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: Scott, Harvey Morgan

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

POSITION TITLE: Professor

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.)

<table>
<thead>
<tr>
<th>INSTITUTION AND LOCATION</th>
<th>DEGREE (if applicable)</th>
<th>END DATE MM/YYYY</th>
<th>FIELD OF STUDY</th>
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<tr>
<td>University of Saskatchewan, Saskatoon, Saskatchewan</td>
<td>DVM</td>
<td>05/1988</td>
<td>Veterinary Medicine</td>
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<tr>
<td>University of Guelph, Guelph, Ontario</td>
<td>PHD</td>
<td>10/1998</td>
<td>Epidemiology</td>
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<tr>
<td>University of Alberta, Edmonton, Alberta</td>
<td>OTH</td>
<td>05/1999</td>
<td>Post-doctoral Fellow</td>
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A. Personal Statement

I am a graduate veterinarian holding a PhD in epidemiology and with post-doctoral training in public health. In addition to private veterinary practice, I have worked in both government (food safety surveillance) and academic settings. I am currently professor of epidemiology in the Department of Veterinary Pathobiology at Texas A&M University. I was recruited there in 2014 as part of the Texas A&M University System Chancellor’s Research Initiative and the University President’s Faculty Reinvestment Initiative on One Health and Infectious Diseases. I relocated from Kansas State University, where I previously held the E.J. Frick Endowed Professorship in Veterinary Medicine. I was drawn to an academic position that emphasizes One Health and Infectious Diseases issues at the interface of animal agriculture and human health, and with obvious environmental emphasis. Antimicrobial resistance is the prototypical One Health issue of our time. Studies of indicator bacteria and the microbiome, using culture-based and metagenomic approaches offer much hope in understanding natural phenomena and the effects of external perturbations on normal flora of the gut, skin and respiratory tract. Much of my research emphasis has been on studying factors impacting antimicrobial resistance among commensal and pathogenic enteric bacteria in food animal production systems, especially where they interface with human populations through direct contact and food consumption, and with a program spanning the realm from the molecular to the sociological. In particular, I am interested in applying both molecular epidemiological and microbial ecological approaches to quantify the emergence, propagation, dissemination, and persistence of resistant enteric bacterial (both commensal and pathogenic) strains in integrated populations of animals, their food products, and in humans. Using this knowledge, I hope to identify opportunities to prevent and intervene against resistance among enteric pathogens in animal agriculture and in human health - both in communities and in health care settings; preferably, by developing readily adoptable, highly effective and cost-efficient management practices suited to human health, public health, and food animal production systems. Four citations are included that illustrate my experience with studies in human and animal populations, investigating mitigation approaches using experimental and observational methods, developing and advanced statistical and analytical approaches, and exploring the microbiome utilizing culture-based and non-cultured-based approaches.


B. Positions and Honors

**Positions and Employment**

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<th>Year</th>
<th>Position</th>
<th>Institution and Location</th>
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<td>1988-1997</td>
<td>Veterinarian, Private Practice, Alberta</td>
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<tr>
<td>1992-1998</td>
<td>Graduate Research Assistant, University of Guelph, Guelph</td>
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<tr>
<td>1998-1999</td>
<td>Post-doctoral Fellow, University of Alberta, Edmonton</td>
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<tr>
<td>2001-2006</td>
<td>Assistant Professor, Texas A&amp;M University, College Station, TX</td>
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<tr>
<td>2006-2009</td>
<td>Associate Professor, Texas A&amp;M University, College Station, TX</td>
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<tr>
<td>2008-2014</td>
<td>Professor, Kansas State University, Manhattan, KS</td>
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<tr>
<td>2014-</td>
<td>Professor, Texas A&amp;M University, College Station, TX</td>
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**Other Experience and Professional Memberships**

- Member, American Society for Microbiology
- Member, American Veterinary Medical Association
- Member, Phi Zeta (Veterinary Honor Society)
- Past President, Association for Veterinary Epidemiology and Preventive Medicine
- Editorial Board, Nature: Scientific Reports

**Honors**

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<th>Year</th>
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<tr>
<td>2013</td>
<td>Zoetis Award for Veterinary Research Excellence, Kansas State University</td>
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<tr>
<td>2015</td>
<td>Outstanding Scientific Achievement Award, College of Veterinary Medicine and Biomedical Sciences, Texas A&amp;M University</td>
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C. Contribution to Science

1. My latest work focuses on utilizing culture-based and non-culture-based approaches to assessing the molecular epidemiology and microbial ecology in complex sample matrices such as feces and nasal secretions. Our work spans indicator (E. coli and Enterococcus spp.) as well as opportunistic pathogens such as Salmonella and Methicillin Resistant Staphylococcus aureus. We approach issues relating to temporal dynamics in feces in response to perturbations such as use of antibiotics or alternatives such as metals and essential oils to evaluate their effects on gut bacterial composition and resistance.


