American Veterinary Medical Association

One Health :
A New Professional Imperative

One Health Initiative Task Force :
Final Report

July 15, 2008

One Health
World Health Through Collaboration

Contents

Preface and Acknowledgments

It has been a special privilege to serve as the Chair of the One Health Initiative Task Force (OHITF). The concept of One Health is not new and perhaps has even enjoyed stronger endorsement and support in past decades prior to the advent of clinical specialization in human and veterinary medicine. Achieving the end point of One Health is truly one of the critical challenges facing humankind today.

The Task Force is acutely aware of the heroes of the past such as William Osler and Rudolf Virchow, the Father of Comparative Pathology. Even the seminal scientific work of both Louis Pasteur and Robert Koch demonstrated the importance of comparative medicine and biomedical research. Both were early practitioners of One Health and their findings represented enormous medical breakthroughs of the 19th century. We also remember the early efforts of Rachel Carson,[1] who raised an awakening of an entire generation to environmental issues, leading to an appreciation of the health of the environment as an integral component to the One Health concept.

Pioneers in this field include former Assistant Surgeon General James Steele, who epitomizes One Health. Dr. Steele organized and developed the first Veterinary Public Health program with the Centers for Disease Control (CDC) in the 1940s, and was responsible for the official inclusion of veterinarians into the US Public Health Service, beginning in 1947. It was the groundbreaking work of Dr. Steele, partnering with physicians and other health professionals, which led to rapid advances in the control and prevention of zoonotic diseases both in the US and internationally.

However, for me personally, and for many members of the Task Force, we fondly remember the pioneering and visionary efforts of Dr. Calvin Schwabe. We were influenced and "converted" to One Health by Dr. Schwabe, who spent a lifetime practicing and teaching the principles of One Health. The Task Force members wish to honor Dr. Schwabe by dedicating this report to him.

> "The challenges and obligations of health professionals have never been tested as we are today to truly reestablish our social responsibility."

Acknowledgments

The American Veterinary Medical Association (AVMA), and this Task Force in particular, have been well served by committed volunteers who give their time and energy to work on important issues to improve and advance the veterinary profession. The American Medical Association (AMA) and American Public Health Association (APHA), as well as other professional organizations, operate similarly and are also dependent on volunteers. I commend these dedicated professionals and salute them for their hard work and aspirations to make a difference in the lives of the people and animals that we serve.

I am especially appreciative and thank my fellow task force members. The OHITF members have added remarkable insights, wisdom, and intellect into this report and to our deliberations. The group has formed a strong camaraderie and has enthusiastically devoted themselves to the cause of One Health today and for the future.

In addition, the AVMA is fortunate to have a talented, energetic, and superb staff. The entire Task Force wishes to both acknowledge and thank Drs. Lynne White-Shim, Heather Case, Elizabeth Curry-Galvin, and Ms. Ellen Pietka, all of whom gave tirelessly to supporting our Task Force and this project. Other staff members, including Dr. Janis Audin, J.B. Hancock, and Sharon Curtis Granskog, have also added real value to our work. Finally, I would like to thank Dr. Roger Mahr, who championed the One Health concept and greatly helped elevate it as part of the AVMA's agenda.

Lonnie King, DVM, MS, MPA, DACVPM
Chair, OHITF

I. Executive Summary

The convergence of people, animals, and our environment has created a new dynamic in which the health of each group is inextricably interconnected. The challenges associated with this dynamic are demanding, profound, and unprecedented. While the demand for animal-based protein is expected to increase by 50% by 2020,[2] animal populations are under heightened pressure to survive, and further loss of biodiversity is highly probable.

On top of that, of the 1,461 diseases now recognized in humans, approximately 60% are due to multi-host pathogens characterized by their movement across species lines.[3] And, over the last three decades, approximately 75% of new emerging human infectious diseases have been zoonotic.[4] Our increasing interdependence with animals and their products may well be the single most critical risk factor to our health and well-being with regard to infectious diseases.

There is a growing concern that the world's latest generation could be the first in history to experience a *reduction* in life expectancy and health in general. Yet, veterinary and human medicines are considered separate entities and the obvious links between them frequently ignored. According to the KPMG study, *"The Current and Future Market for Veterinarians and Veterinary Medicine in the United States,"*[5] published in May of 1999, "our traditional approaches and past requisite skills and levels of knowledge may not be commensurate with the rapid changes and new demands of food-animal industries and the shifting requirements needed for the corporate and public opportunities in the future. These include public health, biomedical research, and the global food system."

The need for a holistic, collaborative approach

One strategy to better understand and address the contemporary health issues created by the convergence of human, animal, and environmental domains is the concept of One Health. Although the concept of One Health is not new—the theory was supported by William Osler and Rudolf Virchow, the Father of Comparative Pathology, and re-articulated in Calvin Schwabe's 'Veterinary Medicine and Human Health'[6] in 1984—our increasing interdependence with animals and their products has spurred the medical and veterinarian professions to readdress such an approach. This approach would encourage the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment.

The benefits of One Health

The benefits of a One Health approach include:

- Improving animal and human health globally through collaboration among all the health sciences, especially between the veterinary and human medical professions to address critical needs
- Meeting new global challenges head-on through collaboration among multiple professions—veterinary medicine, human medicine, environmental, wildlife and public health
- Developing centers of excellence for education and training in specific areas through enhanced collaboration among colleges and schools of veterinary medicine, human medicine, and public health
- Increasing professional opportunities for veterinarians
- Adding to our scientific knowledge to create innovative programs to improve health

The One Health Initiative Task Force (OHITF)

On April 14, 2007, the AVMA Executive Board took official action to establish a One Health Initiative by approving a recommendation by then-president Dr. Roger K. Mahr to establish a One Health Initiative Task Force (OHITF). The purpose of the task force was to study the feasibility of a campaign to facilitate collaboration and cooperation among health science professions, academic institutions, governmental agencies, and industries to help with the assessment, treatment, and prevention of cross-species disease transmission and mutually prevalent, but non-transmitted, human and animal diseases, and medical conditions.

The OHITF, comprising thirteen visionary individuals and communicators (See Appendix A), was charged by the AVMA Executive Board with the task of defining 'One Health', and providing recommendations and strategic actions that would support and expand the concept across the health professions. Just two months later, the American Medical Association House of Delegates followed suit, with unanimous approval of a resolution in support of One Health.

Partnership is critical to success

The veterinary profession must implement solutions to the critical workforce challenges in collaboration with multiple professions, including public health, human medicine, bio-engineering, animal science, environmental science, and wildlife. By working together, more can be accomplished to improve health worldwide, and the veterinary medical profession has the responsibility to assume a major leadership role in that effort. One Health calls for the collaborative efforts of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals and our environment.

OHITF recommendations

The following recommendations, which are not listed in order of priority, were based on the findings of the One Health Initiative Task Force (OHITF) both during their meetings, and in the follow-up sessions held by the working groups. While the AVMA and the AMA plan to take a leadership role in this effort, the success of these recommendations will depend heavily on the collaboration of various health science professions, academic institutions, governmental agencies, and private industries.

1. Create and fund a One Health Joint Steering Committee to begin the execution of the other recommendations and associated actions.
2. Complete a One Health Proposal for Donors as well as a Business Plan and continue the process of engaging potential donors and sponsors.
3. Create and implement initial components of a One Health Communication Effort.
4. Engage an all-inclusive communications firm to develop and implement a communications plan and coordinate on-going media relations, public relations, publicity, marketing and advertising.
5. Plan a study on One Health to be conducted by the National Academy of Sciences and secure the necessary funding to underwrite this effort.
6. Develop, charter and form a National One Health Commission (to replace the Steering Committee) and recruit full-time staff in key positions to support the goals and mission of the Commission and complete the recommendations within this report.
7. Appoint a national/global One Health Advisory Team to help support the National One Health Commission, and give it direction, counsel, and wisdom.

8. Plan and hold a One Health National Summit.
9. Convene several panels and a national meeting to establish a national research agenda for One Health.
10. Work toward the inclusion of key One Health outcomes for listing in the strategies for Healthy People 2020 and Healthy Animals 2010.
11. Inform, engage, and solicit the support of medical, veterinary medical, and public health students and their respective organizations.
12. Create a guiding coalition of liaisons, champions, and key supporters to promote the One Health concept.

Call to action

We now stand at the precipice of health care transformation where disease prevention and health promotion in people, animals, and our environment have become a critical strategic need. The most pressing need for a transformation of this magnitude is almost always vision and leadership. The OHITF recommendations can serve as an action plan to guide individuals and professions during the process of change. But, while the AVMA and AMA are eager and willing to take the lead on this effort, we cannot succeed without the support of others.

We now stand at the precipice of health care transformation where disease prevention and health promotion in people, animals, and our environment have become a critical strategic need.

Decisions made today impact events of tomorrow. We live in a world in which the difference between what can be imagined and what can be accomplished has never been smaller. Veterinary medicine is in a unique position. Veterinarians are well grounded in population health, comparative medicine, and preventive medicine. The profession has the potential to help lead the efforts of One Health. However, this is not a given, and a reluctance by our profession or by the other health sciences to take this step, will, without question, be a lost opportunity that will be picked up by other groups.

The responsibility sits clearly on our shoulders. The human medical profession is faced with the same dilemma—it also must decide on its future role in One Health. Every profession has its defining moments—special points in time when talented individuals work cooperatively to influence the course of events for generations to come. For veterinary medicine and the other health sciences, that time is now.

Our recommendations will only be fulfilled if action is taken, resources identified and committed, and leadership supported. We urge you to join us in supporting the One Health Initiative.

II. Purpose of this Task Force Report

On April 14, 2007, the AVMA Executive Board took official action to establish the One Health Initiative by approving a recommendation by then-president Dr. Roger K. Mahr to establish a One Health Initiative Task Force (OHITF). The purpose of the task force was to study the feasibility of an initiative that would facilitate collaboration and cooperation among health science professions, academic institutions, governmental agencies, and industries to help with the assessment, treatment, and prevention of cross-species disease transmission and mutually prevalent, but non-transmitted, human and animal diseases and medical conditions.

Two key areas of study would include:

- Identify critical workforce shortages and global societal needs, and develop solutions in collaboration with key stakeholders
- Ensure that the nation has the infrastructure and resources to anticipate and respond to public health and animal health emergencies or disasters

The OHITF, comprising thirteen visionary individuals and communicators, was charged by the AVMA Executive Board with the task of defining the "One Health" concept, and with delivering recommendations and strategic actions that would support and expand the concept across multiple health professions.

In addition, Dr. Roger Mahr, Dr. Ron Davis, and Dr. Jay Glasser were appointed as liaisons representing the AVMA, American Medical Association (AMA), and American Public Health Association (APHA), respectively. The Task Force quickly acted to collaborate with key strategic partners including the AMA and the Centers for Disease Control (CDC).

American Medical Association (AMA)

In June of 2007, following the leadership of Dr. Ron Davis, President of the AMA, a resolution was introduced to the AMA House of Delegates by the American College of Preventive Medicine, American College of Occupational and Environmental Medicine, American Association of Public Health Physicians, and Academy of Pharmaceutical Physicians and Investigators calling for the AMA to support the One Health Initiative. The resolution was subsequently passed by unanimous vote.[7]

Centers for Disease Control and Prevention (CDC)

In her keynote address at the 144th Annual AVMA Convention held in July of 2007, Julie L. Gerberding, MD, Director of the Centers for Disease Control and Prevention and Administrator of the Agency for Toxic Substances and Disease Registry, urged veterinarians and physicians to present a seamless front to protect human and animal health in a shrinking global environment.[a]

At the convention, Dr. Davis and Dr. Mahr participated in a joint press conference introducing the concept to the media and explaining the need for the One Health Initiative. Following the press conference they presented in a collaborative session, "One Medicine—Fly under One Flag." They

a. Gerberding J. Keynote address. 144th Am Vet Med Assoc Annu Conv, Washington, DC, July 2007.

were joined at this session by Jarbas Barbosa, MD, head of Health Surveillance and Disease Management of the Pan American Health Organization (PAHO).

These activities greatly increased the visibility of One Health and provided the impetus for the action of the One Health Initiative Task Force (OHITF). The first One Health Initiative Task Force meeting was held November 27-28, 2007, and was followed by a second meeting in January, 2008. This report represents the culmination of discussions, ideas, and perspectives on One Health that were shared at those meetings and in subsequent discussions.

The Task Force's best thinking and set of actions and priorities are reflected in this report, as are its recommendations to the AVMA Executive Board. The report will be presented to the Executive Board at its meeting in Schaumburg, Illinois, in June, 2008.

III. Introduction

The convergence of people, animals, and our environment has created a new dynamic—one in which the health of each group is inextricably interconnected. The challenges associated with this dynamic are demanding, profound, and unprecedented. While the demand for animal-based protein is expected to increase by 50% by 2020, animal populations are under heightened pressure to survive, and further loss of biodiversity is highly probable.[2]

Compounding that is the fact that, of the 1,461 diseases now recognized in humans, approximately 60% are due to multi-host pathogens characterized by their movement across species lines.[3] And, over the last three decades, approximately 75% of new emerging human infectious diseases are defined as zoonotic.[4] Our increasing interdependence with animals and their products may well be the single most critical risk factor to our own health and well-being with regard to infectious diseases.

Environmental degradation promotes expansion of infectious diseases and non-infectious threats

At the same time, pollution and contamination of our environment has greatly reduced the health and sustainability of our environment. Such degradation of the environment will continue to create favorable settings for the expansion of existing infectious diseases, as well as an increasing number of acute and chronic non-infectious disease events detrimental to both human and animal health. In addition, non-infectious threats include toxins and chemical contaminants, such as endocrine-disrupting chemicals in the environment (Our Stolen Future, Theo Colborn, 1996).[8]

Other examples include the melamine contamination of pet foods, fire-retardant carpet chemicals causing adverse effects in pet cats, and marine toxins in manatees. While we have experienced remarkable medical advances, there is a growing concern that the world's youngest generation could be the first in history to experience a reduction in life expectancy and health in general, compared to prior generations. This is already being seen in SubSahara Africa and, most recently, in females in various parts of the US.

The need for a holistic approach to health

Although new opportunities have emerged to promote health in the rapidly changing human, animal, and environment domains, our ability to protect, improve, and advance health cannot be based on strategies and mindsets in the past. Rather, we need to adopt an integrated, holistic approach that reflects both our profound interdependence and the realization that we are part of a larger ecological system—exquisitely and elaborately connected.

We suggest that the strategy to better understanding and addressing the contemporary health issues created by the convergence of human, animal, and environmental domains is the concept of One Health. The term One Health has been defined by the Task Force as the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment. Achieving the end point of One Health is truly one of the critical challenges facing humankind today.

Control of infectious diseases central to One Health

Central to the concept of One Health is the control of infectious diseases which have helped shape the course of human history. There is every indication that infectious diseases will continue to have a significant impact on our health, and the emergence and re-emergence of pathogens will threaten the health and well being of people and animals throughout the 21st century.

...the strategy to better understanding and addressing the contemporary health issues created by the convergence of human, animal, and environmental domains is the concept of One Health.

In addition, according to Jared Diamond, in his book, "Guns, Germs and Steel,"[9] microbes causing diseases such as measles, smallpox, influenza, and tuberculosis likely evolved from animal diseases as a result of the advent of agriculture and the domestication of animals approximately 8-10,000 years ago. Today, microbes pose an increasing threat.

In their article entitled "Microbial Threats to Health, Emergence, Detection, and Response"[10] (NAS, 2003), authors from the Institute of Medicine suggest that a group of factors have simultaneously converged to create a "perfect microbial storm." The most important of these factors include:

- Adaptation of microbes
- Global travel and transportation
- Host susceptibility
- Intent to do harm
- Climate change
- Economic development and land use
- Human demographics and behavior
- A breakdown of both public and animal health infrastructures
- Poverty
- Social inequality

...microbes have much greater opportunities to create new niches, cross species boundaries, travel worldwide very quickly and establish new beachheads in the populations of people and animals.

Most of these factors are man-made, and have produced a remarkable new milieu referred to as "the global mixing bowl," in which microbes have much greater opportunities to create new niches, cross species boundaries, travel worldwide very quickly and establish new beachheads in the populations of people and animals. They are also invading our environment, where they are being uniquely maintained in nature outside of living hosts. The convergence of these domains is creating threats to the health of all three.

Threats to animal and human domains

Numerous examples point to the critical need to address these threats, including:

- The spread of HIV-AIDS, a zoonotic disease with its origin in non-human primates, which has had a severe impact on life expectancy and human health, especially in Africa.[10]
- The incursion of West Nile Virus in 1999, and SARS and monkeypox in the US in 2003—although none of these had ever been found in the Western Hemisphere in prior years.
- The infection of over 1.5 million individuals in the US by West Nile Virus, as well as countless horses and birds, permanently changed the landscape of human and animal medicine in this country.
- The emergence of Bovine Spongiform Encephalopathy (BSE), now recognized as a disease produced by an aberrant protein, has changed the standards of global agricultural trade as well as how cattle are fed. This disease is also recognized as a food-borne human pathogen producing new variant Creutzfeld-Jakob Disease (VCJD) in humans.

