INTEGRATED ENVIRONMENTAL EDUCATION: INTRODUCING ONE HEALTH CONCEPTS INTO VETERINARY TECHNICIAN EDUCATION

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Abstract

Over the past four to five years, there has been notable progress in One Health training opportunities for veterinary medical students (Chaddock, 2012; Wong & Kogan, 2013), but, to date, the need for veterinary technicians to be trained and to play an allied role had not been addressed in published research. The adoption of One Health Core Concepts into veterinary medical education (NAVMEC, 2011) and the opening of One Health, Ecosystem Health, Conservation Medicine, and Global Animal Health Institutes at many American veterinary schools suggest a potential demand for veterinary technicians in new areas of veterinary medicine. The purpose of this project is to investigate whether veterinary technicians have a role to play in One Heath, and if so, then how best to infuse these new, inclusive health concepts and strategies into their educational programs.

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TABLE OF CONTENTS

CHAPTER 1.

INTRODUCTION AND STATEMENT OF THE PURPOSE

Extreme summer temperatures, torrential rainfall, widespread flooding, hurricane events, massive wildfires, Ebola outbreaks, tsunamis, catastrophic mud slides, glacial break ups, and prolonged periods of drought are a handful of the clinical signs that the physical and ecological health of the planet is changing. Predicting and understanding how the health of the planet and everything living it on it are intricately connected has become paramount in the fields of health science, veterinary medicine, and the biological, physical, and ecological sciences. Finding ways to collaborate and share information is critical. One Health is a co-equal, collaborative organization made up of veterinarians, physicians, nurses, biologists, ecologists, public health officials, and other scientists to collectively address serious global environmental issues affecting human health, domestic animal health, wildlife health, and ecosystem health (AVMA, 2014; Norris, 2010;).

According to Chaddock (2012), seventy-five percent of newly emerging human diseases have crossed the species barrier. The advantage of a veterinary perspective in this disease paradigm is indisputable. An article by Rapport & Lee (2004), reported that Canadian veterinary schools were the first professional schools (i.e., medical, dental, law) to adopt ecosystem health concepts into their core curricula. Since then, veterinary educators across the United States have begun the process of integrating One Health concepts, including ecosystem health, into core curricula (North American Veterinary Medical Consortium, 2012; Wong & Kogan, 2013).

A formal call for the veterinary profession to reestablish its social and environmental obligations came early. In 1990, Dr. Susan Clubb, an avian veterinarian from Florida, addressed the American Veterinary Medical Association's (AVMA) House of Delegates. In her address, Dr. Clubb posed this question: "Like an old hound dog in the back of a pick-up --- the winds of

change are blowing in our ears. How will the AVMA respond to the challenge of a shrinking world?" (Olsen & Seal, 1990). In 1990, the AVMA House of Delegates chose not to respond.

Not until 2007, did the AVMA confront the "shrinking world" scenario. Newly elected AVMA President Dr. Roger Mahr began his term by refocusing the AVMA on its obligation to society and its public health roots. Soon after his inauguration, Dr. Mahr commissioned a One Health Initiative Task Force (OHITF) to study the feasibility of establishing collaboration and cooperation among health science professions, academic institutions, governmental agencies, and private industry to help with the assessment, treatment, and prevention of zoonotic disease transmission (AVMA, 2008). The conclusions of this feasibility study acknowledged it was imperative for the veterinary profession to begin working in cooperation with the other health sciences to address looming environmental health concerns. Set in motion by the outcomes of the OHITF, the veterinary profession has actively begun the process of engaging One Health head on (OHITF, 2009).

Project Purpose

Over the past four to five years, there has been notable progress in One Health training opportunities for veterinary medical students, but, to date, the need for veterinary technicians to be trained and to play an allied role had not been addressed in published research (Chaddock, 2012; Wong & Kogan, 2013). The adoption of One Health Core Concepts into veterinary medical education (NAVMEC, 2011) and the opening of One Health, Ecosystem Health, Conservation Medicine, and Global Animal Health Institutes at many American veterinary schools (AVMA, 2014) suggest a potential demand for veterinary technicians in new areas of veterinary medicine. If so, veterinary technician educators, too, should begin introducing One Health concepts into veterinary technician education. In 2012, the University of Pennsylvania

offered an Award of Excellence opportunity for faculty members in their Medical, Dental, Veterinary and Nursing Schools to submit proposals for collaborative One Health research projects and for inter-professional education opportunities (University of Pennsylvania Almanac, 2012). This initiative was among the first to include an allied health profession as an equal, co-contributor to One Health. More recently, Western University of Health Sciences in Southern California created an inter-professional curriculum to connect students from all nine of its health disciplines, including the School of Nursing (Wong & Kagan, 2013).

The purpose of this project was to investigate whether veterinary technicians have a role to play in One Heath, and if so, then how best to infuse these new, inclusive health concepts and strategies into veterinary technician educational programs.

To explore the need for veterinary technicians in these new fields of veterinary medicine, an extensive review of the veterinary education literature for veterinarians was undertaken, since similar documents related to veterinary technician education were non-existent. A large sampling of the articles provided detailed evidence regarding the critical need for veterinarians to receive additional training. Another extensive compilation provided suggestions for, and tried examples of, effective ways these concepts can and have been infused into veterinary medical education programs. One particularly noteworthy document was the White Oak Accords, which was developed by the American College of Zoological Medicine in 2000 (Stoskopf, 2001). One of the primary goals of the White Oak Accords was to develop guidelines for teaching ecosystem health concepts to all veterinary students. In it, key phrasing suggested connections to Environmental Education Literacy Goals, Objectives, and Guiding Principles. Review of the White Oaks Accords prompted a more extensive look at Environmental Education strategies as a potential delivery model for One Health concepts into veterinary technician education.

Project Components

There are three major components of this project: 1) A literature review; 2) an article designed to introduce veterinary technicians to the AVMA's One Health Initiative, and 3) a series of lesson plans designed to introduce veterinary technicians to One Health concepts. The following is a more in-depth explanation of the project components:

1. Literature Review Component.

An extensive literature review was conducted to help evaluate if there is a need to prepare veterinary technicians to enter One Health fields, and to determine appropriate delivery systems. As previously mentioned, by necessity, this search focused on articles related to veterinary medical education programs designed for the training of veterinarians.

2. Article Component.

The purpose of the article is to inform veterinary technicians and veterinary technician students about potential new career and training opportunities and to introduce readers to veterinary technicians who are already making contributions within One Health. Individuals working in varied fields of One Health were interviewed via telephone or the Internet to assess their understanding of, and beliefs about, the need to infuse One Health concepts into veterinary technician education. Questions were designed to determine their personal view of future employment opportunities for veterinary technicians in One Health, and ways in which they feel are best to prepare veterinary technicians to meet these new challenges. A series of questions were presented and answered in a 25-20 minute interview. Two of the interviews were audio recorded and saved for future reference. The third respondent provided his responses in writing. The data gathered from these interviews has been summarized in the article component of this project. The article will be submitted for publication in the peer-

reviewed, *NAVTA Journal* and will be created with AMA style formatting and referencing, as required by the *NAVTA Journal.*

3. Curriculum Development Component.

A series of lesson plans have been developed to educate veterinary technicians and veterinary technician students about One Health. A modified Understanding by Design (Wiggins & McTighe, 2005) lesson planning format has been used to create curriculum and activities that can guide teaching, and assist in the development of effective learner assessments. Environmental literacy goals, objectives, and guiding principles will be used as an underlying framework to guide the instructor's development of lesson plans. Teaching strategies identified as effective in veterinary education programs designed for veterinary students are also used in the curriculum. Several teaching aids accompany the lesson plans, including rubrics and audio-visual aids. A key audio-visual presentation was developed to chronicle the environmental history of the veterinary profession over the past 60 years. Many of the graphics used in this PowerPoint presentation have been removed to avoid copyright infringements.

Definitions

American Veterinary Medical Association (AVMA): a non-profit organization representing

American veterinarians working in both private and corporate practice, government, industry, academia, and uniformed services (AVMA, 2014).

Credentialed Veterinary Technician (veterinary nurse): is defined as a "veterinary technician" who is currently registered, certified, or licensed by the Board (NAVTA, 2014).

Ecosystem Health: an integrative concept that includes biological, physical, social, and health aspects of an ecosystem; it is oriented toward preserving the function of individual ecosystems in relationship to the wellness of the community of organisms it supports (Chaddock, 2012; Rapport, 1998).

One Health: The One Health concept recognizes that the health of humans is connected to the health of animals and the environment. By working with medical doctors, veterinarians, and ecologists to monitor and control public health threats by investigating how diseases spread among animals and humans living within the physical environment (CDC, 2014; One Health, 2009).

Zoonotic Disease: a disease that passes between animals and humans.

CHAPTER 2.

LITERATURE REVIEW

Overview

Peer-reviewed literature regarding the role of veterinary technicians in One Health or Ecosystem Health medicine is lacking. The majority of articles reviewed for this project reflect data collected from professional veterinary education programs, since they are the organizations currently implementing these new programs. The survey of literature covers six areas related to veterinary medicine and ecosystem health: 1) description of ecosystem health, 2) entrance of veterinary profession into ecosystem health field, 3) role of veterinarians in ecosystem health field, 4) integration of ecosystem health concepts into veterinary curricula, 5) failed legislation, 6) One Health Initiative, and 7) the role of veterinary technicians in One Health field. The final section evaluates educational strategies and goals used to deliver instructional lessons.

Ecosystem health: An emerging, trans-disciplinary science

According to Aquirre and Gomez (2009), the biosphere is threatened by phenomena that are happening as the result of increasing human pressures on the planet. Climate change, loss of biodiversity and ecological processes, emerging infectious diseases and global toxification are a few of the dynamic features influencing ecosystem health. Many scientists believe these factors are working synergistically to diminish human, domestic animal, wildlife and environmental health on our planet (Beasley, 2009; Motavalli, 2004; Rapport, D., Hilden, M., & Weppling, K., 2000).

A trans-disciplinary approach which includes conservation biologists, ecologists, veterinarians, public health physicians, biomedical researchers and others is needed to address the interlinked nature of many of today's most urgent health and conservation issues (Nielsen,

1992; Norris, 2001; Rapport, Hilden and Weppling, 2000). The goal of ecosystem health is to bring a diverse coalition of scientists and researchers together around a simple unifying concept: health. Of the numerous potential biological crises facing our planet, the issues of declining biodiversity and emerging diseases are among the most complex and far-reaching (Nielsen, 1992; Norris, 2001; Smith, 2013). The need for cooperation is straightforward: Health connects all living things on the planet (AVMA, 2014; Dierauf, Griffith, Beasley, & Mashims, 2001).

The conservationist, Aldo Leopold, introduced the concept of land health in the early 1940's. In his writings, Leopold explored the similarity between the practice of medicine and the practice of land health. He noted that the practice of medicine was still in its infancy, but that medical knowledge was growing and the medical sciences were advancing. He described how symptoms of illness or injury, manifested by a patient, inform a physician's diagnosis and treatment plan. He felt that the land, too, demonstrated signs of illness and injury that require, as he put it, doctoring. According to Leopold, 1940's farmers routinely practiced the art of land doctoring, and he proposed that the science of land health would likely be a job for the future (Leopold, 1949). Since that time, advances in the medical sciences have expanded exponentially. As for land health, the future is, as Leopold predicted, gradually approaching. Veterinarians must champion conservation and environmental protection measures that directly and indirectly affect animal and human health (Dierauf, et. al., 2001).

Entrance of the Veterinary Profession into Ecosystem Health/One Health

Numerous early studies, reports, medical essays, news reports, journal articles, and magazine articles have been written about the connection between animal and human health (Karesh, 2009; Karesh, B., Cook, R., 2005; Motavalli, 2004; Murphy, 1998). According to Chaddock (2012), of the nearly 1500 diseases now recognized as affecting humans, almost sixty

percent are caused by pathogens with multiple-species hosts. In the last thirty years, seventy-five percent of newly emerging human diseases have crossed the species barrier (zoonotic). In recent history, outbreaks of diseases such as the avian flu (HINI), severe acute respiratory syndrome (SARS), bovine spongiform encephalopathy (mad cow disease), Hantavirus, Ebola virus, West Nile virus, Human Immunodeficiency virus (HIV), and other pathogenic organisms have spread throughout the world (Karesh, 2009; Murphy, 1998; Murray, Sischo, & Hueston, 2006). Some of these emerging, infectious diseases were transmitted from animals or arthropods to humans, who then became the incidental or dead-end host. For example, humans can be infected with West Nile virus, and may suffer severe illness or death, but are not essential to the development and transmission of the virus. A number of these pathogens have the genetic ability literally to make the jump from one species to another. HIV/AIDS is an example of a virus that originated in an animal species and can now use humans as a definitive host (Murphy, 1998). Until very recently, the health sciences have been compartmentalized into human medicine, domestic animal medicine, and wildlife health. This disconnect has hindered efforts to identify, control, and prevent many of these infectious diseases (Karesh, 2009). The advent of field specialization (such as, Surgery, Internal Medicine, Food Animal, Companion Animal, etc.) in both veterinary medicine and human medicine has led to isolation even within professions (NAVMEC, 2011). A recent outbreak of Ebola has emphasized the need for a more holistic approach to emerging, zoonotic disease control and the role of veterinary medicine in society.

In 2001, immediately following an Ebola epidemic in several small villages near Gabon in West Africa, Allela, et al. (2005) reported detectable Ebola virus IgG in feral West African dogs that were known to have high exposure to the Ebola virus; primarily from eating infected dead animals and by consuming vomitus from Ebola-positive humans. Although gorillas,

chimpanzee and duiker carcasses are known to be the primary source of human infection these researchers were interested in whether the virus was capable of infecting dogs that were living in close proximity to Ebola-positive humans. While the dogs in this study showed no clinical signs, and the study tested a relatively small group; the dogs' IgG levels suggest they can be infected by Ebola. The recent quarantine of American health care providers returning from the latest Ebola outbreak in West Africa, and the quarantine of one nurse's Cavalier King Charles Spaniel quickly focused the public's attention on what epidemiologists and health care providers have known and understood for some time: zoonotic diseases are a global concern. In response to this potential global health crisis, in November 2014, President Obama requested that Congress appropriate more than six billion dollars to fund the "Emergency Response to Enhance the U.S. Government's Response to Ebola at Home and Abroad" (White House, 2014).

In many countries, contact between domestic animals and wildlife is commonplace (Karesh, 2009). A broader understanding of the connection between animal, human, and environmental health requires a trans-disciplinary approach. It is imperative that the veterinary profession position itself to meet the challenge of this global health paradigm (Boyce, Yuill, Homan, Jessup, 1992; Nielsen, 1992; Norris, 2001). Biomedical training in comparative (trans-species) medicine and population medicine (herd health) prepares veterinarians to make significant contributions in ecosystem health problems where environmental, human, and animal health intersect (Boyce, et al., 1992). According to Stephen (2009), the expansion of veterinary medicine into ecosystem health provides an opportunity for the profession to re-establish its social relevance in the face of impending environmental catastrophes.

In April 2007, the American Veterinary Medical Association Executive Board took official action to establish a One Health Initiative Task Force (One Health, 2009). The purpose

of the task force was to study the feasibility of establishing collaboration and cooperation among health science professions, academic institutions, governmental agencies, and industries to help with the assessment, treatment, and prevention of zoonotic disease transmission (AVMA, 2008). Some of the findings that resulted from the OHITF included the following: "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" (AVMA, 2008). The concept of One Health embodies the unique opportunity for the veterinary profession to take a leadership role and to act collaboratively for ecosystem health and for the good of society (One Health, 2009).

Veterinarian Dr. Lonnie King, who served as the Chairman of the One Health Initiative Task Force wrote in the Executive summary of the AVMA One Health Initiative Task Force report (King, Anderson, Blackmore, Lautner, Marcus, et al., 2008):

> 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. The challenges and obligations of health professionals have never been tested, as we are today to truly reestablish our social responsibility. We are standing at the precipice of a health care transformation, where disease prevention and health promotion in people, animals and our environment have become a critical strategic need (p. 261)

This realization becomes imperative as the number and virulence of pathogens capable of crossing the species barrier grows in proportion to the global travel of people and animals, and the international transport of food supplies. According to the One Health Initiative (2009), the advantages of a One Health approach to global wellness include: improvement of animal and

human health globally through collaboration among all the health sciences and other scientific professions, the ability to meet new global challenges head-on through collaboration, the development of centers of excellence for education and training that highlight and heighten collaboration among health professions (AVMA, 2008).