2. Dissemination of resistance genes necessarily precedes their selection and propagation. We are exploring approaches to utilizing a variety of molecular epidemiologic approaches including selective media, enrichment, qPCR and next-generation sequencing to more rapidly identify resistance genes and their bacterial hosts as they travel the globe and move between human and animal hosts across a variety of pathways.


3. We are exploring the effects of a variety of alternatives to antibiotics on the resistance profile of indicator organisms of feces, nasal secretions and skin. We have identified strong co-selection potential for resistance among Gram-positive bacteria (Enterococci and Staphylococci) in pigs fed the metals zinc and copper. We have not identified similar effects in Gram negatives such as \textit{E. coli} and \textit{Salmonella}. Strong dose-response of MRSA to Zn dosages are especially worrisome, as is the spread of a copper resistance gene found on a plasmid encoding both macrolide and tetracycline resistance.


4. Studies at the interface of animal agriculture and human health are difficult to conduct in the broader population. Further, it is particularly difficult to assess food source and antibiotic consumption for humans. Studies in a uniquely integrated population of humans and food animals have yielded unique insights into
shared carriage and transmission of fecal bacteria among food animals, food, humans with occupational exposure to food animals, and human consumers of said food animals.


5. There are inherent benefits to both animal agriculture and human health resulting from the prudent and strategic use of antimicrobial products in the prevention and treatment of infectious diseases of animals. Strategic use implies that a framework exists for the coordinated dispensation of antimicrobial products in agriculture - this is not presently the case. It is widely recognized that economic, regulatory and policy factors drive decisions pertaining to the manufacture, distribution, sale and use of antimicrobials in animal agriculture. We have shown that there exist additional ethical, social, and cultural bases for the dispensation of antimicrobials in animal agriculture. Taken together, the aforementioned factors can be said to constitute the moral economy of antimicrobials. The research objective of this integrated program was to identify optimum approaches (and barriers) to managing and regulating the use of antimicrobial products (in order to mitigate against the development and spread of antimicrobial-resistant bacterial species) in the present, and to develop strategies to extend their usefulness into the future. I participate in a number of advisory roles including to WHO (Advisory Group on Integrated Surveillance of Antimicrobial Resistance) and national groups to prioritize antimicrobial use practices.


D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support
2018-68003-27465, National Institute of Food and Agriculture
Harvey Scott (Co-PI)
ASSESSING AND MITIGATING RISK ASSOCIATED WITH ANTIMICROBIAL RESISTANCE DETERMINANTS IN CATTLE FEEDYARD DUST

Our immediate short-term goals are to quantify the contribution of fugitive bioaerosols from cattle feedyards to the dissemination of antimicrobial resistant bacteria in the downwind environment; further, to assist feedyard managers with identifying critical control points that will allow them to make informed decisions about effective mitigation strategies to reduce the risk of antimicrobial resistant bacteria in fugitive dust.

We propose to accomplish these immediate goals by pursuing the following **four objectives**: 1) Estimate the baseline distribution and determinants of viable pathogenic and commensal bacteria and antimicrobial resistance determinants among fugitive bioaerosols emitted by cattle feedyards under field conditions in the U.S. High Plains 2) Intensively characterize and quantify changes in the distribution of viable pathogenic and commensal bacteria and antimicrobial resistance determinants within fugitive bioaerosols that are associated with varying particle sizes and downwind distances from cattle feedyards, 3) Identify effective mitigation strategies that can be applied to cattle feedyards in order to reduce the absolute and relative quantities of viable pathogenic bacteria and commensal, including those that are resistant to antibiotics of importance to human medicine, and 4) Iteratively develop and deploy a decision tool that allows feedyard managers and extension personnel to employ scientific data to make informed decisions regarding the risks and mitigation strategies to reduce the absolute and relative quantities of viable, pathogenic, commensal and antimicrobial resistant bacteria present in fugitive dust.

