# CCAH Update

UC DAVIS SCHOOL OF VETERINARY MEDICINE

FALL 2017



## Predicting Cancer's Spread to Catch it Early

When you hear that cancer has spread to the lymph nodes, it doesn't matter whether the patient is a dog or a human, you know it can't be good. Involvement of lymph nodes can be important in the spread of many cancers for both species. Being able to predict which lymph nodes are most likely to be affected by cancer can make a big difference in catching cancer early and directing appropriate treatment.

With funding from CCAH, veterinary cancer surgeon Michele Steffey has been working to determine the best protocols and techniques for sentinel lymph node mapping—widely used in human cancers—in her canine patients to answer the critical question of which nodes may be involved in cancer's spread.

"That knowledge will help us make important decisions in choosing which nodes to biopsy and how best to target the disease with the most appropriate treatments," Dr. Steffey said. "The main point is to identify earlier and more

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**"Thanks to the CCAH, we hope this research will lead to earlier treatment decisions which supports a longer, better quality of life for affected dogs."**

– Dr. Michele Steffey

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*Center for Companion Animal Health*

Dedicated to improving the health of companion animals

# A Message from the Director

Being part of the University of California, and UC Davis in particular, means that the Center for Companion Animal Health has access to the brightest minds to address the problems facing animal health and welfare. As part of the veterinary school, we are at the forefront of discovery and transfer of that discovery to patient care. Many of our researchers are aligned with, or working directly at, the veterinary hospital, which means we know the most pressing issues that need tackling. We also tap into the best from across the campus—from physicians, biomedical engineers, nutritionists, behaviorists, scientists and so many more—to identify, work on, and solve problems. With the whole university behind us, our integrated teams are able to assemble a vast array of knowledge and skills to help solve the health issues facing our companion animals, and sometimes their two-legged friends as well.

Whether it is a bright young resident working on their first research project, or a faculty member who has been here for decades, your gifts make sure that we have the resources necessary to make an impact. As you will see in this issue, we are able to support individual researchers and also invest in new infrastructure and equipment, such as bringing PET imaging to our future All Species Imaging Center and using 3D printing to improve radiation therapy. Together, we will keep moving forward.

Thank you,

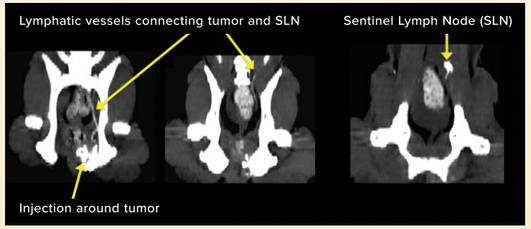
Michael S. Kent, MAS, DVM, DACVIM, DACVR
Director, Center for Companion Animal Health

## Cancer's Spread Continued from page 1

accurately where a particular cancer is going to spread first in the lymphatic system if it is going to metastasize. Our goal is to catch cancer early, and to do it as minimally-invasively as possible, which translates to better outcomes for our animal patients."

Steffey is getting close to her goal of developing the best way to map lymph nodes potentially involved with canine cancer, thanks to support from CCAH donors. As a result, sentinel lymph node mapping techniques, that identify the first lymph node the cancer is likely to spread to, are now available to a wide variety of cancer patients at the UC Davis veterinary hospital.

She and fellow researchers recently published studies in the journals *Veterinary and Comparative Oncology* and *Veterinary Radiology & Ultrasound* that used ultrasound and computed tomography (CT) in dogs with anal sac gland adenocarcinoma to evaluate the ability of different imaging methods to "see" the lymph nodes of the pelvis,




and subsequently to identify the sentinel lymph nodes. A third study evaluating sentinel lymph node mapping in dogs with mast cell tumors is being written up and introduces an exciting new technology with real promise for use in veterinary patients. A fourth study in dogs with oral tumors is ongoing and enrolling patients.