Identifying roles for veterinarians in ecosystem health

One aspect of ecosystem health is the field of conservation medicine (Hutchins, Foose, & Seal, 1991; Miller, 2009; Norris, 2001; Peterson, Lopez, Laurent, Frank, Silvy & Lui, 2005; Phillips, Henry, & Kelly, 2003), an emerging, trans-disciplinary field that studies the relationship between human health, animal health, and environmental conditions. Since veterinarians are trained in epidemiology, infectious disease, pathology, and the effects of environment on animal health, they can play a key role in conservation medicine (Miller, 2009; Rapport & Lee, 2004).

In zoos, veterinarians play a role in education, research, healthcare, and conservation of imperiled species. They also play a unique role in the monitoring of diseases that may impact human and domestic animal health as well as the health of free-ranging wildlife (Miller, 2009; Sikarskie, 1992). According to Miller (2009), West Nile virus was originally detected by a zoo veterinarian at the Wildlife Conservation Society in New York, when he observed and reported high bird mortalities. Zoo veterinarians who supervise collection animals are well positioned to collect baseline data from individual and groups of species that provide valuable information to wildlife veterinarians and other professionals monitoring disease outbreaks in free-ranging populations (Sleeman & Clark, 2003). Surveillance of wildlife morbidity and mortality rates, by wildlife veterinarians, can signal emerging diseases (Norris, 2001) that may affect human and domestic animal health. In 2010, the University of Wisconsin's School of Veterinary Medicine began monitoring the *Wildlife Health Event Reporter*, a surveillance and communication website

set up to record wildlife health observations for injured, sick or dead wildlife (http://www.wher.org). The online system collects reports from citizens groups, wildlife rehabilitators, and other wildlife professionals to create a long-term databank of wildlife morbidity and mortality events. Wildlife rehabilitation hospitals, too, are in a unique position to observe ecological changes that influence the health of wildlife (Sikarskie, 1992; Sleeman & Clark, 2003). Captive breeding of endangered species is another area where veterinary expertise is essential (Hutchins, et al., 1991; Snyder, Derrickson, Beissinger, Wiley, Smith, & Miller, 1996).

Educating practicing veterinarians and veterinary students about the critical role veterinary medicine plays in conservation medicine is vital to ecosystem health goals (Miller, 2009). Research and education are two areas where veterinarians can contribute, particularly in the areas of global infectious disease control. Conservation medicine includes the protection and reintroduction of endangered or threatened species and ecosystems and the investigation of disease outbreaks and environmental threats to populations (Miller, 2009). One example of their contribution is in the California Condor Recovery Program, where veterinarians manage health and injury concerns.

Monitoring of indigenous animal health and the health of domestic animals living within an ecosystem, as indicator species, provide insight into overall ecosystem health. Health monitoring of West Indian manatees and bottlenose dolphin in south Florida are examples of using wildlife species as environmental quality sentinels (Bonde, Aquirre, & Powell, 2004). The single species approach to ecological health evaluation may provide “snap shots” of environmental changes that may affect other animals, humans, or ecosystem health (Bonde, et al,

2004). Nielsen (1992) suggests wildlife and marine mammal veterinarians are well positioned to conduct these studies.

Declining biodiversity and newly emerging diseases signals a need for veterinary involvement in ecosystem health issues (Norris, 2001). Integrating the biomedical perspective of the veterinary profession into health care with the theoretical, ecological perspective of ecologists is important to the preservation of biodiversity (Boyce, et al., 1992).

What role veterinarians will play in ecosystem health issues, and how and to what extent training should be incorporated has been explored (Aquirre, 2009; Miller, 2009; Stoskopf, 2006). Within the past decade, the veterinary profession has clearly begun to recognize the growing need to prepare young veterinarians to enter the field of ecosystem health and conservation medicine (Aquirre, 2009; Aquirre & Gomez, 2009; Boyce, 1992; Nielsen, 1992; Norris, 2001; Stoskopf, 2006; & Stoskopf, Murphy, Kennedy-Stoskopf, & Kaufman, 2006). Stephens (2009) believes that ecosystem health training should include systems thinking to help students gain knowledge and experience in concepts of interdependence of systems components, complexity, and the need for trans-disciplinary thinking. As Aldo Leopold suggested in the early twentieth century, to fully understand the complexity in ecological processes, and to plan and act on time scales of decades and centuries, it will be necessary to think like a mountain (Leopold, 1949). Using a systems approach to address ecosystem health issues echoes Leopold's insightful analogy. Agreeing how best to integrate an ecosystem-health viewpoint into veterinary medical education continues to be investigated and evaluated (Aquirre, 2009; Aguirre & Gomez, 2009; Howard, 2004; Howard & Rapport, 2004; Kaufman, Else, Bowen, Anderson & Epstein, 2004; Mazet, Hamilton, & Dierauf, 2006; Rapport & Lee, 2004; Stephen, 2009; Stoskopf, 2006; Stoskopf, et al., 2006; Wong & Kogan, 2013).

Integrating Ecosystem Health Concepts into Veterinary Education

Developing education programs to serve the needs of veterinary medical students and practitioners is the challenge presently facing veterinary schools (Chaddock, 2012; Rapport & Lee, 2004; Stephen, 2009; Wong & Kogan, 2013). A significant number of articles have been published in the area of ecosystem health education. Topics addressed range from those seeking to identify training deficiencies, those that look at where it best fits into the field of veterinary medicine, to whom and to what extent it should be taught, how best to initiate curriculum changes, and to identify the challenges associated with integrating ecosystem health into veterinary education. The best practices from schools actively integrating these concepts provide good insight into curricular development (Aquirre, 2009; Aquirre & Gomez, 2009; Chaddock, 2012; Howard & Rapport, 2004; Mazet, et al., 2006; Stephen, 2009; Stoskopf, 2006; Stoskopf et al., 2001; Wong & Kogan, 2013).

With the goal of identifying educational deficiencies, Mazet, et al., (2006) conducted a series of surveys to identify the training and educational needs for veterinarians entering wildlife medicine and ecosystem health fields. The study surveyed 125 individuals who were wildlife veterinarians, veterinary students, and/or veterinarians seeking employment in conservation medicine. The purpose of these studies was to determine how best to prepare veterinarians to work within these fields. Sixty-one percent of the respondents indicated that the training they received in veterinary school did not adequately prepare them to enter the field. These individuals reported a need for more coursework, clinical rotations, and mentorship by a professional. Ninety-eight percent of wildlife veterinarians working in the field reported that ecosystem courses should be integrated into veterinary education curriculum. All participants indicated that understanding and maintaining ecosystem health was a primary component of a

wildlife veterinarian's job. In 2012, an online study conducted by Wong & Kogan surveyed veterinary students at Colorado State University's College of Veterinary Medicine regarding their familiarity with One Health. Eighty percent of the students rated the One Health Initiative as very important for public health, wildlife health, and food animal medicine or surgery. According to the authors, most students were very interested in future opportunities to participate in inter-professional educational programs with both human and ecosystem health professionals.

Armed with knowledge about where the training deficiencies exist, the next hurdle for veterinary educators was to determine which AVMA Specialty College should spearhead the training programs. Several articles published by Stoskopf, between 2001 and 2006, chronicled the progression of ecosystem health training for veterinarians. According to Stoskopf (2001), in 2000, the American College of Zoological Medicine held its annual conference at the White Oak Conservation Center in Yulee, Florida. Representatives from thirty-one North American veterinary schools attended the workshop for two primary purposes: 1) to define the role of zoological medicine in veterinary medicine, and 2) to develop guidelines for teaching ecosystem health concepts in veterinary schools. A document now known as the White Oak Accords was developed to provide a roadmap for the training of veterinarians in the field of environmental medicine.

The White Oak Accords define the field of zoological medicine as follows: "Zoological medicine integrates veterinary medicine and the principles of ecology and conservation as applied in both natural and artificial environments" (Stoskopf, et al., 200l, p. 1532). As stated, environmental medicine, as it applies to the practice of veterinary medicine, falls under the auspices of the American College of Zoological Medicine. Some of the major areas encompassed by zoological medicine, under the heading of environmental medicine are: Free-

ranging wildlife medicine, conservation/preservation medicine, ecosystem health, wildlife rehabilitation, marine mammal medicine, and display and pet fish medicine (Stoskopf, 2006).

Ecosystem health curriculum recommendations are also addressed by the White Oak Accords. Guidelines entitled the: "Minimum Expectations of Zoological Medicine Curriculum for Every Veterinary Student" are identified within this document. The recommendations mandate that ALL veterinary students receive training in ecosystem health concepts. In addition, those individuals interested in pursuing careers within the field of zoological medicine should focus their elective coursework in these areas, and participate in preceptorships and internships, where they will be exposed to qualified, expert mentors and where they will have experiential opportunities. As these curricular directives are incorporated into veterinary medical education and the statistics regarding their on-the-ground effectiveness are established, a new source of data will exist. These findings will be closely scrutinized and interpreted when, and if, a need for veterinary technicians is established within this field of study.

Several areas have been identified to effectively begin incorporating ecosystem health concepts into veterinary education. Core subjects such as epidemiology and herd medicine are courses where all veterinary students could be exposed to these concepts. Elective courses such as environmental health and exotic medicine could further expand on ecosystem health concepts for those students wishing to pursue careers in zoological medicine (Aquirre & Gomez, 2009, Stoskopf, 2006). Integrating ecosystem health concepts across the curriculum has been identified as the most effective way to reach the greatest number of veterinary students (NAVMEC, 2011; OHITF, 2008; Stoskopf, 2006). Since the 2000 White Oak Accords were developed, more veterinary schools across the U.S. and Canada have begun to integrate the principles of ecosystem health and conservation medicine into their professional curricula

(Aquirre, 2009, Stoskopf, et al., 2001). Some of these offerings are in the form of elective courses designed for students pursuing wildlife or zoo medicine and conservation medicine specialties. Other efforts strive to integrate these concepts into the core curricula for all veterinary medical students (Aquirre, 2009; Aquirre & Gomez, 2009; Chaddock, 2012; Rapport & Lee, 2004; Stephen, 2009; Stoskopf, 2006; Stoskopf, et al., 2001; Wong & Kogan, 2013).

One challenge that continues to surface when looking at ways to include ecosystem health concepts into veterinary education is defining what ecosystem health is. Some schools and organizations identify it as ecosystem health, or One Health, or One Medicine, or Integrated Heath, or Conservation Medicine (Chaddock, 2013). Stephens (2009), along with others advises avoiding the terms altogether and suggests educators simply state what they want to achieve. Howard (2004) and others identify several barriers to adopting ecosystem health concepts in professional curricula. The three main obstacles identified were: 1). Failure of students, teachers and administrators to see the significance of ecosystem health concepts across the curriculum; 2) educators feeling unqualified or ill prepared to engage this complex subject, and 3) teacher and administrator beliefs that it is impossible to add new content to already overburdened professional curricula (Howard, 2004; Howard & Rapport, 2004; Stoskopf, 2006). The Center for Conservation Medicine at Tufts University School of Veterinary Medicine found it was often difficult for a single-discipline faculty member, accustomed to traditional teaching methods, to embrace a more interdisciplinary teaching perspective (Kaufman, Else, Bowen, Anderson, & Epstein, 2004). Now, a decade later, The Center for Conservation Medicine at Tufts University is described as the campus hub for interdepartmental, interdisciplinary partnerships within the University. It is now home to the world's only M.S. degree in the field of Animals and Public

Policy, and the first Veterinary Masters of Public Health degree with both veterinary and medical students in the same classroom (MSCM, 2014).

Many researchers believe embracing the complexity of ecosystem concepts is more valuable from a problem-solving perspective that allows for teaching in ways that involve the collection and synthesis of solutions, and the taking of a more holistic approach that bridges different levels of management and science and is politically and ethically sound (Howard, 2004; Kaufman, et al., 2004, Stoskopf, 2006). Teaching from a case-based, cooperative learning perspective addresses all of these curricular proposals, and fortunately has become a widespread strategy now used by many veterinary schools (Aquirre, 2009; Kaufman, et al., 2004; Klemm, 1994). According to Stephens (2009) and Chaddock (2012), having faculty model team-based, trans-disciplinary interactions is critical to help students successfully employ ecosystem health/One Health concepts. Chaddock (2012) also suggests incorporating these concepts into non-medical core professional competencies such as communication, leadership development, management, diversity and multicultural awareness, and political action. Familiarizing students with inter-professional learning and collaboration will help future practitioners know where and how to access experts and professionals from other fields when the need arises. One example of a practical One Health approach involved a rabies-positive beaver at the Delaware Water Gap National Recreational Area. A park visitor was swimming when approached and bitten by the animal. The beaver was captured and killed and turned over to park authorities. Park rangers contacted National Park System veterinarians who contacted the National Park System's One Health Network, including state veterinarians. The beaver was tested for rabies at a nearby State Rabies Laboratory and the victim was referred to a hospital for post-exposure treatment the same day. Messages were immediately posted in the area to warn the public of the potential danger

and park rangers were instructed to increase their surveillance of the area for other sick animals. The rangers were also provided with information about personal protection and safety procedures for handling suspect animals. Biologists and CDC specialists quickly conducted a risk assessment of the beaver lodge and the surrounding area finding that it was an isolated incident and that the beaver colony posed little danger to humans. Input from the CDC rabies experts prevented the extermination of the beaver colony. A press release was distributed to local and state media to notify the public of their findings. As the result of the pre-established inter-agency collaboration created via One Health, within 36 hours post-exposure, this potentially problematic issue was resolved (Buttke, D., Castle, K., Wild, M., Wong, D., Hilaire, L, Sorhage, F., Cherry, B., 2014).

While finding ways to effectively integrate ecosystem health concepts into veterinary curricula is challenging, the efforts will result in future veterinary professionals playing a significant role in the ecosystem issues facing our world (Howard, 2004). As stated by Howard & Rapport (2004), "Maintaining and enhancing the 'health of the land' or in today's terminology, 'ecosystem health,' is essential for human well-being" (p. 7).

Legislation

A call for legislation to support environmental concerns within the field of veterinary medicine came early. In 1990, avian veterinarian, Dr. Susan Clubb addressed the American Veterinary Medical Association's (AVMA) House of Delegates and suggested a motion be submitted to establish a resolution decreeing that one-percent of the AVMA's annual budget be pledged toward the conservation of the earth's plants and animals and the ecosystems they inhabit. Support was not present at that time and Dr. Clubb withdrew her motion. She was permitted to read her comments (Olsen & Seal, 1990). The conclusion of her statement was the

following: “Like an old hound dog in the back of a pick-up --- the winds of change are blowing in our ears. How will the leadership of the AVMA respond to the challenge of a shrinking world?” (Olsen & Seal, 1990, p. 183). Twenty years later, in January 2010, a press release from the AVMA announced its support of newly introduced Federal legislation to increase the number of veterinarians specializing in wildlife and zoo animal care (Kirkpatrick, 2010). The H. R. 4497: Wildlife and Zoological Veterinary Medicine Enhancement Act of 2010 was sponsored by Representative Alcee Hastings (D-FL-23) to “expand the workforce of veterinarians specialized in the care and conservation of wild animals and their ecosystems, and to develop educational programs focused on wildlife and zoological veterinary medicine” (House Bill, 2010). “The shortage of veterinarians in environmental medicine fields is attributed to lower salaries, high educational debt and insufficient numbers of training and formal education programs specializing in wildlife and zoo veterinary medicine” (Hastings, 2010). H.R. 4497 addressed the need to train and prepare veterinarians to meet global trans-disciplinary challenges. Unfortunately, the bill died in committee. While unsuccessful, this bill underscored the critical need for veterinarians to enter the field of ecosystem health.