MAXIMIZING VOLUNTARY COMPLIANCE IN ANTIMICROBIAL STEWARDSHIP PROGRAMS: A CRITICAL FACTOR FOR EFFECTIVE INTERVENTION

Our overall long term goal is to identify, evaluate, and implement practical, effective and widely adoptable interventions for managing antimicrobial resistance (AMR) among enteric bacteria. In this project, our focus is on developing - through a systems-based stakeholder-centered process - science-based voluntary stewardship programs suited to animal production. In pursuit of this overall goal we first focus our efforts - herein on beef and dairy cattle production systems - and directly address the following supporting objectives in this proposal: 1) recruit key stakeholders to qualitatively explore the essential components and systems framework to maximize voluntary compliance with highly effective antimicrobial stewardship programs, 2) conduct empirical field studies to provide key microbiological, production, economic, and social science decision support data, 3) perform qualitative and quantitative modeling needed to design, test, and improve essential decision support tools, and 4) engage key stakeholders to further develop, refine and communicate highly effective decision support tools to enhance their voluntary adoption and diffusion and to maximize antimicrobial stewardship.

Role: PI

**Completed Research Support**

2016-68003-24607, National Institute of Food and Agriculture

Completed Research Support

2013-68003-21257, National Institute of Food and Agriculture
Our overall goal is to identify, evaluate, and implement practical and widely adoptable interventions for managing antibiotic resistance (AR) among enteric bacteria in swine and beef cattle production systems. We will pursue these specific aims: 1) understand the impacts (both positive and negative) of alternatives to antibiotics on the antimicrobial resistance and microbial ecology of enteric bacteria in swine and beef cattle, 2) understand the mechanisms of dissemination and co-selection of resistance factors as observed among the enteric bacteria, by focusing on mobile genetic elements such as plasmids, and 3) widely disseminate the findings of our research through outreach and education efforts to assist producers, nutritionists, veterinarians and policy makers to assess the relative risks and benefits of each alternative to antibiotics. The results of our work will fill a knowledge gap that has been identified by stakeholders as critical: finding effective alternatives to antibiotics in modern production agriculture that are safe, and improve the situation with antimicrobial resistance; or, at the very least not make it worse. Our approach to achieving practical and proven interventions against AR will address a significant and pressing food safety problem.

Role: PI

2010-51110-21083, National Institute of Food and Agriculture
Harvey Scott (PI)
09/01/10-08/01/15
PRACTICAL INTERVENTIONS TO EFFECTIVELY MANAGE ANTIBIOTIC RESISTANCE IN BEEF AND DAIRY CATTLE SYSTEMS: A FULLY INTEGRATED APPROACH

The dissemination of antibiotic resistance among normal cattle gut bacteria such as commensal Escherichia coli can yield vast pools of resistance elements which may then be transferred to pathogens such as Salmonella. If pathogenic bacteria resistant to antibiotics enter the food chain, treatment of humans can be complicated. Our overall goal is to identify, evaluate, and implement practical interventions for managing antibiotic resistance in beef and dairy cattle systems. We focus on the longstanding problem of resistance emergence, dissemination, and persistence among commensal enteric bacteria; that is, among beneficial and non-pathogenic bacteria naturally present in the gut of healthy livestock. We will employ a variety of methods to assess and then improve the quality of evidence contained in education and extension materials such as veterinary curricula and commodity specific prudent-use guidelines. We will improve the research base of this knowledge through a series of laboratory and field studies built on a framework of theoretical, basic and applied research. These will culminate in a series of recommended practices best suited to manage resistance in beef and dairy cattle systems. The results of our work will fill a knowledge gap that has been identified by stakeholders as critical: the potential impact of commensal bacteria on antibiotic resistance across host and environmental ecosystems. Our systems-based approach for achieving practical and proven interventions against this pressing problem will address a highly significant applied food safety problem.

