy ducks can help illustrate possible risk factors for transmission of HPAI H5N1 in Indonesia.

This study will be organized in two phases: the first will address the marketing of Muscovy ducks, while the second will address the husbandry of the birds at the village level. Phases I and II will include semi-structured interviews with Muscovy duck vendors and farmers, respectively, in Western or Central Java. A semi-structured interview technique is preferred over a standardized questionnaire because it allows for more detailed answers and further exploration of certain responses. Based on the qualitative data obtained from the interviews, a report will be compiled that addresses the marketing and husbandry of Muscovy ducks and identifies points throughout the process of raising and marketing ducks that may increase the risk of infection and transmission of HPAI. Overall, this study attempts to investigate the possible role that these ducks may play in maintaining the endemicity of avian influenza in bird populations, after which recommendations can be made to better protect humans and animals from infection and further spread of HPAI H5N1.

Awardee: Matthew Gordon V'12

Mentor: Dr. Mark Pokras

Award Type: US Army

Research Project: Juvenile Survival and Long Term Health of a Translocated Population of Gopher Tortoises

Summary: Gopher Tortoises are found in the southeastern United States ranging from southern South Carolina to Florida and west to southeastern Louisiana. Populations have shown declines and the tortoise is currently considered a Species of Special Concern throughout its range. It is federally protected in Louisiana, Mississippi, and western Alabama and was reclassified to Threatened by the Florida Fish and Wildlife Conservation Commission (FWC) in 2007 (Berish, 2007). The primary cause of

decline has been stated as habitat loss by the Florida Fish and Wildlife Conservation Commission (FWC 2007). Due to habitat loss, translocation of the gopher tortoise has become a key element of many conservation plans. However, inadequate long term research has been done on the effectiveness of this tool. In addition, research is lacking on gopher tortoise health in general.

The population of gopher tortoises on St. Catherines Island in Georgia represents one of the first translocated populations in the state. The population provides a unique opportunity to collect needed data on the effectiveness of translocation for this species. This study will focus on two specific aspects. The first will be survival/growth of juveniles tortoises. This will be accomplished through the capture of juveniles and collection of growth and health data. The second aspect of the study will be a continuation of an ongoing mark-recapture health assessment study. This will be accomplished through the capture of 15-20 adult tortoises. Data collected will aid in tracking the health of the population as well as establishing base line data for gopher tortoises.

Awardee: Stacy Green V'12

Mentor: Dr. Robert Bridges and Dr. Elizabeth Byrnes

Award Type: NIH

Research Project: Endocrine Regulation of Neural Prolactin in Lactating Rats

Summary Prolactin is a hormone produced by the anterior pituitary gland. The tuberoinfundibular (TIDA) system is the dopaminergic system primarily responsible for regulating pituitary prolactin release with dopamine receptors present on lactotrophs. Studies have indicated that the brain itself produces its own prolactin and recent findings in Dr. Bridges' laboratory using real time RT-PCR indicate that the most pronounced expression of the prolactin gene is present in the arcuate nucleus of lactating rats. Earlier studies have found peripheral prolactin in the cerebrospinal fluid, which may regulate the actions of prolactin in the brain. Peripheral prolactin enters the brain through the choroid plexus, since peripheral prolactin cannot enter through the blood-brain barrier. Another region of the brain, the arcuate nucleus, may also have an incomplete blood brain barrier, which would allow peripheral prolactin to gain access to this neural region. It has been established that increased levels of lactogens enter the brain in rats and humans during pregnancy and prolactin levels are also elevated in response to suckling in nursing mothers. The goal of this study is to determine whether the neural expression of prolactin is altered by the secretion of prolactin from the pituitary gland in lactating rats. Forty adult 200-225 gram female Sprague-Dawley rats will be used. The female rats will be mated with males from the existing colony and individually housed 3-5 days prior to the expected day of parturition. After parturition, litter sizes will be culled to 10 pups per dam. Five groups of 8 primiparous rats will thereby be generated. On days 4 to 5 postpartum, all pups will be removed from the dam 4 hours prior to the intravenous administration of domperidone, a dopamine D2 receptor antagonist, or vehicle. Tissues and blood will be collected prior to domperidone/vehicle treatment (0 hour) and 1 and 4 hours after treatments. At the time of tissue collection all subjects will be anesthetized with

CO₂ for 30 seconds prior to rapid decapitation. Plasma concentrations of circulating prolactin will be processed with an ELISA assay, and tissue punches of the arcuate region of the brain will be processed using TaqMan[®] to determine the level of prolactin gene expression in the brain. If our hypothesis is correct, it is predicted that elevating circulating prolactin by domperidone treatment will increase the expression of the neural prolactin gene. Although the functional significance of such a change is unknown at this time, identifying this possible endocrine-brain interaction is of interest in light of the role of the arcuate region in pituitary hormone regulation, fertility, and the regulation of neural prolactin

