

On Call



School of
Veterinary Medicine
UNIVERSITY OF WISCONSIN-MADISON

A NEWSLETTER FOR FRIENDS OF THE UNIVERSITY OF WISCONSIN-MADISON SCHOOL OF VETERINARY MEDICINE

WHAT'S INSIDE?



Building a Better Flu Shot

New method could create a more precise influenza vaccine



One Tough Feline

SVM surgeon, students fix a resilient shelter cat's rare defect

Student Hub

Renk family, alumni, and other donors make new learning center a reality

Dog Flu in Cats

SVM and WVDL team up for tests that find felines infected with canine influenza



People-focused Veterinarian

Alumna helps dairy farmers prosper through work as UW-Extension agriculture agent

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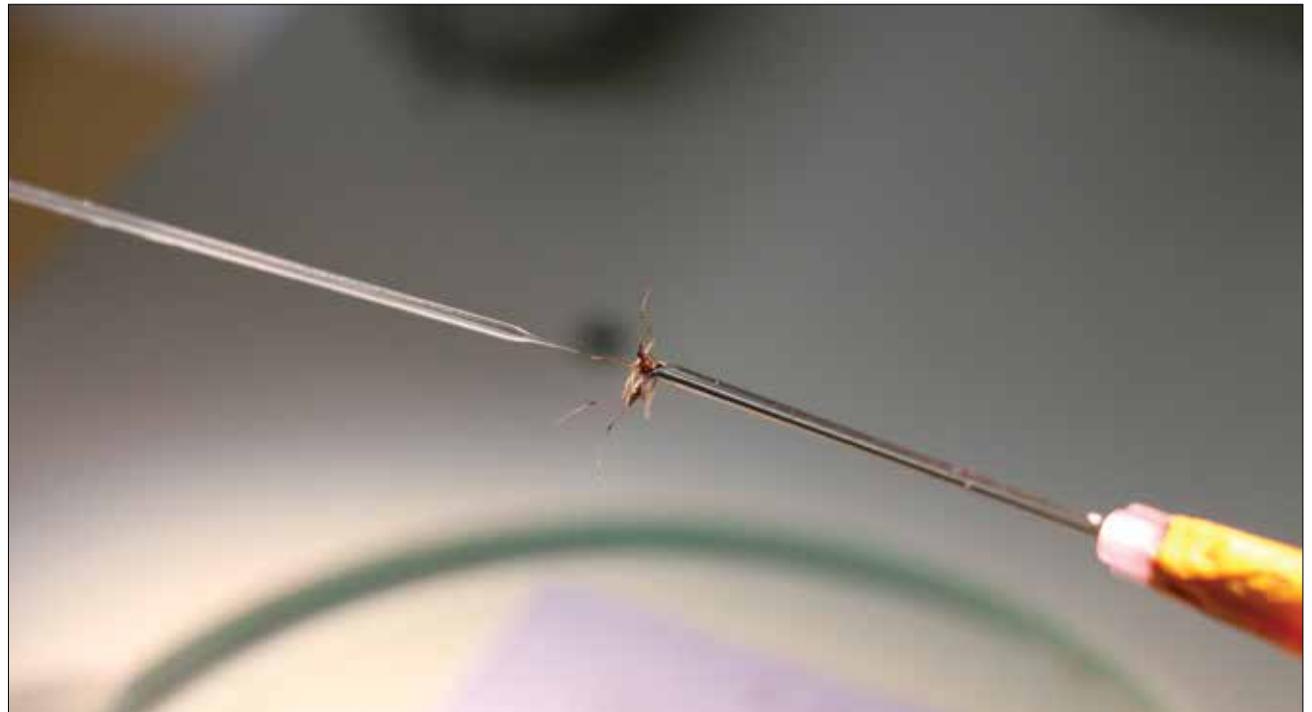


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Scientists Enhance Zika Research with New Model



NICK HAWKINS

A needle saddle with a light suction, or vacuum (right), is used to hold an aedes aegypti mosquito—a key insect involved in the transmission of Zika, dengue, chikungunya, and yellow fever viruses—in the Mosquito Research Lab at the UW School of Veterinary Medicine's Robert P. Hanson Biomedical Sciences Laboratories. The apparatus secures the insect so compounds can be injected into its body using a glass capillary needle (left).

Researchers at the UW School of Veterinary Medicine (SVM) have developed one of the first mouse models for the study of Zika virus. The model will allow scientists to better understand how the virus causes disease and aid in the development of antiviral compounds and vaccines.

"The tools have not been available to people who want to be able to test vaccines and antivirals against Zika virus," says Matthew Aliota PhD '10, assistant scientist at the SVM and lead author of the study that describes the model, published April 19 in the journal *PLOS Neglected Tropical Diseases*. "The caveat is that it's a mouse model, but it does allow us to test vaccines, and the pathology

caused by the virus in the mouse brain could be used to understand the pathology in the brains of humans, especially fetuses."

Zika virus was first described in Uganda in 1947. Before last year, it had circulated in people in Africa, southeast Asia, and the Pacific Islands and only sporadically caused disease. The virus is transmitted by mosquitoes and typically causes mild, flu-like symptoms when it causes symptoms at all.

However, in 2015 the virus began infecting unprecedented numbers of people in Brazil and then spread throughout the Americas. Public health officials in the United States expect it to spread to the southern U.S. this summer as the activity of the *Aedes aegypti* mosquito—the

species that harbors the virus—increases due to the warmer weather.

In early April 2016, the Centers for Disease Control and Prevention (CDC) confirmed Zika virus is responsible for a large rise in brain defects in developing fetuses, including microcephaly. In fact, cases of microcephaly—marked by a small head, reduced brain size, and cognitive impairments—were 20 times higher than usual in parts of Brazil last year. There has been some evidence of neurological effects in adults as well.

Researchers now also know the disease can spread through sexual contact.

"It's scary to know so little about something that can be so devastating," says Katrina Larkin, *continued on page 9*



NIK HAWKINS

K9 Odin sports his new bullet- and knife-proof vest alongside his partner, Sgt. Brent Plisch.

SVM Helps Fund Protective Vest for Campus K9

Each year, police dogs suffer stab or gunshot wounds in the line of duty, yet many law enforcement agencies do not have the additional funds necessary to purchase canine body armor.

But thanks to support from faculty, staff, students, and friends of the UW School of Veterinary Medicine (SVM), one more campus police dog is fighting crime with the added shield of a new bullet- and knife-proof vest.

The SVM holds monthly fund drives for different local charities, most of them helping animals. In February 2016, the school collected donations to purchase a vest for Odin, an 8-year-old German Shepherd who serves as a K9 with the UW–Madison Police Department (UWPD) and is also a UW Veterinary Care patient.

Read more at go.wisc.edu/k9-odin.

A MESSAGE FROM THE DEAN

All Things Great and Greater

The UW School of Veterinary Medicine continues to lead in all that it does, whether it's creating exceptional learning spaces like the school's new Renk Learning Center and its improved clinical skills laboratory, breaking new ground in Zika virus studies, or being recognized internationally for influenza research.

We have been calling for the removal of the non-functional solar panels on the Veterinary Medicine Building's south side for decades, and this spring we finally began to do just that. This is the first step in a major remodeling project that will include the creation of an active integrated learning space, an expanded clinical skills laboratory, an additional counseling office, a meditation room, dedicated study spaces, and more. The entire south facing wall of this new student learning center will be glass, bringing much-needed light into our second floor.

