ANSWERS IN THE DEEP

CLINICAL AND RESEARCH TRAINING IN AQUATIC ANIMAL HEALTH

Story by Sarah Carey

ALISSA DEMING, D.V.M. ('12), COULD SWIM BEFORE SHE COULD WALK, and always had a fascination with the ocean. Growing up in South Florida, she surfed and scuba-dived, but also witnessed significant declines in the reefs, fish populations and sea turtles in her own backyard.

Those observations, coupled with the realization of how environmental health impacts animal as well as human health fueled Deming's passion to pursue a career in aquatic animal medicine during veterinary school at University of Florida and beyond.

This summer, Deming will complete a unique Ph.D. program at UF that has enabled her to combine scientific and clinical skill sets honed on the country's East and West Coasts to advance knowledge of a common cancer in sea lions. Her work has drawn the attention of national news outlets, including National Geographic, which ran an article featuring Deming and her research with The Marine Mammal Center in California in 2016.

"I always knew I wanted to be a veterinarian, but didn't realize I could incorporate my love for aquatic animals with my love of medicine until I was working on my master's degree, studying fibropapilloma virus in sea turtles in the Indian River Lagoon," said Deming, who completed her master's at Florida Atlantic University in 2008 with a focus on stress protein and anti-apoptotic protein expression in a virally induced cancer in sea turtles.

"I have always had a strong interest in how viruses can infect and then hijack cells, resulting, on occasion, in cancer," she said. "Something people don't often realize is that 20 percent of cancers are associated with viral infections, and there are probably many that we are not aware of yet."

Some examples in people are Human Papilloma Virus-associated cervical cancer, and several herpesvirus-associated cancers, such as Kaposi's sarcoma, several types of lymphomas and nasopharyngeal tumors, Deming said.

"Studying these virally induced cancers in people has proven to be challenging, but that is where studying herpesvirus-associated cervical cancer in sea lions can provide a valuable comparative model, allowing us to better understand how viruses induce cancer in a more real-world setting," she said.

Soon after finishing her master's, Deming entered the professional D.V.M. program at UF, through which she completed her certificate in Aquatic Animal Health. After graduating from veterinary school, Deming completed an aquatic

Photo courtesy of The Marine Mammal Center

Photo courtesy of Florida Fish and Wildlife Commission

ABOVE:
Basking California sea lions and Northern elephant seals on San Miguel Island are observed during fieldwork conducted by Dr. Katie Prager, a researcher in Dr. James Lloyd-Smith's group at UCLA, as part of a project on sea lion-Leptospira pathogen dynamics and in collaboration with The Marine Mammal Center and NOAA National Marine Mammal Laboratory.

This photo was taken as part of field research conducted under NMFS Research Permit 16087-2 issued to the National Marine Mammal Laboratory, Alaska Fisheries Science Center, and funded by the National Science Foundation (OCE-1335657), the U.S. Department of Defense (SERDP RC01-020/RC-2635) and the National Marine Fisheries Service John H. Prescott Marine Mammal Rescue Assistance Grant Program.

LEFT:
Dr. Alissa Deming supports a manatee calf in the water as Jody Palmer, director of conservation at the Brevard Zoo, administers supplemental oxygen while the calf's mother receives a health check-up during a rescue.

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20 PERCENT OF CANCERS ARE ASSOCIATED WITH VIRAL INFECTIONS, AND THERE ARE PROBABLY MANY THAT WE ARE NOT AWARE OF YET."

– Dr. Alissa Deming

Photo courtesy of The Marine Mammal Center

A Northern elephant seal pup curls up to his protective mother on San Miguel Island, California. This photo was taken as part of field research conducted under NMFS Research Permit 16087-2 issued to the National Marine Mammal Laboratory, Alaska Fisheries Science Center.

animal veterinary specialty internship at SeaWorld and the National Marine Mammal Foundation/Navy Marine Mammal Program, where she served as clinical veterinarian for marine mammal, avian, reptile, teleost and elasmobranch species.

At the end of her internship, she began discussing the possibility of performing sea lion cancer research with The Marine Mammal Center.

"I had seen cases of cancer during a veterinary externship at TMMC and had several cases of wild sea lions with cancer as a clinician at SeaWorld's rescue and rehabilitation program," Deming said. "Dr. Frances Gulland, the senior scientist at TMMC, had been a mentor of mine, and we had always discussed combining my molecular background and interest in oncogenic herpesviruses to figuring out the role of Otarine Herpesvirus1, or OtHV1, in sea lion urogenital carcinoma."

