

IOWA STATE UNIVERSITY

gentle doctor

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Practice makes
PERFECT

Dr. K. Kraus
Iowa State University

gentledoctor

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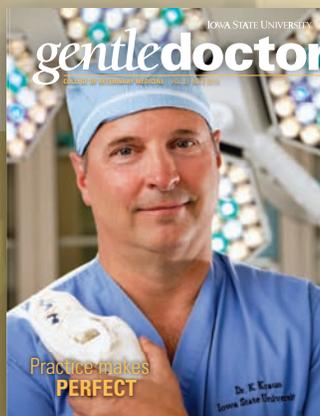
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On the Cover

Dr. Karl Kraus, professor and chief of surgery at Iowa State University's College of Veterinary Medicine. Story on page 10. Photo: Gary Clarke

FROM THE DESK OF THE DEAN



Photo: Catherine Logue

Dear alumni and friends,

I've been passionate about research throughout my career, dating back to my first year of veterinary school. I participated in a program much like today's Summer Scholar Research Program, which was a springboard for me to a career in research and academic veterinary medicine. To this day, I am grateful to the donors, faculty, and administrators who made and continue to make research training a priority for veterinary students.

I truly enjoy spending time in my lab, working alongside some very talented and eager-to-learn undergraduate, professional, and graduate students; postdocs; and visiting scientists. It allows me to stay better connected with the college's researchers whose labs are investigating critical issues in animal and human health, plus food security. It is satisfying to know that their research can directly benefit producers' livelihoods, animal health and well-being, food safety, and human health.

In fact, our college researchers are major players in Iowa State's research success. They hold a significant portion of the university's National Institutes of Health (NIH) funding, and we are also among the top tier of veterinary colleges in U.S. Department of Agriculture (USDA)-funded research. In addition, our researchers received several Health Related Initiative (HRI) and presidential initiative awards in a university-wide competition. Eight of 12 HRI grants came to our college, along with two Presidential awards. Another important benefit of this level of research productivity is the creation of many unique learning opportunities for our students.

A great example of the impact of our research is our veterinary diagnostic laboratory's response to the recent outbreak of porcine epidemic diarrhea (PED) in the United States. Our diagnostic scientists were the first in the country to identify the virus and sequence its genome, which provided important clues to the strain's origin. They have also developed a number of assays to correctly diagnose PED outbreaks, and members of the lab are working closely with key industry groups to advance diagnostics and test prevention strategies for PED virus.

Best regards,

Lisa K. Nolan, DVM, PhD

Dr. Stephen G. Juelsgaard Dean of Veterinary Medicine
Iowa State University

GRADING SYSTEM:

Is It a Useful Prognostic Tool for Canine Soft-Tissue Sarcomas?

By Tracy Ann Raef

For veterinary practitioners, accurate prognosis information is important to help answer client questions and manage the clinical treatment of diseases, as well as cancers such as soft-tissue sarcomas (STSs). For help in diagnosing diseases and predicting outcomes, practitioners rely on the expertise and skills of veterinary pathologists.

Helping practitioners and their clients and patients is one of the reasons Dr. Amanda Fales-Williams became a board-certified pathologist. So when the Department of Veterinary Pathology at Iowa State University adopted the Dennis Grading System for Cutaneous and Subcutaneous Soft-Tissue Sarcomas in Dogs, Fales-Williams wanted to determine whether this system would provide a more accurate prognosis for practitioners than the previous classification system used by the department.

This past summer, Fales-Williams and Anthony Lisankis, veterinary student and summer scholar, conducted a retrospective study to compare actual outcomes of cases seen by the department's pathologists with the prognosis predicted by the Dennis grading scale.

"The Dennis scale is based on differentiation, mitotic index, and distribution of necrosis," Lisankis said. Using this scale, pathologists are able to more objectively separate soft-tissue sarcomas by degree of differentiation, such as Grade I, well differentiated; Grade II, intermediate differentiation; and Grade III, poorly differentiated sarcoma. Each grade is associated with a poorer prognosis. In the study, outcomes of patients diagnosed with soft-tissue sarcomas from 2011–2012 were analyzed and compared to reported prognostic data cited in literature. A total of 314 cases met the criteria. Referring veterinarians

who submitted those cases were surveyed to obtain information on outcomes. Of those contacted, 32 percent responded.

Of the cases for which responses were obtained, the rate of tumor recurrence was highest (70 percent) for the Grade III STSs, as predicted by the grading scale. Grade I and II STSs recurred for about 12 percent of the cases. Metastasis was somewhat more likely for Grade II sarcomas (17.4 percent) than Grade III sarcomas (10 percent), and as predicted, very low for Grade I. "A very low number of Grade III STSs were available for this study, thus these conclusions may not be representative for all cases," Fales-Williams cautioned.

"Tumor-related deaths, which included elective euthanasia, followed the predicted pattern," Lisankis said. "Lowest occurrence was for Grade I and increased with Grades II and III."

"We did the study to ensure that the grading scale used by our department provides an accurate assessment for the behavior of STSs, so our referring practitioners can determine a treatment protocol for their patients," Fales-Williams said. "We appreciate the time it took to fill out the surveys, particularly for clinics that had multiple STS cases, and hope that the clinicians will find this study helpful enough to participate in future studies on other tumor grading scales." 

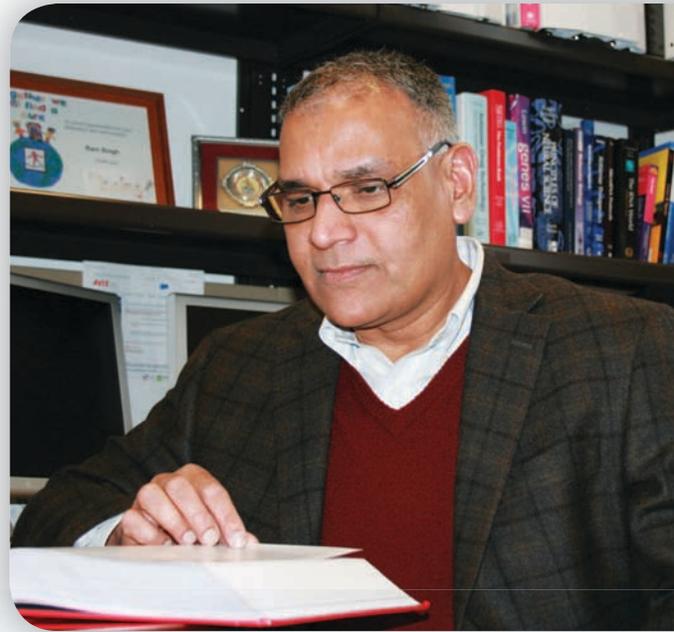
Lisankis, a second-year veterinary student, participated in the college's Summer Scholar Research Program through funding from the Van Gelder Scholarship. He is an Army veteran whose career interests include pathology. He presented a poster summarizing the study at the annual meeting of the American College of Veterinary Pathologists in Montreal, Canada, held in November 2013.