One Health Initiative Includes Ecosystem Health Concepts

Clearly, the more widely accepted venue for ecosystem health principles is via the One Health Initiative. Laura Kahn, MD, and several of her colleagues recently compiled a list of One Health Initiative Supporters. The list includes more than fifty organizations, including the AVMA, the American Medical Association, the American Nurses Society, the National Park System, the American College of Zoological Medicine and many others. It also includes the names of hundreds of professionals who support One Health within their given profession (One

Health, 2009). One Health encompasses the principles of ecosystem health supported by the White Oak Accords and the values and mandates of many other organizations.

Dr. Donald Smith, Professor of Surgery and Dean Emeritus at Cornell University College of Veterinary Medicine (2013) classifies the three major elements of One Health as: zoonotic disease, comparative medicine, and zooeyia (the positive benefits associated with human-animal interactions). Zoonotic disease transmission is the most cited aspect of One Health (Beasley, 2009; Motavalli, 2004; NAVMEC, 2011; One Health, 2009), but Smith states that recent advances in genome research underscore the importance of comparative medicine in One Health --- the understanding that animals and humans share many diseases and conditions. The best-selling book, *Zoobiquity: The Astonishing Connection Between Human and Animal Health* (Horowitz & Bowers, 2013) provides examples of mutual diseases and conditions. A few of the shared diseases and conditions include evidence that chimpanzees in the wild suffer from depression, rhinoceroses contract leukemia, melanoma affects animals and humans alike, and chlamydia is contracted by humans, birds, and even koala bears. The book focuses on the importance of interdisciplinary cooperation, particularly in cancer research, and emphasizes the importance of comparative medicine. The third element of One Health is Zooeyia, pronounced, ZOO-ey-ah (Smith, 2013). Zooeyia is a newly invented word used to describe the positive health benefits associated with having pets in our lives (Hodgson & Darling, 2011). It is the opposite of zoonotic.

In the article, *Zooeyia: An essential component of "One Health"*, Hodgson & Darling (2011) suggest that the world-wide increase in zoonotic diseases are due to numerous converging factors including: increased urbanization, climate change, and human travel and infringement into previously wild areas. These ideas are shared by many (Beasley, 2009; Karesh, 2009;

Murphy, 1998; Nielsen, 1992; Stoskopf, 2006). What is unique about this One Health perspective is the realization that the ubiquitous and intimate presence of companion animals in the family dynamic influences, in a positive way, human well-being. Dog owners exercise more. People with pets refrain from smoking more frequently; pet owners suffer from chronic disease less frequently, and have more social interactions than people without pets. People with pets are 57% more likely to be engaged in civic activities. Cat owners suffer less frequently with hypertension. Oxytocin, the bonding/attachment hormone, increases when a pet owner's dog gazes at them. Elderly people without pets visit their physician more frequently than those with a companion animal in the home. One Health is not limited to the prevention of zoonotic diseases; it also includes the enhanced health benefits for humans from their relationships with companion animals (Hodgson & Darling, 2011). In light of all the recent research that emphasize the positive attributes of the human-animal bond, there exists a need to educate medical and veterinary medical students about these benefits. Veterinarians in community practice are well positioned to provide client education about the human health benefits of pet ownership (Martin & Taunton, 2006; Hodgson & Darling, 2011). Helping individuals select a pet suitable to their lifestyle and their ability to provide for its care is an area where the veterinarian and his/her staff can provide guidance.

Governments and professional and academic institutions around the world have committed to promoting efforts to improve global health through the One Health Initiative (Chaddock, 2012; Nielson, et al., 2012). In 2011, the North American Veterinary Medical Education Consortium released its *Roadmap for Veterinary Medical Education in the 21st Century: Responsive, Collaborative, Flexible* recommendations (NAVMEC, 2011). This report identified the Core Competencies for All Graduating Veterinarians in the U.S. One of its newest

core competencies is: “One Health Knowledge: Animal, Human, and Environmental Health”. It states the following:

> In collaboration with other health professionals, veterinarians responsibly use their expertise and influence to advance the health and welfare of animals, people, their local and global communities, and the environment. Veterinarians appreciate the impact of animal disease on the food supply and society in general (p. 55).

On campuses around the world, veterinary, medical, and dental schools are being challenged to embrace One Health concepts that encompass the health of people, domestic and wild animals, and ecosystems from a multi-discipline medical perspective. Incentives for researchers and educators to develop these inter-professional research projects and educational programs that are designed to share knowledge and improve the health of animals and society are growing in momentum (Nielsen, et al., 2012). For example, in 2012, the University of Pennsylvania offered an Award for Excellence in Promoting “One Health Initiatives” and “Inter-professional Education” with a monetary award for faculty and staff members who designed and implemented research and programs focused on collaborative healthcare education engaging two or more professional programs. The award was offered to faculty and staff from four different professional Schools: Medical, Dental, Veterinary and the School of Nursing (Baillie, 2013). This initiative was among the first to include an allied health profession as an equal co-contributor to One Health. More recently, Western University of Health Sciences in Southern California created an inter-professional curriculum to connect students from all nine of its health disciplines, including the School of Nursing (Wong & Kagan, 2013). The opening of One Health, Ecosystem Health, Conservation Medicine, and Global Animal Health Institutes at many

American veterinary schools and other Universities will provide centers of learning in this new age of inter-disciplinary education (Chaddock, 2012).

The decision and the plan to include One Health concepts, including ecosystem health, into veterinary education has been made. Defining a role for credentialed veterinary technicians in One Health has not been mentioned in published research, including those monitored and published by the AVMA, NAVTA, the American Animal Hospital Association, and the Association of Veterinary Technician Educators.

Determining the Role of Veterinary Technicians in One Health

To date, no literature has been located that specifically explored a role for veterinary technicians in One Health. However, the 11th One Medicine [One Health] Symposium held in December 2014 in Durham, North Carolina includes veterinary technicians in its list of professionals invited to attend (One Health, 2009). It further provided an opportunity for veterinary technicians to earn continuing education credit for attending. Inclusion in this conference marks the first time the veterinary technician career has been professionally linked to One Health.

Despite the lack of inclusion in One Health until very recently, a trend in veterinary medicine suggests that once a specialty area (e.g., American College of Veterinary Anesthesia and Analgesia) has been established for veterinarians to pursue advanced training, the need for veterinary technicians to attain a higher level of training and skills within that specialty area is strongly indicated (NAVTA, 2010). In 2010, the Veterinary Technology Program at Yuba College in Yuba City, California, began offering an online Veterinary Public Health and Food Safety Certificate Program for veterinary technicians. It is available to its current students and working professionals. According to Loghry, the instructor, it is a fully online program that

provides course work, direction and work experience to help prepare veterinary technicians to work in veterinary public health and food safety (B. Loghry, personal communication, August 4, 2012). This year long, 18 credit program focuses on infectious disease control, procedures for monitoring Hazardous Analysis and Critical Control Point evaluation, food sanitation, and zoonotic disease control measures that support the One Health Initiative (Yuba College, 2012). To date, it is the only veterinary technology program known to be directly addressing the One Health Initiative. As mentioned, the program is taught by Loghry, a veterinary technician, who in addition to her veterinary technician degree, has earned a Master's degree in Public Health from the University of California, Davis. Loghry was one of the veterinary technicians interviewed for this project. Her thoughts and responses will be discussed in the Interview portion of this project.

One suggestion that seems to permeate the literature is that it is important to "just do" One Health rather than to try and define it (Chaddock, 2012; Wong & Kogan; 2013). The idea is that whatever it is called (ecosystem health, One Health, One Medicine, One World-One Medicine) or however it is defined, the key factors are that it should be: a worldwide strategy, interdisciplinary, collaborative, co-equal, with a pre-established communication system that rapidly conveys critical information among agencies and individuals with the goal of improving the health of humans, animals, and the environment (Chaddock, 2012; One Health, 2009). There are several organizations that employ the skills of veterinary technicians in this way. For instance, The USDA Animal and Plant Health Inspection Service (APHIS) is responsible for the Animal Health Emergency Management agency whose job it is to act as the leader in animal health emergency management through the National Preparedness and Incident Coordination Center. In 2001, APHIS established the National Animal Health Emergency Corps (NAHERC)

to respond to disease outbreaks and other disasters that affect domestic and wild animals (livestock, poultry, pets and wildlife) and people. Their mission is to train and employ veterinarians and veterinary technicians to respond to local and national animal health emergencies. As a temporary NAHERC employee, veterinary technicians serve their country by helping to protect communities and the U. S. food supply (UDSA-APHIS, 2014). The APHIS website includes a One Health statement that advocates the idea that healthy productive livestock and pets lead to healthy people and viable environments through our food supply and economy and companionship.

Another Federal agency responsible for emergency animal health care is the National Veterinary Response Team (NVRT), an agency within the National Disaster Medical System. NVRT also employs professionals from diverse backgrounds in the veterinary sector, including veterinary technicians, public health personnel, researchers, and communication experts. This Federal agency is among the first line of defense for the treatment of injured or ill animals affected by disasters. Their job is to provide assessments, technical assistance, veterinary care and public health assistance in concert with state and local authorities. The members of this agency are private citizens who serve as pre-trained, on-call, intermittent Federal employees (USDHHS, 2014). The California-based Oiled Wildlife Care Network is another example of One Health in action. Working with more than thirty different Member Organizations, the Oiled Wildlife Care Network responds to spills in four critical areas: Readiness, Response, Research, and Reaching Out. Veterinary technicians are among the professionals providing emergency medical care for affected wildlife (UC Davis, 2014).

To further support the need for allied health personnel, such as the veterinary technology profession in One Health, a broader scope of educational literature was examined. According to

Howard and Rapport (2004), “Ecosystem health education must be an integral part of all levels of education for all who contribute to our society, and therefore must be a key component of all professional curricula” (p. 7). Howard and Rapport (2004) also suggest that ecosystem health concepts should be expanded to other educational levels, and that to be truly effective these concepts should be taught throughout grades K-20 and into professional programs (p. 6). Allied health professions, such as veterinary technology and registered nursing (R.N.), were not specifically identified by Howard and Rapport (2004), but the implication supports this understanding.

Educational Strategies/Frameworks

Since the need for veterinary technicians to be educated about One Health is noticeably on the horizon, it is time to examine which pedagogic methods should be used to incorporate these new concepts into veterinary technician education. Looking at the methods used in veterinary education could inform the process of training veterinary technicians. As stated earlier, the White Oak Accords provided the framework of guiding principles used to instruct veterinary schools how best to infuse ecosystem health concepts into veterinary education (Stoskopf, 2006). One of its recommendations was the following: “Environmental awareness needs to be a part of modern veterinary education, and every student should develop an appreciation of the major environmental impacts on animal health, including zoological species” (p. 334). The reference to ‘environmental awareness’ suggests a connection to Environmental Education goals, objectives, and guiding principles. ‘Environmental awareness’ is one of the five goals/objectives of environmental education (UNESCO, 1978). Defining how best to integrate One Health concepts into veterinary technician curriculum necessitates an evaluation of Environmental Education goals, objectives, and guiding principles.

Environmental Education is an interdisciplinary, multidisciplinary and holistic instructional framework designed to be integrated into all levels of education (Kirts, 1990). William Stapp (1969), defined environmental education like this, "Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (p. 34). From its inception, Environmental Education has been deeply rooted in the belief that global cooperation and collaboration is vital to a healthy planet (UNESCO, 1975). In the 1970's, the United Nations sponsored two influential conferences that set the standard for the field of Environmental Education. Developed in 1975, the Belgrade Charter established the first global framework for Environmental Education:

> To develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO, 1978).

Two years later, international delegates to the Intergovernmental Conference on Environmental Education convened in Tbilisi, Georgia, USSR to explore and expand on the Belgrade Charter. From this collaborative, international effort aimed at addressing unyielding environmental concerns, the Tbilisi Declaration was born (UNESCO, 1978). The Tbilisi Declaration established three comprehensive Environmental Education Goals:

- Foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas.
- Provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.

• Create new patterns of behavior among individuals, groups and society as a whole toward the environment.

Five categories of objectives were also established along with a set of guiding principles. The five objectives are:

Awareness – to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems;

Knowledge – to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems;

Attitudes – to help social groups and individuals acquire a set of values and feeling of concern for the environment and the motivation for actively participating in environmental improvement and protection;

Skills – to help social groups and individuals acquire the skills for identifying and solving environmental problems;

Participation – to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

Some of the guiding principles of Environmental Education are relevant in One Health education, as well:

- Consider the environment in its totality—natural and built, technological and social (economic, political, cultural, historical, ethical, aesthetic);
- Be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective.

- Examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas.
- Focus on current and potential environmental situations while taking into account the historical perspective.
- Promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems.
- Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences.
- Help learners discover the symptoms and real causes of environmental problems.
- Emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills.
- Utilize diverse learning environments and a broad array of educational approaches to teaching, learning about and from the environment with due stress on practical activities and firsthand experience.

One Health embraces many of the concepts and values expressed in the Tbilisi Declaration (One Health, 2009). According to Waltner-Toews (2009), the practice of veterinary medicine has expanded from a concern about the health and diseases of individual animals, to herd and flock health and public health, and since the 1990's, to the idea that the health of all living things are intimately connected to healthy environments. One Health is a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment (One Health, 2009). One of the guiding principles of Environmental Education, as mentioned above, states that environmental education

should be interdisciplinary and should drawing on the specific content of each discipline (UNESCO, 1978). A common thread is indisputable. In 2010, the United Nations and the World Bank recommended adoption of One Health approaches when they released the "Fifth Global Progress Report on Animal and Pandemic Influenza. The document also suggested the importance of adopting a One Health approach to pandemic preparedness (CDC, 2014). A number of the Environmental Education principles are similar to One Health strategies. Therefore, it seems reasonable to use Environmental Education strategies to develop educational materials that prepare veterinary technicians to interface with One Health.

Summary of Literature Review

Our planet is currently facing complex environmental crises that require input from experts in all areas of science and medicine. Climate change, unprecedented human movement around the globe, global toxification, emerging disease, and the intimate relationship that has developed among co-existing species all contribute to a need for a One Health approach to wellbeing and health for people, animals, and the planet (Beasley, 2009; Hodgson & Darling, 2011; Motavalli, 2004; Rapport, Hilden, & Weppling, 2000). The veterinary profession is well suited to provide leadership in One Health because of its long history of population medicine and comparative medicine (Boyce, et al., 1992). Ecosystem health concepts are best taught via One Health curriculum (Chaddock, 2012). The veterinary profession has embraced One Health (One Health, 2009) and veterinary schools have adopted One Health practices into their core competencies (NAVMEC 2011). Best practices for infusing One Health concepts into veterinary education curricula include: clinical rotations and mentorship (Mazet, et al, 2006), teaching from a case-based perspective using cooperative learning strategies, and having faculty model team-

based trans-disciplinary interactions (Aquirre, 2009; Chaddock, 2012; Howard, 2004; Kaufman et al., 2004; Klemm, 1994; Stoskopf, 2006; Wong & Kogan, 2013).

Specifically, veterinary technician students interested in pursuing careers in One Health can receive additional training via Yuba College's Veterinary Public Health online certificate (Yuba College, 2012). Courses such as epidemiology (Public Health), Herd Medicine (Food Animal Medicine) and Exotic Medicine should be designated to provide additional training (Aquirre, 2004; Stoskopf, 2006) for those individuals interested in pursuing careers with wildlife and zoo animals. The method identified as most effective for integration of One Health concepts to the greatest number of students is teaching these concepts across the curriculum (Chaddock, 2012; Stoskopf, 2006; Wong & Kogan, 2013). While information concerning the role of veterinary technicians in One Health is novel, the inclusion of veterinary technicians at the 11th One Medicine [One Health] Symposium held in late 2014 in North Carolina (One Health Initiative, 2012) provided further evidence that there is a need for veterinary technicians to engage with One Health. The critical need for veterinarians in One Health may signal an impending role for credentialed veterinary technicians.

If ecosystem health education must be an integral part of all levels of education, as Howard and Rapport (2004) suggest then, indeed, the veterinary technology profession should begin the process of preparing veterinary technicians to engage this new challenge. The entrance of the nursing profession into One Health (Baillie, 2013) further suggests a need for allied health professionals. There are three primary elements to One Health: zoonosis, comparative medicine and zooeyia. Zooeyia represents a positive perspective to the human-animal relationship in One Health, because having a pet improves human health (Hodgson & Darling, 2011; Martin & Taunton, 2006). Veterinary technicians have a role to play in One Health in public health,

wildlife rehabilitation, animal emergency health and disaster response, and through educating the pet owners about emerging diseases, parasite control, and the health benefits that result from a human-animal bond relationship.