Awardee: Katherine Haman V'12

Mentor: Dr. Flo Tseng

Award Type: US Army

Research Project: Health Assessments and Antibiotic Resistance of Free-Ranging Atlantic Sharpnose (*Rhizoprionodon terraenovae*) and Bonnethead (*Sphyrna tiburo*) Sharks off the Coast of Florida and Georgia

Summary: Baseline health assessments will be performed and the incidence rate of antibiotic resistance (ABR) in bacteria cultured from cloacal swabs will be evaluated in two species (Atlantic Sharpnose and Bonnetthead) of free-ranging shark off the coast of Georgia and Florida. These samples will be collected from sharks captured by trawling on the *RV Georgia Bulldog* during June and July of 2009. Health parameters and diagnostic testing will include physical examination, body weight and morphometric measurements, complete blood counts and plasma biochemistry panels. These data will be analyzed for correlation with the presence or absence of ABR and a variety of heavy metal and organochlorine contaminant levels. These data will also be geospatially quantified with the variables (1) distance from shore and (2) distance from river outlet via ArcMap GIS software. The American Association of Zoological Veterinarians (AAZV) recently (January 2009) issued a call for research to obtain baseline health parameters in order to address and understand the physiological characteristics that affect captive sharks and result in spinal deformities. This project is designed to address these research needs and our data will be made public. This project will also provide information on an important public health concern: antibiotic resistance. Both the Atlantic Sharpnose and the Bonnetthead are recreationally fished and thus regularly come into contact with humans. Our understanding of the geospatial distribution of ABR and the health status of these sharks will improve our ability to monitor and protect humans from potentially harmful transmission of bacterial pathogens, provide information necessary to maintain healthy sharks, both captive and wild, and indicate the level to which overuse of antibiotics has caused their leaching into the environment at large.

This project is a collaborative effort between Tufts University Cummings School of Veterinary Medicine, University of California at Davis School of Veterinary Medicine (UC Davis), the Georgia Sea Turtle Center

(GSTC), the South Carolina Department of Natural Resources (SCDNR), and the Georgia Department of Natural Resources (GaDNR).

Awardee: Susan Hayhurst V'11

Mentor: Dr. Flo Tseng

Award Type: US Army

Research Project: Investigating Antibiotic Resistance and Treatment Effectiveness in Avian Patients in a New England Wildlife Rehabilitation Clinic

Summary: This study will investigate antibiotic resistance and treatment effectiveness in avian patients at a New England wildlife rehabilitation center. Antibiotic resistance is present and may be increasing in wild animal populations. Several studies have detected resistance in bacterial isolates from wildlife rehabilitation centers. Moreover, recent studies have indicated increases in drug resistance in wildlife patients from the time of admission to the time of release. In an effort to help the wildlife clinic assess the effectiveness of its current practices, this study will conduct a survey of bacteria and their resistance to antimicrobials in patients at the center, as well as a clinical comparison to determine if passerine bird cat-bite cases are significantly improved by treatment with amoxicillin trihydrate/clavulanate potassium. The goal of this study is to provide a better understanding of antibiotic use and resistance in a wildlife rehabilitation clinic in order to develop more informed treatment protocols and develop an awareness of the prevalence of antibiotic resistance in this setting.

Awardee: Jessica Hekman V'11

Mentor: Dr. Alicia Karas

Award Type: NIH

Research Project: A Model for Identification and Quantification of Stress in Hospitalized Dogs

Summary: The goal of this project is to develop a behavioral stress scoring system, which will be used to rank the stress levels of hospitalized dogs on a numeric ranking scale based on behavioral observations, and then to test the efficacy of a non-pharmacologic pain/stress intervention. There are two specific aims of the project.

Specific Aim 1:

A scale will be developed from literature review and video taped observation of canine patients hospitalized in the Foster Hospital. To assist in initial characterization of stress parameters, we will record heart rates and measure salivary cortisol levels. We will test the hypothesis that there is a correlation between a higher score on the stress scale and elevated heart rates and salivary cortisol levels. This

phase will occur over the first 3 months (cf. summer proposal submitted).