As highlighted in this issue, much of this project is made possible by generous gifts from friends and alumni of the school, and we are grateful for their support. Construction should be



BRUCE RICHTER

Mark D. Markel

completed by mid-December of 2016. We all look forward to the expanded opportunities we will be able to provide our students beginning next calendar year.

As you will also see in this issue, the school continues to lead the UW-Madison campus and the nation in infectious disease research. The Zika virus outbreak in Brazil, which has now expanded throughout South and Central America, the Caribbean, Mexico, and likely the southern United States, is at the forefront of international interest, particularly because of the Rio Olympic Games this summer.

Our scientists are global leaders in studying the impact and

spread of Zika virus. Many of the articles you have read about Zika highlight the research that is being conducted either on the UW-Madison campus or, more specifically, at the SVM—research that is designed to understand and hopefully create a vaccine for this pandemic outbreak.

In addition, this summer we once again see the impressive contributions that Yoshihiro Kawaoka has made in the field of influenza research, particularly in the development of synthetic influenza viruses using a technology known as reverse genetics (see p.6 for more about his work). Dr. Kawaoka has been selected for the Japan Academy Award, presented this summer at the 106th annual awards ceremony in the presence of Their Majesties, the Emperor and Empress of Japan. Congratulations Yoshi on this extremely prestigious honor!

I hope everyone has an enjoyable summer, and please feel free to visit whenever you are near the UW-Madison campus or the SVM.

Awards and Honors

Faculty and Staff

JAPAN ACADEMY AWARD

Yoshihiro Kawaoka, professor, Department of Pathobiological Sciences

UNIVERSITY STAFF RECOGNITION AWARD

Karen Mier, facilities manager

EDWARD ALEXANDER BOUCHET GRADUATE HONOR SOCIETY 2015–16 SCHOLAR

Yashdeep Phanse, postdoctoral researcher

Students

SOCIETY OF TOXICOLOGIC PATHOLOGY (STP) STUDENT POSTER AWARD

Lydia Ansen-Wilson, Class of 2018 and master's student in the Comparative Biomedical Sciences graduate program

AMERICAN ASSOCIATION OF AVIAN PATHOLOGISTS (AAAP) FOUNDATION POULTRY SCHOLARSHIP

Maria K. Arendt, DVM/PhD student

MERCK ANIMAL HEALTH VETERINARY STUDENT SCHOLARSHIP PROGRAM

Claire LeFevre, Class of 2017

2016 ZOETIS VETERINARY STUDENT SCHOLARSHIP

Jason Kroll, **Kyle Ruedinger**, and **Brandon Scharping** (Class of 2017), and **Sarah Appleby**, **Lucas Budden**, **Amanda Craven**, **Melissa Hayes**, **Holly Hovanec**, and **Miranda Torkelson** (Class of 2018)

Read more about these awards at go.wisc.edu/svm-awards-honors.

New Faculty and Staff



Tatiana Ferreira, DVM, MSc, PhD, has joined the Department of Surgical Sciences (DSS) as a clinical assistant professor in anesthesiology. Previously, she

served as a clinical instructor in DSS. Ferreira earned her veterinary medical degree from the Fluminense Federal University in Rio de Janeiro, Brazil, and obtained her master's and doctoral degrees at São Paulo State University in Brazil. She completed an anesthesia residency at the University of California, Davis and became board certified by the American College of Veterinary Anesthesia and Analgesia. Her clinical interests include balanced anesthesia and pain management of small, large, and exotic animals with special focus on regional anesthesia techniques.



Jessica Pritchard, VMD, has joined the Department of Medical Sciences as a clinical instructor of small animal internal medicine. She earned

her veterinary medical degree from the University of Pennsylvania. She then completed a small animal rotating internship, followed by a small animal internal medicine residency at North Carolina State University. Pritchard's clinical interests include infectious and immune-mediated diseases in dogs and cats. She is a diplomate of the American College of Veterinary Internal Medicine.

Surgeon, Students Repair Unusual Defect to Make Cat's Adoption Possible

Wrapped in a coat of white fur with a black patch like a bandit's mask, Maeve is a sweet, slender, one-year-old domestic shorthair. And she's also tough as nails.

She proved it back in January when she birthed a litter of kittens on the cold, snowy streets of Milwaukee. And she did it while enduring the complications of a congenital defect, one that could have easily cut her life short without help from the UW School of Veterinary Medicine (SVM).

Along with her four brand new kittens, Maeve was brought to the Milwaukee Area Domestic Animal Control Commission (MADACC) where observant staff discovered a large gap in the muscle wall near her belly button. This condition, called an umbilical hernia, can be painful and potentially dangerous if left untreated, but it didn't appear to be life threatening in Maeve's case. So MADACC settled her into a foster home, and after her litter was weaned, they brought her to the SVM for spay surgery and a hernia repair.

Kendra Hayden was assigned to Maeve as part of the school's junior surgery program, where third-year students team up with faculty to conduct spay and neuter procedures for dogs and cats from area shelters. When Maeve was shaved during a pre-surgery examination, Hayden noticed something quite startling—each beat of her little heart could be seen pulsing through the skin that stretched over her chest.

"We weren't expecting that at all," says Hayden, a member of the Class of 2017. "We thought she had an umbilical hernia but nothing more significant than that."

To find out exactly what might be troubling Maeve, Hayden turned to Dr. Sara Colopy, clinical instructor of small animal surgery at the SVM and Class of 2004 alumna. Following a physical



Maeve, a one-year-old shelter cat, endured a major birth defect while birthing and weaning her kittens in January 2016. After a SVM surgeon and several students repaired Maeve's potentially life-threatening defect, a UW Veterinary Care veterinary technician adopted her.

examination, Colopy suspected Maeve's umbilical hernia was actually a more extensive midline abdominal hernia that expanded into her chest through a cleft in her sternum. X-rays confirmed a diagnosis of an incomplete sternal cleft, a birth defect caused by the failure of her breastbone to fuse during development.

"Her sternum has a wishbone shape, and her heart and liver were sitting in the middle of the cleft covered only by skin," says Colopy. "Normally, these organs are protected by bone and muscle."

Fortunately, the X-rays also showed that Maeve's abdominal contents had not herniated into her chest. And an echocardiogram (heart ultrasound), performed by Dr. Rebecca Stepien, Class of 1987, and Dr. Sonja Tjostheim in the UW Veterinary Care (UWVC) Cardiology Service, revealed that she had no congenital heart defects. In other words, hernia aside, Maeve was a healthy feline and a good candidate for surgery—her only option for a normal cat life.

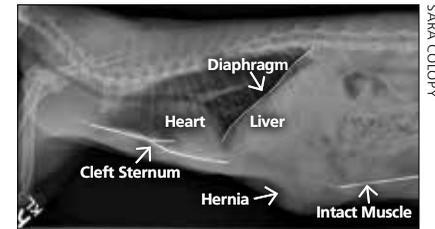
"Before taking on something like this in a shelter animal, I always ask myself if there's potential for a 100 percent cure so

the animal can be adopted, and if we can ensure 24-hour care after the surgery because shelters often don't have the resources for this," says Colopy.