The connections between One Health goals and Environment Education goals are obvious. This association implies that it would be advantageous to use Environmental Education frameworks as a blueprint when developing lesson plans designed to educate and motivate veterinary technicians and veterinary technician students to engage in environmental concerns identified by the AVMA's One Health Initiative. The conclusion of this literature review is consistent with the idea that the field of veterinary technology should prepare to contribute to One Health.

Chapter 3.

The purpose of the article is to inform veterinary technicians and veterinary technician students about potential new career and training opportunities in One Health, and to introduce readers to veterinary technicians who are already making contributions within One Health. Individuals working in varied fields of One Health were interviewed via telephone or the Internet to assess their understanding of, and beliefs about, the need to infuse One Health concepts into veterinary technician education. Each participant understood and agreed that their responses and their names might be used in the development of a journal article to be submitted to a veterinary technician publication. Questions were designed to determine their personal view of future employment opportunities for veterinary technicians in One Health, and ways in which they feel are best to prepare veterinary technicians to meet these new challenges. A series of questions were presented and answered in a 25-20 minute interview. Two of the interviews were audio recorded and saved for future reference. The third respondent provided his responses in writing. The data gathered from these interviews has, indeed, been summarized in the article component of this project. The article, *One Health: A Place at the Table for Veterinary Technicians* will be submitted for possible publication in the peer-reviewed, *NAVTA Journal.* It has been created with AMA style formatting and referencing, as required by the *NAVTA Journal.*

One Health – A Place at the Table for Veterinary Technicians

Introduction

Extreme summer temperatures, torrential rainfall, widespread flooding, hurricane events, massive wildfires, Ebola outbreaks, tsunamis, catastrophic mud slides, glacial break ups, and prolonged periods of drought are a handful of the clinical signs that the physical and ecological health of the planet is changing. Predicting and understanding how the health of the planet and everything living it on it are intricately connected has become paramount in the fields of human health, veterinary medicine, and the biological, physical and ecological sciences. Finding ways to collaborate and share information is critical. In 2009, the AVMA launched its One Health Initiative to join other scientists around the world in a comprehensive effort to better understand and predict the complexity of ecological and health problems challenging our planet.

One Health is a collaborative, all-inclusive movement designed to bring health care providers, including veterinarians, physicians, public health officials, registered nurses, and scientists from biological, physical, and ecological fields together around a single defining concept: health.[1, 2] The intent of this article is to identify and introduce people, places and ways that the veterinary profession is interfacing with One Health, and to educate and challenge veterinary technicians to join the growing number of health care providers working directly and indirectly toward a better understanding of our intimate relationship to all living things.

Hippocrates (c. 460 BC – 370 BC) was the first physician to suggest that human health was reliant on a clean environment.[3] In more recent times, the notion of One Health has been around since the 1940's when environmentalist Aldo Leopold first introduced the concept of land health. In his writings, Leopold explored the connection between the practice of medicine

and land health. "In the field of medicine", he wrote, "symptoms of disease are manifest and doctoring is an ancient art, but medical science is relatively young and still incomplete. The art of land doctoring is being practiced with vigor, but the science of land health is a job for the future", he said.[4] Simultaneously, veterinarians like James Steele and Calvin Schwabe began their lifelong efforts to encourage the veterinary and human health professions to consider disease within a common context.[5] Since then, advances in the medical sciences have grown exponentially. As for land health, the future is, as Leopold predicted, gradually approaching. More than a half century later, the insightful understandings embraced by visionaries like Leopold, Steele, and Schwabe have begun to resonate in the thoughts, writings, and actions of others: "Veterinarians must champion conservation and environmental protection measures that directly and indirectly affect animal and human health".[6]

In 2007, an inquiry into the cause of a deadly neurological disease outbreak in Southern sea otters along the California coast revealed that these animals were infected with *Toxoplasma gondii*, a protozoan parasite carried and shed by domestic cats. Further investigation looked at the source of this incidental parasite. According to Sea Grant, California[7], the study estimated that feral cats were contributing 29.5 tons of feces into the environment and owned cats were adding an additional 76.4 tons of feces annually. Water runoff from feces infected soil was then transporting *T. gondii* into freshwater and then marine ecosystems where they were concentrating in the filter-feeding shellfish consumed by Southern sea otters.[7] These findings are informative not only for biologists and wildlife veterinarians but for private practitioners. Veterinarians guide parasite control in domestic animals, but in many practices, veterinary technicians routinely conduct the parasitology testing. Careful scrutiny for protozoans is one way veterinary technicians can help to protect local wildlife. The Companion Animal Parasite

Council recommends that fecal examinations be conducted two-four times during the first year for kittens and puppies and one to two times per year in adults, depending on patient health and lifestyle factors. Further recommendations include taking the time to carefully screen for protozoans on microscopic fecal examinations, encouraging clients to practice parasite control, and educating clients about the lifecycle of *T. gondii* and its dangerous potential to local wildlife. Clients should be advised to spay or neuter to reduce feral cat populations and thus lower the quantity of infected feces entering waterways, provide litter boxes for owned cats, and properly dispose of soiled litter in landfills.[7, 8]

In 2009, research veterinarians from the University of California Davis, School of Veterinary Medicine's Mountain Gorilla Veterinary Project traveled to Rwanda to participate in research on a long standing study of Mountain Gorilla health. Upon their arrival, all but one of the twelve gorillas within the study group were stricken with a respiratory infection. An adult female gorilla and a newborn died. Pathology results indicated that both gorillas were infected with the human respiratory virus, metapneumovirus.[9] The South African gorillas and the Southern sea otter anecdotes both serve as sentinel examples of the inextricable connection between human, animal, and environmental health today.

Why the Veterinary Profession

Biomedical training in comparative (trans-species) medicine and population medicine (herd health) prepares veterinarians to make significant contributions in ecosystem health problems where environmental, human, and animal health intersects.[10] According to Stephen, the social relevance of the veterinary profession is enhanced by its involvement in ecosystem health concerns.[11] In the foreword of *One Health: A New Professional Imperative*, veterinarian Dr. Lonnie King, who served as the Chairman of the One Health Initiative Task Force wrote:

> 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. The challenges and obligations of health professionals have never been tested as we are today to truly reestablish our social responsibility.[12]

Since then, veterinary schools around the world have begun the process of integrating global health concepts into their curriculum. In 2011, *One Health Knowledge: Animal, Human, and Environmental Health* concepts were added to the Core Competencies required to be taught at American veterinary schools.[13] In addition to veterinary schools, medical schools, dental schools, and nursing schools have embraced One Health concepts. For example, in 2012, the University of Pennsylvania offered an Award for Excellence in Promoting "One Health Initiatives" and "Inter-professional Education" with a monetary award for faculty members who implemented research and programs focused on collaborative healthcare education engaging two or more professional programs. The award was offered to faculty from their medical, dental, veterinary and nursing schools.[14]

Primary Elements of One Health

Three major elements of One Health have been identified as zoonotic disease, comparative medicine, and zooeyia. Zoonotic disease is the most cited aspect of One Health but Smith states that recent advances in genome research underscores the importance of comparative medicine in One Health by understanding that animals and humans share many diseases and conditions.[5, 12] The third element of One Health, zooeyia, pronounced ZOO-ey-ah, is the word used to describe the positive health benefits associated with having pets in our lives. It is the opposite of zoonotic.[15] What is unique about this One Health perspective is the realization that

the intimate presence of companion animals in our lives influences, in a positive way, human well-being. Dog owners exercise more. People with pets refrain from smoking more frequently; pet owners have more social interactions than people without pets, and people with pets are 57% more likely to be engaged in civic activities. Cat owners suffer less frequently with hypertension. Elderly people without pets visit their physician more frequently than those with a companion animal. One Health is not limited to the prevention of zoonotic diseases; it also includes the enhanced health benefits for humans resulting from their relationships with companion animals.[15]

Veterinarians in private practice are ideally situated to provide client education about the human health benefits of pet ownership.[15, 16] The veterinary staff can help individuals select a pet suitable both to their lifestyle and their ability to provide for its care. Client education is an integral responsibility among credentialed veterinary technicians. In this role, veterinary technicians are well positioned to assist clients seeking the resources necessary to create and maintain an appropriate human-animal relationship. Supporting the positive benefits of the client/pet bond provides the veterinary staff with a novel opportunity to promote human health and engage One Health in their daily practice.

Snapshot of Vet Techs Making a Contribution to One Health

The entrance of the nursing profession into One Health[14] suggests a need for allied health professionals to contribute to global health care. Three interviews were conducted with veterinary technicians presently working within the framework of One Health. These people were selected to interview because their individual involvement each represented a different focus area of One Health. Excerpts from these interviews will highlight how and where veterinary technicians are taking their place at the One Health table. The first interviewee is

Bonnie Loghry, a Veterinary Technician Educator. The second interviewee, Steven Nelsen, Jr., works at the Georgia Sea Turtle Hospital. Finally, Jenny Schleps spends her professional time working within the Oiled Wildlife Network.

Bonnie Loghry's Place at the One Health Table

Bonnie Loghry is an instructor at Yuba City College's Veterinary Technology Program. Bonnie received a B.A.S. Degree in Veterinary Technology and a Master's Degree in Public Health. In addition to her teaching duties, Bonnie finds time to work on veterinary public health projects in places like Africa, Haiti and Mali. She also volunteers at a local animal shelter. Her primary professional interest is One Health and equitable global access to sustainable health practices for disease prevention.

Can you tell us about your program at Yuba College?

We looked at our program, we looked at other vet tech programs, and we felt strongly that no one was teaching much beyond the small animal need, and so, with my interest in public health and veterinary work-place safety, and Dr. Haskell's interest in shelter medicine, we have formulated several on-line certificate programs in Public Health, Large Animal Care and Management, Shelter Medicine, and others. These certificate programs are designed for veterinary technician students and practicing veterinary technicians. We try to provide our students with the broadest possible choice, so that when they leave us they fully understand that small animal practice is not their only option --- there are jobs out there for RVTs beyond the small animal practice paradigm.

How do you prepare students to work in the field of global animal health?

With the advent of our Public Health Certificate program, I will be offering food safety and public health courses. What I do is to try and infuse a larger perspective into everything that I

teach. For example, when I come up with exam questions or spin questions, I throw in a camel or donkey with a scenario like: the donkey is owned by a farmer in Haiti, and the donkey is ill and the family now can't get water from the river. I try to come at it from those kinds of perspectives, so that my students comprehend that veterinary technology is much more than just dogs and cats.

In general, do you feel Veterinary Technology programs adequately prepare students to work in the One Health field?

AVMA requires a lot of content in the Vet Tech curriculum and that's why the Associate Degree level curriculum is probably not the best way to approach it. I've tried to cram everything I can into ours, from a One Health perspective, and I think that's probably all we can expect from most Associate Degree programs. That's why I would like to cultivate a public health track in the Bachelor's degree program. In a survey I conducted of vet tech educators and veterinary public health professionals, the overwhelming opinion was that any educational efforts for technicians should be focused at the baccalaureate degree level. That way you've got a trained individual who can make some of the assessments that are necessary in public health. As far as the Associate Degree programs go, no, I don't think that they do. But I don't think it's really their fault.

Do you think ecological concepts should be included in veterinary technician education, as well? Explain why or why not.

Yes, I do, most definitely. I try to tell our students that when this cat or dog is coming in to the clinic it's not coming in by itself; it's part of a larger ecosystem. And in order to fully comprehend what's going on with your patient, it's not enough to just deal with what you've got in front of you, you've got to figure out what's going on in that animal's environment, including

the human world, it's living situation, whether it's a working farm dog or backyard pet; all those kinds of things play a role. But, yes, I think that an emphasis on ecological concepts should be made.

What contribution, if any, do you think the veterinary technology profession can make within global animal health and One Health?

I think that the veterinary profession can make a lot of contributions. Vet techs are 'jacks of all trades', and we don't have that in human medicine. When I was in Haiti, the human health care professionals staying near me were pharmacists, optometrists, and other ancillary medical people. They had come together to help serve this particular village. There's no reason why vet techs can't do the same thing. Because vet techs are trained in such a broad spectrum of things, it gives us an ability to see a bigger picture, especially when dealing with very rural, remote, developing nations. These people do not need fancy solutions. That's where I think vet techs are uniquely suited . . . because of our training . . . and because we do have to look at the big picture. Not to get too deeply philosophical, but we in veterinary practice have to make those difficult decisions about euthanasia, quality of life, and what people can afford; all those things that maybe aren't as prevalent in human medicine. And again, I think *that* skill set, although it may not be taught, is something every tech picks up – you have to in order to work in a clinic. I think that skill set is uniquely applicable in a developing nation, because people do not have resources. You get very good at figuring out how to help them make the most of what they have. Simply de-worming animals and getting them a little better nutrition, and vaccinating them can make a world of difference and again, any vet tech can do that!

What advice would you give to a veterinary technician interested in entering the field of One Health?

I would say, do not stop at the Associate's Degree. I'm always so tickled when I get a Bachelor's Degree student entering my Associate Degree program. I take great pains to let them know, it's going to open doors for them. The RVT is a very powerful license, very powerful. However, the Bachelor's Degree is the entry level key. So find something you're passionate about during your vet tech training; whether it's dentistry, anatomy . . . or go off on a zoological track, or microbiology, if you're into diagnostics. There's a world out there to choose from so get the Bachelor's degree! And, open your mind to the possibilities! Just because an advertisement doesn't specifically say, "RVT", it doesn't mean it can't be done by an RVT. And I think the more vet techs that get into some of these jobs, that start taking their place at the table, then we'll start making some inroads.

Steven Nelson, Jr.'s Place at the One Health Table

Steven Nelson, Jr is the Senior Veterinary Technologist at the Georgia Sea Turtle Center (GSTC). The mission of the GSTC is to provide medical care to sick or injured sea turtles and other native coastal wildlife along Georgia's coastline. Steven is a CVT with a B.A.S. degree in Veterinary Hospital Management and Clinical Care. He has been employed at the GSTC since 2009.

What initiated your interest in the conservation health field? How did you find out about your current position?

I studied abroad in Australia during my freshman year of college and really discovered the field of conservation medicine. After coming back, I decided to go to vet tech school. In tech school I volunteered or interned at different wildlife institutions. I have always been passionate about animals but also I wanted to make a difference in the world. Although tech school is predominantly dog and cat focused, I knew that I wanted to work with wild animals after

graduation. I suspected I'd land a job in a zoo or aquarium. I was told about the GSTC job while interning at Disney's Animal Kingdom, and it was the perfect opportunity for me to move into the field of conservation medicine, focusing on my favorite type of animal --- reptiles!

What special skills would a veterinary technician need in this field? How would they get this training?

Internship and volunteer experiences at different wildlife rehabilitation centers and or zoos/aquariums would be a starting place. We offer an internship for vet techs here at the GSTC. You can check out the application on our website: www.georgiaseaturtlecenter.org.

Do you feel veterinary technology programs adequately prepare students to work in the ecosystem health field?

There is so much more to ecosystem health, wildlife health, and conservation. They just don't have time to teach it in tech school. I do believe it is needed; there needs to be curriculum changes or adaptations. I think the One Health concept is extremely important today.

Jenny's Schliep's Place at the One Health Table

Finally, Jenny Schlieps serves as the Program Coordinator for Focus Wildlife where she assists in their efforts to assist wildlife impacted by oil and chemical spills within the environment.

How do veterinary technicians contribute to the field of ecosystem health in the oiled wildlife care network?

It depends on their level of experience. They might be working directly on a spill, or in 'intake' or in necropsy with the veterinarians. More experienced technicians will treat dehydrated animals, perform basic exams, draw blood, and provide critical care. If they haven't worked with wildlife before, they may be drying animals or working on patient care files. It's easy to teach a tech how to gavage feed birds, if they haven't had much experience. We try to put

people in positions where they can be helpful. It's key for vet techs to learn about the overall process. Often people want to start washing birds as soon as they arrive, but most will die if we don't get them stabilized first. Sometimes they just need food, water and some rest. It's also important to understand each species' behavior and how to stabilize them first or they will die. We watch blood values and behavior to decide when to wash.