Dr. Amanda Fales-Williams, associate professor of veterinary pathology, and Anthony Lisankis, second-year veterinary student. Photo: Tracy Ann Raef

Iowa State researchers explore new treatments for a leading genetic cause of infant deaths

By Fred Love



Researchers at Iowa State University have identified an RNA structure in humans that could lead to a new treatment for spinal muscular atrophy, the leading genetic cause of death in babies and young children.

Ravindra Singh, a professor of biomedical sciences and John G. Salsbury Endowed Chair in Veterinary Medicine at the College of Veterinary Medicine, is the lead author of a paper published this summer in the journal *Nucleic Acids Research* that details the discovery of a novel therapeutic target that could be modified by medication, leading to new treatment possibilities for the disease.

Spinal muscular atrophy results from the loss or mutation of a gene called survival motor neuron 1, often referred to as SMN1. If SMN1 is deleted or doesn't function properly, not enough SMN protein is produced, giving rise to the disease.

Luckily, the vast majority of humans have a nearly identical gene, referred to as SMN2, which can function as a substitute. But a critical portion of SMN2 is sometimes erroneously removed during the process known as splicing, or when pre-mRNA is turned into mRNA by getting rid of nonfunctioning parts of the gene.

In the paper, Singh and his colleagues have discovered an RNA structure exclusively formed by intronic sequences, or sequences that are removed during splicing. By targeting that structure, it may be possible to develop new treatments that prevent the mistake in the splicing process that causes the loss of function of SMN2, Singh said. If so, this is the first time a deep intronic structure can be targeted for therapy.

"About a quarter of a person's genome is made up of introns, or noncoding sequences, that must be removed through splicing throughout life," Singh said. "We've found an RNA structure that aberrantly promotes the escape of one of the coding sequences through splicing."

Singh cautioned that development of a new treatment would have to go through years of clinical trials and further study, but the bottom line is that the research could result in a new way to cure spinal muscular atrophy. In fact, private companies have shown interest in negotiating with Iowa State to begin development of a drug based on the research, Singh said.

He said the paper required about five years of painstaking work, testing hundreds of mutations to individual gene sequences one at a time to see if they have an effect on splicing. "The process involves a lot of trial and error," he said.

Studying RNA structures within the noncoding portion of the human genome is still a relatively untouched frontier with much left to teach us, Singh said. It appears that RNA structures hold enormous information, and new techniques for studying RNA structures are unlocking new possibilities that could have major implications for how we treat genetic diseases, he said.

"In many ways, this is still a very poorly understood field," Singh said. "But around half of all genetic diseases are a result of errors in splicing, so we have much to gain from answering these questions." 

A New Breed of Gentle Doctors

By Veronica Lorson Fowler

Members of Iowa State's veterinary medicine class of 1964 have joined together to ensure new graduates are prepared to lead their profession.

Growing up in Muscatine, Iowa, Meghan Fick looked up to her grandfather, veterinarian Dr. Donald Fick. "He was a surgeon, radiologist, dermatologist, ophthalmologist, anesthetist, dentist, internist, and so much more," she said. "I knew I wanted that same challenge every day."

Because her grandfather attended Iowa State University's College of Veterinary Medicine, "I refused to apply to any other veterinary school," Fick said. So it was especially affirming to receive a scholarship funded by her grandfather and his close-knit classmates.

The Veterinary Medicine Class of 1964 Scholarship allowed Fick to take advantage of an array of opportunities not available to veterinary students in her grandfather's day: externships in shelter medicine in Kansas City, emergency care in Los Angeles, and sea turtle rehabilitation in Georgia, as well as study abroad in Hungary and Italy. "I got to see how veterinary medicine was practiced in different fields, and even in different countries," she said. "I learned from places I never would have been able to visit and made contacts I'll use in the future."

Since 1999, the veterinary medicine class of 1964 has funded scholarships for veterinary students and fellowships and stipends for graduate students.

The class's intent is to provide veterinary students greater opportunities to develop the skills and perspectives needed to lead in their profession.

"This fund is an admirable example of the generosity toward and passion

for the profession shown by our alumni," said Dr. Lisa Nolan, Dr. Stephen G. Juelsgaard Dean of the College of Veterinary Medicine.

Michael Rahe is another example of today's veterinary student. The recent veterinary medicine graduate concurrently pursued a Master of Public Health at the University of Iowa while at Iowa State. He has conducted research on the dengue virus at Stanford University, studied abroad in Thailand, and assisted with H5N1 avian influenza surveillance in Romania.

Rahe says receiving the Class of 1964 Scholarship only confirms his career choice, showing him that this group of experienced veterinarians "love what they do professionally, and they want others to have similar experiences." Rahe will pursue a doctorate in immunology at the University of Minnesota this fall.

As for Donald Fick, it has been wonderful to see his granddaughter embrace every aspect of veterinary medicine she has encountered. As a contributor to the class's fund before Meghan applied to Iowa State, he said, "It's always rewarding to see a good student receive the scholarship. That it also happens to be someone special to me is an exceptional reward." 



A version of this story appeared in the summer 2013 issue of Forward, the magazine of the Iowa State University Foundation. Photo: Erich Ernst

Theriogenology Units Combine to Provide Enhanced Services



Photo: Gary Clarke

Veterinarians today now have access to technologies that dramatically improve the genetics of animals for better productivity and profitability. They can, for example, harvest the eggs from an extremely high-producing dairy cow and fertilize them with the semen of a top bull located halfway across the country. That's especially important when you consider that a top dairy cow can be valued at more than a million dollars, since spreading her desirable traits across a herd or industry can have tremendous value.

In an era of remarkable animal reproduction advances, it only made sense for the College of Veterinary Medicine to revamp and modernize its own animal reproduction program to better serve its clients.

A key in jump-starting the program was the hire of two board-certified specialists in theriogenology. In June, Dr. Patrick Phillips, who started his own company specializing in bovine embryo transfer, was recruited to lead the team.