In Maeve's case, the answer to both questions was yes. Maeve would be housed in UWVC's Critical Care Unit after the operation, and the school's Students, Pets, and You (SPAY) Fund would cover the costs of her care. And for the operation itself, Colopy devised a procedure that had an excellent chance of permanently fixing Maeve's defect. But it had the potential to be a complicated, multi-step surgery.

"Most hernias are umbilical, and they can be quite large," says Colopy. "But a cleft sternum is rare." In fact, Colopy found only one published case report of a feline sternal cleft, so the surgery team found itself in somewhat uncharted territory.

Hayden began Maeve's treatment by conducting the spay procedure with the help of Colopy and junior surgery teammates Stephanie Winske, who administered anesthesia, and Erik Olson. Although the spay went very well, Colopy found another



Top: An X-ray of Maeve's birth defect. Bottom: Maeve in the Critical Care Unit after her recovery with certified veterinary technician Pam Yessa and small animal surgeon Sara Colopy.

defect during the procedure called a urachal diverticulum. Maeve's urachus, a small tube that empties urine into the umbilical cord during in utero development, had only partially shut down after she was born, leaving a vestigial tube extending from the bladder. This dead-end vessel is prone to infection, so Colopy removed it.

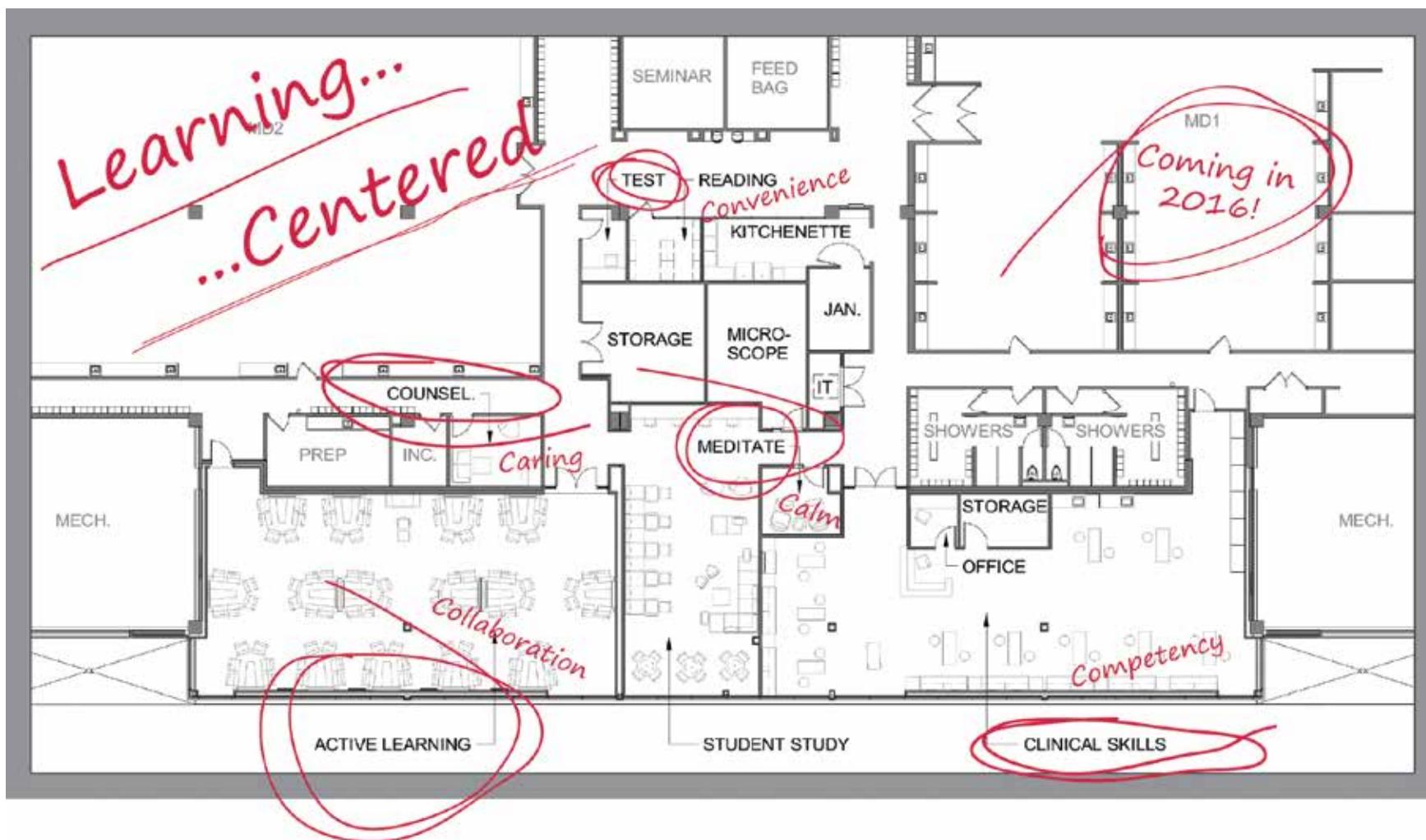
The students then settled in for a unique learning experience while Colopy extended the spay incision to the area of Maeve's hernia to expose her heart and liver. She found that the pericardium—the sack that protects and lubricates the heart—was open and fused to the sternum, tethering the heart close to the hernia. She cut the attachment, allowing the heart to drop down to a normal, safer location in the chest.

Next, Colopy attached Maeve's diaphragm to her chest wall (the defect prevented a normal sternum attachment) to keep the abdominal organs from herniating into her chest. Last, Colopy used delicate incisions to release abdominal and chest muscles from the ribs surrounding the hernia and shifted them over the heart and liver.

continued on page 11

Renk Gift, Alumni, and Friends Help Fund New Student Learning Center

NIK HAWKINS



In the 33 years since the construction of the Veterinary Medicine Building, educational research has unveiled countless ways to improve teaching and learning. And faculty at the UW School of Veterinary Medicine (SVM) have been quick to embrace these modern methods, from adopting active learning exercises, case-based activities, and flipped classrooms to incorporating hands-on clinical experiences into earlier stages of the curriculum.

But only so much can be achieved within the confines of decades-old construction. Fortunately, some of the walls standing in the way of further curricular innovation at the SVM are coming down. Literally.

Thanks to a major gift from two UW alumni, the late Walter and Martha Renk, donations from SVM alumni and friends, and a significant contribution

from the UW-Madison campus, a major portion of the Veterinary Medicine Building's second floor is being gutted and transformed into a student-focused hub dedicated to the latest in teaching and learning.

The extensive remodeling project will repurpose underutilized storage rooms and renovate limited study areas to clear the way for much-needed improvements. This includes an expanded Clinical Skills Training Center for practicing core veterinary medical skills, such as suturing and intubation; an active learning area for team-based problem-solving and case studies; an additional counseling office and meditation room for wellness and mental health support; dedicated study and testing spaces; and much more.

"As we discover more about what's best for veterinary medical students from a teaching and

A major gift from UW alumni Walter and Martha Renk, and significant contributions from SVM alumni and friends of the school, have funded the construction of a new learning center to better serve the needs of veterinary medical students. Construction of the Renk Learning Center began in May 2016.

learning standpoint, and in terms of how we provide additional academic and support services, we find ourselves needing to rethink, adapt, and expand our methods," says Lynn Maki, associate dean for student academic affairs. "This new center will help us continue to evolve in how we teach and serve our future veterinarians."