Deming was awarded the center's Geoffrey Hughes Research Fellowship, which is dedicated to training researchers in the field of marine mammal medicine. That fellowship, combined with support from the UF College of Veterinary Medicine's graduate studies office and additional funding from the college's Aquatic Animal Health program, enabled her to enter the Ph.D. program with a fully funded project.

"As a veterinarian, it is a huge financial sacrifice to pursue a Ph.D., as a Ph.D. stipend is significantly less than the earning potential of a practicing veterinarian," Deming said. "In a time where there is a need for veterinarians who are formally trained in research, expediting this process and providing veterinarians who wish to pursue Ph.D.s with appropriate funding is very important to attract potential candidates to a program."

Deming's Ph.D. program is aimed at determining the role of OtHV1 in the development of urogenital carcinoma in California sea lions. First described in 1979, this cancer has been a persistent cause of stranding and death in sea lions along the Western Coast of the U.S. The cancer starts in the genital tract and aggressively metastasizes to all of the major body organs — "everywhere, really," Deming said.

"Lots of research has been done to try to establish the cause of this common cancer in sea lions," she said. "Findings point to multiple factors, ranging from contaminants in the sea lions' prey, immune suppression, genetic predisposition and this virus I'm studying."

Although herpesvirus has consistently been found in animals with this cancer, researchers have not been certain whether the virus was causing the cancer or if it was just an incidental finding. Deming's Ph.D. focus has been to fully sequence the herpesvirus genome and determine if the herpesvirus had genes known to be associated with causing cancer that had been identified in other known oncogenic herpesviruses.

"I elected to do my research at UF because Dr. Jim Wellehan, an associate professor of zoological medicine and microbiology at the college, has a vast background in viral sequence and the equipment necessary to do this

Photo courtesy of The Marine Mammal Center

Dr. Alissa Deming administers an inhalant anesthetic to a 150-pound male Guadalupe fur seal during an international collaboration between Mexican and U.S. researchers on Guadalupe Island, Mexico. *Activities were performed under National Commission of Protected Natural Areas, Mexico permit # SGPA/DGVS/00091/17.*

work in his lab," she said. "Also, UF is home to the Cancer Genomic Research Institute, providing me with cutting-edge equipment as well as collaborators, like Dr. Rolf Renne, who studies human herpesviruses associated with cancer, to help direct me in my work. Having these resources and collaborators has allowed me to take this work to the next level."

Through her program, Deming has spent about a third of her time as a clinical veterinarian for TMMC in Sausalito, providing care for seals and sea lions at the rehabilitation hospital. She also assists in stranding response and necropsies for cetaceans (dolphins) and large whales, and has provided veterinary support for various field projects.

At UF, Deming also provides veterinary support to the new Marine Animal Rescue Network, under the guidance of Mike Walsh, D.V.M., a clinical assistant professor with the college's Aquatic Animal Health program.

"Establishing a stranding response network is a challenging task to overtake, and Dr. Walsh, Laurie Adler and Mackenzie Russell have done an excellent job with setting up the program thus far," Deming said. "This program will not only provide additional coverage for marine mammal strandings, community outreach and education, it will also afford an opportunity for UFCVM graduate students and staff to get involved with stranding response, which is something no other vet school offers."

An average day for Deming could range from working in Wellehan's molecular lab at UF to spending time on the computer performing bioinformatics to spending a month on an island in the middle of the Pacific providing veterinary support for field projects.

"I was very lucky that my mentors supported my continued work as a clinical veterinarian during my Ph.D.," Deming said. "This ensured that I would keep and improve my clinical skills at the same time as I was developing my research skills in the lab."

Performing clinical work in conjunction with her Ph.D. has also kept Deming plugged into the health of the animals she was doing research on, she said.

"Spending my time between Florida and California throughout my Ph.D. provided me with a better understanding of all aspects of my research project and allowed me to really appreciate the time and significant effort that goes into collecting samples for research projects in a working rehabilitation hospital," she said.

Deming said her time in the professional D.V.M. program enabled her to build a network of mentors within the college, and the Aquatic Animal Health program has offered resources that no other university could provide. In addition to Walsh, Deming said Drs. Iske Larkin and Nicole Stacy had been integral in her professional development in the aquatics field.

Walsh said Deming's ability to bring aquatic research and clinical medicine together will allow her to train future Ph.D. students and veterinary medical students.

"Whoever hires her after she completes her Ph.D. will have someone capable of building a great program as well as push the ceiling on marine species information that will help facilities and the wild populations," Walsh said.

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