A second theriogenologist, Dr. Swanand Sathe, joined the college in August. Dr. Sathe's expertise in small animal and equine theriogenology complements the skills of the others in the team, which include an embryologist (Marianna Jahnke), a cryobiology technician (Rochelle Panthen), and the college's first-ever resident in theriogenology (Dr. Tyler Dohlman '10).

Combining the small animal and large animal theriogenology sections was an important component of the modernization.

Although the team members are in different departments within the college, sharing time, skills, and equipment creates efficiencies that allow for more theriogenology patient services and more research. "We're in the process of acquiring state-of-the-art equipment to better serve our clients," said Dr. Phillips, holder of the Scott and Nancy Armbrust Professorship. For example, this fall, a time when the clinic performs a lot of laparoscopic artificial insemination in sheep and goats, it's natural for one member of the theriogenology team to consult with another and participate in a procedure. Similar efficiencies and collaboration also mean better teaching to students who have given great reviews to the new program.

The college's cryobiology and embryo transfer programs, which deal with semen and embryos in most species, also are benefiting through the establishment of a bovine embryo transfer center, established and managed by Dr. James West ('71). Small ruminant semen and embryo transfer work also is increasing with a far higher patient caseload.

Meanwhile, the program is expanding with improved services. One of the most notable is the "stallion station," managed by Dr. Nyomi Galow-Kersh ('05). It's a place where horse owners bring in their stallions for weeks and often months in order for ISU to collect and ship equine semen across the country and the world – important business since quality equine semen can sell for as much as \$5,000.

The college also houses a large number of mares, left by clients to be bred during the breeding season.

The small animal theriogenology services, managed by Drs. Sathe and Lin Kauffman ('03), cater to both the male and female aspects of reproduction primarily in dogs and cats. "We evaluate male dogs for breeding soundness, collect, freeze, chill and ship semen across the country, as well as treat any clinical cases relating to reproduction (male or female) presented to us," Dr. Sathe said. They also perform cesarean sections on dogs that need them and assess neonatal health.

"An ongoing effort is to provide affordable laparoscopic insemination techniques for breeding dogs to pet owners and breeders," Dr. Sathe said. "We also are interested in developing better and more sensitive hormonal assays to time estrus in dogs as well as developing and evaluating better semen freezing techniques for canine semen. We also have plans for venturing into more advanced reproductive techniques especially dealing with small animal embryo manipulation in the future. The list of interests is always growing."

"We are excited that the college is now also getting the word out around the state about its services and knowledge base in both small animal and large animal theriogenology," Dr. Phillips said. The unit plans on taking on more theriogenology residents and conducting more programs with practitioners, producers, clients, and students around the state. 📍

TO IDENTIFY A the hnu

Dr. Michelle Sprague, swine practitioner at the Audubon-Manning Veterinary Clinic, walked through the barn, estimating that 90 percent of piglets had diarrhea. She also noticed that some of the sows had diarrhea and were off feed.

Sprague collected fecal samples from six piglets and two sows. She suspected TGE, transmissible gastroenteritis, a highly infectious disease caused by a coronavirus. A staff member from AMVC drove the samples to the Veterinary Diagnostic Laboratory at Iowa State University. The samples were tested that day – April 29, 2013. Results: Negative for TGE. The next day after receiving negative results on the initial submission they drove additional samples to the VDL, and again, the day after, receiving negative results on the second submission.

Within a couple days of that initial submission, diagnosticians at Iowa State had received submissions from practitioners in two other states, as well as additional samples from Sprague – all with the same clinical signs and suspected cause, TGE. Repeatedly, results from tests, such as the polymerase chain reaction (PCR) on feces or intestinal contents and immunohistochemical staining on tissues that normally detect TGE, were negative. Yet under the microscope, pathologists saw lesions in the intestinal tissues that resembled acute viral enteritis due to TGE or similar diseases.

“TGE lesions are very distinctive,” said Dr. John Johnson, clinician and serology section leader in the VDL. “TGE destroys the villi that line the intestines. Under a microscope, the lining of the intestine looks like someone took a lawnmower through the villi.”

“At this point, four or five of our pathologists had received similar cases,” said Dr. Eric Burrough, a diagnostic pathologist in the VDL. “This was a pressing issue in that large numbers of piglets were dying in a couple different states.

The practitioners associated with these cases were often phoning several times per day wanting to know if a final diagnosis had been reached so they could manage it on the farm.”

Burrough and fellow pathologist Dr. Greg Stevenson met and decided they needed to step back and look at the case more broadly. That meant examining the samples through an electron microscope (EM).

Burrough explains that the EM is one of the traditional techniques of novel virus discovery. It has been replaced to a large extent by molecular diagnostic testing methods such as the PCR. “We can run numerous PCR tests in the time it takes to do one virus isolation in cell culture and examine it through the EM. However, the EM remains a critical tool for detecting previously unrecognized viruses.”

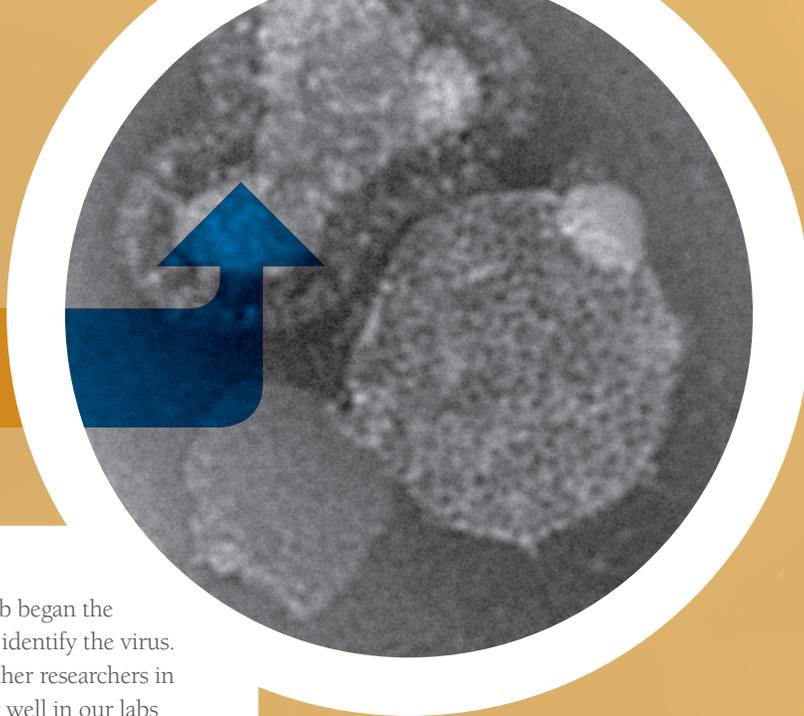
Since time was of the essence, Burrough drove to the National Animal Disease Center in Ames, Iowa, where he was able to examine some of the fecal samples through an EM. What Burrough and USDA collaborator Judy Stasko saw through the EM was definitive coronavirus particles. “That made us think TGE again and we wondered if the PCR assay wasn’t working properly or if the virus had mutated. Since we knew it was a coronavirus, we were able to come back to the VDL with more information for the virologists,” Burrough said. “Dr. Kyoung-Jin Yoon, VDL virologist, had a pan-coronavirus PCR assay to screen for all known coronaviruses. The original clinical samples were run again with that assay and came back positive for the coronavirus family.”