While human lymph node mapping techniques provide some translational knowledge, the specific application isn't exactly the same. Steffey notes the anatomy of lymph nodes and the lymphatic system is different in dogs; it's a species-specific question to answer. More importantly, the gold standard method of lymph node mapping in humans uses a radioactive tracer that is expensive and comes with a lot of logistical and regulatory issues making it unlikely to be widely available in veterinary medicine.

"We needed to find ways to apply available technologies to develop accurate and reliable lymph node mapping for veterinarians treating dogs with various cancers," Steffey said. "Thanks to the CCAH, we hope this research will lead to earlier treatment decisions which supports a longer, better quality of life for affected dogs." https://give.ucdavis.edu/go/PetCancer

# Streamlining Patient Care

Advancements in medical technology are rapidly driving a new age of diagnostic imaging. The veterinary hospital is leading the way in this capacity, and the team envisions an All Species Imaging Center (ASIC) as a hub of the new Veterinary Medical Center. Centrally located in the new facility, ASIC will bring together radiology, ultrasound, nuclear scintigraphy, magnetic resonance imaging (MRI), computed tomography (CT), and positron emission tomography (PET) under one roof to better serve patients and clients.

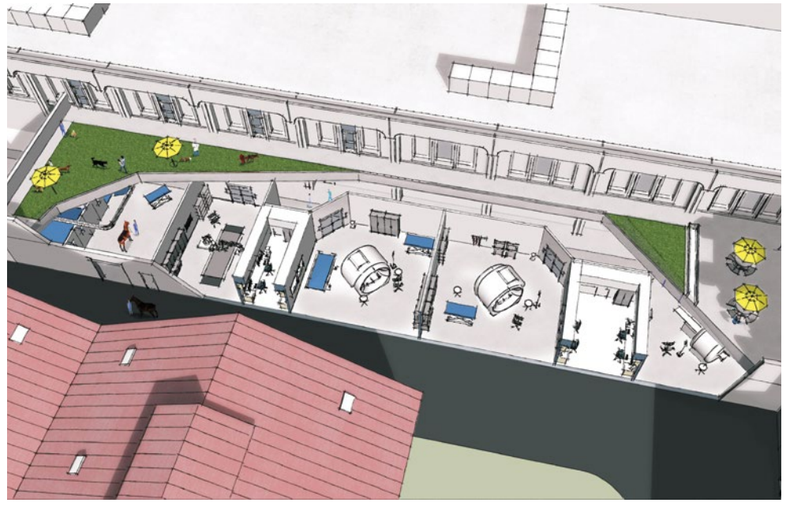
These imaging techniques are critical not just for diagnostics, but to guide the precision therapy clinicians provide to patients. Additionally, imaging is becoming more important in assessing how patients are responding to new treatments. This is crucial to the research that the Center for Companion Animal Health (CCAH) supports and why the CCAH, through its donor support, is helping fund advances in new types of imaging.

"Many of the studies we fund are clinical studies," said Dr. Michael Kent, CCAH director. "Finding better, less invasive ways of tracking disease and seeing how patients respond to new treatments is vital to improved animal health."

Imaging requires cutting-edge equipment and specialized space. Therefore, having a designated area to house this equipment together will streamline patient care. The ASIC will reduce wait and anesthesia times (thus reducing stress on the animal), allow different imaging tests to be conducted at the same time and, above all, promote integrated care and research of the highest quality.

The future of imaging at UC Davis will embrace PET scan technology to diagnose injuries that may not be visible with other imaging modalities. To see more of how the CCAH is promoting new technologies to bring PET scanning to the veterinary hospital and advance research, please see page 5.

The ASIC will also expand our MRI capability and enable space for a second MRI unit to expand clinical operations and enhance research discoveries. Our clinical and research MRI caseload has steadily increased over the past 15 years, nearly tripling since 2002.