Specific Aim 2:

The hospitalized dog stress scale will then be used to determine if treatments with Bowen, a non-pharmacologic body work therapy, reduces behavioral, physiologic and biochemical parameters of stress (stress parameters) in hospitalized dogs compared with active control (presence of a human), or negative control (no intervention). Stress parameters will be evaluated before and after each "treatment." We will test the hypothesis that treatment with Bowen reduces the magnitude of stress parameters compared to active placebo or no intervention. Validation of a behavioral stress assessment tool is procedurally complex and challenging, as it unreasonable to expect to obtain a patient subgroup that is not at all stressed to use as controls. Use of the developed scale to test interventions (both pharmacologic and non-pharmacologic) in conjunction with salivary cortisol data can help us proceed with validation.

Awardee: Erin Jackson V'12

Mentor: Dr. Saul Tzipori

Award Type: NIH

Research Project: The Virulence of *S. sonnei* WRSs3 in Neonatal Pigs

Summary: Shigellosis is a fatal gastrointestinal infection for more than 1 million people in the world every year. Antibiotic treatment is becoming more difficult as various strains of *Shigella* develop resistance to drugs that are commonly available. Researchers have been trying to produce a *Shigella* vaccine for decades but have failed to produce a live vaccine strain that is properly attenuated and effective in endemic populations. This project will use a gnotobiotic piglet model to compare a wildtype *S. sonnei* vaccine strain WRSS1, developed at the Walter Reed Army Institute for Research, to an isogenic strain with fewer virulence factors, WRSs3. It will compare colonization levels, cytology, and inflammation in piglets that have received each strain of *S. sonnei*. If WRSs3 causes less diarrhea in piglets but still results in a strong antibody response, it may contribute to the production of a marketable live attenuated vaccine for *S. sonnei* related shigellosis.

Awardee: Rita Jou V'12

Mentor: Dr. Nicholas Dodman

Award Type: NIH

Research Project: Morphological Alterations In Gray Matter in Doberman Pinschers with Canine Obsessive- Compulsive Disorder: A Voxel-Based Morphometry Analysis

Summary: *Study Objectives:* To investigate differences in brain morphology between dogs affected by symptoms of canine obsessive-compulsive disorder (OCD) and healthy, unaffected dogs.

Hypothesis: Dogs affected with canine obsessive-compulsive disorder (OCD) will exhibit morphological changes in gray matter in various regions of the brain when compared with healthy, non-symptomatic dogs.

Experimental Design and Significance of Proposed Research:

This experiment will investigate the morphological differences between a group of Doberman Pinschers presenting with clinical symptoms of canine obsessive-compulsive disorder (OCD) and a control group of normal, age and gender matched Doberman Pinschers. Neurophysiologic data will be obtained through MRI brain scans and voxel-based morphology (VBM) will be employed to analyze structural differences.

The results of this study will provide valuable insight into the pathophysiology of obsessive-compulsive behaviors in dogs. Such insights may lead to better treatment options that can provide medical and psychological relief to both the dogs and their human owners.

Awardee: Michelle Kneeland V'12

Mentor: Dr. Robyn Alders

Award Type: NIH

Research Project: Evaluating Village Chicken Newcastle Disease Vaccination Campaigns in Chifunda, Zambia: Retrospective Analysis and Participatory Rural Appraisal

Summary: Village chickens play a vital role in the survival and well being of rural households in developing countries. Chickens provide essential protein through eggs and meat when food supply is low, and can be traded or sold to pay for necessities such as clothes, medicine, and school fees. Free-range village chickens can be raised with minimal financial input and labor, and therefore are an ideal livestock species for the poor and disabled. One of the major constraints limiting chicken production in rural villages is Newcastle disease (ND), a highly virulent disease in poultry. The chiefdom of Chifunda in the Eastern Province of Zambia is one particular area that has been strongly affected by this disease, with some villages reporting chicken losses of 75% due to ND. In response to the ND problem in this region, the organization Community Markets for Conservation (COMACO) initiated a ND vaccination campaign in Chifunda in June 2007. The objective of the proposed study is to conduct an impact assessment of COMACO's ND vaccination campaign in Chifunda utilizing both retrospective data analysis and participatory rural appraisal techniques in order to assess both quantitative and qualitative indicators. This will provide a comprehensive, accurate analysis that will help improve

future ND vaccination campaigns, and ultimately improve the health and well being of both humans and livestock living in this region.

Awarded: Michelle Lamond V'12

Mentor: Dr. Joann Lindenmayer

Award Type: NIH

Research Project: Potentially Preventable Hospitalization at the FHSA.

Summary: The goal of the study will be to determine what percentage of admissions to the Tufts University Foster Hospital for Small Animals could be considered potentially preventable and, of those preventable admissions, what percentage has potential zoonotic consequences for owners and veterinary staff.