With those results, Yoon and his team were then able to sequence the product from the PCR and compare it to available coronavirus sequences that were published. What they sequenced was similar to the porcine epidemic diarrhea (PED) virus that was found in Europe and Asia but not known to be in the United States, until now.

By Tracy Ann Raef

VIRUS

nt



With the virus now identified, Dr. Yoon's lab began the process of customizing an available PCR to identify the virus. "There were published PCR protocols by other researchers in Europe and Asia, but they didn't work very well in our labs due to subtle differences in virus sequences between the virus strains," Burrough said. "So Dr. Yoon needed to modify the assays to get them to work with the U.S. isolates. His lab subsequently developed a serology test that wasn't available anywhere to conduct surveillance on herds." (See side bar.)

"It was very stressful not knowing what the diagnosis was initially," Dr. Sprague said. "I appreciate being able to call the pathologists and being informed at every step of the process. The collaboration was critical to help me diagnose the disease and minimize and manage its impact in the herd."

Burrough agrees that the communications among multiple VDLs, the USDA, swine industry leaders, and the American Association of Swine Veterinarians were instrumental in getting rapid and accurate information to practitioners and producers. "A week is fairly fast to do routine diagnostic testing. Within two weeks, we had identified the disease (a novel virus in the United States) at the ISU VDL, adapted a PCR to test for it a week later, and ultimately developed a new serology test for ongoing surveillance."

Next steps?

"There's been a lot of interest in the epidemiology of PED," Burrough said. "As the year goes by, we'll learn more – Is PED seasonal? Is it different from TGE in how we manage it, and how does it spread?"

"I was impressed by the commitment of everyone in the VDL," Burrough said. "There were a lot of late nights and weekends for many individuals in the lab to find answers and to develop tests for practitioners and their producer clients. It was exciting to be part of that and to be on the cutting edge."

ISU VETERINARY RESEARCHERS DEVELOP NEW PEDv TEST*

The Iowa State University Veterinary Diagnostic Laboratory has developed a new test to detect antibodies against PEDv. The new test, called an immunofluorescence antibody or indirect fluorescent antibody assay, will allow veterinarians and producers to know if a pig has ever had the disease in the past.

Dr. Kyoung-Jin Yoon, veterinary virologist at the VDL, led the effort in developing the new test. "The screening works by detecting the presence of PEDv antibodies in a blood sample. If the antibodies are present, then the pig in question has been exposed to the virus before," Yoon said.

"The test will be especially helpful to pork producers who are looking for replacement breeding stock. By performing the test, producers will know if an animal has had a past exposure to the virus before they bring the pig on the farm," Yoon said.

The screening test, available from the VDL, costs \$5.50 per sample and can be requested by veterinarians.

**Adapted from an Iowa State University news release written by Fred Love.*

PRACTICE MAKES PERFECT

In yet another impressive high-tech development, ISU veterinarians are able to print actual replicas of a patient's broken bone, profoundly changing not only the way they help animals but also the way they teach students.

By Veronica Lorson Fowler

Three-dimensional printing is one of those new technologies that for the uninitiated seems like magic.

Feed data into a computer and it transfers it into a box-like machine that “prints” in three-dimensions: a toy, a wrench, or in the case of the Iowa State University's Lloyd Veterinary Medical Center, an actual replica of a patient bone with a complicated break or deformity.

Three-dimensional printing is revolutionizing entire industries, and veterinary medicine is no exception. And Iowa State's College of Veterinary Medicine is leading the way, using up-to-the-moment technology to greatly improve the way bone problems are treated. Not only do the animals receive excellent care, but the veterinary surgeons are finding that 3-D printed bones are an ideal teaching tool.

Previously, to better examine a break or bone problem, surgeons might do a CT scan or an MRI on a patient and then feed the information into a computer. The computer would create an image of the bone or other anatomy, but it could be hard for surgeons and students

alike to decipher what they saw on the screen. “A computer screen is two-dimensional. You have to do surgery in three dimensions,” says Dr. Karl Kraus, professor and section head of small animal surgery at Iowa State University.

With a 3-D print, a surgeon or student can essentially hold the patient's bone in his or her hands for careful, life-size examination. In some ways, it's even better than trying to observe the bone in the patient because with a model there is no tissue, blood, or internal organs to block views. Also, since the bone is not attached to the patient, the model can be turned around to view from all angles.

Having a model to work from also allows surgeons and students to more easily discuss the best strategy to repair the bone. They can pass the bone around, point out and touch key areas, and easily observe it as a group.

With a 3-D printed model, they can even test surgical techniques on a bone.

The type of plastic selected for the printing process in this case is similar to bone, so surgeons and students can drill, cut, scrape, realign, and practice other techniques on the bone before actual surgery.

Veterinary medicine student Kate Napawan says being able to use a 3-D model has been a breakthrough for her. Being able to hold in your hand and manipulate an exact replica of the broken bone has been a complete game changer, she said.

Before, when Napawan was learning about a new surgical procedure, she had to rely on the models on computer screens or films. “When I'm learning from two-dimensional images, I have a hard time translating that to three-dimensional ideas. It's not until I'm working on the patient and actually see it that I fully understand,” says the fourth-year veterinary medicine student from Bettendorf, Iowa.

“Now, with a three-dimensional model, I can see what I'm working on before we go into surgery,” Napawan says. “I clearly understand what we're supposed to do.”