The project also involves tearing down the bank of non-functional solar panels on the building's south side and installing floor-to-ceiling glass to shed some welcome light on students' activities. Demolition and construction



kicked off in May 2016. The new space will be called the Renk Learning Center in recognition of the Renks' contribution of the largest gift for the project.

"This will be a major boon for our students, and it will have a clear and lasting impact on their educational experience here," says

continued on page 11

Dual DVM/PhD Program Meets Student, Research Workforce Demand

Trained veterinarians have unique expertise that can help them excel in designing and conducting studies in the biomedical sciences. This includes in-depth understanding of animal models and recognizing how research findings may apply in actual clinical situations. But a 2014 report by the National Institutes of Health (NIH) suggests that this expertise is not being utilized to its fullest extent.

The study took a close look at the individuals serving as principal investigators for NIH-funded research grants and found a distinct lack of veterinary medical clinician-scientists, or those holding either a DVM or both a DVM and PhD. Concerned that biomedical research may suffer without a more diverse range of experiences among lead scientists, the NIH issued a call to increase the number of graduates with both veterinary medical and PhD training.

In response to this appeal, as well as demand from students, the UW School of Veterinary Medicine (SVM) has launched the Dual DVM/PhD Training Program. The new, formalized program broadens opportunities for research and equips veterinary medical students with the skills necessary to advance the study of animal and human health.

“This is a formal, combined program to recruit students who want to both attend veterinary medical school and go into research,” says Dale Bjorling, associate dean for research and graduate training. “The program encourages students to think and read more critically and strengthens their skills as problem-solvers.”

The opportunity for combined DVM/PhD study has existed at the SVM for many years, but in the past it was managed through a less structured process. Students already admitted to the DVM program would indicate a desire to pursue a PhD at any stage in their



Katherine Luethcke, a student in the SVM's new Dual DVM/PhD Training Program, works on a research project exploring how genetics and exposure to environmental toxins affect bladder cancer risk in dogs in the lab of Lauren Trepanier, professor of internal medicine, at the Veterinary Medicine Building.

program and then work with a faculty mentor to plot out a course to both degrees.

With the creation of a formal dual degree program, students know their path from the beginning. It incorporates PhD study into the DVM curriculum and makes the steps to those degrees clearer and more efficient. Following two initial years of DVM training, students enter four years of PhD training, and they defend their dissertation before completing their two final years of the DVM program.

Bjorling emphasizes that the program is still highly tailored to the interests of individual students and prepares them for a

wide variety of careers. Past DVM/PhD graduates have gone on to positions in regulatory agencies, such as the Food and Drug Administration and the Centers for Disease Control and Prevention; faculty positions at top-tier universities; and research and administrative jobs in industry.

“A PhD should prepare a student to pursue problems that interest them, provide them with flexibility, and equip them to examine a wide variety of relevant problems,” says Bjorling. “The combination of the DVM and PhD degrees significantly increases the career options available to students completing these degrees.”

It was the flexibility of the

combined degree that led current DVM/PhD student Katherine Luethcke to enroll after receiving her bachelor of science in biology at the University of Texas at Austin. Luethcke has completed her two initial years of the DVM program and is now in the first year of her PhD training. Among the many benefits of the program, Luethcke cites the opportunity for students to fully immerse themselves in research and to utilize their veterinary medical knowledge in real time.

“You can take four years to get to know yourself as a scientist,” says Luethcke. “There’s this sense of engagement and excitement that you get when you’re investigating things that really intrigue you.”

Luethcke’s current research focuses on how genetics and exposure to environmental toxins affect bladder cancer risk in dogs. Working under the direction of Lauren Trepanier, professor of internal medicine at the SVM, she and her research team hope to better identify susceptible populations and to gauge how closely cancer in dogs parallels cancer in humans who are exposed to the same toxins. Their ultimate aim is to improve effective measures of preventative care for cancer in dogs and humans.

The project fits well with Luethcke’s career plans. After earning her degrees, she hopes to pursue clinical veterinary oncology. But the DVM/PhD program will leave a number of other doors open for her as well.

For now, Luethcke is part of a select group. The dual degree program is highly competitive, admitting only one student per year. But for those students, it provides opportunities to explore both research and clinical practice, and fosters their development as skilled researchers with the knowledge and experience they need to be effective in the field.

*AnnaKathryn Kruger
and Nik Hawkins*

Comparatively Speaking

New Strategy Could Yield More Precise Seasonal Flu Vaccine

During the 2014–15 flu season, the poor match between the virus used to make the world’s vaccine stocks and the circulating seasonal virus yielded a vaccine that was less than 20 percent effective.

While this year’s vaccine was a much better match to the circulating seasonal strains of influenza, the shifty nature of the virus and the need to pick the viruses used to make global vaccine stocks well before the onset of the flu season can make vaccine strain selection a shot in the dark.

That process—dependent on the careful selection of circulating virus strains and the identification of mutations in the part of the virus that recognizes host cells—could soon be augmented by a new approach. It would more precisely forecast the naturally occurring mutations that help seasonal flu virus dodge the vaccine.

Writing in the journal *Nature Microbiology* in late May 2016, a team of researchers led by UW School of Veterinary Medicine (SVM) virologist Yoshihiro Kawaoka describes a novel strategy to predict the antigenic evolution of circulating influenza viruses and give science the ability to more precisely anticipate seasonal flu strains. It would foster a closer match for the so-called “vaccine viruses” used to create the world’s vaccine supply.

The approach Kawaoka and his colleagues used involved techniques commonly employed in virology for the past 30 years and enabled his group to assemble the 2014 flu virus before the onset of the outbreak. “This is the first demonstration that one can accurately anticipate in the lab future seasonal influenza strains,” explains Kawaoka, a professor in the SVM’s Department of



BRUCE RICHTER

A nursing student fills a syringe with a dosage of H1N1 influenza vaccination during a H1N1 FlashVax clinic held at the Southeast Recreational Facility (SERF) on the UW–Madison campus.

Pathobiological Sciences who also holds a faculty appointment at the University of Tokyo. “We can identify the mutations that will occur in nature and make those viruses available at the time of vaccine (virus) candidate selection.”

Influenza depends on its ability to co-opt the cells of its host to replicate and spread. To gain access to host cells, the virus uses a surface protein known as hemagglutinin, which, like a key to a lock, opens the cell to infection. Vaccines prevent infection by priming the immune system to create antibodies that effectively block the lock, prompting the virus to reengineer the hemagglutinin key through chance mutation.

“Influenza viruses randomly mutate,” notes Kawaoka. “The only way the virus can continue to circulate in humans is by (accumulating) mutations in the hemagglutinin.”

To get ahead of the constant pace of mutations in circulating

flu viruses, Kawaoka’s group assembled libraries of human H1N1 and H3N2 viruses from clinical isolates that possessed various natural, random mutations in the hemagglutinin protein. The viruses were then mixed with antibodies to weed out only those that had accumulated enough mutations to evade the antibody. Because the sources of the viruses were known, the patterns of mutation could be mapped using “antigenic cartography.”