- The incidence in livestock of the highly contagious Foot and Mouth Disease (FMD). Trade consequences from an FMD introduction into the United States include projected losses at more than $37 Billion to the US economy.[b] While it is typically not associated with human disease, the psychological consequences of introduction of FMD in the US could range from food safety fears by the public, to severe distress of livestock producers and other areas impacted directly or indirectly by an outbreak.
- Some disease conditions that affect only animals still have wide consequences on human health. For example, while Porcine Reproductive and Respiratory Syndrome (PRRS) affects only swine, the vast number of swine deaths caused by PRRS outbreaks has had major consequences on the food supply chain and on the economies of swine-producing countries.[11]
- The major decline in amphibian population worldwide being caused by the fungal disease chytridiomycosis that is threatening biodiversity and ecosystem sustainability.
- The death each year of 1.5 million people, mostly of whom are children, from diarrheal diseases—many of which are transmitted through water-borne and food-borne sources.

The words of Dr. Gro Harlem Brundtland, former director of the World Health Organization (WHO), were indeed prophetic. In her speech[12] at the United Nations Global Leadership Awards on April 19, 2001, she stated that in a modern world, bacteria and viruses travel almost as fast as money. With globalization, a single microbial sea washes over all humankind and there are no health sanctions.[12] In actuality, that sea washes not over just all humankind, but also across all animal and environmental domains.

Beyond infectious diseases, it is important to note that "noncommunicable" conditions and risks are crossing species and adversely affecting both animal and human health. Examples include obesity and exposure to secondhand tobacco smoke among pets, pet-owners, and their children.

There is nothing on the horizon to suggest that any of these factors are abating. In fact, these factors are likely to accelerate in intensity and complexity, and will surely create consequences and implications of unprecedented scope and scale and global economic devastation much greater than any previous time in history. By adopting the tenets of One Health, we can devise integrated strategies to control that sea and prevent these threats from crossing domains.

b. Newcomb J. Economic analysis of impacts of Avian Influenza, SARS, FMD and other infectious disease outbreaks (workshop presentation). Beyond Zoonoses: One World—One Health, Bangkok, Thailand, November 2004.

IV. The Charge to the One Health Initiative Task Force (OHITF)

The AVMA Executive Board charged the OHITF to:

1. Articulate a vision of One Health that will enhance the integration of animal, human, and environmental health for the mutual benefit of all
2. Identify areas where such integration exists and where it is needed
3. Identify potential barriers or challenges to such integration
4. Identify potential solutions to overcoming barriers or meeting challenges
5. Prepare a comprehensive written report for the Executive Board detailing its findings and recommendations

V. Responding to the Charge

1. Articulate a vision for One Health

Vision Statement

To promote and improve the health of humans, animals and our environment, individually and collectively, by encouraging and ensuring the acceptance and adoption of One Health and its associated activities.

Definition of "One Health"

One Health is the collaborative effort of multiple disciplines-working locally, nationally, and globally – to attain optimal health for people, animals and our environment.

The Scope of "One Health"

The scope of One Health is impressive, broad, and growing. Some of the dimensions defining the scope of the concept are shown in the chart on the following page:

The Scope of One Health
agro-and bio-terrorism
animal agriculture and animal sciences
antimicrobial resistance
basic and translational research
biomedical research
clinical medicine
combating existing and emerging diseases and zoonoses
comparative medicine
conservation medicine
consumer support
diagnosis, surveillance, control, response and recovery directed at natural or intentional threats that are chemical, toxicological, or radiological in nature
entomology
ethics
food safety and security
global food and water systems
global trade and commerce
health communications
health of the environment and environmental preservation
implications of climate change
infectious disease ecology
integrated systems for detection
land use and production systems and practice
mental health
microbiology education
occupational health
public awareness and public communications
public health and public policy
regulatory enforcement
scientific discovery and knowledge creation
support of biodiversity
training
veterinary and environment health professionals and organizations
wildlife promotion and protection

2. Identify the areas where the integration of human, animal, and environmental health exists

Numerous organizations have recognized the need for integration of human and animal health, and the health of the environment and have taken steps to develop new programs and form new partnerships to support that integration. Some examples are highlighted below:

- In 2007, the Centers for Disease Control and Prevention (CDC), as part of its reorganization, created a National Center for Zoonotic, Vector-Borne and Enteric Diseases (NCZVED). This center has close to 1,000 employees focusing on infectious disease ecology and a One Health mission. They have cross-cutting programs in food-borne, water-borne, zoonotic, and vector-borne diseases, not to mention global health that integrate human, animal, and environmental domains in the areas of research, disease and outbreak investigations, laboratories, pathogen discovery, epidemiology, policy, and communication.
- The Environmental Protection Agency (EPA), United States Agency for International Development (USAID), Wildlife Conservation Society (WCS), Envirovet Summer Institutes, and National Science Foundation (NSF) have existing programs and research projects that have purposefully and effectively brought issues such as environmental degradation, pollution, climate change and ecological stress into the realm of both human and animal health. Poor environmental health conditions may lead to negative health consequences from contamination and pollution, and from the creation of environments that are more conducive to the survival and emergence of new infectious agents.
- The US military has historically linked their health operations in monitoring, surveillance, and lab systems. The US Public Health Service (USPHS), some FDA programs, the US Department of Agriculture Food Safety and Inspection Service (FSIS), and the CDC have integrated programs spanning human and animal health.
- The Global Center for One Health and the Center for Emerging Infectious Diseases have been established as focal points to bring disciplines, professions, and colleges together.
- Today, more than half of US veterinary colleges have formal dual Doctor of Veterinary Medicine (DVM or VMD)/Master of Public Health (MPH) degree programs. This has been a major change of emphasis and coordination just over the last five years.
- Many veterinary and human medical colleges have formed links with schools of public health and created programs in comparative medicine and biomedical research, facilitating further collaboration across the health professions.
- Biomedical research and laboratory animal and comparative medicine examples also highlight such integration. The development and use of animal models for research on the treatment and cures for many human diseases has been a major success, particularly with the development of genetically modified mouse models.
- Several laboratory systems are integrating diagnostics across health domains, including the Integrated Consortium of Laboratory Networks, National Animal Health Laboratory Network, Laboratory Response Network, Zoo Network, ArboNet, Global Avian Influenza Network for Surveillance, the National Biosurveillance Integration System, and the Food Emerging Response Network.

- Human and animal health corporations and pharmaceutical companies in the Kansas City corridor are sharing capacities and innovations linking the biosciences and animal health. In addition, many pharmaceutical companies have both animal and human health products and Research and Development systems that utilize both human and veterinary medical professionals collaboratively.
- One Health research, data, and programs are frequently highlighted in educational journals such as *Eco Health*, the *Journal of Emerging Infectious Diseases, Zoonoses and Public Health,* the *Public Health Reports Journal,* and the *International Journal of Zoonoses*. In addition, ProMed and the Canary Database provide disease reporting based on One Health strategies.
- There are several outstanding wildlife surveillance and conservation projects, such as the Global Avian Influenza Network for Surveillance operated by the Wildlife Conservation Society as well as other surveillance and diagnostic systems, that are working together to address both human and wildlife populations.
- Organizations such as the Delta Society have worked to promote human and animal health through the human-animal bond, facilitating human interactions with pets for the benefit of human health. The Delta Society has also worked to promote health benefits of this interaction, such as lowered blood pressure and increased survivability from heart attacks in people.
- Although still somewhat disconnected, the US preparedness efforts addressing the threat posed by H5N1 Avian (AI) and pandemic influenza has been more integrated than past programs. Planning, detection and parts of the surveillance strategies involve animal and public health and have supported further integration of diagnostic laboratories. The federal interagency planning and test exercises are also examples of where integration is working and, at least, animal and human populations are being considered together.
- At national and local levels, veterinarians, health care organizations, public health agencies, and other stakeholders are collaborating in areas of mutual interest to both—for example, awareness and prevention of pet and childhood obesity and exposure of pets, pet-owners, and their children to secondhand tobacco smoke. As human health benefits are more closely identified with animals in the home, other applications of One Health will continue to involve companion animals.

Finally, natural disaster response and lessons learned from Hurricane Katrina have stimulated more collaboration among animal, human and environmental communities and organizations. Emergency preparedness, both locally and nationally, is much better coordinated today but can still benefit from further integration.

3. Identify areas where the concept and operation of One Health are especially needed

In the article "Animal-Borne Epidemics out of Control"[13] which appeared in The Trust for America's Health, authors studied the incursion of five animal diseases into the US that were mostly zoonotic, and estimated that more than 200 different federal offices, agencies, and programs would have had some jurisdiction in response to these threats. Clearly, the responses were primarily ad hoc and lacked any effective integration. A One Health approach with key linkages and a national integrated strategy is a dramatic and critical need. Real life examples abound:

2006 E.coli outbreak

In 2006, approximately 200 people in 26 different states were diagnosed with a particularly virulent case of *E.coli* 0157:H7.[14] Almost half of the cases were hospitalized and almost 25% suffered from hemolytic uremic syndrome (HUS). If viewed only through only the lens of public health, this outbreak focused primarily on morbidity, mortality, outbreak investigation, laboratory diagnosis, and clinical treatment.

However, once viewed through the lens of animal health, the same causative organism with an exact laboratory finger-print match was found in cattle close to where the spinach was produced in the Salinas Valley of California. This exact strain was recovered from wild hogs that ran through the same fields. When considered through the lens of an ecologist and hydrologist, the ground water and surface water in this high-production agricultural region were being mixed together due, in part, to a drought followed by heavy rains, and a strain on the irrigation system which was trying to keep up with intensified agricultural production.

The same *E.coli* organism recovered from both patient and animal sources was then found in one of the water ditches close to the spinach fields in the area. Thus, when a One Health construct was used, we were able to understand that the spinach field was likely contaminated through irrigation water that contained *E. coli* from the infected hogs running through the fields, and that the organism could survive in the spinach plant throughout processing and distribution.

Only by integrating our knowledge of the environment and ecology could this investigation be completely understood. More importantly, only through this knowledge, can appropriate intervention and prevention strategies be properly implemented. A purely human health approach would have resulted in the focus on clinical care and individual treatment rather than on possible sites for prevention of contamination and infection.

Need for professionals targeting health of the environment

There is a need for additional programs to train health professionals on the promotion of the health of the environment. For example, Envirovet Summer Institutes could be a model for other programs to use in developing a field-training environment, within which professionals can be trained to utilize their skills for the health of the environment. Others could learn how to implement new programs by gaining an understanding of such examples that currently exist.

Rift Valley Fever

Rift Valley Fever is a vector-borne zoonotic disease that infects people, food, animals and some wildlife. It could likely turn into a devastating epidemic with immense economic, commercial, and health consequences across the country if it ever entered the US. A well-integrated public, animal, and environment health strategy is required to ensure appropriate detection, response, and recovery actions.

Emerging and re-emerging diseases

Emerging and re-emerging diseases, such as Hanta virus, plague, leptospirosis, West Nile virus, Lyme disease, and schistosomiasis, are all impacted by changing weather patterns and/or flooding, altered land use, and host-vector dynamics. A collaborative effort is required if they are to be detected and contained.

Bio- and agro-terrorism

Eighty percent (80%) of our recognized select agents, or those of greatest concern for use as bio-and agro-terrorism agents, are zoonotic pathogens. Clearly, these dangerous microbes may show up just as easily in a veterinary hospital or animal diagnostic laboratory as in a physician's

office or a human health lab. Yet, with a few exceptions, we approach these threats as separate and disconnected events and only now are surveillance systems attempting to integrate information.

In the vast majority of veterinary practices, there is no standardized electronic medical record keeping system. Therefore, the profession has not been able to establish a true, evidence-based medical system. Veterinary medicine is unable to coordinate national monitoring or develop an effective and comprehensive early detection system for the millions of companion animals across the country. This inability to bring this growing population into a cross-species surveillance system has created a barrier to One Health.

Collaboration at the local, national, and global levels

The inclusion of a variety of health professionals in local, national, and international organizations is key. For example, locally, veterinarians can provide guidance on issues of importance to local health boards. Local human and veterinary medical associations could meet more frequently to discuss topics of mutual interest in their communities. Nationally and internationally, One Health stakeholder leaders could catalyze the concept to trickle down to clinicians at the local levels.

Threats to the global food system

A One Health approach is needed to meet the challenges of the rapidly increasing supply and demand of our global food system. Two years ago, 21 billion food animals were produced to help feed 6.5 billion people,[15] resulting in millions of tons of animal and agricultural products being transported worldwide. With almost 90% of future human population increases occurring in developing countries, unprecedented animal production is also increasing in these areas of the world. Unfortunately, these countries often do not have adequate human and animal infrastructures in place to control and address current disease, much less the emergence and detection of the next group of microbial threats.

A recent article[16] in *Nature* (Feb 2008; Jones, et al) reports that there have been 335 emerging disease events since 1940. The report states that these events have been progressively increasing over the decades, and, except for emerging antimicrobial resistant organisms, most have originated in developing regions of the world and will likely continue this pattern well into the future.

Yet our existing surveillance systems have been developed and implemented with a bias toward richer and developed countries. Thus, we fail to consider those areas of world at greatest risk and with the highest probability of incubating the next emerging infection. The need to create and establish good surveillance and monitoring systems in developing counties as an integrated strategy and across domains is lacking at a time we need it most.

Water and sanitation systems

Our water and sanitation systems are also under pressure and over 1.5 million people, mostly children, die of diarrheal diseases worldwide each year.[17] In the US, we have just experienced the largest number of outbreaks of cryptosporidia in our history, and the vast majority have been from chlorinated water sources. The ecology of water-borne diseases represents a critical area of study for the future in order to better understand and prevent further water-borne zoonoses. There are also growing issues about contamination of our water supplies with chemicals, toxins, and by-products of drugs and hormones. A One Health approach is critically needed.

A moral obligation

Dr. Mirta Roses, Director of the Pan American Health Organization (PAHO), recently reported that a substantial portion of the world's disease burden was due to the environment, and poor populations are at much greater risk and face greater consequences to their health and quality of life.[18]

She stated, "Millions of families in the world exist—or struggle to survive—in wretched, overcrowded and unsafe slums, shacks, tents, ghettoes, and settlements. They are exposed to harsh weather. Rats and insects bring disease to their homes. Poor ventilation, little light and the need for constant repair aggravate the tragedy. These conditions are especially oppressive for children—their bodies, their growth, and development and their dreams. They live with no clean water, decent sanitation or basic services that many in the world would enjoy daily and take for granted. Yet they are our fellow human beings, a precious human capital and we have the mission to reduce the environmental hazards they face in order to improve their health."[19]

Today, approximately 800 million livestock and poultry keepers worldwide— primarily women and children—depend on their few animals for food, income and stability. Should these valuable assets contract a zoonotic disease, not only is the family's income at risk, but the keepers that are intimately associated with the animals have a high probability of contracting the illness. In addition, indigent populations suffer disproportionately from the negative consequences of environmental degradation, pollution, poor sanitation, and the impact of adverse weather conditions.

Health is an outcome shaped by a wide range of social, economic, natural, man-made, and political environments that form a complex and ever-changing dynamic. Understanding the epidemiology, maintenance, and spill-over mechanisms between vectors and hosts are all part of complex events found at the interface of human animal health and of health of the environment.

4. Identify Barriers or Challenges to One Health

There are significant barriers to the adoption of the One Health concept, perhaps the most important being the need for key leadership to embrace the concept of One Health, to obtain buy-in from medical, veterinary, industrial, and environmental partners, and to execute a change program on a global basis.

Success in adopting the One Health concept will require overcoming many other barriers, including difficulty in changing the mindset of healthcare providers from one of "disease care" to one of preventive medicine, the bias towards clinical care, increasing specialization and fragmentation of the field, as well as a general lack of awareness and education of physicians, and difficulty getting busy practitioners on board.

While we have made progress, additional barriers include differences in organizational cultures, competing priorities, and a lack of resources to promote and further develop One Health. In addition, we will have to address the need for a communication plan that could effectively influence public awareness and motivate a campaign to help influence Congress and key policy makers, the lack of effective models from which to build a national One Health program, and the lack of a critical mass to help evolve and inculcate the concept.

Disease care or preventive medicine?

Today's human health care system in the US is actually a disease care system. In 2005, personal healthcare expenditures in the US reached $2 trillion.[20] This translates to approximately $6,400 per person and 16% of this country's GDP. Almost 98% of all US expenditures in the system are spent on addressing diseases and only about 2% on prevention. We fail to adequately invest in protecting and promoting health, preventing diseases, injuries, disability, and preparing for new health threats. The concept of One Health is very much a strategy with a long-overdue bias

The concept of One Health is very much a strategy with a long-overdue bias towards health promotion and disease prevention across the human, animal, and environmental domains.

towards health promotion and disease prevention across the human, animal, and environmental domains.

The return-on-investment for this strategy is profound when we view the cost savings associated with prevention of diseases and the multiplier effect involved when we consider that a positive impact in one domain is often transferred to a positive benefit in other domains. Thus, One Health is a transformational strategy and is quite different from our traditional health care system. This transformation can be threatening and goes against our current training and mindsets regarding medicine and health care. One Health might be categorized (unfairly) as a "fringe or alternative medicine" because it is non-traditional and its precepts may be considered too avant-garde.

One Health is very much an overarching concept that spans many disciplines, professions, and areas of interest.

Bias toward clinical care

The concept of One Health is a very different view of health when one compares the mindset, education, and training of health professionals in the past with those of today. There remains a strong bias, in both human and veterinary medicine, toward clinical care of individual patients and a significant shift to areas of specialization. This professional orientation and interest will be difficult to overcome in order to embrace the broader vision of One Health. Therefore, academic institutions will need to respond by adopting new ways to educate the next generation of health science professionals.