Veterinary referral hospitals, such as the Foster Hospital for Small Animals (FHSA), serve an additional role as indicators of the quality of primary care within their communities. One measurement of quality is the number of potentially preventable hospitalizations (PPH) in the hospital(s) serving a given community. Prevention Quality Indicators are calculated using hospital admissions for ambulatory care sensitive conditions that could have been avoided if treated early and appropriately. PQIs measure the outcomes of preventive care for both acute illnesses and chronic conditions, reflecting two important components of the quality of preventive care - effectiveness and timeliness. We will conduct a study similar to those of human hospitals in the United States and abroad that use PQI to study trends in potentially preventable hospitalizations.

Our sample population will be the admissions to the Foster Hospital during a single year, January 1st through December 31st, 2008. We will first determine a set of PQI that represent potentially preventable admissions to the veterinary hospital. We will then use a computer software program called FIRST (Flexible Information Retrieval and Storage, version 1.0.4.59) to search the hospital's electronic records for diagnoses that fit the PQI. Once a sub-population of preventable admissions has been established, we will then search those cases for diagnoses of zoonotic diseases that are potentially transmissible to humans.

We will enter patient information into a database for analysis using another computer software program, EpiInfo, version 3.5.2. Only data from the first preventable hospital admission will be entered for each case. We will record each patient's presenting complaint, species, breed, age, sex, duration of the presenting problem, treatment and isolation status prior to hospitalization, and client instructions. We will analyze the collected information for patterns and prepare the data for formal presentation and possible publication.

Awardee: Jamie Lovejoy V'12

Mentor: Dr. Joann Lindenmayer

Award Type: US Army

Research Project: Economic Evaluation of Rabies Treatment and Prevention in Freetown, Sierra Leone

Summary: The aim of this project is to collect primary data regarding the incidence and treatment of human exposure to canine rabies in Freetown, Sierra Leone for potential inclusion in a cost effectiveness analysis. This data would include descriptions of individual treatment seeking behavior, the process by which hospitals determine which treatment to provide, and the nature and costs of current human and canine treatments/vaccinations.

The collapse of Sierra Leone's infrastructure in the recent civil war has caused a significant increase in human rabies exposure. The level of exposure and mortality may easily be underestimated as many exposed individuals choose not to present their cases to the hospital. With proper management, rabies is preventable through the vaccination of reservoir populations, such as the domestic dog. Though this option seems viable, current vaccination programs in Freetown, Sierra Leone are underfunded. A cost effectiveness analysis comparing current post exposure human treatments with a pilot spay/neuter and vaccination program could help determine which course of action would be the most beneficial to counteracting the rabies epidemic in this city.

The methods of collection will be interviews with Freetown residents about health seeking behaviors, interviews with hospital staff regarding treatment decisions and service costs, and finally an intensive review of hospital records for local rabies exposure statistics. These methods are further described in the body of this proposal. This data will be used to develop probability distributions allowing the estimation of human rabies mortality (actual and preventable), which can then be used to determine cost effectiveness of these programs.

Awardee: Jennifer Mahnon V'12

Mentor: Dr. Elizabeth Rozanski

Award Type: NIH

Research Project: Evaluation of Endothelin Expression in Dogs with Five Naturally Occurring Diseases: A Promising New Therapeutic Target

Summary: Endothelin is an exceedingly potent vasoconstrictor which is over-expressed in several pathologic conditions. Vasoconstriction is an excellent compensatory mechanism in many disease states, but in excess, leads to prolonged hypoperfusion, hypertension, multiple organ failure and death. Furthermore, endothelin has recently been associated with ischemia/reperfusion injury in several experimental models. Endothelin receptor antagonists exist, and have been used in human medicine to treat pulmonary hypertension. Little research regarding endothelin over-expression exists in the veterinary literature, especially in patients with naturally occurring disease. We plan to examine endothelin levels in canine patients with five common, naturally occurring diseases: sepsis, pulmonary hypertension, chronic renal failure, intervertebral disc disease and gastric dilation-volvulus. We have a high degree of suspicion that endothelin levels will be elevated in these patients since each of these diseases is associated, to a certain extent, with ischemia/reperfusion injury. Blood samples will be drawn on patients presenting to the Foster Hospital for Small Animals with these diseases and endothelin levels will be measured via an immunoassay that has been validated in dogs. If a positive correlation exists between a particular disease state and that patient's endothelin level, endothelin receptor antagonism may represent a promising new therapy for these patients.

Awardee: Katherine Jane Megquier V'11

Mentor: Dr. Chieko Azuma

Award Type: NIH

Research Project: Expression Profiling of Canine Hemangiosarcomas

Summary: This proposal outlines a 15 month project for the Master's in Comparative Biomedical Sciences which will begin with research this summer. The parts of the project which we expect to complete this summer will be noted for clarity in the "Methods" section.