Napawan appreciates how she can see and feel exactly how large or small the bone and its deformities, growths, and breaks, are allowing her and the clinicians she is working with to better determine what tools and techniques should be used and line them up in advance. An exact replica of the bone also helps her test different tools to see if they're the right design and size and to determine how easily she'll be able to manipulate those tools with her hands. As a result, there is little exploration and discovery that happens in the surgical theatre. "We can do in one hour a surgery that might otherwise take several hours," says Kraus. Shorter surgery time has many benefits, most significantly lower infection rates.

Sometimes veterinary students are taught using generic, mass-produced models of spines and skeletons. But each growth, deformity, or break in each patient is different. A generic model can't show the exact problem.

For example, if a dog has a bone chip in an elbow joint, a CT scan or radiograph will show the problem. A 3-D model, however, can show more visually where



Dr. Karl Kraus, chief surgeon, discusses a surgical procedure with resident Dr. Andrew Burton. Photo: Gary Clarke

the damage has occurred and the extent of the damage. That allows for better planning for the surgery – the surgeon can then arrange in advance to have the proper tools and devices available, and even customize them, all in advance. For example, some implants can be constructed or shaped prior to surgery. They can even be sterilized before surgery, all ready to go.

Models are especially helpful with complicated bones or bones for which

there is high risk. Surgery on spines, for example, "is surprisingly hard to teach," said Kraus. "The learning curve for those types of procedures can be very steep." And risky, "One bad mistake and the patient won't walk for life."

But since the models have similar density to actual bone, students can drill, cut, and realign the bone. "They do the surgery," says Kraus. "We do the surgery first on the model and then we do it on the patient."

“In fact,” Kraus says to a visitor holding a model spine of a dog with a ruptured disk, “that thing you are holding in your hand is my patient.”

The process by which the models are created is fascinating. The 3-D print starts with an MRI or CT scan of the patient. Veterinarians then use specialty software to develop highly detailed instructions, which are then fed into a 3-D printer. There are several 3-D printers on the Iowa State University campus, but for this application, either a printer in the College of Design or the College of Engineering is used.

The printer in Engineering used the most advanced materials and has the highest resolution. An Objet260 Connex, it costs \$170,000 and is about the size and shape of a washing machine. It has a glass door that lifts up to reveal the printer head moving back and forth over the plate on which materials are constructed.

Through a glass window in the front of the printer device, you can view the printer head, moving back and forth, shooting out a small stream of liquid plastic, slowly building the bone model in minute layers from the bottom up.

Instead of inserting ink cartridges into the printer, large foil packages of liquid plastic or powders are installed into the machine. A variety of plastics can be used for printing bone models, including ABS, the plastic used for Legos®. As it works, the printer shines ultraviolet light to cure and harden the plastic. The start-to-finish printing process can take anywhere from minutes to many hours, depending on the complexity of the print.

The process is surprisingly economical, considering the cost of such printers. Each 3-D printed bone costs as little as \$40, so Kraus can print enough for an entire group of students.

Three-dimensional printers for veterinary use have become increasingly common at top veterinary medicine schools. Iowa State’s distinction in the field has come from its work in spinal surgery. Internationally recognized as a top center for spinal surgery training, the Iowa State veterinary medicine program has amassed a world-class library of clinical symptoms. “We have the catalogue of clinical cases,” Kraus says.

As a result, Iowa State is becoming a recognized top location for training courses in veterinary spinal surgery, such as the 7th International Advanced Spinal Surgery Course to be held in February at the college. “We have skilled surgeons coming from all over the world for spinal surgery courses,” Kraus says, “and the 3-D printed models are extremely useful in those courses to explain complicated bone problems.”

Veterinary students also benefit from this remarkable catalogue of clinical cases. “Iowa State offers so much more than other places,” says Napawan. “Not only in the total volume of patients they treat but also in the variety of patients.”

Napawan was able to work on one of the first cases at the hospital that used 3-D printing to plan an actual surgery. The patient was a very valuable hunting dog from Nebraska. It’s one thing to use a model to learn from generally and another to use it to execute a surgery. “It’s really exciting when there are the resources to use this on an actual patient.”

Napawan said working with the 3-D bone prints has been a fascinating experience but that it wouldn’t be as beneficial if she weren’t working alongside seasoned professionals. “Iowa State’s access to cutting-edge learning tools is so important for my education. And while I’m grateful to be able to practice using them, I’m also very appreciative to have clinicians who are current on the latest techniques and willing to teach me what they know.”



Kate Napawan ('14) and classmate Lauren Larsen discuss the patients that will be prepped for surgery that day. Photo: Heather Brewer

Dr. Jennifer Schleining, associate professor and board-certified large animal surgeon, helps fourth-year student Dillon Harvey practice drawing blood from an alpaca.



By Veronica Lorson Fowler

meet petunia

This model alpaca teaches veterinary students the tricky art of taking a blood sample from a camelid.

Back when Dr. Jennifer Schleining went to veterinary school, she never once treated an alpaca or a llama.

Today, her veterinary medicine students are likely to encounter them fairly regularly after graduation as the number of alpaca and llama breeders in the United States continues to shoot upward. The value of animals is also going up, with females suitable for breeding selling for as much as \$20,000. So it's important that veterinary students become familiar with these exotic animals' care.

But one element of their basic care – an injection – is notoriously tricky. The veins of camelids are difficult to access compared to other livestock species. Drawing of blood must occur in the jugular vein of the neck, right next to the critically important carotid artery.

Further complicating things is the fact that the vein isn't raised, the way it is in other animals. Instead, it's covered by a thick muscle layer. In addition, the jugular also may be covered by a long layer of the fleece for which these animals are famous. Small movements of the animal's head also can make an accurate injection difficult.

Since most veterinary students haven't spent much time with llamas or alpacas, they're nervous in a way they aren't with livestock they've spent more time around, such as cattle or horses. With llamas and alpacas, "Their personalities are more like cats," says Schleining, associate professor and board-certified large animal surgeon at Iowa State's College of Veterinary Medicine.

And the stakes are high. If a veterinarian doesn't know that he or she had hit the carotid artery, in some cases, a hematoma could develop, the trachea could collapse from the pressure, and the animal could die. If an anesthetic or sedative is administered into the carotid instead of the jugular, that also could be fatal.

Enter Petunia. Developed by a veterinarian with the assistance of a professor at The Ohio State University, Petunia is a fiberglass and plastic model of an alpaca. Students can press their fingers firmly upon her neck to find certain landmarks that help them find where they should insert the needle. They then draw fake blood from the model. If they're successful, the fluid is blue. If they are not, the fluid is red.