In addition, there is a growing emphasis in specialization and clinical practice focusing either on humans or animals to the detriment of understanding and applying One Health principles. Yet, practitioners in both human and veterinary practice can successfully practice One Health if they have the mindset and educational background to appreciate the concept.

In clinical settings, few One Health teams have been assembled to address the new challenges brought about by the convergence of health domains. For instance, a special need exists today for an integrated surveillance system that rapidly and accurately detects both potential pathogens and non-infectious threats such as toxicants and contaminants in human, animal, and environmental domains.

Although some progress is being made, the separation of the human and animal health education and training systems is still difficult to bridge. Health professionals continue to be educated and trained in professional-centric academic institutions with seemingly little appreciation for the integration and coordination of disciplines especially beyond their own professions.

Specialization increases fragmentation

Today, both human and veterinary health systems are composites of multiple specialties. This is especially an issue in veterinary medicine, where fragmentation of the profession is accelerating and the ability to create and support a national plan and strategy like One Health will be challenging. A few years ago, Dr. Calvin Schwabe, a pioneer in One Health, characterized the veterinary profession as a "big field, small profession." The diverse obligations, responsibilities, and opportunities in veterinary medicine are difficult to fulfill even though societal expectation and needs are unparalleled and growing.

Veterinary medicine is approximately one-tenth the size of the human medical profession and its ability to be optimally and simultaneously successful in areas such as biomedical research, agroterrorism, food safety and security, and public health is challenging at best. Incorporating One Health into their existing specialties will be daunting.

The need for leadership

One Health is very much an overarching concept that spans many disciplines, professions, and areas of interest. While most understand the need to effectively connect these diverse areas into a single coalesced plan, the ability to accept the ideas and then to execute or implement critical strategies that produce One Health is, perhaps, the most difficult challenge. One Health is, in essence, a vision, and a blueprint to guide implementation or to transform the vision into action, although a challenge, is essential to manage and lead change of this magnitude.

The successful adoption and implementation of One Health will be predicated on the leadership ability of its advocates. In order to achieve buy-in across the domains of One Health, key leadership will need to be established, engaged, and empowered.

In his book, "The New Rules,"[21] John Kotter addresses the necessity to muster the courage to overcome complacency, the knowledge and skills to envision a strategic future, and in our rapidly changing world, make changes to the foundation of our culture. Leadership skills are fundamental to the One Health vision and implementation.

"...the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge."

5. Identify Potential Solutions to Overcoming Barriers or Meeting Challenges

We now stand at the precipice of health care transformation where disease prevention and health promotion in people, animals, and our environment have become a critical, strategic need. The most pressing need for transformation is almost always vision and leadership. The OHITF recommendations, found in the next section of this report, can serve as an action plan to guide individuals, institutions, and professions during the process of change. But, most importantly, while the AVMA and AMA are eager and willing to take the lead on this effort, we cannot succeed without support from others.

The opportunity to meet continuing challenges to health through the concept and implementation of new strategies is both exciting and troubling. One Health has the potential to meet critical societal needs and demands, but our health professionals might not appreciate or realize the urgency or need to coalesce and confront the complex issues threatening health.

We need to stop trying to figure what to do by looking at what we have always done, and now focus on what is truly needed and possible. Most new opportunities do not fit neatly into existing organizational boxes or departments. Yet at the intersection of differences can always be found opportunities for creative ideas, innovations and profound transformation—One Health is that challenge.

Decisions made today impact events of tomorrow. We live in a world in which the difference between what can be imagined and what can be accomplished has never been smaller. Veterinary medicine is in a unique position. Veterinarians are well grounded in population health, comparative medicine, and preventive medicine. The profession has the potential to take a major leadership role in the efforts of One Health. However, this is not a given, and a reluctance by our profession or by the other health sciences to take this step, will, without question, be a lost opportunity that will be picked up by other groups.

The Veterinarian's Oath, to which all veterinarians have pledged our professional lives, can be considered a position description for One Health. Failure to assume the leadership role of One Health is a decision not to uphold the principles of the oath, namely, "the protection of animal health, the relief of animal suffering, the conservation of livestock resources, the promotion of public health, and the advancement of medical knowledge."

Much of the responsibility sits clearly on our shoulders. The human medical profession is faced with the same dilemma—it also must decide on its future role in One Health. Every profession has its defining moments—special points in time when talented individuals work cooperatively to influence the course of events for generations to come. For veterinary medicine and the other health sciences — that time is now.

VI. Recommendations

The following recommendations have been based on the findings of the One Health Initiative Task Force (OHITF) both during their meetings and in the follow up sessions held by the working groups. While the AVMA and the AMA will plan to assume a leadership role in this effort, the success of these recommendations will depend heavily on buy-in and participation by the health science professions, academic institutions, governmental agencies, and industries.

The following recommendations, which are not listed in order of priority, will be set in motion should the Executive Board, and other organizations, accept the report and recommendations and commit the resources and funding necessary to support the establishment of a joint steering committee which will begin the execution of the remaining recommendations.

1. Create and fund a One Health Joint Steering Committee, the principle task of which is to form and charter a National One Health Commission and begin the execution of the other recommendations and associated actions of a national commission.

2. Complete a One Health Proposal for Donors as well as a Business Plan and continue the process of engaging potential donors and sponsors and solicit the necessary funds to complete implementation and sustain the effort to roll out and solidify One Health as the cornerstone to promoting and improving human and animal health, and of health of the environment. Private corporations, foundations, philanthropic organizations and government agencies will be likely candidates for future discussions and reviewers of this plan.

3. Create and implement initial components of a One Health Communication Effort including: coordination of distribution of Task Force Report or its summary; coordination of publication of the Report; initial media relations launch and follow-up; and other supportive tasks involving the launch nationally and internationally.

4. Engage an all-inclusive communications firm to develop and implement a communications plan and coordinate on-going media relations, public relations, publicity, marketing and advertising to generate continual interest and branding One Health across the health professions and in the public psyche.

5. Plan a study on One Health to be conducted by the National Academy of Sciences and secure the necessary funding to underwrite this effort. The scientific credibility and national acceptance of this prestigious body will help considerably in both the visibility and acceptance of the concept.

6. Develop, charter and form a National One Health Commission and recruit full-time staff in key positions to support the goals and mission of the Commission and complete the recommendations within this report. The targeted commencement date for the National Commission is March 1, 2009. Its initial charter would be for approximately 3 years (contingent on procurement of necessary funding), and it would replace the One Health Joint Steering Committee. We envision a small staff of talented, committed individuals and an oversight and/or advisory council to give the Commission staff direction, ensure performance, and drive toward measurable outcomes. Whether to extend the life of the Commission beyond its initial charter will be addressed by the Commission and its oversight and/or advisory council, and it will depend on progress made toward achieving desired outcomes (as well as the availability of funding).

7. Appoint a national/global One Health Advisory Team to help support the National Commission and/or Steering Committee, and give it direction, counsel, and wisdom. This group would include any donor or sponsoring organization, as well as key experts.

8. Plan and hold a National One Health Summit. In order to focus attention on One Health, develop further strategies, and catalyze the support and adoption of One Health, a national summit will be planned and executed before Fall 2009. The summit will be instrumental in enhancing the visibility of the concept, deriving key strategies and actions beyond the current recommendations and help build a strong group of alliances and a supportive coalition. In addition, proceedings will be published and widely circulated to the academic communities, across the health professions, and to the general public and congressional staff members.

9. Convene several panels and a national meeting to establish a national research agenda for One Health. It is envisioned that appropriate governmental agencies, academic institutions, and private corporations would be involved. A final research plan should then be shared with Congress, staffers, and other decision-makers. This agenda will serve as a roadmap to address researchable questions, and generate research funding and interest from multiple sources.

10. Work toward the inclusion of key One Health outcomes for listing in the strategies for Healthy People 2020 and Healthy Animals 2010. It is important to express actions that support the recommendations in terms of measurable outcomes when possible, and to make such actions public and supportable. Thus, this recommendation helps address this intent by ensuring that some of the goals that will make up the Department of Health and Human Services (DHHS) Healthy People 2020[22] and the AVMA Healthy Animals 2010[23] are consistent with each other and also reflect the One Health concept. By achieving this recommendation, greater integration of health strategies will be achieved and there will be increased visibility of One Health as the concept will be embedded in the nation's agenda plans to improve health.

11. Inform, engage, and solicit the support of medical, veterinary medical and public health students and their respective organizations. The OHITF greatly benefited by the participation of our medical and veterinary medical students, who represented their respective national associations on the Task Force. The concept of One Health merits the attention of students within and outside of the health professions. Their understanding, enthusiastic support, and commitment to One Health will be essential. Our early experience suggests that One Health is tantamount to a social cause from the viewpoint of students. Promoting and improving human and animal health, and health of the environment, is a calling as much as it is a scientific principle, which resonates well with our students and young professionals. Recruiting students to the effort not only gives energy to One Health but also helps assure sustainability for future generations.

12. Create a guiding coalition of liaisons, champions, and key supporters to promote the One Health concept, engender further support, provide counsel and guidance to the National Commission and ensure strong linkages and partnerships with governmental agencies, non-governmental organizations, academic institutions, professional associations and organizations, industries, and other interested groups and individuals. This group will also be important in helping to maintain a sense of urgency to establish One Health and support its principles. Global organizations, such as the World Organization for Animal Health (OIE), Food and Agriculture Organization (FAO), World Health

Organization (WHO), World Veterinary Association, and World Medical Association should also be part of this coalition.

Reports full of great ideas sit on shelves everywhere, and they remain empty promises because of a lack of skills, resources, and plans to execute them. Our recommendations will only be fulfilled if action is taken, resources identified and committed, and leadership supported. We urge you to join us in supporting the One Health Initiative.

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Appendix A
Task Force Members

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Appendix B
Continuity of Effort: The Formation of OHITF Teams

After the second OHITF meeting, the Task Force members strongly endorsed the idea of continuing activities that didn't require further funds but would add to the group's momentum and commitment to its One Health charge. Thus, five small work groups were established in order to continue our collective work and ensure that further progress was achieved.

The work groups consisted of:

(1) a Communications team was led by Dr. Carina Blackmore; this group worked on communication strategies, work with AVMA staff to help develop a tag line and considered future plans to prepare for the broader communication strategy that was part of the group's recommendations

(2) a Business plan team was headed by Dr. Tom Monath; this group created a business plan that will be used as background information to approach potential donors and corporate entities in support of the OHITF recommendations

(3) a "Wise-Person" team was led by Dr. Bill Stokes. This team interviewed and engaged a number of individuals and organizations who had a special interest in One Health or who wished to be OHITF members but were not selected. The interviews added further insights and key perspectives that were considered by the TF as it formulated this Report and final set of recommendations

(4) an academic team was led by Dr. Marguerite Pappaioanou and this group focused on bringing the One Health concept to the attention of university communities

(5) a writing team was headed by Dr. Lonnie King; this team was responsible for writing the final Report and other articles of interest. This team worked closely with all members of the OHITF and a number of AVMA staff to complete the Report. The Wise-person team findings are listed in the appendix as is the Business Plan.

Appendix C
One Health Initiative Draft Proposal for Funding

Executive Summary:

One Health is the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals, and our environment. The mission of One Health is the establishment of closer professional interactions, collaborations, and educational opportunities across the veterinary and medical professions, together with their allied sciences, in order to improve public health and animal health. Principal drivers for One Health are the increasing threats posed by emerging zoonotic diseases, food- and water-borne diseases and environmental change, which demand a fundamentally new, integrated effort by multi-disciplinary health professions. In addition, One Health is built on the foundation that the health of people, animals and our environment represents a continuum where improvements in health in one domain often produces positive health affects in the others; thus, plans and actions to improve health demand collaborative efforts across disciplines, organizations and communities.

The One Health Initiative (OHI) described in this proposal has four long-term goals that support achievement of its mission.

Goal 1: Develop, implement and sustain a national strategy for improved public health based on the principles of One Health

Goal 2: Create national awareness within the veterinary and medical professions; the broad scientific community; government institutions; the political leadership; and the general public of the power of One Health to improve the health of people, animals and the environment.

Goal 3: Illustrate the value of implementing One Health principles through specific Demonstration Projects

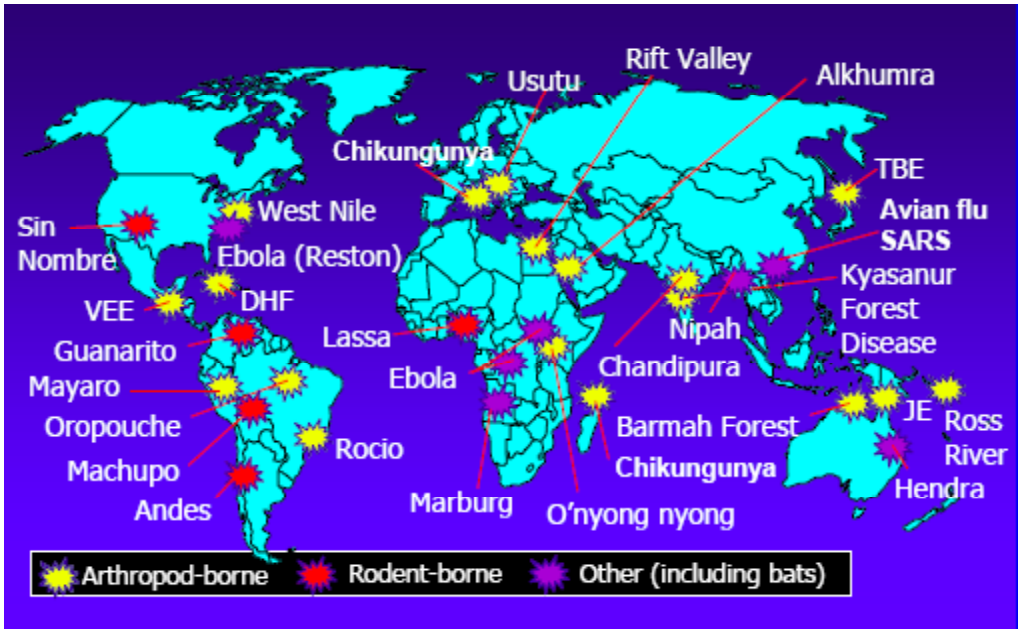
Goal 4: Extend the One Health Initiative to the international community to achieve tangible improvements in global health for both people and animals.

Achieving these goals will require a sustained effort, leadership, and sufficient funding to bring One Health into routine practice worldwide. Achieving this end point of One Health is truly one of the critical challenges facing humankind today. This proposal lays out a practical plan and modest investment strategy to achieve these goals.

1. Background and Rationale

Today, the convergence and interactions of people, animals and our environment has created a new dynamic in which the health of each group is inextricably interconnected and totally dependent. The challenges associated with this dynamic are demanding, profound, and unprecedented. At the same time, new opportunities have emerged to protect and promote health in the rapidly changing human, animal and environment domains. However, these opportunities and our abilities to improve health will not be based on strategies and mind-sets of the past, but rather, on a new integrated approach that reflects both our profound interdependence and realization that we are part of a larger ecological system, exquisitely and elaborately connected.

The key strategy to better understand and address the contemporary health issues created by the convergence of human, animal, and environmental domains is adopting the mind-set and requisite actions that underpin the concept of One Health. The term One Health can be defined as the collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment. Achieving the end point of One Health is truly one of the critical challenges facing humankind today.



Central to the concept of One Health is the control of infectious diseases which have helped shape the course of human history1. There is every indication that infectious diseases will continue to be significant global events and the emergence and re-emergence of pathogens will threaten the health and well being of people and animals throughout the 21st century. A large majority of these diseases are produced by zoonotic microbes, such as HIV, avian influenza, SARS, Ebola, West Nile, Hantavirus, hepatitis E, and many others (**Figure 1**).2 Of the 1461 diseases now recognized in people, approximately 60% are due to multi-host pathogens which are characterized by their movements across species lines. Over the last 3 decades, approximately 75% of new emerging human infectious diseases have been zoonotic diseases (infections of animals transmitted to humans). At the same, time environmental insults will continue to create favorable environments for the development of new infectious diseases as well as an expanding number of non-infectious and chronic diseases and conditions.

Figure 1. Recent emerging infectious diseases that have caused outbreaks of human disease. The majority are zoonotic diseases transmitted to humans via insect vectors or contact with wild or domesticated animals.

In a recent publication by the Institute of Medicine entitled "Microbial Threats to Health, Emergence Detection, and Response"[3] , the authors suggested that a group of factors have simultaneously converged to create a "perfect microbial storm". The most important of these factors include: adaptation of microbes, global travel and transportation, host susceptibility, climate change, economic development and land use, human demographics and behavior, a break down of both public and animal health infrastructures, poverty and social inequality. Most of these factors of emergence are manmade, and have produced a remarkable new milieu referred to as the global mixing bowl where microbes have much greater possibilities to create new niches, cross species boundaries, travel worldwide very quickly and establish new beachheads in the populations of people, animals and are also invading our environment where they are being uniquely maintained in nature outside of living hosts.