The All Species Imaging Center will centrally house ultrasound, MRI, CT, PET and all other imaging modalities at the hospital.

## CCAH Veterinarian Honored for Big Thinking

Dr. Kate Hurley, director of the Koret Shelter Medicine Program and associate director of the CCAH, was one of fifteen winners of the Maddie's Hero Award for her work advancing the welfare of companion animals. The award includes a $10,000 grant for each recipient organization.

"I am honored by the recognition and eager to put Maddie's generous gift to good use," Hurley said. "We are funded completely by private support, and this money allows us to help more animals that need us."

Recognized for being a "top dog," Hurley has long been leading the way with her innovative ideas, progressive thinking and life-saving actions. As co-founder of the Million Cat Challenge, she is accustomed to thinking big—and is happy to be part of a program that is solving some of the most pressing issues involving companion animals today.

The Million Cat Challenge is based on five key initiatives designed to help shelters manage the flow of animals coming through their doors, often by partnering with the public to find solutions outside shelter walls. The initiatives are backed by data and often debunk an age-old myth—namely that the best solution for an animal in need is always admittance to the shelter. For example, the Challenge's first initiative, alternatives to shelter entry, might include asking a Good Samaritan to help reunite an animal and guardian by posting information on the streets and in community forums before bringing it to the shelter. A cat's chance of being reunited with its guardian is increased tenfold by staying in the neighborhood where it is found.

At the time of this writing, the online counter that clocks the number of lives saved on the Million Cat Challenge website reads 923,823 cats, marking the challenge as one of the largest feline lifesaving campaigns to date. https://give.ucdavis.edu/go/ksmp

## Unraveling the Mysteries of FIV

Cats may or may not have nine lives, but they do have healthier lives thanks to the research funded by generous donors to the CCAH. For the past several years, the center has supported three different feline-focused projects with Dr. Brian Murphy that have yielded scientific discoveries to improve the well-being of cats—and in some cases, people. These projects include: feline immunodeficiency virus (FIV), feline infectious peritonitis (FIP) and a gene therapy project exploring ways to correct anemia associated with renal disease in cats.

Murphy, an anatomic pathologist, said the CCAH funding of FIV research has yielded particularly valuable knowledge about a complex retrovirus that causes immunodeficiency disease in domestic cats. FIV-infected cats are found worldwide, but the prevalence of infection varies greatly. In the United States, approximately 1.5 to 3 percent of healthy cats are infected with FIV, while rates are significantly higher (15 percent or more) in cats that are sick or at high risk of infection.

Similar to human HIV infection, FIV attacks the immune system, leaving cats vulnerable to other infections. Although infected cats may appear asymptomatic for years, they eventually develop late-stage disease that makes the cat susceptible to various secondary infections and tumors.

"FIV is tricky and clever, which makes it really interesting to study," Murphy said. "It can hide in tissues or go into a latent form, making the virus itself difficult to detect in a blood test. We're interested in learning where it's hiding, how it remains hidden and what methods can be used to bring it out of hiding to be destroyed."

One of his most recent publications in *PLosOne* revealed that particular lymph node tissues serve as sites for hiding FIV during the late stages of asymptomatic infection.

"This suggests that strategies to eradicate the disease in cats, for which there is currently no cure, will need to address these tissue viral reservoirs," Murphy said.

Murphy said the primary goals of his research are two-fold: to improve the lives of cats and also the lives of people with HIV.

"The reason these types of studies are of value are that they provide a really good model for what people with chronic HIV are dealing with, what the molecular pathogenesis of the virus is, and what can be done medically to reactivate and eliminate the latent virus," Murphy said.

In the past couple of years, Murphy also had the opportunity to mentor two graduate students, Chrissy Eckstrand and Samantha McDonnel Evans, who both worked on the FIV project and helped uncover key molecular features of long-term chronic infection with FIV. Eckstrand is now a veterinary anatomic pathologist and assistant professor at Washington State University College of Veterinary Medicine. Evans completed her Ph.D. with Murphy through the UC Davis Veterinary Scientist Training Program that allows a DVM student to simultaneously obtain a doctorate, and is now a resident at Colorado State University in veterinary clinical pathology.

