No horsing around

Dr Jean Sander discusses the contributions that Oklahoma State University’s Center for Veterinary Health Sciences is making to public health, and explains how the Center is addressing current challenges on both a regional and global scale through its strategic priorities.

To begin, could you introduce your role within the Oklahoma State University (OSU) Center for Veterinary Health Sciences (CVHS)?

I serve as Dean of CVHS, and have done so for about three years. I am a veterinarian with a specialty in poultry health, and a Professor in the Department of Pathology. I oversee all aspects of the college, from facilities to public relations and everything in between. In addition to promoting our faculty and programmes, I am responsible for managing the budget, fundraising, strategic planning, promoting the college to all external constituents, and serving as the liaison with the OSU administration.

Over the years, how have the Center’s aims and strengths evolved?

The Center serves as a top educational and training facility for veterinarians, but also emphasises innovation and research in areas of biomedical and veterinary importance. OSU has made many significant contributions dating all the way back to the 1930s. These include significant advancements in parasitology and tick-transmitted diseases that led to the development of the first successful vaccine for bovine anaplasmosis, and the development of the first anaesthetic machine using endotracheoscopy, which enables safer, smoother delivery of anaesthesia in large animals with minimal restraint.

More recently, OSU’s application of lasers has been important eg. yielding improved procedures and outcomes for back surgery in dogs. Furthermore, CVHS’ mission has expanded since its early days; we now have an animal disease diagnostic laboratory with state- and region-wide clientele, and do more clinical service in companion animal medicine.

CVHS deliberately focuses its efforts in specific research areas, such as lung biology and comparative exercise physiology. Why were these particular areas chosen?

We focus on issues that impact Oklahoma’s people, both through their animal companions and industry. For example, smoking is a huge public health concern and respiratory disease has the single biggest economic impact on Oklahoma’s cattle industry, so lung biology is important. Accordingly, a team of researchers is working on the application of adult stem cells to healing processes in the lung and other tissues. Similarly, exercise and rehabilitation impact our state’s horse racing industry, as well as the health of companion animals and people, so one of our researchers is investigating adaptation to strenuous exercise.

The Center’s research and graduate education programmes have expanded rapidly over the last few years, in spite of the tough economic climate. How has this been achieved?

To become more competitive we began to think bigger, increase collaboration, and recognise that we had to invest in people and facilities. Our research efforts have become more specialised, focusing on areas of strategic importance. Furthermore, we collaborate extensively with industry in addition to our work with other institutions; about one-third of our funding for research comes from industry or private sources. Our National Center for Veterinary Parasitology, for example, is funded primarily by industry, and involves training, service, and independent (pre-competitive) research in parasitology. Meanwhile, our Interdisciplinary Toxicology Program is a good example of collaborative research among faculty from different fields that seeks to cross-train students in the use of multidisciplinary concepts and approaches. This effort pulls together researchers to address complex questions, such as use of nanomaterials in the environment. There have already been some synergies realised in terms of competing for funding.

What does the future hold for CVHS?

In the US, funding for animal health research is becoming scarcer; industry funding is short-term and subject to the dynamics of the marketplace, making it uncertain. We are left with few alternatives for the kind of multi-year funding with which you can build a laboratory team – be it biomedical (through the National Institutes of Health) or basic research (through the National Science Foundation). This is steering us towards working on problems that impact humans as well as animals.

In addition, research will inevitably become increasingly collaborative and international as more humans, animals and animal products move rapidly around the world, and problems related to environmental change, land use and encroachment on wildlife continue to emerge. Similarly, we’ll see a growing focus on the ‘One Health’ theme, which proposes that addressing public health challenges requires cooperation between veterinary, human and environmental health communities.
One world, one health

Collaborative research efforts underway at Oklahoma State University’s Center for Veterinary Health Sciences are making important progress on health issues that impact animals, people and the shared environment.

VETERINARY HEALTH IS intimately linked with the health of humans. Food production, agricultural systems, industrial processes, disease control and even military applications represent just some of the myriad ways that essential societal functions both rely on and are impacted by the health of animals. In addition, animal models of disease serve as critical platforms for learning about human disease. Recognising this, the Oklahoma State University (OSU)’s Center for Veterinary Health Sciences (CVHS) serves as a top training facility and animal treatment centre that bridges the worlds of biomedical and veterinary research. With talented staff and an excellent infrastructure, CVHS’ research has multifaceted implications for both animal and public health.

A SHARED WORLD

As the Earth experiences changes in its climate and land use, the world becomes increasingly globalised and the human population continues to rapidly expand into new environments, public health issues will increasingly intersect across humans, animals and the environment. This calls for an approach to public health that encompasses medical, veterinary and environmental science: the ‘One Health’ approach. This is something that CVHS is eager to embrace. Highlighting its importance, Dr Jerry Malayer, CVHS’ Associate Dean for Research and Graduate Education, explains: “Humans, animals and animal products now move rapidly around the world, and pathogens are adapting, finding new niches and jumping across species into new hosts”.