In a global economy, food for human and animal consumption is no longer produced and consumed locally. Contamination of food exported globally with microbial agents, pesticides, and exogenous toxins have become increasingly frequent, with resulting disease affecting animals and humans[4]. The building global demand for animal-based protein is on target to increase by 50% by the year 2020. The welfare of the animals and sustainability of today's agricultural food systems represent growing and difficult challenges which clearly fall into a new global health agenda for animal agriculture and food supply veterinary medicine. Two examples are noted below:

- Bovine Spongiform Encephalopathy (BSE) emerged in the 1980s as a disease of cows produced by an aberrant protein (prions). This disease is a food-borne human pathogen producing new variant Creutzfeld-Jakob Disease in people. This event has changed how cattle are fed and the standards of global agricultural trade. The investigation of this disease, and its ultimate solution required an integrated approach by scientists and health policymakers across multiple disciplines. A similar disease, chronic wasting disease (CWD) of elk, deer and moose is spreading in North America. The mechanism of transmission is not understood. There is a risk of spread to cattle and other food animals and ultimately to humans, since the prion protein of CWD can be efficiently converted to a form that apparently overcomes the structural barriers between more distant species. A One Health approach to CWD envisions the convergence of human, veterinary, wildlife disease and research scientists to establish improved surveillance and diagnostic methods, define the transmission chain, risk of cross-species spread, and control strategies.

- In 2006 a significant outbreak of *E.coli* 0157:H7 occurred in the U.S. affecting people in 26 different states. Almost half of the cases were hospitalized and ~ 25% suffered from hemolytic uremic syndrome (HUS). Human infections were linked to contaminated fresh spinach. If viewed from only the lens of human health, this outbreak focused primarily on morbidity, mortality, outbreak investigation, laboratory diagnosis and clinical treatment. However, when viewed through the lens of animal health, the same causative organism with an exact laboratory finger-print match, was found in cattle close to where the spinach was produced in California. From the wildlife diseases perspective this exact strain was recovered from wild hogs that ran through the same fields. When considered through the lens of an ecologist and hydrologist, the ground water and surface water in this high production agricultural region was being mixed together due, in part, to old porous agricultural wells, a drought followed by heavy

rains and an irrigation system that was being stained to keep up with intensified agricultural production. Thus, when a Once Health construct was used, we were able to understand that the spinach field was likely contaminated through irrigation water that contained E. coli and/or from the infected hogs running through the fields and that the organism could survive in the spinach plant throughout processing and distribution. Only by using our knowledge of the environment and ecology could this investigation be completely understood. More importantly, only through this knowledge, can appropriate intervention and prevention strategies be properly implemented which must be "upstream" at the source. A pure human health approach would result in the focus on clinical care and individual treatment rather than on possible sites for prevention of contamination and infection.

Wildlife is under increasing pressure to survive and further loss of biodiversity is a highly probable outcome. This represents a potential pernicious erosion of animal populations, loss of biodiversity and an unnecessary increase in animal suffering. Infectious disease affecting wild animals contributes to this phenomenon. We are now experiencing major declines in amphibian populations worldwide. The cause is the fungal disease chytridiomycosis that is threatening biodiversity and ecosystem sustainability. Ebola virus not only affects humans but threatens the survival of great apes already under pressure from ecosystem degradation and hunting. One Health is now needed to consider, study, and devise integrated strategies for the control and prevention of these and other threats across human and animal health and the environment. There is nothing on the horizon to suggest that any of these threats are abating. New threats and risks to health of unprecedented scope and scale and with potential global economic devastation much greater than experienced during any previous time in history are likely to emerge.

In the last century, as scientific knowledge expanded and became more complex, there was a trend toward specialization and separation of disciplines, education, strategies and professions in human medicine, veterinary medicine, wildlife diseases, ecology and environmental health. The resulting separation is counterproductive at many levels in the current context of emerging diseases. Rather these domains must be considered as closely interconnected and linked worlds. With a One Health perspective, multiple disciplines can work, learn and act together. This collective work of the health, life, and social sciences will both enhance our understanding of the complex dynamic of diseases within our changing web of life and our global environment and will help create more effective interventions and prevention strategies to address future disease issues and adverse health events that are certain to be a profound part of our existence.

The power of cooperation and an integrated approach to address microbial threats to health, improve vaccination coverage[5], enhance prediction and early discovery of disease emergences, and enhance economic development is increasingly evident.[6] However, many challenges exist to the recognition of the potential of One Health and to its practical implementation.

The concept and goals of One Health have been endorsed and embraced by many professional organizations, including the American Medical Association (AMA), the American Veterinary Medical Association (AVMA), the American Society for Microbiology (ASM), the American Society of Tropical Medicine & Hygiene (ASTMH), and others.

What is needed now is a coordinated effort to establish a worldwide commitment to One Health with acceptance of actionable objectives and integration of these into local, national and international policies for health. This effort will require vision, leadership, advocacy and initial funding. We believe that success in the early stages will be amplified through additional public-private partnerships leading to a sustained strengthening of public and animal health.

2. Mission and Goals

One Health is the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals, and our environment.

The mission of One Health is the establishment of closer professional interactions, collaborations, and educational opportunities across the veterinary and medical professions, together with their allied sciences, in order to improve public health.

The One Health Initiative (OHI) described in this proposal has four long-term goals that support achievement of its mission. Achieving these goals will require a sustained effort, leadership, and sufficient funding to bring One Health into routine practice worldwide.

Goal 1: Develop, implement and sustain a national strategy for improved public health based on the principles of One Health
Goal 2: Create national awareness within the veterinary and medical professions; the broad scientific community; government institutions; the political leadership; and the general public of the power of One Health to improve the health of people, animals and the environment
Goal 3: Illustrate the value of implementing One Health principles through specific Demonstration Projects
Goal 4: Extend the One Health Initiative to the international community to achieve tangible improvements in global health

3. Objectives and Implementation

Each long-term **Goal** is linked to a series of specific **Objectives**, which in turn will be achieved through a series of **Major Activities**.

Goal 1: Develop, implement and sustain a national strategy for improved public health based on the principles of One Health

Objective 1.1: Form a **National Commission for One Health** to develop and implement a sustainable national agenda for One Health; to oversee the Major Activities listed below (Section 3); to identify critical needs for integrating the medical, veterinary, and other scientific communities; to set an agenda for research and establish new funding lines for research on emerging diseases; and to formulate recommendations for policymakers, national and global organizations, governments, and other stakeholders. We envision a small staff of talented and committed individuals and an oversight and/or advising council to give the commission direction, ensure performance, and drive toward measurable outcomes. March 1, 2009 would be the target date for commencement of this customer-oriented Commission. The Commission is also essential to help build a large following, develop a website, and facilitate the completion of the remaining recommendations. The timelines are outlined in Section 5.

The Commission will develop a comprehensive national action plan to attain sustainable integration at the global, national and local levels.

The Commission will be established as a non-profit corporation, and will comprise representatives from:

Member status:
The American Medical Association (AMA)[1]
The American Veterinary Medical Association (AVMA)[2]
The American Society for Microbiology (ASM)
The American Public Health Association (APHA)
The Association of State and Territorial Health Officials (ASTHO)
The American Society of Tropical Medicine & Hygiene (ASTMH)
The Society of Tropical Veterinary Medicine (STVM)
The Association of American Medical Colleges (AAMC)
The Association of American Veterinary Medical Colleges (AAVMC)
The American Phytopathological Society (APS)
The Association of Schools of Public Health
Government agencies: CDC, USDA, and EPA
The Wildlife Conservation Society
Observer status: representative from:
The World Health Organization (WHO)
The World Organization for Animal Health [Office International des Epizooties (OIE)]
The Food and Agriculture Organization (FAO)

The Commission will have established Articles of Incorporation and By-Laws. It may appoint Task Forces to undertake specific activities or studies.
The Commission will meet quarterly. It will monitor the follow-up process on specific activities of its work and that of appointed task forces, which includes a stock-taking event every year.

A Chairman will be elected by the membership of the Commission, and will have a term limit of one year. The Commission will have a Director, a junior staff member and an administrative assistant funded under this grant, as well as funds for office space, travel, printing, and other logistical functions.

The Commission will terminate 3 years after its incorporation, unless extended by consent of its membership and a renewal of support by a Foundation or other entity.

The Commission and its Director will appoint an Advisory Council to help guide it actions, enhance linkages, communicate the principles of One Health and serve in an advocacy role.

Four Major Activities are proposed that will contribute to the achievement of this objective.

Major Activity 1: Identify strategies to address critical issues

The Commission will define a roadmap for achieving the steps needed to improve public health through integration of the medical, veterinary and allied sciences. This will be achieved through specific events (the One Health Summit), sponsored studies (Institute of Medicine), taking testimony from key leaders in multiple disciplines, tapping into existing databases and published and unpublished reports, and other means the Commission deems appropriate.

Major Activity 2: Obtain endorsements

1 Including the American Medical Association Medical Student Section (AMA-MSS).

2 Including the Student American Veterinary Medical Association (SAVMA)

The Commission will obtain key endorsements of the One Health Initiative from its own constituent organizations, other professional organizations, academic institutions, opinion leaders, leaders in Congress and government agencies, and the biopharmaceutical industry.

Major Activity 3: Establish a research agenda for One Health

The Commission will establish research priorities for the One Health. The goal will be to identify major gaps in current focus and funding, such as field research on the ecology of disease, the factors responsible for cross-species transmission, the health impact of rapidly changing practices in food production, and improved surveillance and diagnostic methods for zoonotic diseases.

It is envisioned that one or more appropriate panels will be constituted with representatives from governmental agencies, academic institutions, and private corporations. The Institute of Medicine study (Objective 2.2) will provide important inputs and guidelines for this process. A final research plan will then be shared with Congress, staffers, and other decision-makers. This agenda will serve as a roadmap to address researchable questions and generate research funding and interest from multiple journals.

Major Activity 4: Oversee activities of the One Health Initiative objectives

The Commission will be responsible for setting the agenda for the One Health Summit (See Goal 2, Objective 2.1).

The Commission will oversee the activities of a professional firm charged with developing and implementing a Communications Plan (See Goal 2, Objective 2.3).

Major Activity 5: Inform Congress and Government Agencies

The Commission will develop broad lines of communication to policymakers and agencies responsible for public and animal health, national security and environmental health for funding research and programs of interest to One Health.

Goal 2: Create national awareness within the veterinary and medical professions; the broad scientific community; government institutions; the political leadership; and the general public of the power of One Health to improve the health of people, animals and the environment.

Objective 2.1 Hold a **One Health Summit.** At the One Health Summit, leaders from the medical, veterinary, public health, and other allied science professions, governmental agencies, non-governmental organizations, private corporations, and other stakeholder entities will present, illustrate, discuss and debate the value of One Health to improved health in all dimensions and domains and will formulate recommendations for specific actions addressing critical needs. The Proceedings of the Summit will be published and made available to stakeholders and policymakers.

Funds for the Summit and publication of the Proceedings are sought under this grant application.

Objective 2.2. Institute of Medicine Study. An IOM study is proposed as a compelling approach to a blue print for sustainable One Health integration to meet the needs of improved public health, education, and national security. The IOM report will make specific recommendations for Congress to direct the U.S. Departments of Agriculture, Homeland Security, EPA, National Science Foundation and Health and Human Services to establish

programs with the authority, expertise and resources necessary to set priorities for enhancing the interactions of the medical, veterinary, public and environmental health communities, for strengthening relevant institutions, improving disease surveillance, and the priorities for research on diseases of animals transmissible to humans.

Funds for an IOM study are sought under this grant application.

Objective 2.3. Develop and implement a Communications Plan. A key success factor is to increase awareness of the rationale for One Health and the ways in which stakeholders can participate in improving public health by implementing principles of One Health. Targets for enhanced communication include the entire medical, veterinary, and public health professions, related scientific organizations, policymakers, and the public at large.

To achieve this objective, funding is sought for a Communications and Public Relations activity that will be contracted to a professional firm specializing in this area. The firm will report to the National Commission for One Health or a designated task force of the Commission.

Three Major Activities are proposed that will contribute to the achievement of this objective.

Major Activity 1: Prepare white papers

The Commission will define a roadmap for achieving the steps needed to improve public and animal health through integration of the medical, veterinary and allied sciences. To communicate this roadmap, a series of White Papers addressing critical issues will be commissioned. Authors will be sought with special insight and expertise.

Major Activity 2: Promote a flow of information

The Communications activity will maintain news flow through the Newsletters and Journals of Professional Associations and Societies (AMA, AVMA, etc), timely press releases, Op Ed pieces, concept papers, and media interviews. A national speaker bureau will be established. A publication series will be initiated which will also support the soliciting of champions and key endorsements.

Major Activity 3: Establish and maintain a One Health website

The website will contain a wide array of information, with links to other relevant sites, publications, and educational materials.

Major Activity 4: Continuing Medical, Veterinary Medical and Allied Health Sciences Education

The Commission and the Communications activity will take steps to promote the granting of reciprocal continuing education credit for scientific meetings and training activities across disciplines. This will encourage professional cross training and education, and foster interactions and collaborations.

Objective 2.4. Incorporate One Health in the national agenda for improving the health of Animals, People and our Environment.

The Department of Health and Human Services issues 10-year plans that represent a comprehensive, nationwide health promotion and disease prevention agenda. These plans contain specific objectives designed to serve as a framework for improving the health of all people in the United States during the next decade. The overarching goals—to increase quality

and years of healthy life and to eliminate health disparities—serve to guide the development of objectives that would be used to measure progress. The objectives are known as Leading Health Indicators selected based on their ability to motivate sustainable action, measurability of progress, and relevance to broad public health issues. The current plan (Healthy People 2010) will be succeeded by a new plan (Healthy People 2020).

Similarly, the AVMA has developed and adopted Healthy Animals 2010 which is a 5-year commitment to promoting and sustaining good health and long life in animals. Healthy Animals 2010 provides a framework for prevention of avoidable injuries and diseases in the nation's animal population. It is a statement of national animal health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats. Healthy Animals 2010 enables the veterinary profession and interested persons and organizations in the public, private, and government sectors to work together towards a significant and sustainable increase in the quality of animal health and welfare within the broader context of public and environmental health. A new plan (Healthy Animals 2020) will build on Healthy Animals 2010 to develop the next set of priorities for the succeeding decade.

Steps will be undertaken to ensure that the two Plans contain objectives that integrate the medical and veterinary professions to achieve improvements in public health and that Leading Health Indicators contained in Healthy People 2020 include measurable outcomes that illustrate improvements based on One Health principles. Some examples include:

- Obesity is a growing problem of both humans and companion animals that adversely affects health by increasing the prevalence of cardiovascular disease, cancer, and diabetes. The prevention and control of obesity in humans and their pets requires similar approaches. Research on the underlying metabolic disturbances that drive obesity linked disease can be studied in animal models.

- Emerging zoonotic infectious diseases represent a growing threat. Improved real-time surveillance through integrated human, veterinary, and wildlife disease systems will reduce time to recognition and enhance disease control.

- Antimicrobial resistance of pathogenic bacteria is a growing concern for humans and animals. New approaches to reducing the risk of antimicrobial resistance are required.

- Passive smoke is increasingly identified as a cause of cancer and lung disease in both humans and their companion animals. Public health interventions can be enhanced by addressing this problem in an integrated way.

- Bioterrorism remains a high priority security issue for the US Government and the G8 nations. Zoonotic diseases represent the leading biological threat agents for human health; moreover the introduction of foreign animal or plant diseases could have potentially disastrous consequences. Although some coordination exists between human, veterinary and agricultural agencies, there is a need for considerable improvement to address the broad threats to health and the economy.

Inclusion of One Health in Healthy People 2020 will result in greater integration of health strategies and there will be increased visibility of One Health as the concept will be embedded in their material plans to improve health.

Funding is sought in this grant application for activities required to promote the incorporation of One Health principles in the plans for Healthy People 2020 and Healthy Animals 2020 and to develop measurable outcomes. The National Commission will be charged with driving this effort, though a designated task force.

Goal 3: Illustrate the value of implementing One Health principles through specific Demonstration Projects

Objective 3.1 Initiate and support 'One Health Challenges'. Challenge Days are conferences at which a specific public health challenge is taken up by participants from the medical, veterinary and allied science professions, with the objective of demonstrating the value of integrated action. Students from medical and veterinary schools will play a key role, instilling specific learnings from the conference into their educational programs and fostering a long-standing interest in One Health issues.

- An example of a successful One Health Challenge is the **World Rabies Day.** In 2006, a group of researchers and professionals formed the Alliance for Rabies Control. They began inviting partners to join the World Rabies Day initiative. The World Rabies Day initiative now involves human and animal health partners at the international, national, state/provincial, and local levels, veterinary, medical and other specialized professional and student organizations, and corporate and non-profit partners. Meetings are held annually to focus on progress from research and public health and to invigorate prevention and control measures.

Funding is sought to increase student participation in World Rabies Day and to create at least one other Demonstration Project with parallel goals. The priorities for the latter project will be established by the National Commission and the One Health Summit. Possible subject areas include:

- Emerging Disease Surveillance
- Neglected Diseases of Animals and Humans
- Avian Influenza
- Food Safety

Public-Private Partnerships also represent a rich collaboration where One Health can be a focus of attention and action. One Health has a number of aspects that can be converted into a strong business proposition where new opportunities are likely to emerge. For example agribusinesses, food companies, retailers and suppliers could work with government agencies and university researchers to improve the understanding of the ecologies of food-borne illnesses and initiate better interventions and prevention strategies to reduce the risks of human illness but implement strategies at agricultural and environmental points along the food continuum.

