UC DAVIS
VETERINARY MEDICINE
Center for Companion Animal Health

CCAH UPDATE

FALL 2021

Unlocking the Genetic Code to Disease

What determines your dog's reddish coat or their long, fluffy tail? Genetics — or the study of how particular physical traits are passed from parents to offspring. This scientific field also applies to understanding disease inheritance.

Drs. Danika Bannasch and Josh Stern at the Center for Companion Animal Health approach genetic studies from several angles. Bannasch identifies mutations in an animal's genetic code or DNA that correlate to a particular disease to develop tests that can decrease that disease incidence. Stern's approach is more clinically based as he unravels the genetic mechanism of a disease to develop novel therapies.

A recent example involved hypertrophic cardiomyopathy (HCM), a heart disease that affects 1 in 7 cats. Stern and other researchers led a clinical trial to look at how a cat's DNA alters how it responds to clopidogrel, a commonly prescribed life-saving medication to prevent blood clots in cats with HCM. Data showed that nearly 20% of cats had resistance to the therapy.

"This study was about figuring out why some cats weren't responding as expected to clopidogrel therapy and leading us towards a more effective prescription," said Stern, who also serves as the chief medical officer for the UC Davis veterinary hospital. "Understanding how genetic mutations in cats reduce the effectiveness of this treatment can help us personalize medicine for them, just as physicians do for particular human diseases."

See Genetic Code on page 4

From the Director

As you know, our Center's focus is to improve animal health. To do this, we take a multi-pronged approach of combining basic science, translational and clinical research. Throughout this issue we highlight some of the work you have helped fund in these areas, as well as some exciting news for shelters and a new comparative oncology training program.

The underlying genetic causes of health and disease are discussed in our cover feature on genetics with Dr. Danika Bannasch. The translation of these techniques to answer clinical questions is highlighted with Dr. Josh Stern's work, looking to see how genetics affect whether or not a patient will respond to a particular treatment. We also help fund equipment to develop novel procedures such as the new 3D laparoscope, and the research undertaken at the J.D. Wheat Veterinary Orthopedic Research Laboratory to treat orthopedic disease with innovative techniques and tools. Our goal is to ensure that we assemble the best teams with the funding and equipment needed to achieve results.

We also recognize the necessity to engage more talented people in research. This means helping in their training. Whether it is a clinical resident who is learning to conduct a clinical research project, such as Dr. Paula Rodriguez, or the training of DVM/PhD students and postdoctoral fellows with the help of our new T32 grant, we are committed to the future of animal health research.

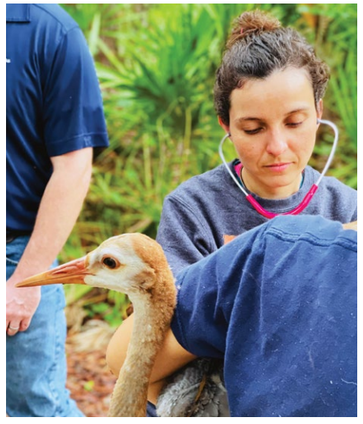
Again, thank you for supporting the Center and making this all possible.

My Best,

Michael S. Kent, MAS, DVM, DACVIM, DACVR
Director, Center for Companion Animal Health

New Pain Relief FOR BIRDS

Through research funding, CCAH provides residents many opportunities not found at other veterinary schools. Following completion of her veterinary degree at the University of Georgia, Dr. Paula Rodriguez is now a resident in the Companion Exotic Animal Medicine and Surgery Service. A CCAH grant is allowing her to conduct a research project entitled "Pharmacokinetics and safety of oral grapiprant administration to red-tailed hawks (B. jamaicensis)," under the mentorship of Dr. Michelle Hawkins. The project will evaluate the properties of a unique anti-inflammatory drug for the first time in birds. Rodriguez has always been involved with wildlife medicine and wanted to focus her research on ways to improve welfare and pain control in raptors, particularly those companion raptors that are involved in falconry.



The pressure-sensing walkway measures weight distribution and analyzes gait patterns.

TEAMWORK
Makes the Dream Work

Make no bones about it, the researchers at the UC Davis J.D. Wheat Veterinary Orthopedic Research Laboratory (VORL) are a team. They're the first to point out that the collaborative environment, along with help from supporters like CCAH donors, are key to translating science to improved patient care.