What type of continuing education would you suggest for vet techs interested in the Oiled Wildlife Care Network?

Taking an 8-hour Hazwopper course; everyone needs to understand the different levels of PPE and awareness at an oil spill. Volunteer at a wildlife rehabilitation center or attend the National Wildlife Rehabilitator's Association Conference.

Do you think ecological concepts should be included in vet tech education?

I worked at the PAWS Wildlife Center in Lynnwood, Washington for 15 years. We saw *Toxoplasma gondii*-positive bobcats, Brucellosis in seals, so yes, absolutely, I 100% agree. There's a bigger picture to what's happening in private practice and I think it's important to talk about it. There are a lot of vet techs who have the skill sets to contribute on a much broader basis.

What advice would you give to a veterinary technician interested in entering the field of ecosystem health? If it interests them, they should go for it. There are whole worlds that vet techs aren't exposed to and when they are, they can find really engaging experiences. If people have an interest in something, volunteer, go to conferences; take the time to learn about seabirds. I think it's great that you are looking at the greater sphere of what vet techs can do. I think One Health is part of the larger ecological question.

Conclusion

Finding ways to engage One Health is a new frontier for veterinary technicians. Whether your passion is working directly with wildlife, in public health, in a veterinary teaching hospital, or a small, one-veterinarian practice in a rural community, there are ways you can make a difference. Volunteer one day a month at a local shelter or wildlife rehabilitation center, take an extra moment to carefully scan for protozoans, educate your clients about parasite lifecycles, help a senior citizen experience zooeyia, or discover your own way to promote and improve the wellness of people, animals, and the planet. The RN profession is already committed to One Health. It's time for the veterinary technology profession to take its place at the One Health table.

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Chapter 4.

LESSON PLANS MATERIALS

Introduction

A series of five lesson plans have been developed to further educate veterinary technicians and veterinary technician students about the American Veterinary Medical Association's One Health Initiative and the veterinary fields that embrace and apply One Health concepts. The fundamental goal of these lessons/workshops will be to prepare veterinary technicians to engage in professional and personal activities that benefit human, animal and environmental health. Some aspects of the Understanding by Design (Wiggins & McTighe, 2005) lesson planning format was used to craft outcome based curriculum and experiential activities, teaching guides, and effective learner assessments. Environmental literacy goals, objectives, and guiding principles have been used as an underlying framework to guide the instructor's development of lessons that strive to accomplish environmental action. The lesson plans also incorporated teaching strategies identified as effective in veterinary education programs designed for veterinary students. These strategies include using a case-based approach, cooperative learning experience, opportunities for mentorship, as well as providing opportunities for learners to observe faculty/educators model team-based teaching from a trans-disciplinary perspective. Opportunities for clinical rotations for interested students have also been described.

A keystone lesson plan has been developed to introduce veterinary technicians and veterinary technician students to One Health concepts. Four supporting lesson plans focus on each specific area of One Health: ecosystem health, emerging disease, conservation medicine/free-ranging wildlife health, and the role of wildlife rehabilitation in wildlife disease

surveillance. The purpose of addressing four distinct domains, where One Health concepts are applied, is to progress each learner's level of awareness, knowledge, attitudes, skills and participation on a wider scope, and to motivate a greater spectrum of learners to action, by recognizing and addressing individual interest levels. Presenting a broader view also helps learners understand how One Health concepts range in scale from individuals to ecosystems.

The following lessons are formatted and presented in this order: When practical, a PowerPoint presentation is included to support the lesson. Topics include:

Lesson 1: Introduction to One Health

Lesson 2: Ecosystem Health

Lesson 3: Emerging Disease

Lesson 4: Free-Ranging Wildlife Health

Lesson 5: Wildlife Health Surveillance

Lesson Plan 1

Topic: Introduction to One Health

Audience: Credentialed veterinary technicians and veterinary technician students/16-20 students per group

Presentation Structure: For continuing education workshop or veterinary technology school presentation

Time Needed: 1-2 hours

Supplies Needed:

Instructor computer with PowerPoint, projector, screen

Student computers with Internet access

Large Post-it Easel Notes and markers for student groups

PowerPoint Presentations: *Identifying a Role for Vet Techs in One Health* (Appendix C), *Environmental History of Veterinary Profession* (Appendix C)

Learning Objectives

Students will:

1. Describe One Health.
2. Discuss ways veterinary medicine contributes to One Health.
3. Express their opinion about the role of veterinary technology in One Health with a group of their peers.
4. Verbally and in writing provide information to clients about the connection between companion animal health, wildlife health, human health, and the health of the environment.

Essential Questions (instructor can use these questions to initiate discussion &/or check student learning.)

1. What is the One Health Initiative?
2. How is the veterinary profession addressing One Health?
3. What is the connection between domestic animal and wildlife health?
4. How can veterinary technicians engage One Health in private practice?

5. What are some local environmental concerns/problems that could benefit from a veterinary perspective?

Learning Plan

Part I – Instructor's Presentation (60 Minutes)

Pre-instruction Group Activity 10 minutes

Challenge learners to come up with an answer to the following question*: How is the family cat accelerating the decline of river otters and sea otters? How can veterinary technicians intercede in this ecosystem health issue?*

Give learners 5 minutes to discuss questions in small groups; then instructor asks for possible answers. Writes ideas on white board.

PowerPoint Presentation: "Identifying a Role for Veterinary Technicians in One Health". It should start with a case history on the epidemiology of *T. gondii* from cats to otters. 30 minutes

Show PowerPoint "Environmental History of Veterinary Profession" 10 minutes
Invite questions, ask learners to describe how they think the veterinary technology profession can contribute. 5 minutes

Part II – Learner Activities: Depending on time allotment, may take 30-60 minutes or more.

Identify local agencies that support ecosystem health issues (wildlife rehabilitation centers, local veterinary-based environmental organizations, i.e., SeaDoc Society, environmental learning centers, animal shelters, etc. Student groups will need access to computers with Internet access. 5-10 minutes

Activity: Ask learners to come up with examples of local environmental issues. Write them on the white board or Large Post It Notes. *Instructor should create a list of local environmental concerns in the event that the group is not well informed. In small groups, have students come up with a list of ways a vet tech could contribute to these issues. 20-25 minutes

Alternative to above activity 1: Invite vet techs working locally in conservation medicine, oiled wildlife, and public health to join a panel of experts; each person talks about their role in One Health followed by Q/A. 60 minutes

Alternative to above activity 2: If only one-hour for presentation, skip the activity and provide learners with handouts that list organizations suggested above.

Part III – Resources

Provide learners with handouts that high light the presentation objectives, identifies places where vet techs can get additional training, and a list of local agencies where vet techs can volunteer their services in local community.

Assessment

Small Group Discussion Questions/Activities

How is the family cat accelerating the decline of river otters and sea otters? And, how can veterinary technicians intercede in an ecosystem health problem like this?

Make a list of local agencies that support ecosystem health issues (wildlife rehabilitation centers, local veterinary-based environmental organizations, environmental learning centers, animal shelters, etc.)

What are some of the environmental concerns in our community? Can vet tech skills and knowledge contribute to solutions?

Make a list of organizations, schools, and continuing education opportunities where vet techs can get involved in projects that benefit global health.

Other Assessment Evidence

Learners create a One Health Client Education Brochure designed to teach clients about the connection between pet health, human health and the environment.

Rubric for Creating a High Quality Client Education Brochure

In a workshop or clinical situation, this rubric can be used to evaluate newly created client education brochures or handouts.

Criteria	Professional	Satisfactory	Modification Needed	Unacceptable
Content Quality	__Demonstrates strong understanding of topic __Accurately uses researched information __Well organized content & format __Clearly and concisely explained content	__Demonstrates adequate understanding of topic __Adequately uses researched information __Content organized and format adequate __Adequately explained information	__Demonstrates little understanding of topic __Poorly but generally uses researched information __Content lacks organization and format is difficult to follow __Information not clearly understood	__Demonstrates poor understanding of topic __Incomplete or lacking researched information __Content disorganized and difficult to follow __Message difficult to understand
Visual Appearance	__Computer generated in appropriate format __Highly creative and original ___Excellent use of appropriate graphics; enhances content	__Computer generated with acceptable format __Creativity acceptable __Adequate use of appropriate graphics	__Computer generated with some degree of formatting __Lacks creativity __Poorly selected &/or excessive graphics	__Hand-made or computer generated with little organization or skill __No originality ___Graphics un-related to topic or lacking
Research Quality	__Five reliable sources used __Accurate use of researched facts	__Three reliable sources used __Adequate use of researched facts	__Two sources used __Questionable reliability of sources __Basic use of sourced facts with questionable accuracy	__Less than two sources used __Lacks reliability of sources __Inaccurate or misused facts

Note: In a workshop or clinical situation, grades/points would not be awarded. If an instructor wishes to use this rubric for graded work, a point system can be added.

Lesson Plan 2

Topic: One Health: A Role for Veterinary Technicians in Emergency Ecosystem Health (Oiled Wildlife Care Network Training)

Audience: Credentialed veterinary technicians and veterinary technician students/16-20 students

Presentation Structure: For continuing education workshop designed for local veterinary technician associations or veterinary technology students

Time Needed: 18 hours (including prerequisite)

Supplies Needed:

White board and markers, computer, screen, projector, PowerPoint presentations

Learning Objectives
Students will:

1. Describe the relationship between domestic animals, wildlife, and ecosystem health.
2. Understand the purpose of the One Health Initiative.
3. Identify organizations, schools, and continuing education opportunities where veterinary technicians can gain skills and get involved in projects that benefit global health.
4. Give examples of local environmental agencies where vet tech skills and knowledge may contribute to solutions and make a positive difference.
5. Use their nursing and animal care skills to provide medical assistance to domestic and wild animals during an oil spill or other environmental disaster.

Essential Questions (instructor can use these questions to initiate discussion &/or check student learning.)

1. How can veterinary technicians contribute during natural and man-made environmental disasters?
2. Why is it important for veterinary personnel to respond to environmental problems?
3. What are some local animal health agencies involved in emergency responses?
5. How can veterinary technicians prepare themselves to assist during environmental disasters?

Learning Plan

Note to Instructor: Make a connection with a local Oiled Wildlife Network Agency and contract an entry level training event for vet techs. Plan workshop on a weekend or during other non-school day in the summer.

Part I – Instructor's Pre-Workshop Presentation (60 Minutes)

1. PowerPoint presentation: " One Health: A Role for Veterinary Technicians" (Appendix C)

2. Workshop expectations: prep students regarding what to expect, what to bring, and what they will receive (benefit).

Part II – Students will be given an opportunity to participate in free 8-hour HAZWOPER Training:

HAZWOPER stands for Hazardous Waste Operations and Emergency Response. HAZWOPER Training is mandated by OSHA to prepare emergency responders to conduct clean-ups and or emergency response operations. Receiving a HAZWOPER certificate will be a pre-requisite to the Oiled Wildlife Training Workshop.

Part III – Two-day Workshop focused on Oiled Wildlife Care (8-hours). Training provided by local Oiled Wildlife Network Organization. Students will receive training certificate.

General Content Areas:

1. Overview of Incident Command System and the role of First Responders
2. Overview of the agencies involved in dealing with an oil spill
3. First Responder health and safety
4. Capture procedures for oiled wildlife
5. Transportation protocols

Focus Area for Veterinary Technicians:

1. Wildlife handling techniques
2. Temporary housing options for oiled wildlife
3. Critical animal care and stabilization during the first 48 hours in captivity

Site Visit

If available, students will tour a mobile oiled wildlife unit

Assessment

Successful students will receive an 8-hour HAZWOPER certificate of completion and a training certificate from the Oiled Wildlife Network Organization workshop.

Lesson Plan 3

Topic: One Health: A Frontline Role for Veterinary Technicians in Emerging/Zoonotic Disease Control

Audience: Credentialed veterinary technicians and veterinary technician students/16-20 students

Presentation Structure: For veterinary technology students or veterinary technician association workshop

Time Needed: 1-2 hours

Supplies Needed:

PowerPoint Presentation: "One Health: A Role for Veterinary Technicians in Emerging Disease and Zoonosis Control" (Appendix C), Computer, screen, projector

Learning Objectives
Students will be able to:

1. Describe the relationship between domestic animals, wildlife, and ecosystem health.
2. Understand the purpose of the One Health Initiative.
3. Identify organizations and schools where veterinary technicians can get involved in public health concerns.
4. Create client education materials to promote One Health concepts in zoonotic disease prevention.
5. Give examples of local and international organizations that promote zoonotic disease prevention.
6. Volunteer with an animal health organization focused on reducing the spread of zoonotic diseases.

Essential Questions (instructor can use these questions to initiate discussion &/or check student learning.)

1. Why are we seeing so many new and re-emerging disease pathogens in the last 20 years?
2. Why is it important for veterinary personnel to respond to environmental problems?
3. What does the family cat have to do with the decline of river otters and sea otters?
4. How can veterinary technicians intervene in disease transmission between companion animals, wildlife and people?

Learning Plan

Part I – Instructor's Presentation (45 Minutes)

1. PowerPoint Presentation: One Health: A Frontline Role for Veterinary Technicians in Emerging/Zoonotic Disease (Appendix C)

2. On the first slide, challenge learners to come up with an answer to the following question*: How is the family cat accelerating the decline of river otters and sea otters? How can veterinary technicians intercede in this ecosystem health issue***?**

Part II - Learner Activities/Resources: One Health Educational Materials

Directions: In small groups, students will be challenged to develop one of the four technician/client education tools:

1. Client Education Brochure – informs pet owners about the spread of disease between wildlife, feral animals, pets, livestock and people and gives examples of things they can do to prevent this problem.

2. Talking Points – A one page list of comments/ideas for vet techs to share with clients regarding the importance of de-worming and vaccinating pets to prevent spread of disease to people, wildlife and other pets.

3. An IMovie or PPT presentation to educate clients about ways they can participate in controlling the spread of zoonotic disease. To be shown in the waiting room or exam room on the Client-ED A/V screen.

4. Poster – Designed to educate the public about the spread of disease among people, pets, and wildlife and problems associated with feral animals.

Project Assessment: Students will turn in assignments for teacher evaluation/grading. Students will be given opportunities to revise projects and resubmit for final evaluation. Instructors may use the Brochure Rubric (Appendix C) to evaluate the client education brochure or it can be modified to meet the requirements of the other educational instruments.

Part III – Field Experiences to Educate Public – Effective for Vet Tech Student Chapters of NAVTA or local Veterinary Technician Association members.

Field Experience 1

Students volunteer a day to work with local animal shelter. Free fecal checks for cats and dogs in the shelter and community. Students can coordinate with local vets &/or veterinary pharmaceutical rep to donate de-wormer. Goal of free clinic is client education. Students can use brochures and posters to educate public about epidemiology of parasites (e.g., *T. gondii*),

importance of cleaning up pet feces, how to protect wildlife, and how to prevent spread of wildlife diseases to pets and humans (e.g., raccoon roundworms, vector-borne diseases)

Field Experience 2

Sponsor and man a booth at the local Eco-Fair to promote environmentally friendly pet care practices.

Field Experience 3

In small groups, vet tech students can make presentations to local animal shelter personnel, Feral Cat Program volunteers, 4-H groups, or other similar organizations to educate the public about environmentally friendly pet care practices.

Lesson Plan 4

Topic: One Health: Conservation Plan for Free-ranging Manatees in the Crystal River Complex

Audience: Credentialed veterinary technicians and veterinary technician students/16 students

Presentation Structure: For continuing education workshop

Time Needed: 1.5 day workshop

Supplies Needed:

1. Transport van for trip from Orlando to Crystal River, FL and back.
2. Reservation with Bird's Underwater Dive Company. Bird's provides dive boat w/captain and all scuba gear.
3. United States Fish & Wildlife Service (USFWS) DVD – *Guidelines for West Indian Manatee Interactions.*
4. Manatee Fact Sheet Handouts, Conservation Health Handouts, Crystal River National Wildlife Refuge Conservation Plan overview handout (Get current handouts from WSFWS).
5. Lap top, projector, PPT presentations.
6. Bring check for Bird's Underwater rentals.
7. Remind participants to bring money for one dinner and one lunch.
8. First aid kit & local emergency contact numbers.
9. Make certain all release forms have been returned prior to excursion date; turned into Dive shop or kept w/Instructor during trip.