Hemangiosarcoma (HSA) is an aggressive malignant cancer of the vascular endothelial cells characterized by rapid widespread metastases and short survival times. (Bulakowski, 2008; Hammond, 2008; Kim, 2007) HSA is by far most common in dogs, with a particularly high incidence in certain breeds, including the golden retriever, German shepherd, and Labrador retriever. It is important in that it accounts for approximately 2% of tumors (Bulakowski, 2008; Clifford, 2000) and carries a grave prognosis. More work must be done to understand the biology of the disease to allow for better tests and treatments to be developed. In addition, canine HSA is important in that it could potentially be used as a model for human angiosarcoma and other cancers that have shared pathways. We hypothesize that dogs with HSA have altered gene expression that leads to malignancy. As part of an ongoing study (PI:Azuma), which included my summer research project last year, we will use Affymetric gene microarrays to test the gene expression profile of hemangiosarcoma and normal tissues. The microarray data will provide global gene expression patterns and likely identify a number of differences between HSA and normal tissue. I will identify the gene expression profile of 5 of the candidate genes that were identified based on location of HSA associated loci previously

discovered by Azuma and Lindblad-Toh. Many of the HSA mutations seem to be in non-coding regions of the chromosome, and may have a regulatory effect on the genes rather than being a direct mutation of the gene itself. We expect to generate data that will identify novel genes and pathways involved in HSA and to start characterizing their functional consequences through microarray and qRT-PCR. This should enable a wealth of additional characterization of the biology of HSA and in the long run should identify new therapeutic targets for HSA.

Awardee: Catherine Newman V'11

Mentor: Dr. Jun Xu

Award Type: NIH

Research Project: Effects of Neonatal Exposure to Novel Odors on Adult Repetitive Grooming

Summary: Gender differences and experiences early in development are among the risk factors being investigated in the occurrence of social disorders such as autism. Animal models can provide information regarding the development of such disorders as well as be useful for investigations of predisposing genetic components, in such a way that would be impractical in human studies.

This study will expand on the initial findings of Yuri Lawrence's 2008 DVM summer research project in Dr. Xu's lab concerning post natal tactile stimulation and adult mouse social behavior in the BL6 strain. This proposal aims to investigate repetitive grooming, a phenotype with face validity to certain autism behaviors. We will employ the BTBR mouse strain, which has been used as a model for autism studies.

BTBR mice, compared to the BL6 strain used in the previous study, display lower social interactions and higher rates of repetitive self grooming throughout their various stages of development. These behavioral predispositions make this strain a useful example in studying the manifestation of three hallmark symptoms of autism, impaired social interactions, communication deficits, and repetitive behaviors. In this study, we will test if an enriched environment such as one including novel odors in development alters their repetitive self grooming behaviors as adults. We will also determine if this novel sensory exposure affects both sexes similarly.

To identify the mediators between the early intervention and changes in adult behaviors, we will perform analyses of gene expression in the hypothalamus, a brain region that has been suggested to play a role in repetitive behaviors, following behavioral observation.

In summary, the goal of this proposal is to investigate the effects of neonatal olfactory stimuli on behavior and gene expression. Additional comparisons can be drawn between BL6 mice (less frequent groomer) and BTBR (frequent groomer), and between males and females.

Awardee: Lauren O'Connell V'11

Mentor: Dr. Elizabeth Byrnes

Award Type: NIH

Research Project: Estrogen Receptor Alpha and Activation of the Amygdala Following Reproductive Experience

Summary: Last year in the laboratory of Dr. Bridges and Dr. Brynes, we observed an anxiolytic effect of PPT, an estrogen receptor- α (ER α) agonist, when administered to primiparous female rats. However, no such effect was seen when dealing with the nulliparous females. Next the lab examined c-fos activation, an indicator of neuronal activity, in the brains of rats with reproductive experience versus activation in the brains of nulliparous individuals. These studies revealed parity associated differences in the reaction to PPT treatment. The most striking difference was seen in the basolateral amygdala, with PPT treated parous animals having markedly higher levels of activation than their nulliparous counterparts. Since the amygdala plays a part in anxiety like behavior, this data indicates that the observed behavioral differences may be due to ER α -mediated activation in this brain region. The proposed experiment will use double labeling for ER α and c-fos within the amygdala, along with other brain regions known to be involved in one's response to stress, in an effort to determine whether PPT increases activity specifically in ER α -positive neurons or whether c-fos activation takes place in neurons that do not possess ER α .