The mapping, says Kawaoka, identifies clusters of viruses featuring novel mutations, which, according to the new study, can effectively predict the molecular characteristics of the next seasonal influenza virus. Such a prediction, says Kawaoka, could then be used to more effectively develop the vaccine virus stockpiles the world needs each flu season.

Each year the World Health Organization (WHO), comparing genetic sequence and antigenic



JEFF MILLER

Yoshihiro Kawaoka

data, makes recommendations about which circulating strains of influenza will make the best matching vaccine. The method described by Kawaoka and his colleagues is conceptually different in that it mimics the mutations that occur in nature and accelerates their accumulation in the critical hemagglutinin protein.

“Our method may therefore improve the current WHO influenza vaccine selection process,” Kawaoka and his group conclude in the *Nature Microbiology* report. “These in vitro selection studies are highly predictive of the antigenic evolution of H1N1 and H3N2 viruses in human populations.”

The study was supported by grants from the Bill & Melinda Gates Foundation, the National Institute of Allergy and Infectious Diseases, the Japan Science and Technology Agency, the Japan Initiative for Global Research Network on Infectious Diseases, and others. This research was also supported in part by a grant from the National Institute of Allergy and Infectious Diseases (NIAID) Public Health Service Research Grant and NIAID Contract HHSN266200700010C.

Terry Devitt

Recent Research Grants for CBMS Faculty Trainers

Golos, Research Teams Earn NIH Grants for Studies on Advanced Imaging, Stem Cell Therapies



Ted Golos, professor of veterinary reproductive sciences and chair of the Department of Comparative Biosciences, is part of two interdisciplinary

UW–Madison research teams that have received nearly \$5 million in research grants from the National Institutes of Health (NIH) for studies aimed at improving human and animal health.

One study, funded by a nearly \$3 million grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, will investigate the safety and effectiveness of using advanced magnetic resonance imaging (MRI) of the uterus to measure placental function in pregnant macaque monkeys and, eventually, humans. Their goal is to determine whether MRI is better than currently used technologies at detecting placental conditions—such as inflammation or changes in oxygen levels—that commonly precede the development of harmful pregnancy complications like preeclampsia and fetal growth restriction. Golos is serving as lead investigator for the nonhuman primate arm of the study; principal investigators for the overall project are Dinesh Shah and Oliver Wieben from the UW School of Medicine and Public Health (SMPH).

A second study, funded by nearly \$2 million from the NIH Office of Research Infrastructure Programs, will develop an animal model for evaluating the effectiveness of AIDS virus therapies that involve the transplantation of genetically modified hematopoietic stem cells—the cells found in red bone marrow that give rise to all other blood cells. The animal model also has potential applications for studying the effectiveness of West Nile virus vaccines and therapies for other infections. Golos is serving as principal investigator for the project along with Igor Slukvin from the SMPH.

Suresh Secures Two NIH Grants to Explore How Combination Adjuvants Improve Vaccines



M. Suresh, professor of immunology in the Department of Pathobiological Sciences, was allotted two grants totaling more than \$2.3 million

by the National Institute of Allergy and Infectious Diseases (NIAID), a division of the National Institutes of Health (NIH), to investigate the effectiveness of combination vaccine adjuvants.

Adjuvants are substances, such as inorganic alum or bacterial products, designed to improve the effectiveness of vaccines, as well as their lifespan, and stimulate and enhance immune response, effectively eliminating the need for boosters. Current adjuvants primarily induce antibodies, which are proteins that identify and neutralize viruses, bacteria, and other pathogens. But they fail to induce potent T-cell (white blood cell) memory, which is critical for protecting against diseases such as AIDS, malaria, and tuberculosis. In addition, relatively little is understood about the molecular mechanisms behind adjuvants or how these substances work in combination.

However, new research is exploring the way adjuvants interact with one another and with the body's immune system, as well as how they induce potent and durable T-cell memory. Suresh's studies will examine two areas: 1) the mechanisms and effectiveness of novel adjuvants in stimulating immune response and prolonging immunity, and 2) the molecular mechanisms that regulate how well memory CD8 T cells (cells that have previously encountered and responded to a pathogen) protect against virally induced disease. According to the NIAID, researchers like Suresh will help speed the development and improvement of vaccines for infectious diseases such as AIDS and tuberculosis.

Duncan Awarded National MS Society Grant for Study of Myelin Regeneration



Ian Duncan, professor of neurology in the Department of Medical Sciences, has been awarded a nearly \$700,000 grant from the National Multiple

Sclerosis Society to support his research on myelin regeneration and prevention of nerve loss in multiple sclerosis (MS) and other demyelinating disorders.

Duncan's study delves into the damage and repair of myelin, a conductive coating that forms around nerve fibers in the brain and spinal cord and promotes nerve signaling. In cases of MS, this coating often erodes, leading to the loss of myelin and axons (nerve fibers), which results in neurologic dysfunction.

Duncan and his research team hope to induce regeneration of myelin in an animal model and to visualize changes that occur non-invasively through the use of magnetic resonance imaging (MRI) technology. Collaborating with Aaron Field, professor in the UW School of Medicine and Public Health, their objective is to gain a better understanding of how myelin repair occurs and how it may be stimulated.

Talaat Receives USDA Funding for Nanotech Vaccine Project



Adel Talaat, professor of immunology in the Department of Pathobiological Sciences, has received a \$476,000 grant from the United States

Department of Agriculture (USDA) to support his research on the use of nanotechnology in animal vaccines.

Poultry is a \$44.1 billion industry in the United States, and its success hinges on the control of viral and bacterial infections in flocks. Talaat's project will develop new nanovaccines and evaluate their safety and effectiveness in controlling poultry infections in comparison to that of current commercially available vaccines. His primary goal is to develop

platform technology—a standardized process that reduces costs and speeds up production—suitable for developing effective nanovaccines that can combat emerging viruses in poultry.

Talaat's research team also includes Balaji Narasimhan of Iowa State University and Mark Cook, professor of animal science at UW–Madison. The project was funded by the USDA's Agriculture and Food Research Initiative.

Arendt Awarded Komen Grant for Breast Cancer Study



Lisa Arendt, assistant professor in the Department of Comparative Biosciences, has earned a three-year, \$450,000 grant from the Susan

G. Komen Foundation for her study of the role of macrophages, a type of white blood cell, in promoting aggressive tumor growth in obese women with breast cancer.

Obesity is one of the most important risk factors for postmenopausal women in the development of breast cancer. Arendt and her team will examine how macrophages, when activated by obese fat, prompt changes in breast cells that make them more prone to develop tumors and to grow tumors more quickly. Specifically, the study aims to identify the particular macrophage-produced cytokines—small proteins that play an important role in cell signaling—that increase the number of aggressive and treatment-resistant tumor cells and also promote an environment that enhances tumor development.

This research could point toward new treatments for breast cancer in obese women. Because cytokines have already been investigated for the treatment of other diseases, such as rheumatoid arthritis, there are already clinically safe and efficient drugs on the market, or in development, that could be used in combination with existing therapies to significantly decrease breast cancer mortality rates in obese women within the next decade.

Compiled by AnnaKathryn Kruger and Nik Hawkins



BRUCE RICHTER

Owners Clarence (right) and Kelly wait with their dogs Ike (left) and Tina to see the vet at a Wisconsin Companion Animal Resources, Education, and Social Services (WisCARES) clinic in Madison.