Learning Objectives

Students will:

1. Understand the role of veterinary medicine in conservation medicine.
2. Explain how national wildlife refuges use comprehensive conservation plans to conserve wildlife listed as endangered or threatened species.
3. Describe the relationship between West Indian manatees, human visitors, and the Crystal River Complex.
4. Lawfully and respectfully snorkel in close proximity to West Indian manatees.

Essential Questions (instructor can use these questions to initiate discussion &/or check student learning.)

1. Why is the Crystal River complex a critical habitat for West Indian manatees?

2. What factor(s) motivate WIM movement into and out of the Crystal River complex?

3. What is the ecological importance of West Indian manatees in South Florida?

4. What role does conservation medicine play in the recovery of endangered and threatened wildlife?

Learning Plan

1. Electronically send registered participants the itinerary and release forms for van ride and the dive shop forms 3-4 weeks before conference.

2. Afternoon before dive: Pick up participants at 3 p.m. at Orlando Conference Center and transport to Crystal River, FL hotel. Stop for dinner along way. Arrive hotel at 6:00 p.m.

3. Check into hotel in Crystal River. Participants meet back at van at 6:45 p.m.

4. 7:00 p.m. Crystal River National Wildlife Refuge Visitor's Center Classroom: Evening before dive.

   a. **Instructor's presentation:** Begin with question, "Why is the Crystal River Complex a critical habitat for WIM?" Show PPT slide of aerial shot of hundreds of WIM in the spring system. Participant discussion, then Natural History of W.I. Manatees and role of vets/vet techs in rehabilitation of injured/ill WIM. 1 hour

   b. **Intermission:** Participants may explore manatee exhibit at visitor's center. Provide coffee & dessert. 30 minutes

   c. **USFWS Public Affairs Officer presentation:** Discussion & PPT on "West Indian Manatee (WIM) Research and Conservation Plan", then show 8 minute DVD on *Guidelines and Laws for interacting with WIM*; discussion time included. Handouts provided. 1 hour

5. Return to hotel at 9:30 -10:00 p.m.

6. Arrange for 5:00 a.m. wake-up call for all interested participants. Leave at 5:45 a.m. coffee in lobby.

7. Arrive dive shop at 6:00 a.m. where outfitter issues rental dive gear and provides use and safety instructions. Review Guidelines & Laws for Interacting w/Manatees. Participants with own dive gear will change into suits. Provide check to Dive shop.

8. Board dive boat and head out into Kings Bay toward Three Sister's Spring:
   a. Instructor and captain interpret NWR ecosystems & spring ecology; questions answered and/or discussed.
   b. Continental breakfast served on dive boat; restroom and changing area on dive boat.

9. Boat anchors at entrance to Three Sisters Spring. Instructor leads participants up passageway to spring system & models appropriate WIM interactions. Second instructor follows at rear to assist anyone having problems.

10. Using techniques shown in DVD, previous night, and re-cap by boat Captain, students passively interact with manatees. Participants may return to boat when cold or tired. 3 hours

11. Participants and instructors return to boat and move to "floating" manatee information station to complete activity and find answers to questions on handouts.

12. Boat moves to final site at Hunter Spring: Instructor provides information about spring systems, including magnitude, and water quality. Interested participants may get out for swimming and exploring at the springhead.

13. 11:00 a.m. return to Bird's Underwater dock. Participants change into street clothes and return rentals.

14. Participants given program evaluation form and pencil to complete while at lunch. Turn in back at van.

15. Lunch at local restaurants, on-your-own, within 1-2 blocks of dive shop. Return to van by 1:00 p.m.

16. Participants turn in Program Evaluation; follow up discussion on van ride back to Orlando.

Assessment

Continuing education quiz sent via NAVTA CE quiz module – Available today & for one-week following vet conference. Participants have 30 minutes to complete and submit.

Continuing education credits granted to participants earning 80% or above. CE certificate sent to home address or via email.

Lesson Plan 5

Topic: The Role of Wildlife Rehabilitation Centers in One Health: Wildlife Health Surveillance

Audience Size: Credentialed veterinary technicians and veterinary technician students/12-24

Presentation Structure: For continuing education workshop or veterinary technology school presentation

Time Needed: Varies based on activities selected

Supplies Needed:

Set up visit date with PAWS on a Saturday.

Contact potential guest speakers and set time; presentations.

Check with guest speakers to see if they need projector, computer, screen, white board or other equipment/supplies.

Reserve van(s) to take students down to Lynnwood to tour PAWS.

Learning Objectives

Students will:

1. Understand the purpose and scope of One Health.
2. Define ecosystem health.
3. Describe the relationship between domestic animals, wildlife, human, and ecosystem health.
4. Compare and contrast wildlife management and wildlife rehabilitation goals.
5. Understand the role of wildlife rehabilitation centers and veterinary professionals in wildlife health surveillance.
6. Visit a wildlife rehabilitation center to learn more about wildlife health surveillance, and the Wildlife Health Event Reporter (WHER) website.
7. Identify organizations, schools, and continuing education opportunities where veterinary technicians can gain skills and get involved in projects that benefit global health via wildlife rehabilitation centers.
8. Volunteer for eight hours at a wildlife center or animal shelter.

Essential Questions (instructor can use these questions to initiate discussion and/or check student learning.)

1. How do the goals of wildlife managers and wildlife rehabilitators differ? Where can they find common ground in ecosystem health?

2. How do sentinel animals inform ecosystem health researchers?

3. Where is our closest wildlife health surveillance center?

4. If a veterinary technician were interested in working in ecosystem health fields, how and where would s/he get started?

Learning Plan

Part I: Expert Panel Presentation and Discussion

Note: If this lesson is delivered to students in a veterinary technology program, the guest speaker panel might convene in a classroom or conference room on campus. If presented to a group of practicing veterinary technicians, the guest speaker panel could take place at the wildlife rehabilitation center.

Introduction: Begin by watching a two minute video from WHER: http://www.youtube.com/watch?v=wcTpai168vg; followed by introduction of guest speakers.

Guest Speaker Panel

Each panel speaker will be given 20 minutes to discuss their pre-arranged topic. Students should be encouraged to ask questions regarding interagency cooperation and guests' view of One Health.

- **Speaker:** Wildlife Biologist from the Washington Department of State Fish & Wildlife
  Topic: Wildlife Management Goals

- **Speaker:** State Wildlife Veterinarian
  Topic: Wildlife Diseases of Concern in Washington Wildlife; Reporting wildlife disease via the Wildlife Health Event Reporter

- **Speaker:** Wildlife Rehabilitation Center Director/Employee responsible for collecting samples and reporting wildlife disease to WA State Department of Fish and Wildlife and WHER
  Topic: Process for Collecting/Reporting Wildlife Disease: Diseases they are seeing in our local area? Which species is/are of greatest concern in local community?

Part II – Field Trip Experience

Tour Wildlife Rehabilitation Center where wildlife health surveillance is reported to State &
WHER. In Lynnwood, WA this facility is the PAWS Wildlife Center.

Part III – Experiential Opportunities

- Students will volunteer for eight hours at a local rehabilitation center or animal shelter.
- If working in practice, students can talk to their employer veterinarian(s) about setting up an account with WHER. They might create a poster or brochure to inform clients about how to use WHER to report wildlife health concerns. A brochure rubric can be found in Appendix C.
- Students can provide local animal shelters/animal control agencies with WHER information, such as a brochure for their front desk.
- Students can use WHER to report wildlife health issues.

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APPENDIX A

COPY OF IRB CONSENT FORM & INTERVIEW QUESTIONAIRES

Blank IRB Consent Form

You were recently contacted by Sharon Lane, a graduate student in Environmental Education at Montreat College, in North Carolina, regarding an article she is writing, as a partial requirement of her graduate project. You were asked to consent to an interview regarding information about veterinary technicians working in the fields of ecosystem health, conservation medicine, and One Health. Please read this form carefully and ask any questions you may have before agreeing to take part in the interview.

What the study is about: The purpose of this study is to learn how veterinary technicians are contributing, or might contribute, to the various aspects of veterinary environmental medicine.

What we will ask you to do: If you agree to participate, the interview will include questions about your job, whether or not you currently work with veterinary technicians, and if so, what kinds of tasks they perform. You will be asked whether you see a future for the field of veterinary technology within conservation medicine, ecosystem health, and emerging disease fields of veterinary medicine. The interview will take about 20-30 minutes to complete. With your permission, I would also like to tape-record the interview. Or, if more convenient, the questionnaire can be emailed and you may fill it out on your own and return it.

Risks and benefits: The article may be submitted to a veterinary technician journal for publication. There is the risk that your comments may be included in the article.

There are no benefits to you. The purpose of this article is to identify potential career paths for veterinary technicians in the various fields of veterinary environmental medicine. Your input may provide career resources for veterinary technicians, and increase awareness of the role of veterinary personnel in conservation medicine, ecosystem health, and One Health initiatives.

Taking part is voluntary: Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with Montreat College. If you decide to take part, you are free to withdraw at any time.

If you have questions: The graduate student writing this article is Sharon Lane. If you have questions now or later, you may contact Sharon Lane at slane@nwtech.k12.wa.us or (360) 588-4114. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at (828) 669-8012 ext. 3405 or by contacting Dr. Dorothea Shuman at dshuman@montreat.edu. You will be given a copy of this form to keep for your records.

Statement of Consent: I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

I would prefer to:

____ Have the questionnaire sent to me and I will fill it out independently and return it via email.

____Be interviewed over the telephone. I consent to being tape-recorded.

Your Signature _____Date _____

Your Name (printed) _____

In addition to agreeing to participate, I also consent to having the interview tape-recorded.

Your Signature _____Date _____

Signature of person obtaining consent _____ Date _____

Printed name of person obtaining consent _____Date _____

This consent form will be kept by the researcher for at least three years beyond the end of the study and was approved by the IRB on May 2, 2012

Signed forms should be emailed to slane@nwtech.k12.wa.us or mailed to: 1094 Andis Road, Burlington,WA 98233 or faxed to: (360)848-7586. If faxed, please address: ATTN SHARON LANE

I. Questions to be asked of expert in area of **Ecosystem Health and Oiled Wildlife Care**

Interview Questions:

1. Please state your name and your position at the _____(facility).
2. How long have you been employed at _____? How many veterinarians are employed?
3. What is your educational background?
4. What initiated your interest in the ecosystem health field/oiled wildlife care? How did you find out about your current position?
5. How do veterinary personnel contribute to the field of ecosystem health/oiled wildlife care?
6. Tell me about your work at the _____. Can you define your job tasks? What percentage of time do you spend performing each skill set?
7. Do you know of (other) veterinarians working in different areas of the ecosystem health field? If yes, what kinds of jobs are they performing?
8. Do you work with (other) veterinary technicians? Yes / No

If yes:

   a. How many veterinary technicians are employed at your facility?
   b. Are they credentialed veterinary technicians? Do you know if they graduated from an AVMA-accredited program?
   c. What are their specific job titles and duties?
   d. Do you feel they had adequate training before they came to your facility? If not, what kinds of skills would you have liked them to possess?

   If no:

   a. Have you ever worked with credentialed veterinary technicians?

   b. Would you like to have veterinary technicians assisting you?

   c. What do you see as barriers?

   d. Do you think you would hire (or suggest hiring) a veterinary technician over other non-veterinary technician employees?

9. What contribution, if any, do you feel the veterinary technology profession can make within the field of ecosystem health/oiled wildlife care?

10. Do you feel veterinary technology programs adequately prepare students to work in the ecosystem health field? (choose one)

   a. If not, do you think they should do more to prepare students for these fields? What would you suggest they add to the curricula?
   b. If yes, how so?
   c. Do not have knowledge of veterinary technology program curricula
11. What type of in-house training did your organization provide for you and the veterinary technicians (if any) working in your facility?
12. Do the veterinary technicians working at your facility attend continuing education programs? If so, where do your veterinary technicians receive their continuing education?
13. AVMA policy on global climate change and animal health suggests the need for educational initiatives to raise awareness. The White Oak Accords established by the American College of Zoological Medicine provide guidelines by which all veterinary students should receive ecosystem health training. This includes the idea that environmental awareness needs to be a part of modern veterinary education and that every veterinary student should develop an appreciation of the major environmental impacts on animal health, including zoological species. Do you think ecological concepts, particularly ecosystem health concepts, should be included in veterinary technician education as well? Explain why or why not.
14. What other areas of environmental veterinary medicine have you seen veterinary technicians working in?
15. What advice would you give to a veterinary technician interested in entering the field of ecosystem health/oiled wildlife care?
16. What do you know from your real-world experience about this profession's future and the potential role for veterinary technicians?
17. Is there anything else you would like to add to your comments?

II. Questions to be asked of expert in area of Conservation Medicine

Interview Questions:

1. Please state your name and your position at the _____ (facility).
2. How long have you been employed at this facility? How many veterinarians are employed there?
3. What is your educational background?
4. What initiated your interest in the conservation health field? How did you find out about your current position?
5. Tell me about your work at the _____. Can you define your job tasks? What percentage of time do you spend performing each skill set?
6. Do you know of other veterinarians/veterinary technicians working in different areas of conservation medicine? If yes, what kinds of jobs are they performing?
7. Do you work with other veterinary technicians? Yes / No
    a. How many veterinary technicians are employed at your facility?
    b. Are they credentialed veterinary technicians? Do you know if they graduated from an AVMA-accredited program?
    c. What are their specific job titles and duties?
    d. Do you feel they had adequate training before they came to your facility? If not, what kinds of things would you have liked them to know or what technical skills do you wish they'd had?
    e. What special skills would a veterinary technician need in this field? How would they get this training?
    f. What kind of in-house training programs does your organization offer to veterinary technicians?
8. Tell me about your internship program for veterinary technicians. Where do your interns typically find employment? Can you give examples?
9. Do your veterinary technicians attend continuing education programs? If so, where do your veterinary technicians receive this training?
10. Do you feel veterinary technology programs adequately prepare students to work in the ecosystem health field? (choose one)
    a. If not, do you think they should do more to prepare students for these fields? What would you suggest they add to the curricula?
    b. If yes, how so?
    c. Do not have knowledge of veterinary technology program curricula
11. AVMA policy on global climate change and animal health suggests the need for educational initiatives to raise awareness. The White Oak Accords established by the American College of Zoological Medicine provide guidelines by which all veterinary students should receive ecosystem health training. This includes the idea that environmental awareness needs to be a part of modern veterinary education and that

every veterinary student should develop an appreciation of the major environmental impacts on animal health, including zoological species. Do you think ecological concepts should be included in veterinary technician education, as well? Explain why or why not.

12. What contribution, if any, do you feel the veterinary technician profession can make within conservation medicine?
13. What other areas of environmental veterinary medicine have you seen veterinary technicians working in?
14. What advice would you give to a veterinary technician interested in entering the field of conservation medicine?
15. What do you know from your real-world experience about this profession's future and the potential role for veterinary technicians?
16. Is there anything else you would like to add to your comments?

III. Questions to be asked of expert in area of Global Animal Health - Emerging disease (Public Health), Ecosystem Health, One Health Initiative

Interview Questions:

1. Please state your name and your position at the _____ (facility/organization).
2. How long have you been employed at _____? How many veterinarians are employed/volunteer there?
3. What is your educational background?
4. What initiated your interest in the global animal health field? How did you find out about your current position?
5. Tell me about your work at the _____. Can you define your job tasks?
6. Do you work with (other) veterinary technicians? Yes / No
    a. How many veterinary technicians are employed/volunteer at your facility? Are they all engaged in Global Animal Health concerns? Explain.
    b. How do you prepare students to work in the field of global animal health? How many students do you train to work in this field each year?
    c. Is the training you provide for students interested in global animal health for ALL students in your program or a specialty/elective course of instruction? Why or why not?
7. Do you feel veterinary technology programs adequately prepare students to work in the One Health field?
    a. If not, do you think they should do more to prepare students for these fields? What would you suggest they add to the curricula?
    b. If yes, how so? In which courses?
8. AVMA policy on global climate change and animal health suggests the need for educational initiatives to raise awareness. The White Oak Accords established by the American College of Zoological Medicine provide guidelines by which all veterinary students should receive ecosystem health training. This includes the idea that environmental awareness needs to be a part of modern veterinary education and that every veterinary student should develop an appreciation of the major environmental impacts on animal health, including zoological species. Do you think ecological concepts should be included in veterinary technician education, as well? Explain why or why not.
9. What contribution, if any, do you think the veterinary technology profession can make within global animal health and One Health healthcare?
10. What other areas of environmental veterinary medicine have you seen veterinary technicians working in? (Conservation Medicine, Ecosystem Health?)
11. What advice would you give to a veterinary technician interested in entering the field of emerging disease and global animal health?