"I've been extremely fortunate to have the support of CCAH to continue this research," Murphy said. "In the long run, I hope the discoveries we've been able to make benefit the health of cats, as well as people suffering from these immunodeficiency diseases."



## At the Forefront of Imaging

The Mini Explorer II project will bring PET scans to small animals at UC Davis.

Since animals cannot tell their doctors where it hurts, veterinarians rely heavily on the accuracy of enhanced imaging to diagnose disease and develop a treatment plan. Imaging is also essential for clinical research—allowing us to see where disease exists, how it progresses and how it responds to treatment. To continue providing the highest standard of care and advance health through research, the school is committed to staying at the forefront of innovations in imaging technology.

In 2015, veterinary radiologists from the school were the first to image a horse using a prototype of a newly created positron emission tomography (PET) scanner that was here to image brain tumors in dogs for a clinical trial. The school later acquired the scanner permanently and continues to make breakthroughs in demonstrating the success of PET scanning—detecting lesions that other advanced modalities (such as CT or MRI) do not identify.

Now we are expanding our PET capabilities at UC Davis. On the horizon is the Mini Explorer II project. This next generation PET scanner is expected to be operational within the next few months. It will provide a significant increase in sensitivity for total body imaging and perform scans more quickly and with a much lower radiation dose—reduced by 40 times.

The Mini Explorer II is made possible by a gift from the estate of the late Ernest and Madeline Wellington to the Center for Companion Animal Health (CCAH). The Wellingtons were animal lovers and especially devoted to their dog, Bonnie Girl. Their devotion inspired them to include the CCAH in their estate plans because of the impact the center has on advancing animal health.

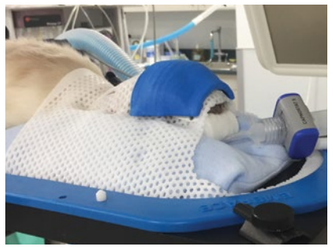
"The legacy the Wellington Estate brings to the school is a whole new type of imaging that will help countless animals by diagnosing disease earlier and more completely, and helping us to plan and direct treatment," said Dr. Michael Kent, radiation oncologist and director of the CCAH. "It will also help us develop new treatments for our patients. This is going to make a huge impact, and we are grateful for their gift."

Bringing the Mini Explorer II to the school is the result of a collaborative effort by UC Davis biomedical engineer Dr. Simon Cherry (College of Engineering), medical physicist Dr. Ramsey Badawi (School of Medicine) and the veterinary hospital's Diagnostic Imaging Service. The school's multidisciplinary approach discovers new ways to prevent, diagnose and treat diseases by harnessing the expertise and resources of the entire university behind each veterinarian.

"Innovations in diagnostic imaging technology are critical to our school's comprehensive vision for the future," said Dr. Erik Wisner, associate director of Imaging Services. "This includes an All Species Imaging Center as a central feature of the future Veterinary Medical Center. We are committed more than ever to leading the way toward innovation and discovery to improve the health of our patients."

# 3D Printing Improves and Personalizes Radiation Therapy

In radiation therapy, the goal is always to maximize the dose on the tumor and minimize radiation going to normal tissues. One way to do this is to use bolus material for tumors that are near the surface of the body and skin. Boluses act as an artificial tissue that absorb radiation doses. A bolus can be made of many types of materials—water-soaked gauze, a modeling compound like Play-Doh, or prefabricated sheets of artificial "skin." None of these are ideal because they do not mold directly to the surface, are not the same density as the tissue, and can leave air gaps where the body surface changes shapes. These air gaps interfere with the radiation dose. For example, a flat sheet cannot completely cover a curved part of a body, such as over the nose.