Role: PI

2003-35212-13298, National Institute of Food and Agriculture
Harvey Scott (PI)
09/01/03-08/01/08
TRANSMISSION DYNAMICS OF ANTIMICROBIAL RESISTANCE IN INTEGRATED ANIMAL AND HUMAN POPULATIONS

The overall objective of this project is to generate for the very first time, valid and reliable quantitative data on the group-level transmission dynamics of phenotypic and genotypic bacterial antimicrobial resistance (AMR) traits in commensal enteric bacteria (E. coli and Enterococcus spp.) within a carefully monitored, semi-closed and integrated population of swine and humans. We then will use these data to develop a framework for, and test mathematical models of, the transmission dynamics of AMR in integrated populations. There are two specific research objectives: Objective #1: We will establish the baseline prevalence of host-specific and host-common antimicrobial-resistant enteric bacteria (E. coli and Enterococcus spp.) and then conduct a 3-year
longitudinal study tracking group-level, housing-defined cohorts of swine, swine-barn workers, slaughter-plant workers, and pork-product consumers in order to quantify the transmission of resistant strains - including any ‘unique’ strains introduced by incoming humans and/or swine. Working Hypothesis: Prevalence levels of resistant strains of E. coli and Enterococcus spp. either unique or common to the two host species will initially vary within and among host sub-populations. Over a 3-year period, strains of antimicrobial-resistant enteric bacteria unique to humans or swine will be differentially disseminated within each of the host-species populations and, eventually, across host species. In contrast, strains of resistant enteric bacteria that are initially common, will remain prevalent and stable within animals and humans only if they continue to be favored over competing strains through on-going selective pressures. Objective #2: We will develop and empirically assess mathematical models of the transmission dynamics of antimicrobial-resistant commensal bacteria within the multi-site, multi-stage swine production system, and among the groups of: 1) swine, 2) swine workers, 3) slaughter-plant workers and, 4) consumers of pork that are integrated within the system. Working Hypothesis: Inter-host-species transmission, establishment of stable prevalence levels within host populations, and the rise or decline in established prevalence will vary between the species and strains of enteric bacteria and will depend on differential direct (e.g., animal-human and human-human) and indirect (e.g., via pork product) contact rates between host groups, fitness advantage (via antimicrobials) and inherent features of each of the strains.

Role: PI

2002-51110-01969, National Institute of Food and Agriculture
Harvey Scott (PI)
09/01/02-09/01/07
THE MORAL ECONOMY OF ANTIMICROBIALS IN ANIMAL AGRICULTURE: ADVANCING POLICY AND PRACTICE IN AN ERA OF ANTIMICROBIAL RESISTANCE

We will initially focus on a single food animal production industry; with consideration of the use of antimicrobials in beef cattle feedlots. We will work with feedlot personnel, feedlot owners/management, veterinarians, pharmaceutical companies (sales/marketing and management), regulatory agencies (FDA and patent office), and legislators who have served on congressional or senate hearings on related matters. We will carry forward the practical information gleaned from this applied research and share this information in novel classroom and extension/outreach settings with present and future stakeholders identified from the analyses. We will build on a recognition of the inherent benefits to both animal agriculture and human health accruing from the prudent and strategic use of antimicrobial products in the prevention and treatment of infectious diseases of animals. The overall objective of the proposed program is to identify optimum approaches for managing and regulating the use of antimicrobial products in the present, and to develop strategies to extend their usefulness into the future. Working from acquired knowledge on the ethical, social, cultural, and economic bases for the contemporary dispensation of antimicrobials in animal agriculture, we will advance future scenarios for optimized antimicrobial usage under different management and regulatory frameworks. There are separate objectives for each of the three areas of applied research, education, and extension:

Research Objectives: 1. Determine the past and present social norms and obligations governing the marketing, prescription and use of antimicrobials in cattle feedlots. 2. Facilitate a systematic review by a panel of experts, in order to generate a range of future scenarios under which existing and to-be-developed antimicrobials might be regulated and managed to optimize their therapeutic use, extend their life, and protect public health. 3. Examine the way that the current social norms, obligations and regulatory frameworks determine the barriers and opportunities that exist under each of the futuristic scenarios. Education Objective: 1. Develop, implement and evaluate new curricula aimed at providing awareness and education on antimicrobial resistance issues and any forthcoming changes in the use of antimicrobials in animal agriculture to both veterinary and animal science students. Extension Objective: 1. Prepare, deliver and evaluate novel extension materials for providing
practicing veterinarians and cattle producers with cutting edge information pertaining to changes needed to extend the useful life of antimicrobials while protecting human health.