VORL provides technical support, equipment, and training for anyone interested in musculoskeletal research. From examining new ways to repair fractures in the notoriously brittle bones of rabbits to 3-D printing canine jawbones, researchers identify situations where success rates have been less than ideal in the clinic, and work to develop solutions.

"We have a very energetic, collaborative environment where everyone works in teams," said VORL founder Susan Stover. "That's the part I really love."

Named after a former UC Davis professor of equine surgery, the laboratory's focus was initially on orthopedic research in horses. The work quickly transcended species and now covers companion animals and exotics. The technology has advanced too. The facility houses a range of systems used for clinical trials, understanding orthopedic diseases, and developing new treatments. Capabilities range from quantifying locomotion, specialized imaging, biomechanical testing, 3-dimensional modeling and manufacturing for surgical planning and artificial parts, to cell and molecular biology.

Through VORL's more than 25 years of operation, the CCAH – and its donors – have played integral roles in its growth and sustainability. One of the original motivations for establishing VORL was to centralize specialized equipment, an area for which funding is traditionally challenging to obtain. Over the years, support from the CCAH has enabled the purchase of new equipment and software, as well as upgrades and maintenance for existing equipment.

"Without CCAH equipment funding, many of the advances that we have made would have been significantly delayed," said orthopedic surgeon Denis Marcellin-Little.

Support from CCAH has also helped with more focused projects for junior researchers and residents, as well as proof-of-concept projects. This has a trickledown effect, providing opportunities for undergraduates and veterinary students to participate in research.

"Most universities don't have funding mechanisms for residents, so they depend on a faculty member to have funding for their projects," said orthopedic surgeon Amy Kapatkin. "We have this advantage of resident training grants that enable UC Davis to jump start residents' research careers."

Clinical applications made possible by VORL research include novel ways to treat spinal fractures, enhanced standard of care for repairing mandible fractures, and the use of CT scans to predict the possibility of fractures and optimize treatments in dogs with osteosarcoma.

"What CCAH is doing is a tremendous boost to state-of-the-art technology," said Marcellin-Little. "When we combine clinical knowledge with basic science, we can really push the envelope in novel ways."

Training Future
Comparative Oncologists

Savannah Tobin, Class of 2024, is one of five individuals to receive support from the Comparative Oncology Training Program funded by the NIH T32 grant. She is also enrolled in the Veterinary Scientist in Training Program to pursue her Ph.D. concurrently with her DVM.

"This is team science at its best. With this NIH grant, we will be at the forefront of training the next generation of clinicians to do research in comparative oncology."

– Dr. Michael Kent

UC Davis is taking a major leap forward in training the next generation of scientists engaged in basic and translational cancer research for animals and humans, thanks to a prestigious National Institutes of Health (NIH) T32 grant.

The grant supports institutions to develop or enhance research training opportunities for pre- and postdoctoral fellows to be trained in comparative oncology. The university has been awarded approximately $1.9M over five years for the UC Davis Comparative Oncology T32 program, which is comprised of members from the School of Veterinary Medicine, School of Medicine, and the Comprehensive Cancer Center.

"This is the first time that the UC Davis Schools of Veterinary Medicine and Medicine have been awarded this level of support for an innovative Comparative Oncology Training Program," said CCAH Director Michael Kent, a veterinary oncologist who serves as a co-principal investigator (PI) of the program. "It signals that the NIH recognizes the importance of One Health and that we can learn a lot about cancer by studying and treating animals with cancer."

Kent will be serving as co-PI along with Dr. Robert Canter, a surgical oncologist from UC Davis Health, and Dr. Xinbin Chin, a professor and basic science cancer researcher in the veterinary school.

"Tackling complex cancer research problems should include investigators with broad experience across animal and human species, presenting a unique opportunity for DVMs and MDs to have a crucial role in basic and translational research," Canter said. "Veterinarians can strengthen comparative approaches essential to multidisciplinary research accelerating innovative treatments for animals and humans, while medical doctors bring a patient-centered approach linking biology with clinical therapy."

Five individuals at a time will be supported by the funding over a five-year period. Twenty-seven faculty members from five academic departments will provide training and mentoring.

The UC Davis Comprehensive Cancer Center is one of 51 centers around the country that receive National Cancer Institute designation and funding. The UC Davis center received its comprehensive status five years ago and is the only one in the U.S. to have a formal program dedicated to comparative oncology.

"This is team science at its best," Kent said. "With this NIH grant, we will be at the forefront of training the next generation of clinicians to do research in comparative oncology."