Before Petunia arrived on the scene, students learned injections on camelids with a PowerPoint presentation. But as Dr. Schleining points out, so much of veterinary medicine is learning the feel of an animal. "We have to develop eyeballs on our fingers."

Petunia also comes with a breakaway portion of her neck that has no skin to show students and allow them to feel the position of the jugular and carotid.

Once students have perfected their technique on Petunia, they can then move on to live animals with confidence.

Schleining said she's gotten excellent feedback on how realistic Petunia is. "Students have told me the only thing she doesn't do is spit." 

Virtual Surgery... a Future Reality

By Fred Love

An anatomy expert at Iowa State University is developing digital tools that could help surgical students gain nearly lifelike experience with a scalpel without having to cut into cadavers or living subjects.

Diana Peterson, PhD, an assistant professor of biomedical sciences in ISU's College of Veterinary Medicine, has high hopes for a project that could lead to realistic surgical training in a virtual world. Peterson envisions a 3-D virtual reality program that simulates both human and animal anatomy and recreates the surgical experience better than almost any existing training method short of the real thing.

"Eventually, we'd like to create a virtual surgery suite that uses virtual reality glasses and haptic gloves," Peterson said. "You'd basically go into the suite and be the surgeon."

The high-tech surgical suite would combine the virtual world with tactile

models simulating the body of an animal or human requiring surgery, she said.

The idea began to take shape two years ago while Peterson was teaching an animal anatomy class. Her background is in human anatomy, and she found that the technology used to teach students about the inner workings of the human body far outpaced what was used in veterinary classes.

"In most cases, veterinary students only have textbook-flat diagrams to help them visualize the anatomy of animals," she said. "They don't benefit from the technology that human anatomists have."

So she began working with Stephen Gilbert, assistant professor of industrial and manufacturing systems engineering, and Eliot Winer, associate professor of mechanical engineering, to create highly detailed 3-D digital diagrams using data from CT scans of animals. In addition to a human, they put together detailed representations of a beagle and a horse's leg.

Using a computer, the diagrams allow the user to isolate specific structures and systems within the body, such as bones, muscles, or blood vessels, and see how they fit together in a 3-D space.

Peterson said she's going to use the 3-D models to supplement the traditional 2-D representations in a veterinary anatomy class this fall and track how the students respond. She's begun the process of applying for grants, and, if the project attracts enough funding, she's hoping to have a virtual reality surgery suite up and running within three years.

Existing surgical training programs have utilized digital models, but Peterson said she plans to add a variety of complications to the virtual reality technology. For instance, she said existing programs focus on completing a surgical procedure the correct way. They don't allow students to make mistakes.

Peterson said she wants her program to respond realistically if a student makes a mistake. She is working to create a variety of complications that the surgical trainee would encounter during the surgery that could be either random or controlled by an instructor. The ultimate goal would be to simulate an experience as true to life as possible.

"It's one thing to know on an intellectual level how to perform surgery, but it's another to actually do it," she said. "And the program will let the students mess up and show them what happens when they make a mistake in a realistic way. I don't think this will replace dissection for teaching anatomy, but it can dramatically augment the learning curve." 



A computer rendering of a beagle composed using data collected by CT scans will help veterinary students understand the anatomy of animals.
Illustrator: Cindy Robertson

Dr. Pettit is a practitioner and partner at AMVC, where she has worked since 2001.
Photo: Jenn Williquett

Putting the Right Things First

By Margarita Landeros



Throughout her career, Dr. Jodie Pettit ('01) has met many people. Over the years, she has realized that veterinary medicine, and life itself, is all about people and the relationships that develop along the way.

"These relationships are rewarding both personally and professionally," Pettit said. To her, the connections and relationships are "worth their weight in gold."

Farm Roots

Pettit grew up on a farm near Shannon City, Iowa. She realized at a young age that she wanted to be a veterinarian with the help of her family's veterinarian.

"I knew that I wanted to be a veterinarian from the age of six," said Pettit. "Our family farm's veterinarian, Dr. John Thomson, who later became professor and dean at Iowa State University, was a wonderful role model. He made being a veterinarian look like a pretty fantastic thing to do."

One of the first veterinarians she job shadowed with was Dr. Rex Wilhelm from Stuart, Iowa. "It was a positive experience," Pettit said. "We saw everything from a cow with a vaginal prolapse to a dog with diarrhea. I was hooked. I knew that I wanted to step in and make a difference for these animals and their owners."

Her family's livestock consisted primarily of hog production. "I hated pigs at first because I associated them with a lot of long sweaty mornings with me on the

working end of a scoop shovel. When I started veterinary school, I wanted to do anything but work with pigs."

Practice and Career Growth

Despite this proclamation against pigs, Pettit began working at the Audubon-Manning Veterinary Clinic (AMVC), a predominantly swine practice after graduation. Her primary focus is now large animal medicine, where she splits her clinical time evenly between cattle, pigs, and horses.

"Private practice is very challenging and fulfilling for me," she said. "As a mixed animal practitioner, I have the luxury of doing lots of new things. I have found that swine medicine is very rewarding despite what I expected when I first started vet school," Pettit said, referencing the fact that swine diagnostic testing is focused and precise.

A positive constant in Pettit's career has been her involvement in the Iowa Veterinary Medical Association. Pettit was the 2012 IVMA president, passing the gavel to Dr. Hans Koehnke in September 2013. "Without my partners' support, I would've had a hard time fulfilling my duties as IVMA president."

Beyond Veterinary Medicine

Despite a busy practice, Pettit finds time to serve others as a member of the Timber Creek Charities Board of Directors. "I like the idea of giving back to those who need it and those who have helped me before. Simply put, it feels good to volunteer," she said.

Timber Creek Therapies is an outpatient facility where people with disabilities receive physical and speech therapy. It is unique because patients have the option to receive therapy while on horseback. Horses are used as tools for medically directed physical and cognitive therapies, as well as the recreational activity known as therapeutic riding. "I volunteer my time with the therapeutic riding program," said Pettit. "Timber Creek helps me recharge my batteries. It's a nice way to unwind."

Pettit's hobbies include riding her Harley-Davidson Street Glide motorcycle. "I bought a motorcycle and discovered it was a great way to connect with people I may have otherwise never met. One unexpected joy I discovered when I started motorcycling was a new connection with my brother. He is a mechanic and we didn't have a lot in common before. Now we hang out a lot and go riding.

Recently, Pettit has become a honeybee keeper. "I have two business partners who are beekeepers," Pettit said. "Just hearing them talking about this world that honeybees live in and all the intricate things that you have to consider while beekeeping was fascinating."