SVM's WisCARES, Mosquito Tracking Program Earn Baldwin Grants

Two UW School of Veterinary Medicine programs have received grants from the Ira and Ineva Reilly Baldwin Wisconsin Idea Endowment.

Wisconsin Companion Animal Resources, Education, and Social Services (WisCARES), a partnership between the SVM and the UW School of Social Work that assists homeless and housing-unstable individuals with pets, has received two years of funding to hire a full-time social worker.

The new social worker will provide direct educational support to social work and welfare students and help

expand services for WisCARES clientele. The project is led by WisCARES Director **William Gilles**, Class of 2013, and Associate Dean for Clinical Affairs **Ruthanne Chun**, Class of 1991.

In addition, **Jorge Osorio** MS '88, PhD '96, SVM professor of pathobiological sciences, and **Rachel Sippy**, a doctoral student in population health sciences, were selected to receive a Baldwin mini-grant for their project, which seeks to establish a mosquito surveillance pilot project in Santo Domingo, Ecuador. Read more at go.wisc.edu/svm-baldwin-2016.

UW Shelter Medicine Advocates for Strays and Rescues Near and Far

The Shelter Medicine Program at the UW School of Veterinary Medicine played an integral role in two recent efforts to make significant improvements in the lives of shelter animals.

In Wisconsin, program director **Sandra Newbury**, a graduate of the Class of 2003, testified before state legislators in support of passing Assembly Bill 487/Senate Bill 450, which was signed into law in March 2016. The life-saving bill helps animals in Wisconsin shelters move on to new homes more quickly and reduces their stress by shortening the required hold times prior to adoption. It also gives animals involved in legal cases a chance to be adopted.

The UW Shelter Medicine Program is also making an impact on a national level by serving on the board of Shelter Animals Count: The National Database Project. A collaboration of numerous animal welfare organizations, the project seeks to establish comprehensive statistics for the millions of dogs



NIK HAWKINS

UW Shelter Medicine Program Director Sandra Newbury examines Neptune at the Dane County Humane Society.

and cats that end up in shelters or rescues every year. By tracking exactly how many animals are admitted, how they get there, and if they are adopted or euthanized, the group hopes to promote better decision-making and understanding of the issues facing rescues and shelters nationwide. And it promises to be useful at a local level because the organization of the data is modeled on the U.S. Census, making county level comparisons possible.

UW Shelter Medicine, WVDL Find Canine Influenza in Cats

It may be called canine influenza, but Sandra Newbury, clinical assistant professor and director of the Shelter Medicine Program at the UW School of Veterinary Medicine, confirmed in late March 2016 that the virus that sickened a large number of dogs in the Midwest last year had infected a group of cats in the region.

Newbury, in collaboration with Kathy Toohey-Kurth, virology section head at the Wisconsin Veterinary Diagnostic Laboratory (WVDL), tested multiple cats at an animal shelter in Northwest Indiana and found them positive for the H3N2 canine influenza virus.

“Suspicious of an outbreak in the cats were initially raised when a group of them displayed unusual signs of respiratory disease,” says Newbury, a graduate of the Class of 2003. “While this first confirmed report of multiple cats testing positive for canine influenza in the U.S. shows the virus can affect cats, we hope that infections and illness in felines will continue to be quite rare.”

Feline cases previously reported in South Korea suggested that the virus—which was not seen in the U.S. until 2015—was capable of making the leap from dogs to cats. However, just one cat tested positive for H3N2 on a single occasion in the U.S. last year. In that case, no repeated sampling was done because the sample was not known to be positive until long after the cat’s symptoms had resolved.

It now appears the virus can replicate and spread from cat to cat.

“Sequential sampling of these individual cats have shown repeated positives and an increase in viral loads over time,” Toohey-Kurth says.

Preliminary work to study the genetic signature of the virus shows it to be identical to the H3N2 virus that infects dogs. WVDL scientists are also conducting a full genetic analysis and study of the virus.



NIK HAWKINS

The first confirmed report of canine influenza in cats comes from a joint effort by the UW Shelter Medicine Program and the Wisconsin Veterinary Diagnostic Laboratory.

Newbury and the UW Shelter Medicine team worked closely with the animal shelter to manage the influenza outbreak.

Cats that have contracted the virus in the shelter have displayed symptoms such as runny nose, congestion, general malaise, lip smacking, and excessive salivation. Symptoms have resolved quickly, and the virus has not been fatal in cats. Infected dogs may develop a persistent cough, runny nose, and fever. Some show no symptoms; others exhibit more severe signs of illness. The virus has been linked to some deaths in dogs, but most dogs recover with supportive care.

Dogs and cats infected with canine influenza virus should be housed separately from other animals and precautions should be taken to prevent spread of the virus on hands and clothing.

An H3N2 vaccine is now available for dogs; dog owners should consult a veterinarian to determine whether vaccination is needed. No vaccine is currently approved or recommended for cats. Learn more at www.uwsheltermedicine.com and www.wvdl.wisc.edu.

Ashley Voss

ZIKA from page 1

a UW–Madison undergraduate student and a study co-author. “Learning how instrumental animal models can be to combating diseases makes this work even more urgent.”

Mouse models allow researchers to conduct larger-scale studies than animal models like nonhuman primates and to perform experiments that are not possible to conduct in humans.

The mouse model described by Aliota and the rest of the research team, including Jorge Osorio MS '88, PhD '96, professor of pathological sciences at the SVM, is an immunocompromised mouse the laboratory already possessed for research on viruses similar to Zika, like dengue virus. The team learned they could inject Zika virus into the foot pads of the mice, and under their skin, and the virus would then spread throughout the body, including the brain. Other mouse strains are resistant to infection with Zika virus.

“Similar models have been revealed [recently], but there are also differences between those and ours,” says Aliota, who was part of the team that first found Zika virus in Colombia (learn more at go.wisc.edu/zika-colombia). The differences in their model will allow the researchers to test how exposure to other viruses, like dengue, may influence how the body responds to Zika infection.

The team’s mouse model lacks three types of interferons—known as alpha, beta, and gamma—which are among the immune system’s first lines of defense against some types of viral infections. Mice with normal interferons are resistant to Zika virus infection, but those lacking them get sick. Humans also have interferons, but they are less effective at blunting Zika virus infection.

In the study, once the mice were infected with a range of Zika virus doses—including doses



NICK HAWKINS

During the injections, the mosquitos are sedated at low temperatures (39.2 degrees Fahrenheit) using ice.

similar to human exposure following a bite from an infected mosquito—they rapidly became ill. The researchers examined the effects of the virus in various organs of the body, including the liver, spleen, brain, kidney, intestine, heart, lungs, and skeletal muscles. The virus had spread throughout the body, but Aliota says they were surprised to find it caused pathology only in the brain and skeletal muscle.

“It looks really bad for the brain,” he says, noting they saw evidence of meningitis, cell infiltration, and necrosis (abnormal cellular death).

In addition to providing an opportunity for researchers to study vaccines and antivirals, the model also affords scientists the ability to study how the virus works, including whether it can replicate, or make copies of itself, and spread within brain tissue.