A cat being treated with radiation therapy for nasal lymphoma with a 3D printed bolus (blue) in place.

After a patient has a CT scan of the area to be treated, a bolus can be "drawn" on the surface. This can then be imported into other software which allows for the creation of a three-dimensional (3D) structure which can be printed using a rubbery material that exactly conforms to the patient and is placed on them before each treatment. Each bolus takes between six and 12 hours to print, depending on the thickness and size.

"The 3D printer allows oncologists to make a bolus that is the exact shape as the contour of the patient," said Dr. Michael Kent, radiation oncologist and director of the Center for Companion Animal Health. "This eliminates air gaps and helps change how the dose distributes to the tissue."

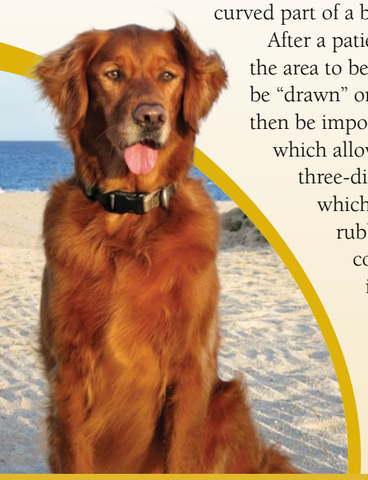
To see a timelapse version of the printer in action, please see the "UC Davis 3D Printer Timelapse" video on YouTube.

Bob and Lori Pryt brought their dog Enzo to the veterinary hospital in 2012 for treatment of a jaw cancer. After several surgeries and a course of radiation therapy, Enzo remains happy and cancer free. Last year, the Pryts asked Dr. Kent about equipment needs at the center. Dr. Kent mentioned how 3D printing could improve radiation treatments.

The Pryts supported the purchase of the 3D printer and the needed computer equipment to provide the best care possible for each patient. After researching the best type of material with which to print (one that would closely replicate tissue), the radiation oncology specialists began printing custom boluses for each patient that needs one.

Because of the Pryts' gift and support of the research to bring this technology to the veterinary hospital, boluses can be printed for just a few dollars each, allowing the service to implement this new technology without increasing costs.

"This is a great example of how practical translational research can quickly be brought to the clinic and impact our patients," said Dr. Kent.



▲ Enzo (after his cancer treatment), who inspired his owner's gift to advance radiation therapy.

## Lasting Tribute – Forever Friends



You may wish to honor a much-loved pet, pay tribute to a family member or friends, or recognize a special veterinarian. If you would like to create a memorial brick in Edna's Garden or a personalized etched plaque in Angel's Courtyard at the Center for Companion Animal Health, please call 530-752-7024 or visit https://give.ucdavis.edu/Go/MemorialBrick



# Thank You

## July 1, 2016 to June 30, 2017

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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. We welcome visitors to come and learn more about our mission and programs. To schedule a visit, please call 530-752-7295.


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## Highlights of Donor Funded CCAH research studies

**Here are just some of the studies we are currently funding with your support. Thank you for the impact you are making.**

- Better ways to diagnose elbow dysplasia in dogs using PET scanning (Dr. Mathieu Spriet)
- Developing a toxoplasma vaccine for cats (Dr. Jeroen Saeij)
- A new drug for treating bladder infections in dogs (Dr. Jane Sykes)
- Using vinblastine chemotherapy in cats (Dr. Luke Wittenburg)
- How to use narcotic pain medications in parrots (Dr. David Guzman)

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Isn't it nice to receive caring words from friends and family when they acknowledge the special relationships we have with our beloved animal friends? You can return the kindness with a gift to the Companion Animal Remembrance and Endearment (CARE) fund. Your honorees are sent a special letter from the director of the CCAH notifying them of your meaningful tribute. Gifts to the CARE Fund benefit companion animal health studies.

For more information visit:
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