Because One Health is built on the concept of collaboration and cooperation, new skills and knowledge will be needed to be learned and used by participants. Working across disciplines and organizations in today's complex and rapidly changing world is progressively more difficult. Thus, demonstration projects where new leadership and managerial skills are taught to participants will help ensure new ways of collaborating and also ensure that leaders have the requisite skills and experiences to succeed. The new concept of Meta-leadership that stresses the ability to work across organizations and jurisdictions yet often without clear authority is a new reality and represents a new skill critical to the execution of One Health strategies and activities.

Objective 3.2 Integrated Medical Education. For the most part, medical schools and veterinary colleges follow separate education streams and students do not benefit from interactions and the cross-fertilization of ideas and information. There is a little teaching on zoonotic infections arising from wild animals, disease ecology, transmission of infections from pet animals to humans, and other subjects that would be best taught in an integrated way to medical and veterinary students[7]. Similarly, while some schools have active departments of Comparative Medicine, which are productively engaged in the exploration of animal models of human diseases[8], this discipline is woefully underfunded. The disciplines of veterinary pathology and human pathology

are operationally separated[9], despite the obvious benefits that would accrue from an integrated approach to cancer biology, genetic diseases and the pathogenesis of infectious diseases. While a national agenda for change will be the subject of study by the Commission, there is considerable value in a project to demonstrate the value of integrated programs and to develop Case Studies.

The concept of One Health merits the attention of students in and out of the health professions. Their understanding, enthusiastic support, and commitment to One Health will be essential. Early experience suggests that One Health is tantamount to a social cause in the viewpoint of students. Promoting and improving human, animal, and environmental health is a calling as much as it is a scientific principle, which resonates well with our students and young professionals. Recruiting students to the effort not only gives energy to One Health but also helps assure sustainability to further generations.

A significant positive trend is the establishment of links by medical and veterinary schools with schools of public health. Today, more than half of the U.S. veterinary colleges have formal dual DVM(VMD)/MPH degree programs. This has been a major change of emphasis and coordination just over the last five years.

Over half of the 28 US veterinary colleges are co-located in a city that also contains a medical school (Table 1), creating the potential for interactions and collaborations. Leadership at the top is essential to establishing such interactions, and the demonstration of value of doing so is in turn critical to bringing leadership to bear on the problem. There are some examples of universities that have taken steps towards integrating activities of departments and colleges within the University system. Most universities with strong potential for collaborations and integration have been slow to recognize the potential benefits of integrated programs and to implement them. In some university systems, significant health science centers have been created where exciting programs in One Health would be a natural fit and would help drive further integration and collaboration in teaching and research.

Table 1. Co-localization of medical and veterinary colleges and schools

School	Location
University of Florida College of Veterinary Medicine University of Florida College of Medicine	Gainesville FL
Edward Via Virginia College of Osteopathic Medicine Virginia-Maryland Regional College of Veterinary Medicine	Blacksburg VA
University of Illinois College of Veterinary Medicine College of Medicine-University of Illinois	Urbana-Champaign IL
University of Pennsylvania School of Veterinary Medicine University of Pennsylvania School of Medicine	Philadelphia PA
North Carolina State University College of Veterinary Medicine Duke University School of Medicine	Raleigh-Durham NC
The Ohio State University College of Veterinary Medicine The Ohio State University School of Medicine	Columbus OH
University of Wisconsin School of Veterinary Medicine University of Wisconsin School of Medicine and Public Health	Madison WI
University of Tennessee College of Veterinary Medicine University of Tennessee Graduate School of Medicine	Knoxville TN
University of Massachusetts Medical School Cummings School of Veterinary Medicine at Tufts University	Worcester MA N. Grafton MA
Michigan State University College of Veterinary Medicine Michigan State University College of Human Medicine	East Lansing MI
University of Minnesota College of Veterinary Medicine University of Minnesota Medical School	Minneapolis-St Paul MN
University of California School of Veterinary Medicine University of California Davis School of Medicine	Davis CA
University of Missouri School of Medicine University of Missouri College of Veterinary Medicine	Columbia MO
Louisiana State University School of Veterinary Medicine Louisiana State University Medical School	Baton Rouge LA
Western University of Health Sciences College of Veterinary Medicine Western University of Health Sciences Medical School	Pomona CA

Funding is sought to develop two Case Studies of a university system that has taken positive steps toward improved integration and one that has not. In each case the rationale for change, the improvements, gains, barriers, challenges, and unrecognized potentials will be explored. Measurable outcomes will be evaluated. The Case Studies will provide examples and roadmaps for change in other academic institutions, and models that can be used by the AAVMC and AAMC in formulating policy. Resource requirements for enhancing facilities and access will be identified, and the impact on future generations of physicians and veterinarians will be assessed.

Goal 4: Extend the One Health Initiative to the international community to achieve tangible improvements in global health

Zoonotic diseases threaten the global health of animals and humans. Rapid air travel, commerce and trade in domesticated and wild animals, demographic changes including urbanization, climate change, deforestation, and many other factors increase the potential spread of infectious diseases. Migratory birds and bats are capable of introducing infectious diseases across international borders. Recent examples illustrating the potential of zoonotic diseases to affect human populations and animal species across wide regions of the world include HIV, SARS, avian influenza, Chikungunya, West Nile, and Nipah viruses.
Food safety is another obvious concern, since the global economy depends on importation and exportation of a wide array of animal and plant materials that can be the source of human infectious diseases. The introduction of exotic animal, insect and plant pathogens can have damaging effects on local economies.

To mount an effective response to such global threats, it is necessary to coordinate the knowledge, expertise, and experience of a multi-disciplinary force of physicians, veterinarians, and allied health professionals. The key success factor will be the extension of One Health to the local and community levels worldwide[10]. This effort could be most effectively catalyzed by the existing United Nations organizations that are concerned with health worldwide, i.e. the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the World Organization for Animal Health [Office International des Epizooties (OIE)].

To achieve outreach of the One Health Initiative internationally, the UN organizations and the OIE listed above will be engaged in the following ways:

- The UN and OIE organization leadership will have observer status in the National Commission for One Health and their participation will be promoted and encouraged by the Commission
- The UN and OIE organizations will be invited to play a key role in the One Health Summit
- Reciprocal arrangements will be sought to engage the Commission in relevant meetings of the UN organizations, and to seek ways to promote One Health initiatives within those organizations
- The UN organizations will be encouraged to promote One Health initiatives at the regional level (through the Regional offices of WHO, FAO, OIE, etc) and thereby to the national level.
- One Health Communications Plan deliverables (white papers, op-ed articles, etc.) will be made available to UN and OIE organizations and their global distribution encouraged
- World Challenge Days (see Goal 3, Objective 3.1) will engage health professionals worldwide
- Global organizations listed are critical to reducing health disparities in vulnerable populations and helping to protect the almost 800 million poor livestock and poultry keepers worldwide. These populations experience dual threats – economic devastation of diseases to their animals and also complications of acquiring zoonotic illnesses especially in women and children who mostly care for these animals.

4. Attributable Benefits

Achieving the One Health Initiative Objectives and Major Activities described above will have broad and sustainable benefits. These benefits include:

- Integration of human, veterinary, wildlife disease, and environmental health disciplines

at multiple levels necessary to face increasing challenges to health, nutrition, security, and economic growth worldwide

- Improved surveillance, early recognition, diagnosis, investigation, prevention and control of emerging and re-emerging infectious diseases, especially zoonoses.
- Increased knowledge of the factors responsible for cross-species transmission of infectious diseases
- Reduced regional and global economic disruption by emerging diseases
- Improved food safety in a global economy dependent on consumable import/export markets
- More rapid sustainable development of emerging economies, through improved human and animal health and productivity of food animals
- More rapid and efficient discovery and development of new drugs for human and animal health
- Increased application of comparative medicine and animal models to resolve major chronic diseases
- Integrated approach to the study and treatment of spontaneously occurring cancers in animals and humans
- Enhanced education and training of veterinarians, physicians, and allied scientists
- Creation and dissemination of new knowledge on infectious disease ecology and One Health to enable our adoption of more effective strategies for diseases control and prevention.

5. Monitoring and Evaluation

5.1 Milestones

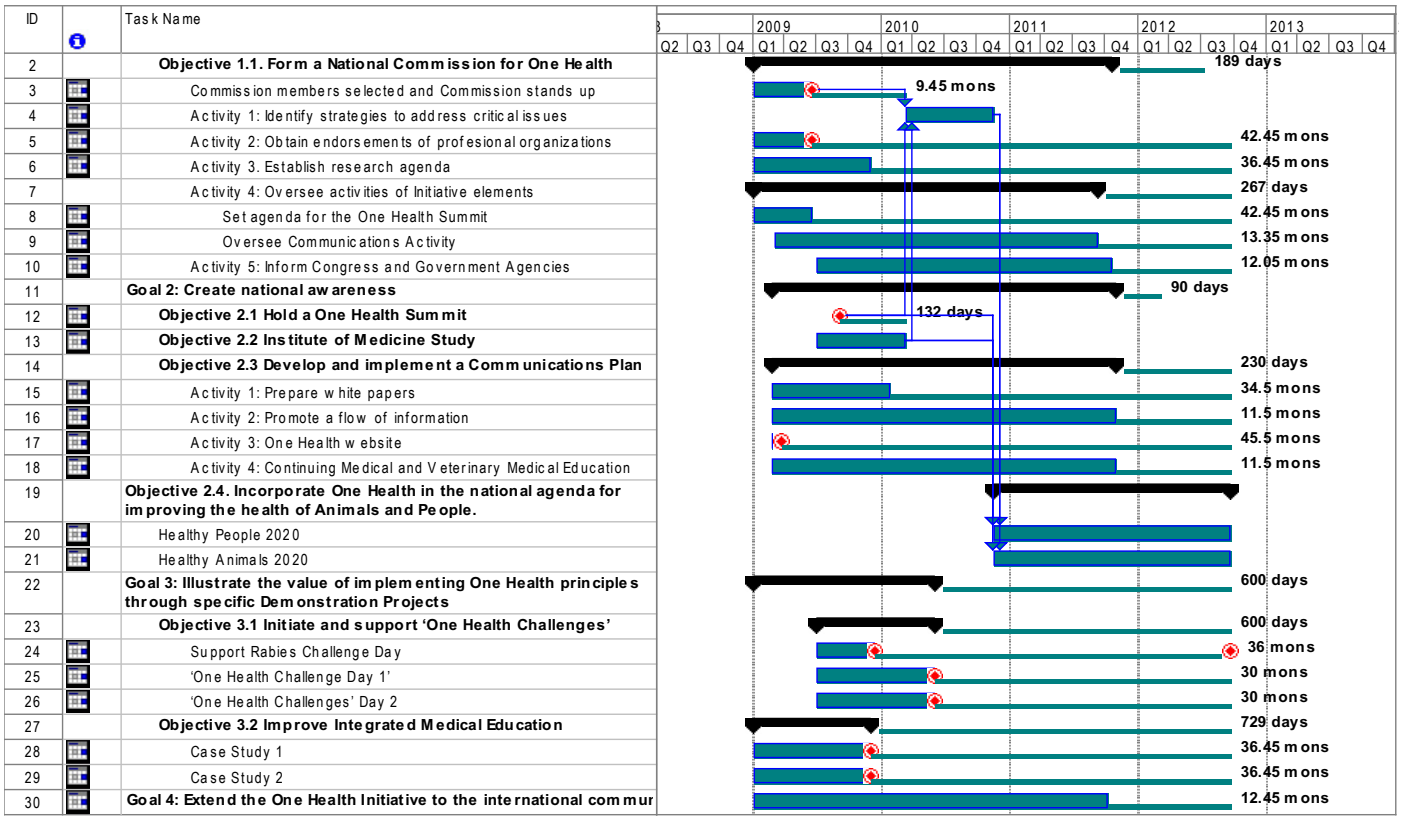
Major milestones and expected outcomes are shown in Table 2, and timelines are illustrated in Figure 2.

Table 2. Major milestones

Goal	Objective	Milestone	Target date (completion)
Goal 1 (National Strategy)	1.1 Form National Commission	Commission stood up	1Q09
		Finalize national strategy/road map	1Q10
		Obtain endorsements from professional organizations	2Q09
		Establish research agenda for One Health	4Q09
Goal 2 (Create awareness)	2.1 One Health Summit	One Health Summit held	3Q09
	2.2 IOM Study	IOM Study	1Q10
	2.3 Communications Plan	PR firm hired	2Q09
		Prepare series of white papers	4Q09
		Website established	1Q09
	2.4 Include OHI in national agenda plans	Healthy People 2020 Plan	4Q11
		Healthy Animals 2020 Plan	4Q11
Goal 3 (Demonstration projects)	3.1 One Health Challenges	World rabies day	4Q09
		One Health Challenge Day 1	2Q10
		One Health Challenge Day 2	2Q10
	3.2 Integrate medical education	Case Study 1	4Q09
		Case Study 2	4Q09

Goal 4 (International initiative)	WHO, FAO, OIE participation	Representatives to the National Commission National Commission representatives at WHO, FAO, OIE Regional Offices promote OHI	1Q09 2Q09 2Q10

Fig. 2 *Timelines for objectives and tasks*



6. Organizational and Management

The National Commission will have a staff of three (3), including a Director, a junior staff member, and an administrative assistant. Recruitment of the Director is a key element to success of the Initiative. A One Health Steering Committee, to be established and comprised of selected members from the AVMA One Health Initiative Task Force and leaders from other health professional associations that have endorsed the concept of One Health (AMA, ASM, etc.), will identify, recruit and select a visionary individual to serve as Director. Recruitment will depend on having a commitment of funding. The Director will in turn recruit other staff for the Commission.

The Director will have an advanced degree (MD, DVM, PhD) and at least 10 years experience in a field relevant to One Health, such as public health, preventive medicine in public or private practice, education, health policy, or research. He/she will have demonstrable passion and vision for the goals and objectives of One Health. Essential attributes will include exceptional ability to articulate and explain complex issues to both sophisticated and lay audiences, to enlist the support of others to his/her view, and to organize and manage the efforts of peers to achieve results. He/she will have a strong network within academia, government, international health or other relevant fields.

7. Budget

A budget of $2,978,682 is requested to fund the Initiative for a period of 3 years. The majority of the budget is for salaries and benefits (45%), contracts (30%) and travel (22%).

(Endnotes)

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Appendix D
"Wise-Person" Discussion and Summary of Comments

The following individuals were contacted by the One Health Initiative Task Force Wise-Person Working Group. The charge of the Working Group was to contact stakeholder groups and individuals who are interested in the One Health Initiative, and to obtain their ideas on key areas and concepts that the Task Force could consider in preparing its report. This included individuals nominated for the Task Force, and individuals and organizations who previously provided written materials for the Task Force to consider.

- **L. Garry Adams**; DVM, PhD, DACVP; Member, AVMA Council on Research; Associate Dean for Research, College of Veterinary Medicine, Texas A&M University
- **Marianne Ash**; DVM; Member, AVMA Council on Public Health and Regulatory Veterinary Medicine; Director, Biosecurity and Preparedness Planning, Indiana State Board of Animal Health
- **Mike Auslander**; DVM, MSPH; State Public Health Veterinarian, Kentucky Department of Public Health
- **John C. Baker**; DVM, PhD, DACVIM; Vice-Chair, AVMA Council on Research; Associate Director, Michigan Agricultural Experiment Station, Michigan State University,
- **Val Beasley**; DVM, PhD, DACVT; Professor, Veterinary Biosciences and Assistant Department Head, Veterinary Biosciences, College of Veterinary Medicine, University of Illinois; Executive Director, Envirovet Summer Institute
- **Edward Belongia**; MD; Member, National and Global Public Health Committee, Infectious Diseases Society of America; Senior Epidemiologist/Director, Epidemiology Research Center, Marshfield Clinic Research Foundation
- **Philip Bergman**; DVM, MS, PhD, DACVIM; President of the American College of Veterinary Internal Medicine (ACVIM) Board of Regents, Board Member of the ACVIM Foundation; Chief Medical Officer, BrightHeart Veterinary Centers
- **Mike Bolton**; DVM; President, American Association of Bovine Practitioners
- **Steven C. Budsberg**; DVM, MS, DACVS; Member, AVMA Council on Research; Professor, Department of Small Animal Medicine & Surgery, College of Veterinary Medicine, University of Georgia
- **Tom Burkgren**; DVM, MBA; Executive Director, American Association of Swine Veterinarians
- **Bonnie Buntain**; MS, DVM, DABVP, DACVPM; Professor, Public Health; Assistant Dean, Government & International Relations; Interim Department Head, Ecosystem & Public Health; University of Calgary Veterinary Medicine
- **Jules Cass**; DVM, MS, DACLAM, DABVT; Retired
- **Billy Clay**; DVM, MS, DABVT; Member, AVMA Council on Public Health and Regulatory Veterinary Medicine; Owner, Vetta Consulting LLC
- **Leslie Dierauf**; VMD; Director, National Wildlife Health Center, United States Geological Survey
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- **William McCulloch**; DVM, MPH, Co-founder, Delta Society

- **Tracey McNamara**; DVM, DACVP; Professor, Pathology, Western University of Health Sciences
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- **Kate Sulzner**; DVM; Founder, Ecovet International
- **Jeff Toll**; VMD, DACVIM; Chair, ACVIM Education and Research Committee; Board Member, ACVIM Foundation

The following selected comments are provided to give insight into the breadth and depth of the perspectives of those individuals contacted in the Wise-Person calls.