Genetic Code from page 1

Bannasch and Stern also pointed out the translational value of genetic studies for people. Last fall, several faculty members at the school published a study in the journal, *Genes,* that identified the mutation for succinic semialdehyde dehydrogenase (SSADH) deficiency in Saluki dogs. It's a rare neurological disease that closely resembles a similar condition in humans.

"We were able to help establish the only translational large animal model for the development of novel therapeutic strategies for people who suffer from this condition," said Bannasch, who holds the Maxine Adler Endowed Chair in Genetics.

Genetic studies have changed dramatically in the past several decades with the evolution of advanced molecular tools, she explained. We've come a long way from the 1950s when scientists spent many years using cross breeding and large pedigrees to identify chromosomes associated with disease. Whole genome sequencing now makes it possible to test a single dog for an inherited disease and enable rapid, effective treatment.

"CCAH donors make all the science we bring to the public possible—and the improvements we're able to make in animal's lives," Stern said. "Their support has provided seed money that leads to critical larger funding, including four National Institutes of Health grants in recent years. Even if it's a small amount, it gives us a huge advantage."

Soft tissue surgeons utilize polarized glasses to see a 3D image from a laparoscope.

Pioneering 3D Minimally Invasive Surgery

Louie, an 8-year-old male Boston terrier with Cushing's disease, was cured after undergoing the world's first laparoscopic adrenalectomy on an animal utilizing 3D technology at the UC Davis veterinary hospital. The pioneering surgery was made possible by generous CCAH donors who enabled the purchase of a three-dimensional scope used for minimally-invasive surgical procedures.

Soft Tissue Surgery Service faculty member Ingrid Balsa led the surgery to remove a tumor in Louie's right adrenal gland that was causing the condition. Cushing's disease causes a dog's adrenal glands to produce too much cortisol, a chemical that controls many aspects of a dog's body, including its weight, ability to fight infections, blood sugar levels, and many other vital functions.

As a pioneer in minimally invasive procedures, UC Davis has been performing laparoscopic surgeries for many years, including adrenalectomies. Normally, these surgeries are guided by an on-screen two-dimensional (2D) image from a camera in the scope. Surgeons are able to navigate the animal's body proficiently after a learning curve, however they lose depth perception with a 2D image which may lead to surgical errors or prolong surgical time.

While 3D technology has been used in human surgeries for several years, it is a new advancement for veterinary medicine. Studies on human procedures have shown 3D surgeries decrease surgical time and decrease surgical errors.

The new 3D scope greatly improves on the 2D technology. With two cameras in the scope instead of one, two images are presented on-screen. When viewed with 3D glasses, the two images are fused together due to the polarization of the glasses, creating a 3D image on the monitor, helping veterinarians to better navigate their surgical field.

While 3D technology has been used in human surgeries for several years, it is a new advancement for veterinary medicine. Studies on human procedures have shown 3D surgeries decrease surgical time and decrease surgical errors, and the school's faculty hope to see those advantages realized for their veterinary patients.

"I hope this allows us to push the envelope for different types of surgeries that we could consider performing in a minimally invasively fashion," said Balsa, who will continue to investigate 3D capabilities with fellow faculty surgeon Philipp Mayhew. "I think this will also provide a stepping stone for resident training in regard to laparoscopic procedures, which have different instrumentation and techniques compared to traditional open surgeries. The 3D scope will remove loss of depth perception in laparoscopy."

HOPE FOR A CURE

Carol Horace (center right), president of SOCK FIP, presented the organization's latest donation to the CCAH. Also pictured from left to right are CCAH Director Michael Kent, Dr. Niels Pedersen and Dr. Brian Murphy.

Carol Horace has always been an animal lover, but cats intrigue her the most. When her kitten, Fennster, died from feline infectious peritonitis (FIP), Horace vowed to help find a cure so that other beloved cats wouldn't have to suffer the same fate.

FIP is a devastating and nearly always fatal disease that arises from a mutation of the common feline coronavirus. The illness particularly affects young cats from catteries, animal shelters, and kitten/cat rescues.

In 2008, Horace co-founded Save Our Cats and Kittens from Feline Infectious Peritonitis (SOCK FIP), a volunteer, non-profit organization dedicated to eliminating this disease though philanthropic research funding. She has also personally contributed to the CCAH to support FIP research.