Awardee: Sarah Raabis V'12

Mentor: Dr. Eric Brum

Award Type: US Army

Research Project: Sustainable Food Security and Rural Family Livelihoods: A Descriptive Evaluation of Small-Scale Livestock Production in the Limpopo National Park Support Zone

Summary: The Limpopo National Park (LNP) of Gaza, Mozambique is home to many communities that struggle with food security, water availability, and sustainable income. The establishment of the Great Limpopo Transfrontier Conservation Area (GLTFCA), the linking of three Southeast African parks (Kruger National Park of South Africa, Gonarezhou National Park of Zimbabwe, and the LNP of Mozambique), has further complicated these issues. The GLTFCA was instituted to facilitate socioeconomic growth in the LNP region through the tourism sector; however, the local communities are facing intensified problems of increased wildlife encroachment, disease transmission, and further limitations to land and water resources. Currently, the International Rural Poultry Center (IRPC) of the KYEEMA Foundation is working to improve village poultry production: an important development strategy that provides food security and increases purchasing power of communities. The proposed research will involve further

evaluation of village livestock, with an emphasis on small species production. A baseline questionnaire survey will be administered to households in four communities in the Massingir district of the LNP support zone as part of a Participatory Rural Appraisal (PRA) to better understand the role of livestock in rural livelihood strategies. To qualify and expand on data collected from household interviews, Focus Group Discussions will be organized in each community according to guidelines outlined in a relevant participatory tools manual (Bagnol 2008). The descriptive results of this baseline study will facilitate future improvements in animal health and wildlife management strategies of the IRPC to maintain sustainable food security and livelihoods for the people of LNP.

Awardee: Lydia Scheidler V'11

Mentor: Dr. Gretchen Kaufman

Award Type: US Army

Research Project: Risk Factors Associated with the Transmission of Tuberculosis in Captive Elephants in Nepal

Summary: The aim of this study is to investigate the risk factors associated with the transmission of tuberculosis in captive elephants in Nepal. A 2006 study, which was the first to systematically test captive elephants in Asia for tuberculosis, found that at least 15 of the 120 elephants tested in Nepal were positive. Very little is known about the epidemiology of the disease in captive elephants in Asia. How these elephants are contracting tuberculosis and any additional risk factors, have not been documented.

A close-ended survey will be used to investigate the risk factors for the transmission of tuberculosis in captive elephants in Nepal. It will be given to owners and managers of captive elephants in order to assess information about the captive elephants in their care. The survey will be divided into five sections: general history, activities, diet, housing and interaction (with other elephants, livestock and wildlife).

Research into the risk factors associated with the transmission of tuberculosis in elephants has many positive implications for both human and animal health. Further knowledge on how captive elephants in Asia are contracting tuberculosis could inform the development of elephant management practices that reduce transmission, thus preventing more elephants from contracting this debilitating disease. Because tuberculosis is zoonotic, an understanding of how the disease is transmitted could also help improve the health of those in close contact with captive elephants in Asia. Increased knowledge of how tuberculosis is transmitted between people and animals also has broader public health implications for this important disease.

Awardee: Annie Shea V'11

Mentor: Dr. Robert McCarthy and Dr. Joann Lindenmayer

Award Type: NIH

Research Project: Antibiotic Use in Dogs at Small Animal Hospitals: A Case Study at the Foster Hospital for Small Animals at Tufts University

Summary: Overuse and non-prudent use of antibiotics and recent concern about increasing antibiotic resistance in human and veterinary infections has prompted several national and international organizations to call for more judicious use of antibiotics among all populations. Although resistant strains in companion animals have been reported in recent years, there has been little broad surveillance about antibiotic use in dogs in general. The aim of our study is to conduct some initial surveillance of antibiotic use in dogs at the Foster Hospital for Small Animals at Tufts. This will serve as the first phase of my Advanced Learning Experience (ALE) toward my Masters in Public Health (MPH). The second phase will be completed in my third and fourth years and expand to include local primary care hospitals. We will conduct a retrospective random sampling of records in the FIRST and VetConnect systems to answer the following questions:

1. What percentage of the time that antibiotics were prescribed in dogs was a culture/sensitivity done to determine if the infection was susceptible to the antibiotic chosen?
2. In cultures done, what percentage showed antibiotic resistant strains?
3. For all cases in which an antibiotic was prescribed, identify the specific antibiotic, length of treatment course and infection targeted. This information will seek to answer:
 - a. What are the most commonly prescribed antibiotics?
 - b. Are drugs prescribed for the shortest recommended course?
 - c. What are the most common infections treated with antibiotics?

A survey of the current state of antibiotic use in dogs will help determine if guidelines are being followed and help to direct future research and policy.