“It’s pretty easy for people to see on the news that there’s this illness affecting lots of people and wonder why no one has come up with a vaccine yet,” says Emma Walker, another undergraduate researcher and study co-author, “but for Zika, which hasn’t really been studied before, there’s a lot of pressure just to find out more basic things—like how the virus works—before you can try to tackle ‘curing’ the illness.”

Aliota calls the students who worked on the study, including Ph.D. student Liz Caine, “outstanding,” and says it would not have been possible so quickly without their dedication and long hours in the lab. Zika findings from labs across the country have published at breakneck speed as researchers focus their efforts on combating the disease. In fact, Aliota and colleagues at UW–Madison have made other aspects of their collaborative research available to other scientists and the public in real time.

Aliota also credits the resources available at UW–Madison for the pace of Zika study progress here.

“UW has become a center of Zika virus research. There are a lot of people with diverse expertise to take on this problem,” he says. “That’s the advantage of having a medical school, a veterinary medical school, and a primate center.”

For Aliota, who has long studied infectious diseases like Zika, the fact that his work and that of his team has had such profound impact in the response to a significant public health issue is vastly rewarding.

“It’s scary for the people living with it,” Aliota says. “Our goal is to translate what we find to the field. To see such immediate impact, that doesn’t happen often.”

Kelly April Tyrrell

Fund Supports Nine New Research Projects to Advance Companion Animal Health

Thanks to grants from the school’s Companion Animal Fund, faculty and residents at the UW School of Veterinary Medicine (SVM) will launch nine new research projects aimed at improving animal health care.

More than \$81,000 in grants were distributed this year to help SVM researchers explore new treatment and prevention strategies for different strains of feline herpesvirus, test pain management options in snakes, evaluate the use of radiotherapy in treating canine lymphoma, and more.

The Companion Animal Fund is supported by donations from veterinary medical clinics with strong ties to the school as well as individual donors, including many whose animals have been patients at UW Veterinary Care. Through a competitive annual process, the school uses the funds to award faculty with grants to further research that will enhance the care of companion animals.

Read more at go.wisc.edu/caf-2016.

Ashley Voss

IN MEMORIAM

The UW School of Veterinary Medicine regrets to announce the loss of an alumnus.

Paul Nicoletti, MS’62, passed away on Sunday, Jan. 31, 2016. He earned his master’s degree from the Department of Veterinary Science, the precursor to the school’s Comparative Biomedical Sciences graduate program.

Nicoletti, a veterinarian and an epidemiologist, spent the bulk of his professional life with the U.S. Department of Agriculture and the University of Florida College of Veterinary Medicine. He led a distinguished career marked by numerous awards, including the Florida Veterinary Medical Association’s Veterinarian of the Year award and the Meyer-Steele Gold Head Cane Award, the highest honor of the American Veterinary Epidemiology Society.

Alumna Finds Perfect Fit in Working with Wisconsin Farmers to Apply UW Research

Sarah Mills-Lloyd recalls vividly the accident that introduced her to veterinary medicine. She was 6 or 7 years old, living in her hometown of Sheldon in northwestern Wisconsin, on the day her family's beloved Dachsund mix, Penny, suffered a broken leg.

"She always found a safe haven in the drooped fabric back of our living room recliner," says Mills-Lloyd, a 2005 graduate of the UW School of Veterinary Medicine. "Unknown to me, she was asleep in her favorite spot when I sat down and reclined the chair."

Penny limped out from underneath the furniture with an injury that had to be repaired with an external fixation device, but she was soon back to her old self. Mills-Lloyd, however, was changed.

Through this experience, she learned the fulfillment that can come from caring for an animal. But she also recounts the patience, kindness, and compassion of the veterinarians involved—not only toward Penny but the entire family. And what ultimately drew her into the field was the revelation that veterinarians can truly touch the lives of people.

"I realized the profession of veterinary medicine provides the opportunity and ability to speak into the lives of others and become a trusted source of knowledge," Mills-Lloyd says.

She certainly felt this connection with her clients during her eight years of private practice in northeastern Wisconsin, and it continues today in her current role. As a University of Wisconsin-Extension agriculture agent in Oconto and Marinette counties, part of Mills-Lloyd's job is to offer individualized consultations on agricultural issues for government agencies, youth, and farmers. Although her primary role on the farm has changed, she continues to share her knowledge and make



SEVIE KENNON

Sarah Mills-Lloyd, Class of 2005, has found her niche in helping dairy and beef farmers in northeastern Wisconsin improve their operations.

a difference for others.

Her influence can be seen in the experience of the Finger Family Farm in Oconto, Wis. Phil and Laura Finger contacted Mills-Lloyd after noticing a chronically elevated somatic cell count among their dairy herd, a sign of mastitis and a potential drop in milk quality. Following a diligent review of herd records, protocols, and treatments, she connected the Fingers with Pamela Ruegg, professor of dairy science in the UW-Madison College of Agricultural and Life Sciences, who recommended re-establishing an on-farm culturing system.

Mills-Lloyd then made multiple trips to the farm to help implement the system and teach the Fingers how to interpret

results. Today, they are able to monitor cases of mastitis more carefully and establish treatments sooner, all to the benefit of the herd and the milk it produces.

"Now, looking back, it has all come together and feels so easy to figure out what pathogens we are fighting so I know what class of antibiotics, if any, should be used," says Laura Finger. "I credit Sarah for her patience and technical expertise in developing our 'lab.'"

In addition to consultations, Mills-Lloyd teaches workshops on dairy science, livestock, and agri-business management for general audiences and conducts applied research in collaboration with faculty at University of Wisconsin System campuses. Her teaching abilities have earned her a spot as an instructor in calf and

youngstock health with the Nestlé Dairy Farming Institute, a program created by UW-Madison dairy scientists to bring best practices in dairy management to China. In addition, she recently used her knowledge, skills, and education to develop an innovative on-farm research project, the Calf Sanitation Audit program, which dairy farmers can use to test the effectiveness of their cleaning programs.

It comes as no surprise that Mills-Lloyd excels in these many roles given her wide variety of experiences beyond large animal veterinary medicine. This includes working on dairy farms as a youth; completing internships focused on epidemiology, food safety, and veterinary diagnostics; teaching high school science; and serving on veterinary medical mission trips to Asia and Central America.

"It's truly a blend of my knowledge and education as a veterinarian," says Mills-Lloyd, who credits the SVM for preparing her for a range of careers. "In this position, I not only have the ability to educate people, but I have the ability to influence others. During my extension career, it has been my privilege to get to know many agricultural families on a personal as well as a professional level."

The Fingers are one such family. Since her initial farm visits to address the mastitis issue, Mills-Lloyd has been back to troubleshoot other problems. And she is a very welcome presence.

"Sarah's overall knowledge and personality are simply amazing," says Laura Finger. "She is so farm friendly ... combined with being academically skilled and mixed with her worldly experiences. Sarah can also ask the right questions to get people to open up and help troubleshoot answers to get our industry to where we need to be."

Nik Hawkins

RENK from page 4

Dean Mark D. Markel. “The lead gift from the Renks helped us leverage additional funding from the UW-Madison campus as well as alumni and friends of the school. We are extremely grateful for the generosity of everyone involved.”

The Renks have made considerable gifts to UW-Madison in the past in support of agribusiness education and cancer research. At the SVM, they donated \$900,000 to establish the Walter and Martha Renk Endowed Laboratory in Food Safety.