12. Where would a veterinary technician interested in these fields look for employment?
13. What do you know from your real-world experience about this profession's future and the potential role for veterinary technicians?
14. Is there anything else you would like to add to your comments?

APPENDIX B

NAVTA GUIDELINES FOR JOURNAL AUTHORS

NAVTA Editorial Policies

The NAVTA Journal is a bi-monthly, peer-reviewed publication providing information pertinent to the veterinary healthcare team. We welcome articles on a variety of topics pertaining to veterinary technology. Please contact editor@navta.net, before submitting articles to ensure that there is not another author working on the same topic. All articles are submitted with the understanding that *The NAVTA Journal* staff, CE editors and editorial board will edit as deemed necessary and appropriate.

The staff reserves the right to edit and print articles in the edition of their choice, based on editorial focus.

Reprints

The corresponding author will receive two complimentary copies of the edition in which their article appears. Authors may purchase reprints; contact NAVTA for prices and information.

General Guidelines for Articles:

- Articles should be typed and double spaced in Microsoft Word and submitted electronically via email to editor@navta.net.
- Preference will be given to articles that complement our focus for that edition; however, we encourage authors to submit articles of any topic throughout the year.
- Each individual listed as an author must have participated sufficiently in the creation and revision of the article or study. It is recommended that at least one author dealing with clinical topics must be a veterinary technician or higher level of education.
- Acknowledgements can be used to identify contributions from individuals who do not quality for authorship.
- Words to be abbreviated should be spelled out in full the first time they appear in the text, with the abbreviation given in parentheses. Thereafter, the abbreviation should be used. It is preferable to use abbreviations only when the word is used multiple times (i.e., more than three or four times).
- Cite footnotes by superscript numbers in the order in which they appear in the text. Footnotes should be listed in numeric order just before the references section, but not listed more than once in the footnotes. For example, if five sources are used multiple times, each source is listed once in the footnotes with the source first cited in the article as number one and listed first, and so on.
- Authors are asked to cite all quotations and references at the end of the article. Citations should be numbered in the order of their citation with superscript numbers. Follow the AMA Manual of Style format. *[Reference samples included below]
- Supplementary materials, such as glossaries, may also be included.
- Registered trademarks, copyrights, and so on, should be identified by the correct symbol.

*Citing References

Book—single author

Shepard TH. Catalog of Teratogenic Agents. 7th ed. Baltimore, MD: Johns Hopkins Press; 1992.

Book—more than one author (list all authors if six or less, otherwise list first three followed by "et al.")

Baselt RC, Cravey RH. Disposition of Toxic Drugs and Chemicals in Man. 4th ed. Foster City, CA: Chemical Toxicology Institute; 1995.

Book—with editors
Armitage JO, Antman KH, eds. High-dose Cancer Therapy: Pharmacology, Hematopoietins, Stem Cells. Baltimore, MD: Williams & Wilkins; 1995.
Chapter from a book
Degner LF, McWilliams ME. Challenges in conducting cross-national nursing research. In: Fitzpatrick JJ, Stevenson JS, Polis NS, eds. Nursing Research and its Utilization: International State of the Science. New York, NY: Springer; 1994:211-215.
Article from journal—single author
Moldofsky H. Sleep, neuroimmune and neuroendocrine functions in fibromyalgia and chronic fatigue syndrome. Adv Neuroimmunol. 1995; 5:(1):39-56.
Article from journal—more than one author (list all authors if six or less, otherwise list first three followed by "et al.")
Raux H, Coulon P, Lafay F, Flamand A. Monoclonal antibodies which recognize the acidic configuration of the rabies glycoprotein at the surface of the virion can be neutralizing. Virology. 1995;210(2):400-408.
Monographic series
Davidoff RA. Migraine: Manifestations, Pathogenesis, and Management. Philadelphia, Pa: FA Davis; 1995. Contemporary Neurology Series, No. 42.
Online journals with volume and page information
Simon JA, Hudes ES. Relationship of ascorbic acid to blood lead levels. JAMA. 1999;281:2289-2293. http://url. Accessed July 11, 2009.
Online journals without volume and page information
Mast CT, DeMuro-Mercon C, Kelly CM, Floyd LE, Ealter EB. The impact of rotavirus gastroenteritis on the family. BMC Pediatrics. 2009;9:11. doi:10.1186/1471-2431-9-11.
Online website
King MW. The Medical Biochemistry Page. http://themedicalbiochemistrypage.org. Updated July 14, 2009. Accessed July 14, 2009.

Guidelines for Case Studies:

- Less than 750 words.
- An unusual or extraordinary case in which a veterinary technician was involved.
- Photos/images must be used to illustrate points (see photo requirements).
- Technical information on symptoms, laboratory tests and results, surgery and outcomes must be included with the study.

Guidelines for Continuing Education Articles:

- From 3,000 to 3,500 words (not including cutlines, breakout boxes, footnotes and so on).
- May not have been published in any other trade publication words.
- Minimum of two references.
- Include drug footnotes.*
    - *Drug Footnotes - Products, equipment, and drugs should be identified by chemical or generic names or descriptions. A trade name may be included in a lettered footnote if that specific product, equipment or drug was essential for the outcome. For example, the article may reference aspirin. A drug footnote should be included with the manufacturer's name and location [i.e.: city, state and country, if outside the US].
- Authors must complete a RACE Presentor Biographical Form (PDF). Submit it via email to editor@navta.net

- Include a statement of purpose/objective for the CE article with specific information, concepts and/or skills that participants are expected to obtain when they complete the offering. Example:
    - Objective — Readers should gain an understanding of the pathophysiology of degenerative myelopathy (DM), its diagnosis, and the potential management options available. They will also be able to identify breed predispositions, signalment, and overall prognosis. Participants will obtain the knowledge needed to develop a skill-set for performing appropriate physical rehabilitation and for teaching owners how to perform physical rehabilitation on their pets at home with the intention of impacting quality of life. An understanding of the basic concepts and purpose of the rehabilitation exercises performed will be obtained.
- Include 10 multiple choice questions for the continuing education quiz:
    - Four answers per question.
    - No true/false questions or "all of the above" or "none of the above."
    - An answer with "a and b," "c and d," or other combination, is appropriate.
    - Highlight the correct answer for each question.

Review Process:
All continuing education articles and case studies are reviewed three ways before publication. The first is for readability, the second for scientific accuracy, and the third is by peers in the field. Throughout the process, the editor looks to communicate with the writer to make sure that edits stay true to the writer's voice and central message. However, the staff will edit as needed, based on the requirements for the publication and organization.

Book Reviews

- Up to 500 words.
- Photo of reviewer is recommended (300+dpi).
- Use objective language (even if you do not like the book).
- If you choose not to review the book, please return the book as soon as possible so that it may be reassigned to another reviewer.
- Recommendations for books similar to the one being reviewed is appropriate.

Letters to the Editor

- Address the letters to the editor, and email to editor@navta.net.
- Must provide: Name, degree or certification, city and state and email address. NAVTA will not publish email addresses in the journal unless the author requests so in writing.

Photos, images and illustration guidelines:

- For print, photos/images must be 300+ dpi.
- Digital photos only.
- Journal cover photos must be vertical orientation.
- We encourage authors to submit images and illustrations to supplement their article.
- Tables, figures, photos and other images should be submitted as an individual high-resolution (>300 dpi) JPG or TIFF (do not embed within the article).
- Captions/descriptions should be provided for each photo at the end of your document, not on the photo itself.
- The author must obtain permission from individuals in the photos.
- Identify individuals in the photos.

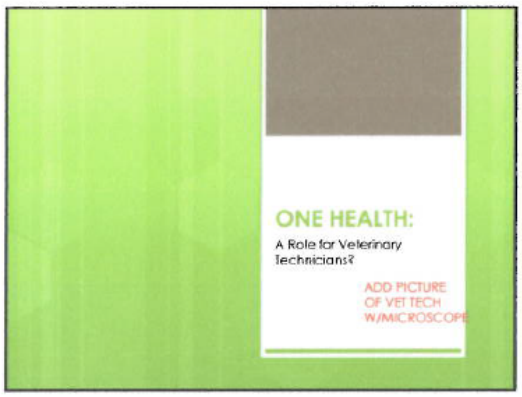
CORRECTIONS

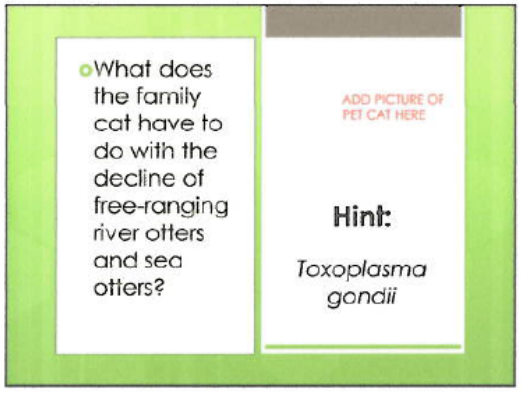
Readers who detect errors in *The NAVTA Journal* are encouraged to notify the editor-in-chief, Kara Burns at editor@navta.net, immediately so that a correction can be published. NAVTA reserves the right to evaluate the reported error and determine whether it is indeed an error or a divergent opinion. Corrections of errors will be published in the next available issue, as well as posted online and linked to the original article in which the error occurred. If an error has occurred in an online quiz, corrections will be posted immediately.

APPENDIX C

LESSSON PLAN AIDS

Lesson 1: One Health PowerPoint Presentation





Veterinary Technicians Evaluate Most Parasitology Slides in Private Practice

- Feline fecal tests
- Identification of *T. gondii*
- Client education: "Parasite Control"
- Client compliance with parasite control
- Helping clients understand ecological consequences

Why Vet Profession is Needed in Environmental Fields

- Biosphere is threatened by what's happening from increased human pressures.
- Climate change, loss of biodiversity and ecological processes, emerging infectious diseases and pollution.
- Problems working synergistically to diminish human, domestic animal, wildlife and environment health
- Society ill-equipped with adequate knowledge, institutions, ethics, and professional expertise to address human induced degradation of environment

(Aguirre & Gomez, 2009; Eaton, Nielsen & Beasley, 2004; Norris, 2001; Howard, 2004)

Expansion of Veterinary Profession into Environmental Medicine Fields

- Enhance social relevance of profession in face of looming environmental catastrophes

(Aguirre, 2009; AVMA 2010; Chandler, 2003; Karesh, 2009; Rapport & Lee, 2004; Stephens, 2009)

ADD PICTURE OF BEACHED DOLPHINS

Animals as Sentinels for Human Health

- First to come in contact with microbes, contaminants, and pollutants that can make people sick.
- Animal symptoms and responses to conditions around them can serve as an early warning system for potential threats to the environment and human health.

ADD PICUTRE OF PACIFIC CHORUS FROG

Pacific Chorus Frog

Sentinels

- Earthworms, swallows, bats, other wildlife, and even our pets are all animal sentinels
- Alert us to disease, allergens, and contaminants in our environment.
- Scientists are designing and monitoring sentinel systems to help public health officials take preventative actions before disease outbreaks can occur.

Veterinary Environmental Medicine

- Major area encompassed by Zoological Medicine
- Includes: conservation medicine, free-ranging wildlife medicine, ecosystem health, wildlife rehabilitation &, emerging disease

Ecosystem Health

- Trans-disciplinary science that integrates ecology, health sciences, economics, social sciences, and other fields (Rapport & Hilden & Weppin 2000).
- Loos at health as a function and structure of ecosystem as a whole (Aguirre, 2009; Rapport, Hilden & Weppin, 2000).

ADD PICTURE OF TURTLE WITH PAPILLOMAS

Conservation Medicine/Free-ranging Wildlife Medicine

- Goal: Develop and apply health management practices & policies (Tufts, 2010).
- Biomedical training in population & trans-species medicine uniquely prepares vets to make significant contributions in ecosystem health and conservation medicine (Boyce, et al., 1992; Hutchins, 1991; Norris, 2003).

ADD PICTURES OF WOLF AND ELK BEING RELEASED INTO WILD

Wildlife Rehabilitation

- Wildlife health monitoring
- Reported via new Wildlife Health Event Reporter
- 2010 Monitored by the University of Wisconsin Vet School

ADD PICTURE OF WILDLIFE HEALTH EVENT REPORTER WEB PAGE

Emerging Disease

- At least 30 new diseases, many which originated in animals are affecting humans in the past 2 decades (Gough, 2007)
- New centers of excellence opening at vet schools around the world.

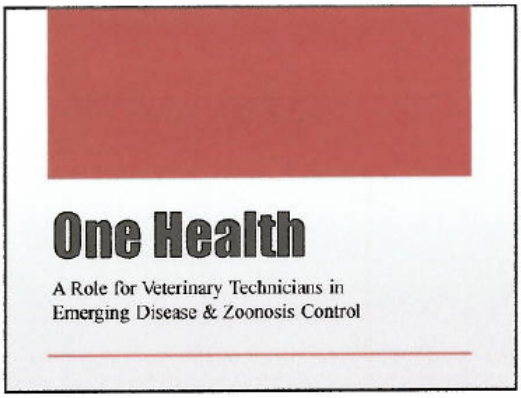
ADD PICTURES OF NEW CENTERS

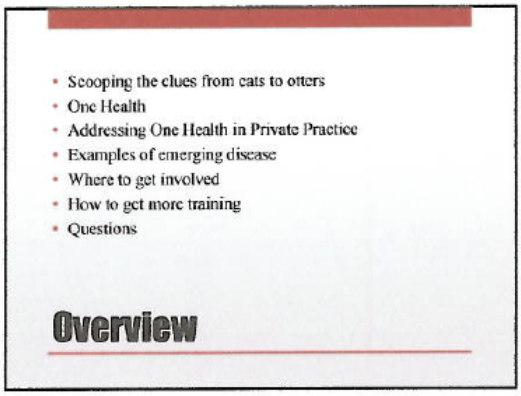
What's next?

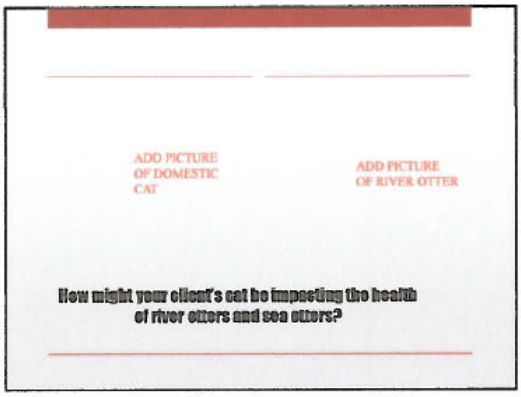
- A role for veterinary technicians

ADD PICTURES OF VET TECHS WORKING WITH WILDLIFE

Lesson 3: Emerging Disease PowerPoint Presentation







- SeaDoc Society research: What are the impacts to health of Salish Sea river otters?
- River otter populations threatened in 20 other states
- Maintaining our river otter population requires that we understand what impacts them and what we can do to prevent them from becoming endangered.

Sea Doc says Pacific Northwest River Otter Population Robust

ADD PICTURE OF OTTER

- Disease is one important regulator of river otter populations
- Protozoan parasite of cats: *Toxoplasma gondii* is one of the most common disease agents known to infect river otters in our region.
- 17% of river otters sampled had been exposed to this parasite.
- In California, *T. gondii* is a major cause of death for the threatened southern sea otter.
- Causes inflammation in the brain of otters but just how many river otters are dying from this disease is still unknown.