CVHS’ parasitology research, which began in the 1940s, is a good example of the link between human, animal and environmental health. Ticks can be hugely problematic as they feed on both livestock and human blood, transmitting pathogens in the process. New tick-borne diseases can surface when humans move into rural areas and disrupt the resident wildlife populations that traditionally serve as pathogen reservoirs, or as warming climates cause the tick population to spread to new territories. At CVHS’ Tick and Tick-borne Pathogen Vaccine Development Laboratory, Professor Dr Katherine Kocan’s team is studying an emerging tick-borne infection caused by the bacteria Anaplasma phagocytophilum, which infects a wide variety of hosts including dogs, cattle and humans. She is also developing a two-pronged vaccine that can both control ticks and prevent pathogen transmission. Vaccines to protect against tick diseases are becoming increasingly important as ticks develop resistance to heavily-used pesticides.

Another link between human, animal and environmental health is in respiratory disease, which has been a focus area in the Center for several decades. This is partly in response to the fact that respiratory disease in cattle is a major economic burden in the state. Since the 1960s there has been a lot of excellent work in this area performed at CVHS by individuals such as Drs Roger Panciera, Richard Corstvet and Harold Rinker, with much effort being dedicated to the development of protective vaccines against the main pathogens thought to be responsible for respiratory disease. For example, Drs D L Step and Jared Taylor have been working to characterise pathogens implicated in the disease in order to understand what changes may be occurring in sick versus healthy animals. Furthermore, a few years ago Dr Lin Liu began cell- and molecular-based studies of lung development and the response of the lung to various insults; work which has implications for chronic obstructive pulmonary disease (COPD) and other human diseases. Currently, further research is underway relating to respiratory viruses, immune response and processes of tissue regeneration.

DIFFERENT SPECIES, RELEVANT RESEARCH

Not only does an evolving environment disrupt the dynamics between animal and human health, but insights from veterinary research have relevant crossover for human disease processes. Malayer argues that this is one of CVHS’ greatest strengths: “The combination of applied and basic research in comparative medicine with a variety of species is a powerful platform with the potential to impact both human and animal health”.

Consistent with this concept, Associate Professor Dr Diane McFarlane is studying degenerative diseases in horses to uncover clues that can help understand similar diseases in people. Her current work focuses on the cause of neural degeneration in a disease called pituitary pars intermedia dysfunction (PPID) seen in ageing horses, which represents the only known naturally occurring disease model for the study of the degeneration of dopamine-induced neurons – the same type of neurons affected in Parkinson’s disease. Natural animal models hold advantages over experimentally-induced disease models, as they permit researchers to investigate the natural course of disease progression and address questions related to the causes, triggers and genetic differences that determine whether the disease manifests in a specific individual. The goal is to ultimately translate findings from this work to neurodegenerative conditions such
INTELLIGENCE
CENTER FOR VETERINARY HEALTH SCIENCES

OBJECTIVES

- To educate and develop skilled veterinarians for a lifetime of investigation, innovation and care and protection of animal health
- To discover and disseminate knowledge concerning health and disease mechanisms of biomedical and veterinary medical importance
- To create and utilise effective methods for the diagnosis, treatment and prevention of animal diseases and those transmissible to humans
- To provide a state-of-the-art veterinary medical resource center that serves the citizens of Oklahoma, the US and the world

PARTNERS

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as Parkinson’s disease, amyotrophic lateral sclerosis, Huntington’s and Alzheimer’s disease.

CVHS also utilises animal models of exercise physiology to inform on physical resilience in humans. For instance, Professor Michael Davis is working to improve the health of improvised-explosive-device (IED) detection dogs in the military. These animals may be called upon to work in a variety of extreme environments, and can experience high levels of physical and mental stress. Davis’ work has demonstrated that IED detection dogs are susceptible to exercise-induced gastric ulcers and have nutritional requirements which are almost 50 per cent higher than previously supposed. Subsequently, CVHS was able to provide the military with specific suitable nutritional and water requirements. In addition to improving the health of these essential animals, findings can potentially be extrapolated from these studies to genetically-similar mammals, and even athletes or soldiers, who perform similar levels of strenuous activity.

ON THE FRONTLINES

Another area with both environmental and military implications is the possibility of neurotoxic effects from pesticides and chemical weapons. In CVHS’ multidisciplinary Neurotoxicology Laboratory, Professor Carey Pope is investigating the effects of xenobiotics (chemical compounds that are foreign to living organisms) on neurological function. He focuses on how endogenous and exogenous factors can modify neurotoxicity from exposure to acetylcholinesterase inhibitors, which are found in pesticides and some chemical weapons.

“Understanding these factors has the potential to make these materials safer for common use, and possibly mitigate the consequences of exposure to more dangerous forms of these chemicals for illicit use,” explains Malayer.

Along these lines, a team of CVHS researchers have received funding to develop a nanoparticle delivery system to protect soldiers and first responders from the toxic effects of nerve agents. “This is the next generation of therapeutic delivery — the goal is to have the therapeutic already present in the body in a form where it can respond when needed,” Malayer elucidates. “This work is still in its early stages, but the pieces are coming together very well.”

LOOKING AHEAD

Not unlike other sectors of biomedical and scientific study, veterinary researchers have had to contend with the reality of shrinking resources in recent times. CVHS has adapted by increasing collaboration and focusing on key areas that can have real impact. The above examples represent a broad spectrum of work, but the common link is that they all have relevant applications to both animal and human health.

In a changing environment that will continue to create new public health challenges, the One Health approach will become increasingly important. Malayer emphasises the role of veterinary research to this greater good: “The veterinary profession contributes to human and public health by improving agriculture and food systems; advancing biomedical and comparative medical research; preventing and addressing zoonotic diseases; enhancing environmental and ecosystem health; and helping manage 21st Century public health challenges.”