Veterinarians in wildlife health, public health, human medicine, the human-animal bond, clinical practice, academia, research, agriculture, and the AVMA's Council on Research and Council on Public Health and Regulatory Veterinary Medicine:

- There is a large impact of human health benefits from animal therapy visits around the country, reaching out to at least 1 million people per year and promoting the human-animal bond. This role of animals in contributing to human well-being and health needs to be emphasized in the Federal Healthy People 2020 document.
- There are examples of good collaboration between some research training programs between veterinary and medical schools, which benefits the students, the faculty overseeing the labs, and funding for the training from federal agencies.
- Many new findings in one medical field (human or veterinary) can be translated into use for the other medical field, and these include orthopedic tools and biologic agents (vaccines and other prevention and treatment strategies).
- The value of One Health collaboration between agriculture and public health is exemplified by programs such as the tuberculosis and brucellosis eradication programs.
- Veterinarians have, can, and should take part in emergency response organizations that target both human and veterinary medicine needs.
- Current surveillance programs with strategic partnerships include ArboNet, the Global

Avian Influenza Network for Surveillance, and the National Biosurveillance Integration System.

- Field training programs such as Envirovet provide an opportunity for veterinary students and veterinarians to learn how to apply the One Health concept to sustaining healthy wildlife, people, and ecosystems. Such programs should be strengthened and supported to provide veterinary and other professionals with the skills to implement effective programs around the world.
- Continued animal use in research is a major concern for ensuring development of future technologies for use in both human and veterinary medicine.
- Every effort should be made to ensure that human health, animal health, and health of the environment are given equal consideration under "One Health."
- Illustrating the small business benefits of One Health to practitioners at the local level is key.
- Workforce expansion and pay equity among health professions are pertinent, not only in the public sector but also in private enterprise and in academia.
- There is a need for a comprehensive integrated surveillance system with adequate information sharing, including incorporation of members of the general public for unusual animal and human health findings.
- Multiagency coordination with local jurisdictions has worked effectively and should be further encouraged, an example being the abatement of plague spread from prairie dog towns into the endangered and federally funded black-footed ferret communities.
- Antimicrobial resistance, climate variability, wildlife preservation, and food safety are all major issues of significance to One Health.
- Congressional interests in issues wax and wane based upon perceived threats, so funding for diseases that are currently under control due to targeted public health activities might (paradoxically) be in danger of losing Congressional funding.
- Federal funding for interdisciplinary research is not always available due to set charges of various federal agencies. Cross-agency coordination and cooperation should be further encouraged and supported to foster One-Health multi-disciplinary research.
- A "cookbook" type document should be available for practitioners to transition more easily from practice to public health careers.
- Development of a web-based clearinghouse of One Health information, including distance learning, could be pursued.
- At the local level, practitioners could seek positions on local boards of health, provide One Health-based brochures to clients, and/or consider volunteering for state or county emergency response teams.
- A One Health-based journal could be developed.
- Multidisciplinary activities with professions such as social sciences and economics should be pursued, for a more holistic approach to target biodiversity loss and conservation.
- There are significant cost savings when ecosystem health is preserved proactively in contrast to reacting to negative changes resulting in and from the ecosystem.
- Consideration should be given to the concept that plant diseases do not directly affect animals, but economic impacts of such disease would have impacts on animal production.
- Research what One Health budget currently exists in the federal government as a baseline, in order to determine what funding is still needed.
- Human drug development and safety evaluations have a need for veterinary expertise, examples being that veterinarians are needed to conduct and interpret special studies in animal models, welfare assurance, Good Laboratory Practice standards, and good manufacturing processes.
- Certain topics should be pursued to exemplify One Health as a collaborative effort, including dietary recommendations on animal-based foods for children and antimicrobial resistance.

American College of Veterinary Preventive Medicine Diplomates:

- There have been examples of One Health courses taught to professional students from varied professions, including medical anthropology and social sciences.
- Funding at the interface of people, animals, and the environment, including at the community level, might be difficult to obtain.
- One Health includes syndemics and economy epidemics, so to solve challenges there needs to be not only the health professions but also the social scientists involved.
- The perception of veterinarians should be transformed so that they are seen as being health care providers to solve public health shortage. Implementing higher loan repayments, promoting public service, and facilitating paths from practice to public health are means to transform that image.
- Leadership skills should be more highly regarded than credentials for One Health promotion.
- Biodiversity loss has been associated with food crises and poverty as resources are lost, and international research is identifying integrated approaches to solving these challenges.

American College of Veterinary Internal Medicine

- There are examples of effective collaboration between ACVIM Diplomates and physicians in research on chronic disease, infectious disease, and oncology.
- Unity among the veterinary profession is key; this includes ensuring that veterinarians understand how the profession fits into a wider group of health professions, and that workforce expansion cuts across the entire veterinary profession.
- Other means to promote One Health include promoting dual appointments for academicians, encouraging co-sponsored (veterinary and human medical) presentations at specialty conferences, providing technical support to policymakers, and sponsoring research programs for veterinary students.
- A comprehensive national strategy should include identifying veterinarians as clinical scientists along with other health professionals.

Select examples to communicate One Health concepts to the public

- Explanations of the role of various professions in helping to quickly detect and control zoonotic and Emerging diseases, such as Bovine Spongiform Encephalopathy, Highly Pathogenic Avian Influenza, Lyme Disease, West Nile Virus, Ebola, Monkeypox, and Severe Acute Respiratory Syndrome.
- Health professions are more similar than they are different.
- Cancer is cancer, whether in people or animals. All substances known to cause cancer in people also cause cancer in animals.
- One Health is the concept that spans disciplines. Many diseases affect different species so there should be a broad species perspective to meet today's challenges. The diseases emerging are zoonotic, so they cannot be tackled by veterinary or human medical perspectives alone.
- Because of the freedom to go anywhere in the world so quickly, coupled with the majority of emerging diseases being zoonotic, we need to have new approaches to new and old pathogens.
- We need to understand the interrelatedness of human, animal, and environmental health, including the veterinarian's special perspective of understanding agricultural production systems, which is important as the demand for animal protein grows and as people encroach on rural areas.
- Damage to the environment, including climate change, is modifying disease vectors.
- The message should exemplify a proactive, not a reactive, approach, and should be a part of a communications strategy.

One Health Initiative Support from the American Society for Microbiology:
Microbiologists also embrace the interrelatedness of human, animal, and environment health. Specifically, the American Society for Microbiology (ASM) has endorsed the One Health Initiative. Microbiology is seen as a major interface among the disciplines of human, animal, and environmental health, and microbiology research also furthers goals of the Initiative through collaboration with both veterinary and human medical fields. One Health issues that are relevant to the ASM include areas such as emerging infectious diseases and climate change.

Appendix E
The Academic Community Bringing One Health to Action

Academic Summary Prepared by the Academic Team[1] of the AVMA One Health Initiative Task Force and Partners[2]

Introduction

Putting One Health into action requires that professionals from across different disciplines have an understanding and appreciation of the links among human, animal, and ecosystem health, and the importance of and commitment to working together to address health challenges. Additionally, having resources available and mechanisms in place to promote and facilitate multidisciplinary collaborations are essential to make One Health collaborations a reality. Thus, collaborations among professions in academic settings in the areas of education/teaching, research and community service both locally, nationally, and globally provide the foundation for achieving One Health goals and objectives.

At the national level, multiple professional societies of the health professions have endorsed One Health and are committed to building strengthened collaborations and partnerships among their constituent members. The Association of American Veterinary Medical Colleges, Association of American Medical Colleges, the Association of Schools of Public Health, the Federated Association of Societies of Health Professions, the Association of Academic Health Centers, and the National Association of State and Land Grant Universities and Colleges have all recognized the importance of and have endorsed the One Health Initiative (Public Health Reports, Daryl Kirsch, personal communication). These associations, which represent hundreds of Universities, Colleges and Schools of the health professions, and colleges of agriculture and natural resources, are promoting One Health approaches to achieving improved human, animal, and ecosystem health. Many of their member institutions are actively promoting and pursuing collaborations that embody a One Health integrated approach in education and teaching, basic and applied research, and community service to achieve improved health for all.

In this appendix we have highlighted several illustrative examples that demonstrate the leadership that Academia is providing in successfully implementing One Health approaches in teaching, research, and community service. While these illustrate examples of university initiatives, they do not necessarily reflect current AVMA policy. There are many more initiatives and projects among the universities and colleges of the allied health professions that for space reasons are not possible to include, but we hope that the material presented will underscore how a One Health approach is being successfully employed in the academic setting, which is essential in providing future generations of health professionals who will collaborate and bring a One Health approach in all that they do to meet the health needs of society and our environment.

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2 Allison Foster, ASPH; Darrell Kirch, AAMC; Steven Wartman, AAHC; Lisa Freeman, Kansas State University; Christian Sandrock, UC Davis; Carol Cardona, UC Davis; William Saville, The Ohio State University; Bonnie Buntain, University of Calgary; Kirsten Gilardi, UC Davis; Val Beasley, University of Illinois; Will Hueston, University of Minnesota; Lance Perryman, Colorado State University; Garry Adams, Texas A & M; James Roth, Iowa State University; Chris Olsen, University of Wisconsin

Examples of One Health Research Funding Opportunities

During the past several years, there have been a growing number of research funding opportunities that have promoted and rewarded a multi-disciplinary, One Health approaches in research that is addressing important information gaps in key areas. Examples of major research initiatives that embody a One Health approach include the following:

1) NIH funded Clinical Translational Research Centers (http://www.ncrr.nih.gov/clinical_research_resources/clinical_and_translational_science_awards/), and NIAID Centers of Excellence for Influenza Research and Surveillance (http://www3.niaid.nih.gov/research/resources/ceirs/)

2) CDC funded Cooperative Research Centers—Avian Influenza at the Human Animal Interface (http://grants.nih.gov/grants/guide/rfa-files/RFA-CI-06-009.html)

3) National Science Foundation (in collaboration with the NIH Fogarty International Center) funded research projects through the Ecology of Infectious Diseases Initiative (http://www.fic.nih.gov/programs/research_grants/ecology/index.htm).

4) Department of Homeland Security funded Centers of Excellence that bring multiple disciplines working together to achieve shared goals and objectives including the National Center for Animal and Zoonotic Disease Defense (http://fazd.tamu.edu/) at Texas A & M University, working in collaboration with UC Davis, and the National Center for Food Protection and Defense (http://www.ncfpd.umn.edu/) at the University of Minnesota, in collaboration with Michigan State University and several other partners.

5) The Bill and Melinda Gates Foundation recently gifted Washington State University with a multimillion dollar grant to establish a School for Global Animal Health, which will focus on the dependence of human health, food security, and economic security on animals, with particular attention to livestock (JAVMA News, Vol 232 (9): 1272-1274).

Examples of One Health Initiatives in Academic Settings

1) Colorado State University Addressing Global Health Challenges Through Superclusters

In 2004, Colorado State University began exploring how to marshal its resources to address the global problems and to transfer innovative biomedical and technical research to help address critical global challenges. The University has established "Superclusters" -- an alliance of experts in research, engineering, business and economics-- that are focused on improving quality of life, by promoting the application of research outcomes to improve the health of communities and for global society's benefit. At Colorado State University, three superclusters have been formed to address specific global needs in the areas of infectious disease, cancer, and clean energy.

- **Infectious Disease (http://www.cvmbs.colostate.edu/mip/idsc/#)**

  This supercluster was formed to speed the transition of life-saving research on infectious diseases from the academic world into the global marketplace. Alliances of academic researchers, economists and business experts have come together to facilitate and promote collaboration and bridge the vastly different worlds of business and academia. Multiple colleges of the University are participating, with the College of Veterinary Medicine the lead college.

- **Cancer Research (http://superclusters.colostate.edu/pages/neotrex.aspx)**

  The Cancer Supercluster is a collaboration between the Colleges of Veterinary Medicine and Biomedical Sciences, Natural Sciences, Applied Human Sciences, Agricultural Sciences and Engineering, and is focused on developing effective treatments and products in the fight against cancer and making the advances available through marketing to people who need them. Funding is provided by NASA, the NIH, the National Cancer Institute, the Morris Animal Foundation and U.S. Department of Energy. An example of successful research by participating human and animal cancer researchers includes the development of a limb-sparing surgical technique to treat osteosarcoma in dogs that has been adopted for treating human cancer. A$9.7 million NASA-funded Specialized Center of Research is focusing on advancing cancer research and treatment for pets and people by developing innovative approaches to estimate cancer risks from space radiation by identifying genetic changes that are responsible for radiation-induced leukemia. The Cancer Supercluster is built upon a nationally dominant foundation of cancer research at Colorado State and the university's Animal Cancer Center, which is devoted to caring for animals with cancer and researching cures and preventive medical interventions for the disease. The Animal Cancer Center has an international reputation for its collaborations with human cancer institutions such as the Mayo Clinic, the National Cancer Institute and the M.D. Anderson Cancer Center.

- **Clean Energy (http://superclusters.colostate.edu/pages/clean-energy.aspx):**

  More than 100 faculty members in all eight colleges at Colorado State– from Liberal Arts to Engineering – are participating in developing alternative energy solutions and policies in the areas of biofuels, solar energy, wind power and clean-burning engines, helping Colorado's efforts to lead the nation in creating clean and renewable energy technology and training the "green-collar" workforce. The goals are to collaborate with partners to reduce emissions of greenhouse gases by 20 percent by 2020, and even deeper emissions cuts by 2050.

2) UC Davis -- Avian Flu School, Emergency Preparedness and Response, and Center for One Health

- **Avian Flu School** (http://www.vetmed.ucdavis.edu/whc/flu_school/guidetomodules.html)

  Funding: Global Livestock CRSP and the National Center for Foreign Animal and

Zoonotic Disease Defense (Department of Homeland Security)

This program was developed as a collaborative effort with veterinarian and human medical specialists in response to avian influenza outbreaks. The education, research, prevention, and response to avian influenza on the wildlife, poultry, and human side were so closely related that a universal approach was needed. Avian Flu School (AFS), an international train-the-trainer program, covers the key topics and skills important for preventing, detecting and responding to H5N1 HPAI outbreaks. The full AFS course is a four-day course curriculum for training instructors regarding the critical information for H5N1 HPAI emergency management and communications, surveillance in domestic and wild birds, public health and worker safety, outbreak prevention and response, and practical skills (using PPE, packaging diagnostic samples, and swabbing, bleeding, vaccinating, and cleaning a chicken). The AFS course is designed to be adaptable to different countries and environmental conditions. UC Davis and collaborators have given presentations in over 15 countries and faculty includes both MD and DVM trained specialists working together.

- Avian Influenza Research Study group

  Funding: Mixed from NIH, CDC, USDA, others

  An Avian Influenza group at UC Davis is focused on a One Health Approach to research and public health investigations. The group includes a poultry veterinarian, public health physician, immunologist, respiratory pathogen research scientist, and a molecular detection engineer, and is focusing on novel detection methods along with basic public health epidemiology. Areas of study include live bird markets, poultry farms, and wild life-human interfaces.

- Emergency Preparedness -- ESCAPE Project (Enhancing Surge Capacity and Partnership Effort)

  Funding: Assistant Secretary for Preparedness and Response (ASPR) in the Department of Health and Human Services

  This project is a $5 Million partnership aimed at developing relationships and plans with regard to public health and disaster preparedness to enhance surge capacity for effective human health response. After the experience of mixed human and animal (companion and livestock) disaster responses following Hurricane Katrina and California wildfires, UC Davis and partners have developed a human –veterinary disaster response partnership, which includes integrated human and animal response, care for humans in prepared veterinary facilities, veterinary specialists providing response to human issues, and an integrated curriculum geared toward both human and animal health specialists. This is a One Health disaster response partnership, integrating teaching, response, and treatment. Two additional partnerships have been developed with animal Medical Reserve Corps (websites http://medicalreservecorps.gov/detail.asp?State=22&id=362 and http://www.medicalreservecorps.gov/detail.asp?id=1393&State=6)

- **Calvin Schwabe Center for One Medicine**

Funding: University of California, Davis and School of Veterinary Medicine

The overall goal of the newly formed Center for One Medicine is to increase diversity at all levels in the future veterinary student body to reflect our nations diverse profile, endorse a broader encompassing veterinary education, prepare and support DVM students in endeavors to secure professional careers in One Medicine in conjunction with the MPH and MD curriculums. The short term goals include 1) Address diversity issues in veterinary medicine, 2) Describe outcome goals for increased diversity in DVM student body using current research in nations diversity literature 3) Curriculum support for expanded education in public health, environmental health, public policy, food safety, biosecurity, epidemiology, ecosystem health, etc, 4) Advocate and actively endorse Rural Heath practice 5) Support student involvement in activities/research associated with production, foreign animal disease, public health, zoonotic disease emergence, etc, 5) Initiate links, 'partnerships' with multidisciplinary professionals/ agencies/programs in an effort to establish a 'team' approach to teaching, research, and critical thinking. Collaborators include UCDMC, UCD Betty Moore Nursing School, UCD Law and Business, CDC/DHS/USGS/Plum Island/FAZD, State and local Public Health Departments, Wildlife Health Center, UCD programs: Wildlife, Fish, and Conservation Biology, John Muir Institute for the Environment. Longer term goals include integration of the medical and veterinary pre-sciences curriculum, coordination of the MPVM and MPH curriculum (already done), and the development of a larger One Medicine School at UC Davis.