Disease Impacting River & Sea Otter Populations

A Mountain of Cat Poop

ADD PICTURE OF FERAL CATS ON JETTY

- Study in California showed that in the small communities of Cayucos, Los Osos and Morro Bay:
- Feral cats were estimated to put 29.5 tons of feces into the environment annually
- Owned cats defecating outdoors contributed an estimated 76.4 tons of feces annually.

www.seadoc.org

How do cats transmit a parasite to otters?

ADD PICTURE OF
ONE HEALTH LOGO

- One Health means that we recognize that human, animal, and environmental health are closely related and intimately linked. Over 60% of all infectious diseases are diseases transmitted from animals to humans.
- One Health links veterinarians, physicians and public health professionals for one purpose….the health of all.

ADD PICTURE OF AVMA PRESIDENT
ROGER MAHER

2008, AVMA President Embraces One Health Approach

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

ADD PICTURE
OF DR. KING

Dr. Lonnie King, Chairman
One Health Initiative Task Force
(AVMA, 2008)

Addressing One Health in Private Practice

Back to our cat and the sick otter...

- Feces and its contaminants move across land via rain, sprinkler systems, extreme storms, erosion, plus.
- Moves from the yard to the drainage system at the street and into freshwater creeks, streams, and rivers

- River otters are likely exposed when they drink fresh water or when they eat filter feeding bivalves like mussels that can concentrate the infective form of *Toxoplasma gondii*.
- Water and contaminants move on to marine systems

ADD PICTURE OF OTTER

- Sea otters can be infected with *T. gondii* by eating filter feeders (mussels, clams, abalone)
- Humans eating infected raw shellfish can become infected, too

ADD PICTURE OF HUMAN CONSUMING CLAMS

Parasite Control Should Be Guided by Vet

Most Parasitology Lab Tests conducted by: Veterinary Technicians

- Annual heartworm testing in dogs; test cats prior to placing on preventative
- Conduct fecal examinations2-4 times during the 1st year and 1-2 times/year in adults, depending on patient health and lifestyle factors.
- In areas where Lyme disease is considered endemic, vaccinate at risk dogs against *Borrelia burgdorferi*
- In endemic regions patients at risk should be tested annually for regionally relevant vector-transmitted pathogens.

Companion Animal Parasite Council Recommendations

ADD PICTURE OF VET TECH AT MICROSCOPE

- Screen for protozoans on microscopic fecal exams
- Encourage clients to practice parasite control
- Educate clients about lifecycle of *T. gondii* and danger to local wildlife

ADD PICTURE OF T. GONDII OVA

A Role for Vet Techs

Client Education: Advise clients to:

- Spay or neuter to reduce feral cat populations
- Provide litter boxes
- Dispose of feces in a landfill
- Preventative Parasite Control Program

Reduce Wild Otters' exposure to *T. gondii*

ADD PICTURE OF FLORIDA PANTHER

- From 2002 through 2005, an outbreak of feline leukemia virus (FeLV) occurred in Florida panthers (*Puma concolor coryi*).
- Florida Panthers are one of the most endangered mammals on earth.

www.vetmed.ucdavis.edu

Emerging Infectious Disease

ADD PICTURE OF YOUNG GORILLA IN JUNGLE

- UC Davis Vet School, Mountain Gorilla One Health Program
- For the first time, a virus that causes respiratory disease in humans has been linked to the deaths of wild mountain gorillas.

http://www.vetmed.ucdavis.edu/vhc/programs/mountain_gorilla.cfm

2009 Newly Emerging Infectious Disease

ADD PICTURE OF SOMEONE INSPECTING BEEF CARCASSES

- Public health jobs for veterinary technicians

Food Safety and Inspection Service

USDA FSIS

- Food Safety and Inspection (FSIS) USDA
- Veterinarians without Borders
- World Vets
- Heifer International
- Peace Corp
- Local Animal Shelters
- Many associated with religious organizations
- Many others

Organizations

Certificate in Public Health

- Credentialed vet techs can earn an on-line certificate in Pubic Health
- Yuba Community College Vet Tech Program
- 18 credits
- Check out their website: http://vettech.yccd.edu/public-health.aspx

MS degree in Public Health (MPH)

- Veterinary Technicians who have already earned a B.S. degree
- Check out your local University's programs

This is interesting. How do I learn more?

QUESTIONS?

Environmental History of the Veterinary Profession PowerPoint Outline

1 **Environmental History of the Veterinary Profession**

Sharon Lane
Graduate Student, Montreat College
MS in Environmental Education Program
Thesis Project

2 **1957-SOUTHEASTERN COOPERATIVE WILDLIFE DISEASE STUDY**

- First diagnostic and research service established for the specific purpose of investigating wildlife diseases. Housed at the University of Georgia, College of Veterinary Medicine.
- Prior to its inception, only speculation & myth existed regarding massive wildlife die-offs.

3 **1968 UC Davis Vet School**

- World's first veterinary school-based program in zoological medicine was organized by Dr. Murray Fowler.

4 **Early 1970's**
"Ecosystem Health" Concept is Conceived

- First called, "ecosystem medicine".
- Concept developed during a conversation between a medical doctor and an ecological statistician.
- Idea of an ecosystem having "vital signs" was born.

5 **1971**

- Founded by British naturalist Gerald M. Durrell to protect endangered species.
- Pioneer in the field of conservation medicine.
- "EcoHealth Alliance works at the intersection of ecosystem, animal, and human health through local conservation programs and develops global health solutions to emerging diseases."
- Employs expertise of veterinarians and other scientists.

http://www.ecohealthalliance.org/about/

6 **1973 Endangered Species Act**

- Opened the door for scientists and wildlife veterinarians to engage in the protection of wildlife.
-

7 **1975 – USGS National Wildlife Health Center**
Madison, WI Founded

- First federal program devoted to addressing wildlife disease problems.
- National Wildlife Health Center*...advancing wildlife and ecosystem health for a better tomorrow.*
- *"Wildlife health and ecosystem health go hand in hand".* http://www.nwhc.usgs.gov/

8

1977- AQUAVET®

- Sponsored by University of Pennsylvania and Cornell University Veterinary Schools.
- "Founded to encourage veterinarians to contribute to well-being of aquatic environment and its inhabitants."

9 **1982**

- Established by philanthropist Howard Gilman, White Oak Conservation Center provides conservation options for the future by maintaining genetically diverse populations of threatened species in spacious, natural facilities in Yulee, Florida.
- Provides internships for veterinarians and veterinary technicians interested in conservation medicine.
- Site of the American College of Zoological Medicine's landmark conference in 2001.

10 **1983 American College of Zoological Medicine Established by AVMA**

- The American College of Zoological Medicine was originally dedicated to excellence in furthering the health and well being of captive wild animals.

11 **1990 - Early Call for American Veterinary Medical Association to Re-engage Social and Environmental Obligations**

- "Like an old hound dog in the back of a pick up --- the winds of change are blowing in our ears. How will the leadership of the AVMA respond to the challenge of a shrinking world?" Dr. Susan Clubb's Address to AVMA House of Delegate, 1990
- AVMA House of Delegates choses not to respond.

12 **1991 First Ecosystem Health Workshop**

- Seminal Ecosystem Health conference held at University of Illinois, Urbana-Champaign
- Convened by David Schaeffer and David Rapport
- Ecosystem Health = health of environment + health of organisms
-

Rapport & Lee, 2004

13 **Veterinary Perspective Needed in Ecosystem Health Field**

- Biomedical training in population & trans-species medicine uniquely prepares veterinarians to make significant contributions in ecosystem health (Boyce, et al., 1992; Hutchins, 1991; Norris, 2001).

14 **1991 - First Envirovet Summer Institute**

1 - Envirovet Summer Institutes have provided intensive educational programs in wildlife and ecosystem health to approximately 225 animal health professionals to date.

http://vetmed.illinois.edu/envirovet/

2 - Goal: Increase numbers and effectiveness of veterinarians in ecosystem health research around the world.

15 **1993**

- Veterinary schools were the first professional schools (e.g., medical, dental, law) to adopt ecosystem health concepts into their core curricula (Rapport & Lee, 2004).

16 **1993 Canadian Vet Schools Offer first Ecosystem Health Clinical Rotation**

- Senior vet students
- Electro-fishing to inventory a section of Speed River during first rotation in Guelph.
- Part of a risk assessment exercise related to a proposed landfill site near a wetland.

17 **1994 - UC Davis Vet School,**
Oiled Wildlife Care Network Established

- The Oiled Wildlife Care Network, housed at the Wildlife Health Center, is the world leader in oiled wildlife response
- Operates through legislative mandate in California but provides national and international assistance
  http://www.vetmed.ucdavis.edu/whc/
-
-

18 **1995 - Alliance of Veterinarians for the Environment**

- Organization formed in 1995 to promote environmental health and the conservation of nature through education.

19 **1997 Tufts University Vet School Opens**
New Center for Conservation Medicine

- Pioneered the concept of Conservation Medicine as a new approach focusing on the health relationships occurring at the interface of humans, animals, and ecosystems.
  http://ase.tufts.edu/biology/labs/reed/index.html
-

20 **1997 Veterinary Emergency Response Team Created**

- UC Davis Vet School initiated program to save animals during California disasters such as floods and fires.
- They now deploy to natural disasters around the country.

21 **1999 SeaDoc Society**
Founded

- *The SeaDoc Society works to protect the health of marine wildlife and their ecosystems through science and education.*
- Conducts and sponsors scientific research in the inland waters of the Pacific Northwest.
- SeaDoc has determined the top ten principles for designing healthy ecosystems, for people and wildlife.

22 **SeaDoc's Ten Principles for Healthy Ecosystems**

1 - Political boundaries are arbitrary
- Account for Ecosystem connectivity
- Understand the food web
- Avoid fragmentation
-

2 - Respect ecosystem integrity

- Support nature's resilience
- Value Nature: It's money in your pocket
- Watch wildlife health
- Plan for extremes
- Share the knowledge

23 **1999 – Seminal Event**
West Nile Disease in NYC

- The emergence of West Nile virus in humans in NYC ignited the need for One Health concepts.
- Zoo veterinarian linked this newly emerged virus to flamingoes, emphasizing the critical role for One Health principles in public health.

24 **2000 Flu School**

- The Veterinary Medical Extension and the Wildlife Health Center at UC Davis launched the International Flu School to train veterinarians, public health experts, and producers dealing with prevention or outbreaks of highly pathogenic avian influenza. Flu School is now offered in six African countries. www.vetmed.ucdavis.edu/

25 **2001 American College of Zoological Medicine Increases its Scope**

- *Expanded to include new areas …*
- "Zoological medicine integrates veterinary medicine and the principles of ecology and conservation as applied in both natural and artificial environments" *(Stoskopf, 2006)*
-
-

26 **2001**
White Oak Accords Established

- Seminal document developed by American College of Zoological Medicine called the White Oak Accords
  - Changes definition of zoological medicine to include field of "Environmental Medicine" (conservation medicine, ecosystem health and emerging disease).
  - Set guidelines for "Minimum standards for teaching zoological medicine to ALL VETERINARY STUDENTS". (Stospkopf, 2006)

27 **2001 – National Aquatic Animal Health Plan (NAAHP) Enacted**

- Joint Subcommittee on Aquaculture (JSA), under the auspices of the Executive Office of the President (EOP) , Office of Science and Technology Policy (OSTP), commissioned a national task force to develop a national health plan for aquatic animals.
- "Farmed aquatic animals more closely monitored before release."

28 **2001**
Veterinarians Without Borders U. S.

- "Healthy Animals Sustain A Healthy World"
- Established by Dr. Audra Macorkie

29 **2004 Education**

- Ecosystem health education must be an integral part of all levels of education for all who contribute to our society. (Howard, 2004; Howard & Rapport, 2004).
-

30 **2006**

Laura Kahn, M.D.

- Published a paper in *Emerging Infectious Diseases* on the need for medical and veterinary medical disease collaboration.
- The One Health Concept is born.

31 **2007-2008**

AVMA's New President: Dr. Roger Mahr

32 **2008 – Finally, the AVMA answers the call to engage in environmental concerns....**

33 **Expansion of Veterinary Medicine into Ecosystem Field**

- It is time to enhance social relevance of the veterinary profession in face of looming environmental catastrophes. (Aquirre, 2009; AVMA, 2010; Granskog, 2008; Karesh, 2009; Rapport & Lee,2004; Stephens, 2009)
-

34 **2009**

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

Dr. Lonnie King, Chairman
One Health Initiative Task Force
(AVMA, 2009)

-

35 **2009 – AVMA's One Health Initiative Finalized**

- One Health means that we recognize that human, animal, and environmental health are closely related and intimately linked. Over 60% of all infectious diseases are diseases transmitted from animals to humans.
- One Health links veterinarians, physicians and public health professionals for one purpose....the health of all.

36 **"Systems" Approach Needed**

- Ecosystem health training should promote systems thinking and help students gain knowledge and experience in concepts, systems components, complexity, uncertainty, and the need for trans-disciplinary thinking. (Eyre, Nielsen, & Bellamy, 2001; Stephens, 2009)

37 **2009**
Newly Emerging Infectious Diseases

- UC Davis Vet School, Mountain Gorilla One Health Program
- For the first time, a virus that causes respiratory disease in humans has been linked to the deaths of wild mountain gorillas.
  http://www.vetmed.ucdavis.edu/whc/programs/mountain_gorilla.cfm

38 **2010 University of Florida**
SPICE Program

- Science Partners in Inquiry-based & Collaborative based Education
- 5-year project - National Science Foundation to train UF graduate students to teach and foster inquiry-based learning of science, tech, engineering, and math in Florida's low-performing middle schools.
- Program Theme: "Ecosystem Health and Sustainability"
-

39 **2010- Tufts University-Offers New MS degree in Conservation Medicine**

- Multi-disciplinary program designed to examine the relationships between environmental, animal and human health.
- Program engages graduate students from a variety of fields to confront the disciplinary gaps that obscure the broad view of "One Health."
  http://www.tufts.edu/vet/ccm/about-profile.html

40 **2010 - Wildlife Health Event Reporter**

- Surveillance and communication tool set up to record wildlife health observations for injured, sick or dead wildlife
- On-line system collects reports from the public, citizen groups, wildlife rehabilitators and other wildlife professional organizations to develop a long-term dataset of wildlife morbidity and mortality event data
- Monitored by University of Wisconsin
  School of Veterinary Medicine

http://www.whmn.org/wher/

41 **H. R. 4497: Wildlife and Zoological Veterinary Medicine Enhancement Act of 2010**

- Sponsored by Representative Alcee Hastings (D-FL-23)
- Purpose: "to expand the workforce of veterinarians specialized in the care and conservation of wild animals and their ecosystems, and to develop educational programs focused on wildlife and zoological veterinary medicine"

- Bill died in committee; not enacted
  http://www.govtrack.us/congress/bills/111/hr4497

42 **June 2010 - Washington State University Veterinary School groundbreaking for ...**

43 **June 2011**
Scientific Taskforce for Wildlife and Ecosystem Health Conference Convened
- First international conference met in Beijing, China.
- 22 colleagues in attendance from 12 different countries representing 15 separate organizations
- Mandate: Identify wildlife diseases of high priority with respect to human, environmental, livestock, and wildlife health in hopes of recognizing diseases with devastating potential before they emerge.

http://wildlifeandecosystemhealth.org/

44
2011
World Veterinary Year
250th Anniversary of Veterinary Education

45 **2011**
Three Components of One Health
- One Health's principal efforts promote the understanding , prevention, and treatment of Zoonotic Diseases.
- Comparative Medicine – animals and people share many of the same diseases and health conditions
- Zooeyia – the human health benefits that result from the human-animal bond (Hodgson & Darling, 2011)

46 **Bridging the Gap ...**

47 **Challenges for the Future...**

48 **Avoid Habitat Fragmentation**

49 **Political Boundaries Are Arbitrary**

50 **Understand the Food Web**

51 **Respect Ecosystem Integrity**

52 **Value Nature:**
It's Money in Your Pocket

53 **Watch Wildlife Health**

54 **Support Nature's Resilience**

55 **Account for Ecosystem Connectivity**
Florida Everglades Restoration Project

56 **Plan for Extremes**

57 ☐ **Manage Ecosystems Responsibly**

58 ☐ **Embrace Wildlife's Resilience**

59 ☐ **Share the Knowledge**

60 ☐ **HEALTHY ECOSYSTEMS ...**