Role: PI

2007-55204-17755, National Institute of Food and Agriculture
Harvey Scott (PI)
11/01/06-11/01/11
RESOLVING THE SOCIAL FACTORS INFLUENCING VARIABLE COMPLIANCE AND RISK COMMUNICATION IN FOREIGN ANIMAL DISEASE DEFENSE PROGRAMS

The objective of this study is to determine factors influencing the compliance behavior of parties affected in the instance of a FAD outbreak and in addition use these factors to establish guidelines for foreign animal disease contingency plans. It is necessary to map the factors influencing compliance by conducting interviews and surveys of the potentially affected producers and involved parties if we are to improve the compliance behavior of individuals during FAD outbreaks. We propose to develop tools to enhance and manage communication between regulatory agencies, farmers, and other involved parties for foreign animal disease outbreaks. We suggest the following two objectives to resolve the overall goal of the proposed research. Objective 1: Determine local farming practices and the ethical, moral and social norms and obligations governing producers’ and other intermediary parties' compliance with government actions and imposed regulations in the face of a foreign animal disease outbreak. The following two specific aims will facilitate the completion of objective 1: Specific Aim 1: Conduct face-to-face interviews with stakeholders to determine the entire spectrum of local farming practices and the ethical, moral, social, and economic beliefs of all persons involved in FAD response. Specific Aim 2: Develop a quantitative questionnaire that will be distributed to a sample of persons with the potential to be involved in FAD outbreak response. Objective 2: Establish guidelines to improve contingency plans for FAD outbreaks.

Role: PI

2006-35205-16715, National Institute of Food and Agriculture
Harvey Scott (PI)
03/01/06-03/01/10
HAPLOTYPES OF THE BOVINE MHC

Reconstruct BoLA haplotype structure based on inheritance of microsatellite markers. Integrate genetic polymorphisms associated with animal health phenotypes into the BoLA haplotype structure. Identify and validate single nucleotide polymorphisms (SNPs) for high throughput haplotyping of BoLA.

Role: PI

2003-35204-13255, National Institute of Food and Agriculture
Harvey Scott (PI)
07/01/03-06/01/08
CONTACT RATES AMONG FERAL SWINE AND DOMESTIC CATTLE IN TEXAS: ADDRESSING VULNERABILITY TO FOREIGN-ANIMAL DISEASES

Objective #1: We will intensively track concurrent movements and land-usage patterns of domestic cattle and feral swine over two years on a single defined ranch that exhibits multiple ecological landscape features, in order to better estimate direct and indirect inter-specific contact rates and to understand spatio-temporal variability in landscape usage by each of the two species. Objective #2: We will conduct a short-term, less-intensive tracking of concurrent movements and usage patterns of domestic cattle and feral swine on four additional ranches over a 6-12 month time period representing additional landscapes. We aim to pilot-test the methods on additional sites with varying and additional landscape features, climate, and anthropomorphic disturbances. Objective #3: Develop a useful, valid, and concise survey instrument for estimating regional
interspecific contact rates between feral swine and domestic cattle. This instrument will be designed to be rapidly administered by state and federal emergency response officials to land-owners and ranch managers and other local people so that a rapid assessment of regional risk for inter-specific transmission can be developed.

Role: PI

SRS M1600071, National Cattlemen's Beef Association
  Harvey Scott (PI)
  09/01/15-05/01/17
PREVALENCE, QUANTITY, AND ANTIBIOTIC RESISTANCE PROFILE OF SALMONELLA ENTERICA AT SLAUGHTER IN RESPONSE TO ANTIBIOTIC USE EARLY IN THE CATTLE FEEDING PERIOD
Role: PI

15-072, National Pork Board
  Harvey Scott (PI)
  01/01/15-01/01/17
EFFECTS OF ANTIBIOTICS ON INTESTINAL AND EXTRA-INTESTINAL MULTIDRUG-RESISTANT AND PAN-SUSCEPTIBLE SALMONELLA IN SWINE
Role: PI

15-024, National Pork Board
  Harvey Scott (PI)
  01/01/16-01/01/17
INFLUENCE OF ANTIBIOTIC ADMINISTRATION ROUTES ON THE DEVELOPMENT OF ANTIMICROBIAL RESISTANCE IN SWINE
Role: PI