"It is my hope to provide the CCAH with the resources it needs to sock it to FIP — funding that will help researchers find even better treatments that are safe, effective, affordable and available to all," Horace said.

Founding CCAH Director Niels Pedersen dedicated a half century of his career to finding a cure for FIP. In collaboration with other scientists, he made a key discovery about the feline coronavirus behind FIP, but finding a vaccine or an effective treatment proved difficult.

"The capstone of my career was the discovery of two novel antiviral drugs to effectively treat FIP," Pedersen said. "Thousands of cats from around the world have been cured of FIP with antiviral drugs researched at UC Davis over the last two to three years, but there is still much more research that needs to be done before FIP is controlled."

Dr. Brian Murphy joined the fight against FIP and has been instrumental in discoveries that change the understanding of the development and treatment of this disease. He was recently honored by the American Veterinary Medical Association with the 2021 American Veterinary Medical Foundation EveryCat Health Foundation Research Award.

Thanks to the work of Pedersen and Murphy, the tides are changing. FIP, once an incurable disease for decades and a death sentence for thousands of cats, is now curable in many cats.

"The support that Carol and SOCK FIP have provided to the CCAH over the years has been instrumental in fighting this disease," CCAH Director Michael Kent said. "We are very grateful for their dedication and efforts."

State Funds KSMP-Led Animal Shelter Program

California Gov. Gavin Newsom signed budget legislation in July that includes $45 million in one-time support for a statewide Animal Shelter Assistance Program. The program represents the first time a state has earmarked grant funds for animal shelters and reflects the governor's commitment to providing resources that can help communities realize the state's long-held policy that "no adoptable or treatable animal should be euthanized."

Newsom tapped the Koret Shelter Medicine Program (KSMP) to set up a grant process, create and distribute educational materials, and perform in-person consultations to help achieve the policy's goals. He cited the program's reputation for leadership in the field and its long history of working with California shelters.

"This represents a promise fulfilled for animal shelters and communities, especially those that historically have been under-resourced," said CCAH Director Michael Kent. "As the first academic program of its kind in the world, the KSMP is well-positioned to provide the expertise required to earn the greatest return on this investment."

A $5 million allotment for a two-year pilot project was funded in April. The $45 million augmentation restores the funding and longer timeline of the governor's original proposal of $50 million over five years that was made in January of 2020.

"We're honored to be chosen to administer this pioneering program," said Dr. Kate Hurley, KSMP's founder and director. "This truly is a generational investment that has the potential to change the landscape for vulnerable animals and their families in California."

Those working in animal shelters say the help can't come fast enough. The number of animals being surrendered by their owners has been accelerating since spring, coupled with a spike in litters entering shelters—the aftermath of spay/neuter programs having been scaled back or suspended for much of 2020. Some animals entering shelters have been either displaced or burned by California wildfires. Further compounding the crowding, the shortage of veterinarians and technicians in clinics and shelters has created a bottleneck that prevents even healthy animals from moving through shelters quickly.

"The additional $45 million allocation not only shows agencies throughout the state just like mine that our sacrifice and dedication is recognized, but also provides crucial financial support for programs essential to helping our communities rebuild from this devastating time," said Cassie Heffington, animal services manager at Tulare County Animal Services.

THANK YOU!

Friends of Companion Animals Honor Roll

Thank you for making a difference in the lives of our beloved animal companions! With your partnership, we are able to advance the knowledge and treatment options for dogs, cats, birds, rabbits and other pets. Science and research are the keys to advancing companion animal health, and we will continue to work for all species to live healthy, long lives with their families. All the work that we do is thanks to friends like you. We are pleased to recognize donors who contributed $1,000 or more to the Center for Companion Animal Health from July 1, 2020 to June 30, 2021.

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The CCAH is dedicated to advancing studies in veterinary medicine—encompassing new ways to prevent, diagnose and treat diseases including cancers, genetic and immune disorders, infectious diseases, kidney and heart diseases, and nutritional disorders in companion animals. To learn more about the Center, please call 530-752-7295.
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THE CCAH at Work

139 Faculty Projects

Dogs	90	Rabbits	4
Cats	35	Fish	2
Pig	1	Multispecies	7

29 Resident Projects

Dogs	17	Rabbits	2
Cats	2	Fish	1
Birds	2	Multispecies	5

19 Research Pieces of Equipment Purchased, Totaling: $259,902

37 Newly Submitted Projects Totaling: $516,732

GIFTS from the Heart

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