As she looks forward to other new adventures, Pettit is confident that if there is any problem that comes along, help is never too far away. 🐾

2013 STANGE AND SWITZER

AWARD RECIPIENTS

Distinguished alumni were recognized during college and university ceremonies held at Homecoming in November.

The Stange Award for Meritorious Service was presented to Drs. James Carpenter ('60), John U. Thomson ('67), and Samuel Vainisi ('57). In addition, the William P. Switzer Award in Veterinary Medicine was presented to Dr. Paul Ambrecht ('71). Each honoree was cited for his contributions to the veterinary profession.

STANGE AWARD FOR MERITORIOUS SERVICE

Dr. James Carpenter's expertise in pathology has influenced countless pathologists and veterinary clinicians throughout the United States. His experience in clinical veterinary medicine has permitted critical correlation between pathological and clinical findings to arrive at specific diagnoses in a multitude of patients.

Throughout his career, Carpenter's attention to detail and his high standards in the discipline of pathology helped provide superb training for future pathologists and clinicians. His patient teaching style and ability to capture an audience through his lectures has earned him high praise. In all, he modeled a multidisciplinary approach to diagnostic pathology.

Carpenter has held a number of academic appointments at Harvard Medical School, Tufts University, and the University of Pennsylvania. He has been a visiting lecturer at the Massachusetts Institute of Technology and the Boston Veterans Administration Hospital. The majority of his career was spent at Angell Memorial Animal Hospital in Boston where he was an intern, staff veterinarian, director of clinics, and department head of pathology.

He has authored many publications on a variety of topics in small animal medicine and pathology. He was instrumental in the initial recognition and reporting of conditions and diseases such as canine parvovirus, feline hyperthyroidism, lead poisoning, and xanthomatous keratitis in Cuban tree frogs. His greatest contribution was a section on tumors of the cat in the book *Diseases of the Cat*. His section is still widely used as a reference for veterinary oncologists and pathologists.

Iowa State University College of Veterinary Medicine professor and dean emeritus **Dr. John U. Thomson** has built a career of tireless service to the veterinary profession and society.

At Iowa State, Thomson's lasting legacy is the transformation of the college. He created new curricular programs, grew the college budget, increased the number and expertise areas of the faculty, and oversaw the renovation and construction of a centerpiece veterinary medical center.

Thomson's professional achievements, though, didn't begin at Iowa State. He was a successful mixed animal practitioner in Clearfield, Iowa, before entering academics. At South Dakota State University, he spearheaded the efforts to improve the physical infrastructure of the school's diagnostic laboratory and improved its service through innovations in database management. As dean at Mississippi State University, he restructured the college's academic units and curriculum and consolidated the three diagnostic laboratories into a state diagnostic laboratory system administered by the college. He acquired funds to construct a new diagnostic laboratory, a Center for Environmental Health Sciences, a small animal medicine and critical care unit, and an equine reproduction and research unit.

At the national level, Thomson developed the concept of creating a student loan forgiveness program for veterinarians



HONORED

HOMECOMING WEEKEND

who were willing to practice in underserved locations in the United States. He marshaled it into law in 2003 and funding in 2010.

Dr. Samuel J. Vainisi is one of the country's pioneers in veterinary ophthalmology. He was the first veterinarian to complete a comparative ophthalmology program with M.D. residents at Stanford University Medical Center. After completing the program, he established the ophthalmology program at the Animal Medical Center in New York, later returning to the Midwest to start referral clinics in Green Bay, Wis., and Chicago, Ill.

Vainisi is one of the founding fathers of the American College of Veterinary Ophthalmologists, having also served as its secretary and president. He was the first veterinarian to be admitted into the American Society of Retinal Surgeons, and his instructional video on canine retinal surgery won the prestigious film award, "Oscar," given by the society. One of his famous patients who had his retina reattached was movie star Benji.

He also is a member of the faculty at the University of Illinois in Chicago, where he is the only veterinarian to have reached the rank of full professor at the medical school. He currently consults at the university's toxicology research laboratory.

In 2010, he was awarded the Distinguished Achievement Award from the Wisconsin Veterinary Medical Association. In 2005, he received the Assisi Award by the Green Bay Humane Society and Shelter.

Vainisi continues to practice part-time in Green Bay at his ophthalmology referral center with his wife Gretchen Schmitt, who is also a veterinary ophthalmologist.

WILLIAM P. SWITZER AWARD IN VETERINARY MEDICINE

Throughout his career, **Dr. Paul Armbrecht** has had a substantial impact on the practice of swine medicine and the pork industry. He is well known for his practical and innovative recommendations on the health and welfare of his patients and has demonstrated a tremendous commitment to the well-being of Iowa pork producers and to the survival of each producer, regardless of operation size.

As a leader and participant on the Iowa Pseudorabies Advisory Committee, Armbrecht was instrumental in advancing the eradication efforts in the largest swine-producing state in the United States. He also has been committed to the recognition and prevention of the entry of a foreign animal disease into the U.S. swine herd through his participation in the American Association of Swine Veterinarians Foreign Animal Disease Committee. He was selected to attend a two-week training program at Plum Island, N.Y., earning the designation of "foreign animal disease diagnostician" by the U.S. Department of Agriculture.

In 2010, he was named a "Master of Pork Production" by *National Hog Farmer* magazine. The Iowa Pork Producers Association named him Honorary Pork Master. In 2004, his family was selected ISU Family of the Year. The veterinary profession also has recognized his efforts with the 1991 AASV Swine Practitioner of the Year Award and the 1989 Iowa Veterinary Medical Association Veterinarian of the Year. He is a lifetime member of the IVMA. 🐾

Dean Lisa K. Nolan with the 2013 Stange Award recipients (from left) Drs. James Carpenter, John U. Thomson, Samuel Vainisi, and Switzer Award recipient Dr. Paul Armbrecht.
Photo: Catherine Logue

New Non-Thesis Master's Program WELCOMES ITS FIRST CLASS

In August, 19 graduate students began a new one-year, professional, master's program at the college working toward an M.S. in biomedical sciences. In the fall semester, they took courses in comparative anatomy, physiology, cell biology, toxicology, and microbiology. During the spring semester, they will present a creative component with their faculty mentor. The program, geared toward preprofessional and industry-bound students, is now accepting applications for fall 2014. The college hopes to double the number of students in this graduate program next year. For more information, contact Sarah Adams at seadams@iastate.edu.