Awardee: Rebecca Anne Swimmer V'11

Mentor: Dr. Elizabeth Rozanski

Award Type: NIH

Research Project: Validation of the 6-Minute Walk Test in Dogs

Summary: The purpose of this study is to analyze oxygen saturation (oxygen count) in the blood stream of dogs after a 6-Minute Walk Test, 6MWT. This test is widely used in human medicine to provide an objective evaluation of pulmonary impairment. However, this test has yet to be established as a clinical diagnostic indicator of pulmonary dysfunction in veterinary medicine. It is our goal to first evaluate this model in a healthy population of dogs using pulse oximetry to measure oxygen saturation. My second aim is to analyze the degree of saturation after the 6MWT in dogs with mild to moderate pulmonary dysfunction.

I hypothesize that there will be a significant decrease in the distance walked and the degree of saturation in dogs presenting with mild to moderate pulmonary dysfunction when compared to the baseline established by the healthy controls. This test has the potential to become a great asset to veterinary medicine due to its non-invasive objective nature, low cost of implementation and ease of utilization. It is my goal to evaluate and ideally validate the 6-Minute Walk Test as a useful clinical diagnostic tool for mild to moderate pulmonary dysfunction in dogs.

Awardee: Samantha Swisher V'12

Mentor: Dr. Robyn Alders

Award Type: US Army

Research Project: Potential Impact of Improved Poultry Yields on Bushmeat Hunting in Limpopo National Park, Mozambique

Summary: I will investigate the roles that village poultry and bushmeat play in the diet, economy, and cultural practices of the communities in and around Limpopo National Park, Mozambique. Through household discussions and focus groups, I will determine the current uses of bushmeat in the area and whether poultry might prove an acceptable substitute for bushmeat if yields were improved. As developing countries around the world are struggling to balance wildlife conservation with the basic needs of the rural poor, it is imperative to find development strategies that benefit both people and wildlife. This research will investigate the contribution that village poultry might make to such a development strategy.

Awardee: Hannah Tadros V'11

Mentor: Dr. George Saperstein

Award Type: US Army

Research Project: Variety, Frequency of Use, and Medicinal Efficacy of Indigenous Medicinal Treatments Used by donkey Owners in Giza, Egypt to Prevent and Treat Disease in Their Working Animals

Summary: My research will investigate the use of indigenous medicinal treatments, not generally prescribed or practiced by those in the modern veterinary profession, on donkeys in the outskirts of Giza, Egypt. I will travel with veterinarians staffing a mobile clinic sponsored by the UK-based charity, The Donkey Sanctuary, which treats between 25 and 200 hundred donkeys daily. I will both conduct a standard clinical exam on the donkeys and interview the owners to determine the frequency, variety, and efficacy of traditional treatments used. This descriptive study will establish a baseline of common practices used by laymen and often untrained 'farriers' in lower Egypt which could be further expanded in future studies to determine if knowledge and use of traditional treatments shows discrepancies between rural and urban regions of Egypt.

Awardee: Jana Thomas V'12

Mentor: Dr. Julie Ellis

Award Type: NIH

Research Project: Prevalence of Two Genes Encoding Antibiotics Resistance in Cloacal Contents of Juvenile and Adult Herring Gulls (*Larus argentatus*.)

Summary: Antibiotic resistance (AR) in pathogenic microorganisms is one of the most important contributors to emerging infectious diseases worldwide. Traditionally, the resistance crisis has been attributed to overuse of antibiotics in medical settings, but there is increasing evidence of transmission from agriculture, sewage treatment lagoons, and other non-medical settings. The AR bacteria from these environmental reservoirs can then be acquired and transmitted by mobile organisms (e.g. wildlife) that come into contact with or ingest them.

Gulls are a particularly apt model species in which to study AR transmission. Their foraging habits bring them into contact with reservoirs of AR bacteria (e.g. sewage), they breed in dense colonies, and they disperse widely, giving them ample opportunity to shed AR bacteria into comparatively pristine areas. However, many of the steps between acquisition of AR bacteria and its wider transmission by gulls are poorly understood. For example, virtually nothing is known about the temporal dynamics of AR bacteria in the GI tract of wild birds, and little is known about differences in prevalence of AR bacteria and genes between age classes.