3) **University of Calgary, College of Veterinary Medicine-- Capstone Course on One Health for students in the health sciences and Summer Field Institute in Tanzania (for information, contact: bonnie.buntain@ucalgary.ca)**

The One Health Capstone course provides an opportunity for health science (social, veterinary, and medical) students to assess and analyze the contribution of their specific concentration to global health research. The course is intended to give students an appreciation of the complexity of health research in a developing country context while raising their awareness of the need for multidisciplinary teams to solve complex health problems. The students are introduced via an interactive seminar course to ecosystem, global and one health conceptual frameworks. The course provides a learning environment where students can share and integrate their learning from previous Inquiry Courses and discipline specific studies. The course draws on both Canadian and African examples of research challenges in food safety public health (Brucellosis and TB**)** by examining the wildlife/animal/human interface. Learning objectives for students include their being able, by the end of the course, to 1) demonstrate knowledge of and be able to make distinctions between the concepts of Global Health, International Health, Globalization and One Health; 2) understand and demonstrate in discussions and in writing the contributions of diverse disciplines within a One Health framework e.g. veterinary medical scientists, social scientists, biologists, ecologists, environmental scientists, biomedical professionals, etc. 3) identify the roles of stakeholders such as government (local, national), NGOs, donors, academia, international organizations (WHO, UN, etc), and the community in research, program and policy development; 4) use the One Health conceptual framework to generate researchable questions; and 5) understand the value of research partnerships.

The Summer Field Institute in Tanzania brings together a One Health team of students

from the disciplines of the social, veterinary and human health sciences to work on priority health concerns of a local community. The richness of this experience is that all of the disciplines learn to collaborate on cross-cutting health issues at the interface of people, animals and the cultural and physical environment. Veterinary students learn how to utilize social sciences in honoring community knowledge and how to improve knowledge mobilization and translation regarding HIV-AIDS, malaria, TB and brucellosis.

4) University of Minnesota – NIAID Center of Excellence for Influenza Surveillance and Research and Summer Public Health Institute

- NIAID funded Center of Excellence for Influenza Research and Surveillance

The Minnesota Center of Excellence for Influenza Research and Surveillance (MCEIRS) is working to rapidly identify and characterize influenza viruses that have pandemic potential by monitoring domestic and international wild bird, poultry, and swine populations. The center is prepared to respond to research and public health needs in a time of increasing concern over the possibility of pandemic flu. The MCEIRS performs animal flu surveillance in multiple countries and states in the US. Domestic research will include: monitoring wild birds in U.S. wetlands; identifying low pathologic influenza strains in Minnesota poultry; characterizing swine viruses in animal populations from Minnesota to North Carolina; and conducting virologic surveillance in live bird markets in the Midwest and Northeast. Internationally, the center will conduct avian influenza surveillance of people, poultry, pigs, dogs, cats, and wild birds in rural Thailand; wild waterfowl in Vietnam; wild bird populations in Laos; and commercial poultry operations in other Asian countries. The majority of diagnostic testing and virus characterization will occur at the University of Minnesota College of Veterinary Medicine's Veterinary Diagnostic Laboratory and Genomic Center. Faculty will obtain and characterize multiple types of influenza viruses, adding to the world database that supports research on how humans become infected with influenza, what factors influence the severity of illness, and the development of vaccines and antiviral medications. The Center is built around the strength of the University of Minnesota's interdisciplinary corridor of research in infectious disease. The University will help pave the way in influenza research and contribute valuable and influential information to the federal government regarding pandemic preparedness. Partners include the University of Minnesota colleges and schools in veterinary medicine, public health, and supercomputing. External partners include: Chulalongkorn University in Thailand (medical and veterinary faculty); Southeastern Cooperative Wildlife Disease Study at the University of Georgia; the Wildlife Conservation Society; the U.S. Geological Survey National Wildlife Health Center; Cargill, Inc.; the Minnesota State Board of Animal Health; the Minnesota Department of Agriculture; and the Minnesota Department of Health.

- **Summer Public Health Institute (http://cpheo.sph.umn.edu/institute/)**

The Summer Public Health Institute at the University of Minnesota provides professionals with a unique opportunity to immerse themselves in a chosen field of study for a single day or three weeks. The Institute offers a variety of courses for everyone practicing in or studying public health or fields related to public health. Participants can build or expand their professional expertise, learn best practices, broaden career options, network with other professionals or explore a new area of interest. Course content emphasizes theory to practice with opportunities for field trips, case studies, hands-on labs and simulations. Institute participants have included representatives from public health and other health and human service organizations; city, county, state and federal government agencies; and

private-sector businesses. Previous enrollment has included: Public and environmental health professionals, including nurses, veterinarians, physicians, dietitians, toxicologists, epidemiologists, engineers, sanitarians, inspectors, scientists and hazardous materials specialists; Food production and processing professionals, including microbiologists, food safety specialists, quality assurance personnel and agribusiness professionals; Graduate students enrolled in public health, veterinary medicine, nursing, agricultural, food and environmental sciences, and other postgraduate academic programs. Four of the many courses offered through the Institute and which demonstrate a One Health approach are described below:

Approaches to Infectious Disease Control in Animals and Human Populations

The challenges of infectious diseases in public health and animal health arenas are determined by the interaction of host, agent, environmental and demographic factors. Control of infectious diseases in populations can be pursued with a range of strategies that individually and collectively contribute to reducing the risk of transmission of infectious agents and/or the impact of infectious diseases on affected hosts. Although the fundamental tools for disease control are essentially generic, their practical application is highly variable according to the ecological and epidemiological scenarios involved. The course reviews the basic principles of infectious disease control in populations and examines the evolution of practices employed to reduce intraspecies and interspecies disease transmission in wild animal populations, major domestic food animal populations (swine, poultry and ruminant) and humans. The course is designed to provide broad conceptual knowledge of disease control strategies and a holistic appreciation of the challenges to health maintenance of populations under different and changing demographic circumstances.

Globalization and Health

Global health concerns cross the borders of developed and developing nations. This class focuses on the effect of globalization on social and scientific consequences in public health. Topics include the interplay between global stressors such as population, war, economics, urbanization and environment and their effects on the health of women and children, the spread of infectious and chronic diseases, nutrition and environmental health.

Principles of Public and Animal Health Surveillance Systems

This course focuses on principles, methods and evaluation of surveillance systems for infectious diseases in human and animal populations. In recent years, increased scrutiny has been placed on the scientific adequacy and validity of various public and animal health surveillance systems. The course helps participants understand the purpose of health surveillance, methods employed for surveillance and strategies for evaluating the validity of surveillance systems. Existing surveillance systems are emphasized, with discussion of real and potential connections between animal and human health.

Global Food Safety System Leadership

Since the dawn of civilization, food and beverages have been traded extensively. Currently, food ingredients are sourced, processed, packaged, transported and marketed

through food service and retail outlets in every country on the globe. Animal and plant production and processing practices change to remain economically viable in the face of dynamic harvesting, transportation, processing and consumer demands. A myriad of food safety processes, quality assurance schemes and regulatory mandates exist. Nevertheless, safe food and water remain one of the most pressing global public health challenges. Every country in the world faces new and changing food safety threats. While science provides invaluable results necessary for evidence-based public health, good science alone is not enough. Decisions affecting public health are made daily in the face of significant gaps in our scientific knowledge. This course explores the critical competencies for leadership in industry, government and academia necessary for ensuring an abundant, affordable and safe global food supply.

5) Envirovet Summer Institute: ***Leadership for One Health on Earth, Changing lives and Creating leaders around the world***

Since 1991, Envirovet has provided unique-in-the-world, ground-breaking training in ecosystem health practice to more than 400 veterinarians from 44 nations. Each class of the annual Summer Institute (http://www.cvm.uiuc.edu/envirovet/) consists of 25 carefully-selected veterinarians and veterinary students from developed and developing countries who have demonstrated their commitment to wildlife, public, and ecosystem health through prior studies and activities. The eight-week Summer Institute runs 8-14 hours a day and 6-7 days a week. Throughout the course, the students draw upon the knowledge, wisdom, and technical expertise of up to 80 world-class "instructor-mentors" for whom Envirovet is a teaching highlight. Envirovet students engage one-one-one with these role models during lectures, discussions, labs, and field exercises, and over meals or during unscheduled times. Such interactions help the students develop and catalyze plans for careers in wildlife health and conservation, public health, and ecosystem restoration and recovery.

The Envirovet Summer Institute begins in mid-June at White Oak Conservation Center in northeastern Florida (http://www.wocenter.org/) with two weeks of immersion-style learning about the big drivers that undermine health and biodiversity. Also included are proven intervention methods to yield positive short- and long-term gains. This unit includes: the value of biodiversity, ecosystem economics, and environmental law and policy; epidemiology; and the basis for disease emergence and resurgence, including efficient diagnostic tools. It addresses methods for restoration of populations of threatened or endangered species in the wild, including wildlife capture and translocation—and provision of ample habitat. It also focuses on counteracting overharvest, poaching, invasive exotic species, and predator-prey imbalances. Throughout this unit, ways to reduce risks to public, domestic animal, and wildlife health from shared infectious diseases are strongly emphasized. The Summer Institute continues with two-weeks of intensive instruction in aquatic animal health, ecotoxicology, and ecosystem rehabilitation at Harbor Branch Oceanographic Institution (http://www.hboi.edu/index_05.html). This unit begins with instruction on the dynamics of aquatic ecosystems and how they are assessed. It focuses on the sources, fate, detection and control of contaminants, explains the causes of—and solutions for—declines in major ocean fish communities, as well as fisheries impacts on the food supply of marine mammals. It provides contact with environmentally-beneficial aquaculture, teaches the causes of marine mammal strandings, and first-hand experience in forensic studies. The aquatic unit stresses opportunities for better stewardship of aquatic ecosystems and animal populations to enable recovery of aquatic biodiversity, cleaner water supplies, and more and safer fish and shellfish for human consumption. The third unit of each Summer Institute takes place in a developing country (e.g. Kenya, Brazil, South Africa) and emphasizes ways to accommodate the economic and food security needs of people in the poorest regions of the world through better stewardship of lands, water, wildlife,

and domestic animal populations. The unit addresses prevention of diseases shared between wildlife and humans, as well as between wildlife and either livestock or poultry. It demonstrates proven methods to re-establish self-sustaining wildlife populations in ways that improve the lives of nearby human groups. Leading biomedical scientists, conservation biologists, and environmental managers work side-by-side with the Envirovet group in hands-on work. Tribal leaders share first-hand knowledge about wildlife/livestock conflicts. Throughout this unit, the need to look holistically at the challenges—and solutions—lying at the human/wildlife/domestic animal/environment interface are emphasized.

Former Envirovet participants have gone on to fill important leadership roles in ecosystem stewardship within universities, non-governmental organizations, corporations, private consultancies and governments in the United States and around the world. Moreover, Envirovet students stay connected with each other, forming a global network of like-minded, inspired, highly-motivated and trained professionals providing leadership for one health on Earth. The Envirovet Summer Institute has received financial support from the Geraldine R. Dodge Foundation, Eli Lilly and Company, the Russell E. Train Educational Fund for Nature of the World Wildlife Fund, the Wildlife Conservation Society, the US Agency for International Development, and the Nathan Cummings Foundation.

6) Iowa State University-- Center for Food Security and Public Health

The Centers for Disease Control and Prevention (CDC) provided a three year grant (July 2002 – June 2005) for almost $3 million to establish the Center for Food Security and Public Health (CFSPH) at the Iowa State University College of Veterinary Medicine. The CFSPH is a CDC Center for Public Health Preparedness and is the only Center to focus on veterinary medicine and zoonotic diseases. The mission of the Center is to:

Increase Awareness
The CFSPH has worked to increase awareness of bioterrorism, agroterrorism and foreign animal diseases among veterinarians, farmers, medical personnel and the general public. CFSPH staff developed a comprehensive set of fact sheets, PowerPoint presentations, and handouts on important diseases which can be found here: www.cfsph.iastate.edu/DiseaseInfo. This information was distributed nationwide through a Train-the-Trainer program partnering with state veterinary medical associations, the Cooperative Extension Service, universities, and federal agencies to recruit trainers. As of March 1, 2006, our trainers have given over 870 presentations in 47 states to 35,600 individuals.

Provide Tools
Since February 2004 the CFSPH has been developing biological risk management tools. Individuals can use these tools to better protect animals (and humans in the case of zoonotic diseases) from infectious diseases. These materials focus on the route of disease transmission and provide practical disease management strategies. The CFSPH is working to encourage veterinarians to use these materials. These tools can be found at www.cfsph.iastate.edu/BRM. The USDA Risk Management Agency funded the development of Biological Risk Management materials for beef and dairy producers. These tools were delivered to extension specialists from 47 states in July 2006.

Prepare for Animal Emergencies
The CFSPH is working with a number of state veterinary teams on training for animal emergency response. The CFSPH helps to organize the training meetings and develop

resource materials for the teams.

Zoonoses Handbook Now Available - February 2008
With support from Bayer Animal Health, the CFSPH has published the Handbook for Zoonotic Diseases of Companion Animals. The Handbook is for veterinary and human medical professionals and addresses the etiology, prevention and liability issues for zoonoses of companion animals. It also contains materials to educate staff and clients. (Zoonoses Handbook; http://www.cfsph.iastate.edu/About/purpose.htm)

7) **University of Tennessee – Food Safety and Preparedness, Public Health, Human-Animal Bond (**http://www.vet.utk.edu/cafsp/)

Center for Agriculture and Food Safety and Preparedness - Homeland Security funded course developed by UT College of Veterinary Medicine (UTCVM) and several partners to educated the food industry (from farm, wholesale, transportation, to retail, including law enforcement and public health officials). Objective is to teach how to access vulnerabilities in order to "harden these targets."

Public health epidemiology certificate course directed at officials in local and state public health departments. Training developed and implemented through partnership between the UTCVM, UT Dept of Public Health, and the State and County Health Departments

Human Animal Bond in Tennessee (HABIT) http://www.vet.utk.edu/habit/

H.A.B.I.T. is comprised of representatives from the University of Tennessee College of Veterinary Medicine, volunteers from the community, and private veterinary practitioners. H.A.B.I.T. sponsors programs which foster pet visitation to nursing homes, assisted-living residences, retirement centers, mental health centers, residences for children with special needs, rehabilitation facilities, hospital settings, and other facilities. H.A.B.I.T. offers resources such as trained volunteers, medically and behaviorally screened animals, and guidance regarding pet visitation, program development, and evaluation.

Humans and Animals Learning Together (HALT) http://www.vet.utk.edu/halt/

HALT provides a therapeutic intervention for at-risk adolescents through dog obedience training. HALT addresses the following objectives: 1) to offer adolescents an opportunity to develop a positive sense of accomplishment, self worth and pride; 2) to offer adolescents an opportunity to improve specific living skills such as assertiveness, patience, staying on task, communication and commitment; 3) to introduce adolescents to career opportunities in animal related fields; 4) to provide a successful experience for the adolescents and dogs; and 5) to increase the adoptability of selected adult dogs through basic obedience training. Through a series of classes, a canine obedience instructor helps student trainers teach basic obedience commands to dogs from an animal shelter. Suitable dogs are selected from a local animal shelter and medically and behaviorally screened. They are given a standard series of inoculations, neutered or spayed, and boarded at the class site. Student trainers are adolescents from residential centers for treatment of substance abuse, behavioral or alienation problems. They are selected by the staff of their agency and are transported to the class site for the classes. The student trainer commits to one four-week course, meeting two times per week. Up to three agencies may furnish student trainers to work with one group of dogs. They train on different days. The dogs get up to 6 hours of quality attention each week. Each dog is placed in a suitable home after graduation.

Veterinary Social Work - http://www.vet.utk.edu/socialwork/

A new sub-discipline in Social Work was developed through and partnership between the UTCVM and the UT College of Social Work. The primary mission is to provide support and education for students, faculty, staff, and clients of the University of Tennessee College of Veterinary Medicine. This education and support is intended to 1) educate students, clients, faculty, staff, as well as the professional and general public about the human animal bond and veterinary social work; 2) provide clinical consultation, support, and referral to students, clients, staff, and faculty of the veterinary teaching hospital; 3) conduct evidence-based veterinary social work practice. This includes both using empirically supported interventions as well as conducting on-going program and clinical practice evaluation; 4) provide service to the community. This service includes work with and integration of both human and animal related professionals.

8) Kansas State University (K-State) – Interdisciplinary Master of Public Health, Veterinary Fellowship, Veterinary Training Program for Rural Kansas, K-State Public Health Group, Kansas Animal Health Corridor

K-State Interdisciplinary Master of Public Health (MPH): The interdisciplinary MPH at K-State is described in detail at http://www.k-state.edu/mphealth/index.htm. The MPH degree is an interdepartmental program with faculty participants from many academic departments of the university, and the Director in the CVM. The 42 semester hour program is designed to provide graduate-level education for individuals currently employed or anticipating a career in the field of public health. In addition to the core requirements, students select an area of emphasis in food safety and biosecurity, infectious disease+zoonoses, human nutrition or physical activity. The focus in infectious diseases and zoonoses has specific programs of study that target non-DVM students, post-DVM students and concurrent degree (DVM-MPH) students.