WELLMAN JOINS COLLEGE DEVELOPMENT TEAM

In July, Trent Wellman became the new director of development for the College of Veterinary Medicine, replacing Amy Knoll who had served as director.

Previously, Trent had served as the membership communications manager at the Iowa Cattlemen's Association for six years. In that role, he directed membership recruitment efforts, built relationships across the state with individuals in the beef cattle industry, represented the association through public relations activities and events, and worked with agricultural leaders in the state legislature.

Trent is a graduate of Iowa State. He grew up on a diverse livestock farm in southeast Iowa and now resides in Ankeny, Iowa, with his wife, Kristina, and Golden Retriever, Shaylee.

2013 Summer Scholar Research Program

Twenty-two veterinary students participated in the college's annual Summer Scholar Research Program held May–August 2013. The eight-week program offers first- and second-year veterinary students hands-on experiential learning opportunities. Students in the program work with mentors on research projects related to veterinary, animal, and human health. Additionally, students gain an appreciation for research and develop skills in planning and completing a research project.

At the conclusion of the program, the students participate in the college's Research Day during a poster session where they present their projects. At the conclusion of the poster session, a luncheon is held at which time the Zoetis Award for Veterinary Research Excellence is presented. This year's recipient was Dr. Jeff Zimmerman ('84), professor of disease ecology in the Department of Veterinary Diagnostic and Production Animal Medicine. The award is given in recognition of outstanding research effort and productivity. Each college selects a researcher who then will be eligible for the national Veterinary Research Excellence award.

LET US KNOW WHAT YOU THINK

We're committed to providing a high-quality magazine with interesting and useful information about Iowa State University's College of Veterinary Medicine. As part of that process, we'd appreciate your feedback. Please take a few minutes to complete the online survey at <http://vetmed.iastate.edu/about/publications>. And, as always, feel free to contact Tracy Ann Raef, editor, with suggestions, comments, and story ideas.

HIXSON-LIED SMALL ANIMAL HOSPITAL EARNS GOLD CERTIFICATION

The renovation and construction that produced a state-of-the-art small animal hospital at the College of Veterinary Medicine earned LEED® Gold certification, the second highest level in the green building rating system.

LEED (Leadership in Energy and Environmental Design) was introduced by the U.S. Green Building Council in 1998 to measure environmentally sensitive building design, construction, operations, and maintenance.

“We are certainly proud to be awarded the LEED® Gold certification,” said Dr. Lisa Nolan, the Dr. Stephen G. Juelsgaard Dean of Veterinary Medicine. “It was our vision to design a hospital to better serve our clients and patients while reducing the hospital’s environmental footprint. The result is one of the most advanced veterinary teaching hospitals in the world and one that both conserves environmental resources and enhances our ability to provide exceptional care to our patients and to train future veterinarians. Truly a win-win for the citizens of Iowa.”

CLASS OF 2017 PROFILE

Gender: Male 24% | Female 76% **Age:** Average 24 yrs. | Range 20–45 yrs. **Degrees:** No Degree 12 | Bachelor’s 127 | Master’s 11 **Cum. GPA:** Mean 3.54

One hundred and fifty students began classes at the college in fall of 2013. The class enrollment includes 26 Nebraska-resident students who are enrolled in the Formal Educational Alliance with the University of Nebraska–Lincoln.

Awards & Honors

Dr. Melissa Beyer ('06) received the 2013 Rising Star Award from the Iowa Veterinary Medical Association.

Dr. Gayle Brown (III, '86), assistant director of the college’s Center for Food Security and Public Health, has been selected as the college’s 2013 Pfizer/Zoetis Distinguished Teaching Award recipient. Each veterinary college chooses a recipient who, in turn, can compete for the national teaching award.

Dr. Beth Carlson ('01) was the recipient of the 2013 Veterinarian of the Year Award from the North Dakota VMA.

Dr. Lawrence Evans ('63) received the 2013 Veterinarian of the Year Award from the Iowa VMA. He recently retired from the college where he was the head of the theriogenology section of the Lloyd Veterinary Medical Center.

Dr. John Greve (MSU '58) emeritus faculty at Iowa State, and **Dr. Kent Schwartz** ('78), veterinary diagnostician at Iowa State, both received the 2013 Outstanding Service Awards from the Veterinary Medical Alumni Association at Iowa State University.

Ms. Marianna Jahnke, embryologist at Iowa State’s College of Veterinary Medicine, received the 2013 Healthcare Team Member Service Award from the Iowa VMA.

Dr. Ron Kelpe ('84) was installed as president of the California Veterinary Medical Association in July 2013.

Dr. Hans Koehnk ('00) was sworn in as president of the Iowa VMA in September 2013.

Dr. Dustin Oedekoven ('02) was presented with the 2013 Emerging Leader Award from the South Dakota VMA.

Dr. Jack Johnson ('70) is the 2013 recipient of the Iowa Hereford Breeders Association’s Hall of Fame Award.

Dr. Anumantha Kanthasamy, distinguished professor and the Dr. Eugene and Linda Lloyd Chair of Neurotoxicology in the college’s Department of Biomedical Sciences, was elected president of the Neurotoxicology Specialty Section of the Society of Toxicology.

Dr. Jennifer Schleining ('01) was elected vice president of the Iowa VMA in September 2013.

Dr. Dave Schmitt ('73) was the 2013 recipient of the Iowa VMA’s President’s Award.

Dr. David Starling ('75) lecturer in the college’s Department of Biomedical Sciences, was appointed to the AVMA’s Clinical Practitioners Advisory Committee, representing Aquaculture and Seafood Medicine. His term will expire August 2016.

Dr. Ben Wileman ('05) received the 2013 James A Jarrett Award for Young Leaders from the American Association of Bovine Practitioners.



The CVM Iowa State Fair team posed with ISU President Steven Leath who visited them during his trip to the fair. From left: Dr. Tyler Dohlman, Zane Gray, Cory Haglund, President Steven Leath, Dr. Bruce Leuschen, Cara Haden, and Aubrey Cordray.

CVM at the State Fair

Dr. Bruce Leuschen, senior clinician in the Department of Veterinary Diagnostic and Production Animal Medicine at Iowa State, once again served as the veterinarian for the 2013 Iowa State Fair. He and his assistant veterinarians, along with several veterinary students, were responsible for the health of

the thousands of animals being exhibited, as well as those participating in special events. "We're at the fair 24/7," Dr. Leuschen said. "For us, like the state fair theme says, 'Nothing Compares.' We are privileged to serve the people of Iowa in this role."