In this study, we will address two questions related to carriage of AR genes by gulls. First, we will compare the abundance and sequence diversity of two key AR genes (*tetB*, which confers resistance to tetracycline-family antibiotics, and *bla_{TEM}*, which confers resistance to penicillin-family antibiotics) in the feces of the same 10 adult Herring Gulls once a month for three months. These data will enable us to assess temporal dynamics of AR genes in individual gulls. Second, we will compare the abundance and sequence diversity of those same AR genes in the feces of juvenile vs adult gulls, to determine whether AR genes differ between the two age classes due to differences in foraging and nesting behavior. Because of their greater dependence on anthropogenic food sources, juvenile gulls are more frequently exposed to a variety of microorganisms, including those which carry AR genes. If AR bacteria are transient in the gut, juveniles will show a greater diversity and quantity of AR bacteria than adults, who will have lost initial colonies. In order to address these two questions, we will use a combination of standard and RT-PCR techniques to quantify the abundance of these two genes. We will also sequence each sample, allowing us to compare levels of allelic variation (an indicator of diversity in source).

Awardee: Deborah Thomson V'12

Mentor: Dr. George Saperstien

Award Type: US Army

Research Project: Assessment of the Impact of Animal Husbandry Education in Heifer International-Donated Water Buffalo

Summary: This project will detect subclinical and clinical mastitis in water buffalo owned by either untrained or trained Nepalese. The Nepal Chapter of Heifer International (HIN) operates a program to donate animals and train their recipients. HIN does not actively monitor the health of donated animals and, therefore, cannot assess their education program. By comparing my collected data, I will evaluate the impact of HIN's training sessions in the field. Mastitis, a potentially contagious condition where environmental bacteria enter an animal's udder, is a common concern of farmers world-wide due to its detrimental financial impact; in Nepal, the water buffalo is the predominant source of dairy and contributes substantially to the nation's economy. Animals with subclinical or clinical mastitis will produce less milk, which will be of poorer quality. At five villages where HIN-trained and HIN-independent handlers are found, I will detect mastitis by using the California Mastitis Test (CMT) and the Strip Cup test. With a sample size of at least 200 animals, I will use the Chi-squared Test to detect association and the crude Odds Ratio to assess the size of the effect. Adjusted Odds Ratios will be used to quantify the impact of training on mastitis. Information gathered by an objective questionnaire will explore the significance of confounding factors. HIN will use my results to improve their training sessions (e.g. prioritize time spent on certain topics) for future recipients of water buffalo.

Awardee: Amy Vlazny V'11

Mentor: Dr. Sandra Ayres

Research Project: Survey of Tzeltal May Farmer's Knowledge of Swine Health and Husbandry Systems.

Award Type: US Army

Summary: This project aims to elucidate and evaluate Tzeltal Maya farmers' knowledge of swine health and disease in Aguacatenango, Chiapas, Mexico. I will use semi-structured interviews in a participatory approach to reveal perceptions about (1) domestic swine health, (2) occurrence and seasonality of common diseases, (3) impacts of diseases on production, and (4) when and how diseases are treated. I will specifically focus on identifying any disparities in these variables when comparing two systems of swine husbandry: the low-input practices used in raising the local pig breed, and a more intensive system of raising "farm breed" (mostly Yorkshire) pigs. I hypothesize that farmers recognize the local breed as more vigorous and resistant to disease, but that economic factors cause farmers to be more attentive to ailing farm breed pigs and more interested in restoring them to good health. By uncovering farmers' understanding of the roles of breed and husbandry in swine health and production, this study will help clarify the complex intersection between traditional and modern methods of animal husbandry in Aguacatenango. Research to this point has suggested that Tzeltal Maya animal producers use experiential and traditional methods of evaluating health, classifying diseases and determining appropriate treatments. The appropriate use of modern husbandry knowledge and veterinary medical practices to complement indigenous knowledge has not been determined, and represents an important concern for development efforts.

Animal production in rural indigenous communities in Mexico is a subsistence activity of great economic and cultural importance to its practitioners. From a practical perspective, domestic animals that can be raised on minimal inputs have entered essential roles in Mayan farmers' lives, through both providing dietary protein and acting as a quick source of funds for emergency expenses. Previous research and development work has suggested that traditional, indigenous knowledge of animal husbandry methods and ethnoveterinary practices provides low-income animal producers with techniques that are inexpensive, easily managed, locally available, culturally acceptable, and adapted to local ecological conditions.

Research to date in Aguacatenango has revealed general animal husbandry practices and the most common symptoms that afflict production animals. However, it remains to describe a more detailed classification of these symptoms; to investigate indigenous knowledge of the causes, associations, progression, prognoses and treatments of animal diseases; and to correlate indigenous empirical

knowledge with objective data through the use of modern veterinary medical methods. The purpose of this study is to contribute to answering these questions, allowing for the development of region-specific, culturally appropriate recommendations for improvements in local production animal health. The findings from this study will be disseminated back to the community through training and capacity building led by the Institute for Indigenous Studies at the Autonomous University of Chiapas, in conjunction with whom the present study is to be conducted.