K-State Pathways to Public Health: The future of the interdisciplinary MPH program at K-State depends on the ability to recruit and retain students in the baccalaureate and professional degree programs that feed the four emphasis areas. The coordinating committee that oversees the graduate program has recognized the importance of increasing undergraduate student awareness of public health careers and accepts this responsibility. To this end, we have developed an integrated recruitment and retention strategy that targets community college students who are interested in learning more about public health professions, as well as undergraduate students enrolled in bachelor's degree programs relevant to public health (for example: biology, food science, human nutrition and kinesiology). The proposed program, "Pathways to Public Health", consists of four components: 1) an introductory survey course focused on public health topics that will be made available at KS community colleges through distance education; 2) an 8-week summer immersion experience that will expose students to the four public health emphasis areas: food safety, infectious diseases and zoonoses, human nutrition, physical activity; 3) a 5-year concurrent BS/MPH option; 4) a Director of Undergraduate Public Health Programs dedicated to mentoring students. Together, these components should stimulate and increase the number and preparation of students seeking a baccalaureate or higher degree in the disciplines relevant to public health practice. At the present time, funding is being sought from a number of sources to support implementation of "Pathways to Public Health" at K-State. The Kansas Health Foundation has reacted positively towards the proposed program, and a strong partnership is anticipated.

***K-State MRCE Veterinary Fellowship*:** K-State is one of three veterinary schools participating in the Veterinary Fellowship program associated with the Midwest Regional

Center of Excellence in Biodefense and Emerging Infectious Diseases (http://mrce.wustl.edu/index.php?id=dynamic_page&itemid=40). The first fellow focused her MPH in the area of Food Safety and focuses on the use of molecular technologies to compare genetic markers for Shiga-toxin 2 virulence between cattle and human clinical Shiga-toxigenic Escherichia coli O157:H7 and non-O157 serotypes. The One Health theme is emphasized heavily in the application for renewal of the K-State Veterinary Fellowship associated with the Midwest Center. Specifically, the proposed fellowship program will provide post-graduate veterinarians with 1) the opportunity to receive biomedical research training focused on emerging infectious diseases and zoonoses. Research programs focused on RNA viruses and food-borne pathogens will be emphasized, because of institutional strength in these areas and because these agents are associated with emerging diseases with significant impact on human health. The research training experience will include participation in a professional development course focused on the principles of biosafety and biocontainment; 2) the opportunity to integrate research training focused on infectious disease with development of competency in core public health core disciplines. Fellows will accomplish this through the pursuit of either a PhD in Pathobiology plus a graduate certificate in core public health concepts, or a Master of Public Health (MPH) degree with a research-based thesis. "Infectious Disease and Zoonoses" is one of four defined areas of emphasis associated with the interdisciplinary MPH at K-State; 3) the opportunity to experience work environments focused on human health care. Veterinary Fellows will spend three weeks shadowing physicians who specialize in emergency medicine, pediatrics and infectious disease in office, clinic and hospital settings. To this end, the fellowship program will partner with a 400 bed acute care community and referral medical center, its outpatient units and medical staff. These components form a well integrated health care system that is based in the state capital, and located near the county health department and the Kansas Department of Health and Environment.

***The Veterinary Training Program for Rural Kansas*:** This debt forgiveness opportunity is made available to five students in each class who are committed to food animal medicine and public health. This program is intended to boost the number of students entering rural veterinary practice. Students are selected for the program during the first year of veterinary college through a competitive selection process. Each student receives $20,000/year for up to four years. For each $20,000 a student receives, he/she is expected to spend a year working in the rural community. These students are required to emphasize public health and livestock biosecurity in their professional training. Because it is recognized that veterinarians in rural areas serve as key resources on human health issues, they receive advanced training in rural sociology, public health, and management of emerging infectious diseases. Externship opportunities are provided by the KDHE, the National Veterinary Services Laboratory at Plum Island, and the CDC. In the view of KSU's Dean, Ralph Richardson: "These students will be our 'boots on the ground' in protecting the community from potential public health concerns."

The K-State College of Veterinary Medicine Public Health Group: This organization was formed in 2007 by veterinary students interested in public health. Students drafted a club constitution and by-laws, and petitioned successfully for recognition and support from the K-State Student Chapter of the American Veterinary Medical Association. The organizational objectives of the newly formed group are: to promote education, awareness, and activities regarding public health; to promote public health careers and networking opportunities for K-State students; and to stimulate veterinary student interest in the field of public health. Active participation is encouraged not only from students in the DVM curriculum, but also from students in the interdisciplinary MPH program and other K-State communities interested in public health. This club plans to seek affiliation with a national public health organization, such as the American Association of Public Health and National Association of State Public Health Veterinarians. This group has also been active in seeking collaboration with the public

health student group at the University of Kansas Medical Center (KUMC). To date, two student-driven events have occurred under the banner of "One Health. First, Nicholas King from McGill University spoke to students from both institutions at the KU campus in the history of medicine library on "What's Wrong with Health Inequalities?". Then, Roger Mahr spoke to students from both campuses about "One World, One Health, One Medicine"; this event was held at K-State.

K-State and Animal Health Corridor: Kansas City has acknowledged that our region has a strong cluster of companies engaged in animal health and nutrition research, innovation, business functions and production, by branding the region as the Animal Health Corridor (http://www.kcanimalhealth.com/). In this context, the K-State and U Missouri CVM's work closely with industry to promote "One Health". This is accomplished through sponsorship of a One Health-related symposium in conjunction with the Central Veterinary Conference, as well as through sponsorship of an afternoon lecture series/social hour. Invited speakers at these events have included: Alfonso Torres, Lonnie King, and Ron DeHaven.

K-State Olathe Innovation Campus (http://kstateoic.ksu.edu/): A new K-State campus will anchor the Kansas Bioscience Authority's Kansas Bioscience Park, bringing research, education, and outreach offerings to meet the greater Kansas City area's rapidly growing needs in the life sciences. K-State's Olathe Innovation Campus (KOIC) will focus on experiential learning, applied research and technology discovery in areas relevant to One Health, such as animal health, plant science, food safety and security and bioenergy. In these endeavors, KOIC will collaborate with existing educational institutions at every level including K-12, community colleges, and four-year colleges and universities. The local school district has 21st century science programs focused on biotechnology and geosciences; veterinarians from K-State and the animal health industry have been deployed in these classrooms to talk to students about veterinary careers in public practice and to link the concept of One Medicine to classroom activities.

9) University of Wisconsin-Madison School of Veterinary Medicine-- One Health/One Medicine initiatives with academic health partners

- Master of Public Health (MPH) program

  The School of Veterinary Medicine is a partner in the UW-Madison MPH program. The MPH is administered through the Department of Population Health Sciences in the School of Medicine and Public Health (SMPH), but the program integrates the four primary health science schools on campus (human medicine, veterinary medicine, nursing, pharmacy) as well as additional campus partners such as the Nelson Institute for Environmental Studies, the Center for Sustainability and the Global Environment, the LaFollette School of Public Affairs, the law and business schools, and others. The School of Veterinary Medicine is represented at several levels in the MPH program: program faculty, steering committee, admissions committee. A dual DVM-MPH degree program allows students to complete both degrees in 5 years. The MPH program provides multidisciplinary education and training in public health concepts and methods to current and future health professionals. The degree provides a practice-oriented program for students in health professional education programs who want to strengthen general knowledge and skills in public health. Students pursue a combination of required and elective coursework, as well as a 10-week public health field project and capstone experience. Funding for the MPH comes from tuition dollars as well as core funding from the SMPH through its Medical Education and Research Projects (MERC) funds of the Wisconsin Partnership Program. The later funds were derived from the conversion of Blue Cross/Blue Shield United of Wisconsin to a for-profit company.

- Center for Global Health

  The Center for Global Health (CGH) is a multidisciplinary, campus-wide enterprise incorporating the Schools of Medicine and Public Health, Veterinary Medicine, Pharmacy and Nursing, as well as the Division of International Studies. The goals of the Center are to: develop global health education programs; advance global health research; facilitate global health partnerships and exchanges; and, foster an interdisciplinary network of global health scholars and practitioners. The CGH sponsors monthly seminars, a yearly global health symposium, and on-campus and in-country educational programs, including a 9-credit Certificate in Global Health that students in the health sciences can take accompanying their primary professional degree (MD, DVM, PharmD, Master of Nursing). Current formal in-country programs occur in Ecuador, Thailand, and Uganda – in each case, multidisciplinary teams of students and faculty from across the health science schools travel, live, work and study together, with a strong sense of one health/ one medicine. Additionally, students from across the health science schools on campus have completed a wide variety of independent study programs in many additional countries. In addition, the CGH helps to facilitate international health field projects for our campus MPH students.

  Core funding for the CGH comes the five primary campus partners as listed above, as well as philanthropic support from campus and community donors, and grants. The interdisciplinary nature of the Center and its educational programs is largely unique among international health centers; a paper describing the creation of the Center around its interdisciplinary themes has just been published in the journal Academic Medicine and can be viewed at: http://www.academicmedicine.org/pt/re/acmed/abstract.00001888-200802000-00007.htm;jsessionid=LJzTXMnYDJMFgBksT2NhyhmQnv11x5QbLzx8KBGvPJY2mQllT20n!774718804!181195629!8091!-1.

10) North Carolina State University -- Annual One Medicine Symposium (http://www.onemedicinenc.org/)

The North Carolina State University, the North Carolina Department of Health and Human Services, the North Carolina Department of Agriculture and Consumer Services, and other partners have sponsored an annual One Medicine Symposium the last four years, to educate and provide attendees with take-home tools that will improve and enhance preparedness for a natural or man-made disaster or infectious disease outbreak. The theme of the 2007 symposium was, "Globalization and Emerging Risks: A One Medicine Approach to a Changing World," which focused on the effects of globalization on agriculture, public health, and animal health. The agendas encourage human and animal health professionals to come together to answer key questions to improve awareness and understanding of issues benefiting from a One Medicine approach.

11) Texas A & M—Center for Environmental and Rural Health (http://cerh.tamu.edu/); **Emergency Response—Surge Capacity**

- Texas A&M University established the Center for Environmental and Rural Health (CERH) in 1998 with a mission to: 1) foster interdisciplinary research focused on understanding the cellular and molecular mechanisms of toxic injury induced by environmental factors and 2) develop and implement strategies for the detection, prevention, and management of environmentally related diseases encountered with high frequency in rural populations in the State of Texas. Since its inception, the

Center has brought together nationally and internationally renowned scientists and has facilitated interdisciplinary collaborations focused on basic and translational research, which is carried out in two Research Cores focused on the Environment & Reproduction and the Environment & Cancer. Research is enhanced by an Integrated Health Sciences Facility Core that provides important infrastructure for carrying out research activities. Interdisciplinary research in the Environment & Reproduction Research Core is focused on birth defects, the third leading cause of infant mortality in the U.S. Interdisciplinary research in the Environment & Cancer Research Core is focused on both basic and clinical/translational research on Cancer, a major public health problem in the United States, accounting for one in four deaths. Both Research Cores incorporate interdisciplinary environmental research to predict toxicity and screening for chemicals posing the greatest risk to human health. The Texas A&M University Center for Environmental and Rural Health has an extensive rural network that provides services to population centers as well as cutting-edge biomedical research support throughout the state. At the present time, both research and clinical activities are concentrated in Houston, San Antonio and the lower Rio Grande Valley.

- Conversion of Large Animal Facility to House Hurricane Rita Refugees-- CVM facilities served as a special needs hospital during Hurricane Rita (JVME 32 (4): 562, 2005). After being emptied and sanitized, the Large Animal Clinic facility housed approximately 650 people, including patients, families, and caregivers. 350 patients included badly burned children from Shriners Hospital in Galveston, geriatric patients from nursing homes and physically handicapped children. Partners included TAMUS Health Science Center administration, VMTH staff and faculty, CDC, US Army, FEMA, local human hospital staff members and physicians.

12) The Ohio State University - Public Health Preparedness for Infectious Diseases

This is a collaborative initiative of the colleges of Biological Sciences, Food, Agricultural, and Environmental Sciences; Medicine; Pharmacy; Public Health, and Veterinary Medicine. Its aim is to protect public health by minimizing animal to human, environmental, and food borne infectious disease threats through innovative interdisciplinary research. A program of research excellence that is broad in scope encompassing the full range of relevant sciences from the laboratory bench to the community has been established. An interdisciplinary program has been developed, recognizing that breakthroughs will likely emerge at the interface of scientific disciplines. Thus, this program draws strength from both the diversity of academic programs that underlie it, as well as a unifying focus and direction related to public health preparedness and infectious diseases. Particular research goals include:

1) translate scientific discoveries into clinical applications e.g. new diagnostics, therapies, and vaccines for infectious diseases; 2) Detect the presence of emerging infectious diseases within communities, the underlying mode of transmission, and strategies for prevention, control and treatment; 3) Prevent human infection from antibiotic resistant zoonotic (animal to human) micro-organisms through an understanding of livestock immune systems -- particularly the gastrointestinal tract -- with an aim to reduce use of antibiotics in animals; 4) Address food safety issues during food production, processing, transport, storage, retail, or consumer use, with an aim to decrease infections and associated fatalities caused by food-borne illness; and 5) Train professionals in veterinary public health and infectious diseases public health preparedness.

13) Washington State University—The School for Global Animal Health

Funded by the Bill and Melinda Gates Foundation in 2008, this newly established school will focus on three interrelated approaches: 1) Vaccine development and deployment, focusing on vector-borne diseases of livestock that are an impediment to economic development and human livelihoods in Africa, Asia, and Central and South America; 2) Emerging pathogen and disease detection that will lead to early intervention by health care organizations, and 3) Control of disease transmission from animals to humans. The school will be specifically focused on improving human health and well-being by better control of animal diseases (JAVMA Vol 232 (9), News May 1 2008, pgs 1272-1274)

14) AAVMC/ASPH Collaborations-- Joint Symposium, Partnerships for Preparedness: Future Directions for Schools of Public Health and Colleges of Veterinary Medicine, April 22-24, 2007, Emory Conference Center Hotel in Atlanta, Ga. and joint programs in veterinary medicine and public health

- In 2007, the Association of American Veterinary Medical Colleges and the Association of Schools of Public Health held a joint symposium on research and education in veterinary public health to increase the strong connection between public health and veterinary medicine, which includes issues such as population health, zoonotic diseases, food safety, and food security. Over 225 public health and veterinary professionals and deans, faculty and students from schools of public health and colleges of veterinary medicine attended the two day symposium. Papers were presented on Academics, Research and Practice, Workforce and Training, and Public Policy. Selected papers presented at the Symposium have been published jointly by Public Health Reports (Public Health Reports May-June, 2008, Volume 123), and the Journal of Veterinary Medical Education. Built upon the strong connection between public health and veterinary medicine, the symposium focused on how schools of public health and colleges of veterinary medicine can work together to improve academic programs, public policy, workforce training and research. Veterinarians promote both animal and human health by emphasizing population health, comparative medicine, zoonotic diseases, food safety, and food security. Public health professionals study the impact of diseases on populations and promote health by focusing on preventive measures as opposed to curative medicine. The Symposium was funded by the Centers for Disease Control and Prevention of HHS, and the Animal Plant Health Inspection Service of the USDA. Collaborative efforts are underway to plan next steps in strengthening and sustaining this important partnership in One Health. Details on the meeting have been posted on the ASPH (www.asph.org) and AAVMC (www.AAVMC.org) websites.

- CDC has funded a national network of Centers for Public Health Preparedness, collaboration between academic institutions and state and local public health departments and other community partners to provide life-long learning opportunities to the public health workforce. Several of these Centers focus on veterinary public health as a cross-disciplinary issue. These include Centers located with Emory University, Iowa State and University of Iowa, University of Michigan, University of Minnesota, University of Nebraska, and the University of Albany.

- Joint DVM-MPH Programs. Over the past several years, programs in veterinary medicine and public health have been established in AAVMC member institutions. These programs, several of which lead to a joint DVM-MPH degree, are listed in attachment 1.

Conclusion

As the examples included in this appendix clearly illustrate, there are many successful activities underway in the Colleges and Schools of the Allied Health Professions and their partners,

which are bringing multiple disciplines together to improve the health of animals, people, and the environment, locally, nationally, and globally, through education / teaching, research, and community service. The Academic Community is providing important leadership in implementing One Health in local, national, and international settings. As indicated earlier, the examples included in this document are not intended to be a comprehensive list. Many more projects and activities are underway in our colleges and schools than could be included in this appendix. Continued commitment and support are needed to sustain, strengthen, and grow all these and other efforts that are underway and/or planned for the future, to allow the One Health initiative to achieve its greatest potential for improving the health of our fellow humans, the animals that we depend on for food, fiber, companionship, and work, and the environment we all share.

Public Health Programs at U.S. Colleges/Schools of Veterinary Medicine in Collaboration with Schools of Public Health

Colleges/Schools with Professional Public Health Degree Programs

- Auburn University, College of Veterinary Medicine
- Colorado State University, College of Veterinary Medicine
- Iowa State University, College of Veterinary Medicine
- Kansas State University, College of Veterinary Medicine
- Michigan State University, College of Veterinary Medicine
- North Carolina State University, College of Veterinary Medicine
- The Ohio State University, College of Veterinary Medicine
- Texas A & M
- Tufts University, Cummings School of Veterinary Medicine
- University of California, Davis
- University of Georgia, College of Veterinary Medicine
- University of Illinois at Urbana-Champaign, College of Veterinary Medicine
- University of Minnesota, College of Veterinary Medicine
- University of Tennessee-Knoxville, College of Veterinary Medicine
- University of Wisconsin-Madison, School of Veterinary Medicine
- Virginia-Maryland Regional College of Veterinary Medicine

Colleges/Schools with a Public Health Program but Without a Formal Joint Degree Program

- Cornell University
- Louisiana State University
- Oklahoma State University
- University of Florida
- University of Missouri, College of Veterinary Medicine
- University of Pennsylvania