Walter Renk, long considered one of the nation’s leading agriculturalists, earned his bachelor’s degree in agricultural economics and meat and animal science from UW in 1924. As a UW regent from 1967-75, he was instrumental in lobbying for and establishing the SVM. Martha Renk graduated from UW with a degree in English and history in 1930.

Historically, the Renk family has been highly influential in the field of agriculture. They were the first family farm in the nation to incorporate, and their family-owned Renk Seed company, headquartered in Sun Prairie, Wis., has been at the forefront of hybrid seed production for decades.

In addition to the Renks’ contribution, nearly 100 SVM alumni and other friends have made financial contributions to

the remodeling project so far, thanks in part to a matching gift from an anonymous donor through the 512 Wingra Street Fund. Other portions of the learning center will bear the names of key donors, including the meditation room (Gary and Cammy Seamans), the testing room (Class of 1987 alumnus Terry Clark and his wife, Irene), the reading room (Class of 1988 alumnus Mark Tetrick and his wife, Catherine), and the kitchenette (Nestlé Purina PetCare Company).

Nik Hawkins

Leave a Legacy for Learning

Naming opportunities for spaces in the Renk Learning Center are still available.

Learning Center Pods (\$2,500)
Student Study (\$25,000)
Counseling Center (\$25,000)
Active Learning Center (\$100,000)
Clinical Skills Lab (\$100,000)

For more information about naming opportunities or making a gift in support of the Renk Learning Center, contact Heidi Kramer, director of development, at (608) 327-9136 or heidi.kramer@supportuw.org. You can also learn more about the project or make an online donation at go.wisc.edu/svm-learning-center.

SVM Alumni Clinics among ‘Best of Madison’

Several Madison-area clinics that employ alumni of the UW School of Veterinary Medicine have earned awards in the 2016 “Best of Madison” readers’ poll.

The awardees include Sondel Family Veterinary Clinic (**Jesse Sondel**, Class of 2003); Truesdell Animal Care Hospital and Clinic (**Susan Jeffrey**, Class of 2006, and **Brittany White**, Class of 2003); and True Veterinary Care (**Sarah Kalstrup**, Class of 2004).

The Best of Madison is an annual readers’ poll conducted by *Madison Magazine* to determine the city’s premiere businesses in the categories of food and drink, arts and entertainment, home and lifestyle (which includes the veterinarian category), and fitness and recreation.

Alumna and Husband Shine in Outstanding Young Farmer Contest

Sarah Diedrich, Class of 2013, and her husband, Dan, were honored in January at the 2016 Wisconsin Outstanding Young Farmer contest, where they were named first runners up and also received the Speak Up for Agriculture Award. The couple was recognized for their career progression, advocacy on behalf of agriculture, and involvement with their community and the agricultural industry.

Dan Diedrich manages the business side of Diedrich Farm, a 240-cow dairy near Hobart, Wis., and Sarah Diedrich tends to the herd. She conducts herd checks twice per week and provides vaccinations and emergency services while also working as a part-time associate veterinarian at Northwoods Veterinary Service in Birnamwood, Wis.

Thank You for Supporting Students



Dear alumni,
Thanks to the generosity you showed last year, the Renk Learning Center is becoming a reality! Your gifts—com-

bined with those from others and support from the campus—are creating a much-needed expansion to the school that will help us provide the very best education for our students. We can’t wait to put this space to use next year.

Gifts support our students in so many ways, most obviously through scholarships. Last year, we awarded 312 scholarships, which is double what was awarded 10 years ago (156), and the average scholarship amount increased from \$812 to \$2,157 during that time. Our scholarship support has helped us keep debt for UW veterinary medical students lower than the national average. In fact, debt for our graduates over the last five years is 18.5% less than the national average.

But there is always more to be done. Last year, 87% of our scholarship applicants received an award. We’d like to see that percentage grow, and we hope you will help. Recently, you received an invitation to make a gift in celebration of our 30th class of veterinarians who graduated this past May. This alumni scholarship will not only provide financial support for our students, it will also offer encouragement. After all, you understand better than anyone the sacrifice and dedication it takes to become a veterinarian. If you haven’t done so already, you can make a gift at supportuw.org/giveto/vetmedalumnscholarship.

Through your gifts—and your mentorship, and your service as externship and ambulatory practice hosts, and your advocacy for the profession, and your referrals to UW Veterinary Care, and so much more—you play a critical role in the success of our students. Thank you!

Kristi V. Thorson
Associate Dean for Advancement
and Administration

MAEVE from page 3

“This created a two-layer muscle cover for her heart,” says Colopy. “She had all of her normal muscles, but they were split. This closed the gap.”

To complete the surgery, Colopy and Hayden closed up the lengthy skin incision together. “The surgery went well, and Kendra and the team did a really great job,” says Colopy.

Following several days of recovery in the CCU and junior surgery ward, under the watchful

eyes of technicians and students, Maeve was ready to find a permanent residence. She didn’t have to look very far. Pam Yessa, one of the CCU technicians who cared for Maeve during her recovery, decided to adopt her.

“Maeve has done fantastic since coming home,” says Yessa. “I had her confined for a week after she was discharged, but now she has free roam of the house, and she takes advantage of it.”

According to Yessa, Maeve enjoys scrutinizing birds from the porch, playing in empty bathtubs, and harassing her canine housemate, Bounce, a one-year-old Australian Shepherd.

No longer a shelter cat, she’s found herself a place to truly call home.

Nik Hawkins

www.vetmed.wisc.edu

On Call is published by the University of Wisconsin School of Veterinary Medicine. We welcome your suggestions and contributions, though we reserve the right to edit submissions.

No state funds were used to print this newsletter.

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On Call

SUMMER 2016

A NEWSLETTER FOR FRIENDS OF THE UNIVERSITY OF WISCONSIN-MADISON SCHOOL OF VETERINARY MEDICINE

Veterinary Medical Students Volunteer for Urban Coyote, Fox Tracking Project

Fox and coyote populations are rising in U.S. cities, which can lead to conflict between these wild canids and people (as well as their pets). But UW-Madison faculty and students, including veterinary medical students, are working to find solutions through the UW Urban Canid Project.

Led by David Drake, associate professor of forest and wildlife ecology, the overarching goal of the project is to understand more about these city-dwelling relatives of dogs and help find ways for humans to peacefully coexist with them. This includes monitoring the health of the animals being tracked.

To assist in this effort, dozens of students from the UW School of

Veterinary Medicine take turns working with the research team. They swab the nasal and rectal areas and collect fecal and blood samples from each trapped animal and test them for disease, particularly those also found in the domestic dog population, like heartworm.

Since 2014, the project has heavily emphasized outreach and public engagement in the study of Madison's foxes and coyotes. Research from across the country shows this can enhance wildlife management efforts and effectiveness, improve attitudes toward urban canids, and reduce conflict between humans and wildlife.

Read more at go.wisc.edu/urban-canid.



During a winter morning late last year, UW School of Veterinary Medicine students Miranda Torkelson, Kaylyn Goertz, Holly Hovanec, and Melanie Iverson work with graduate student Marcus Mueller to weigh a sedated, 36-pound adult coyote caught at Curtis Prairie at the UW-Madison Arboretum as part of a research effort to study the behavior of growing fox and coyote populations in the city of Madison.

JEFF MILLER