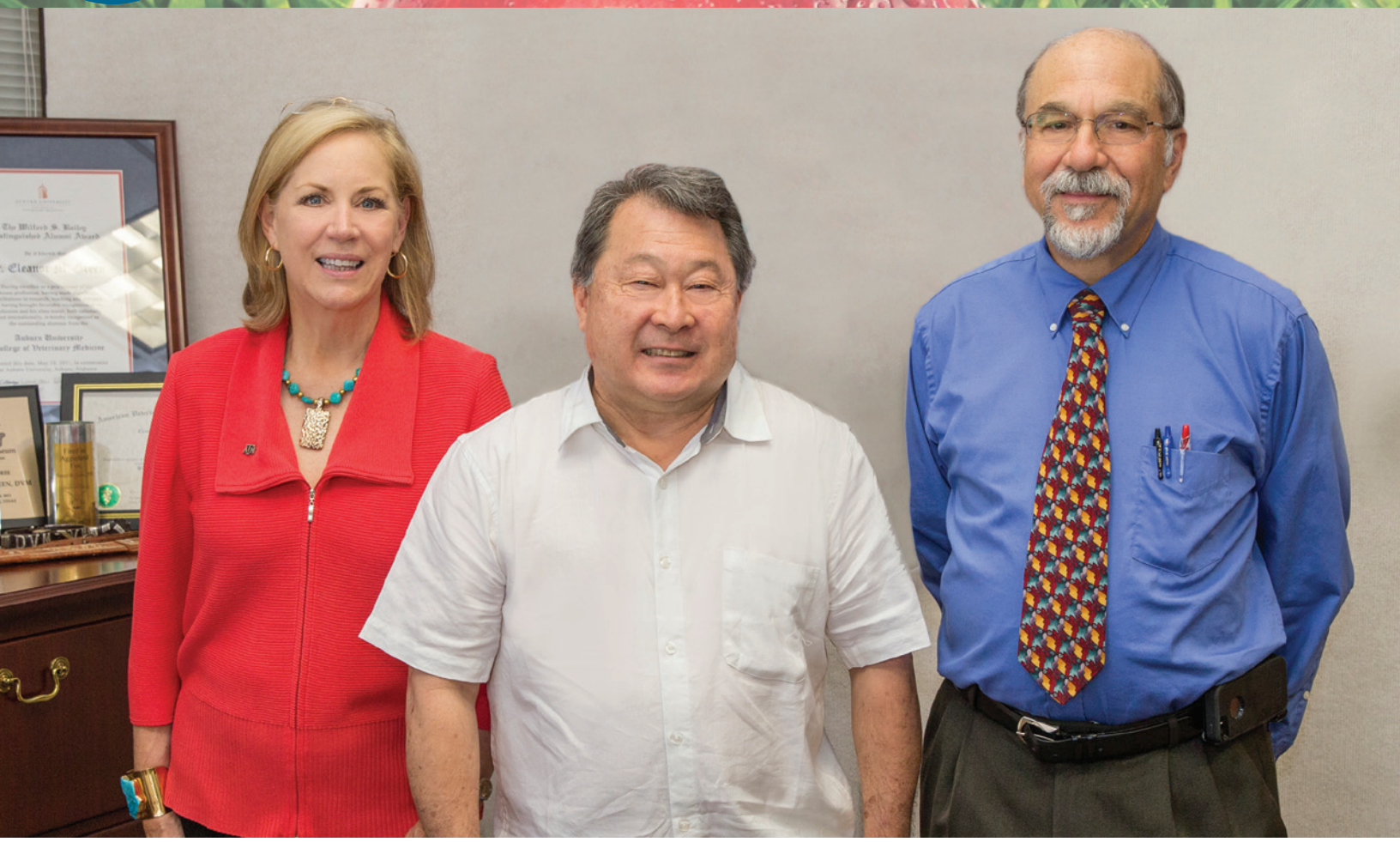

Dr. Eleanor M. Green, the Carl B. King Dean of Veterinary Medicine (left), and Dr. John Stallone, professor and interim head of the Department of Veterinary Physiology & Pharmacology (right), welcome Dr. Ken Muneoka (center) to the college.

Dr. Ken Muneoka:

by Roberto Molar

A pioneer of regenerative medicine

In the summer of 1978, graduate student Ken Muneoka attended a popular course on embryology at the Marine Biological Laboratory in Woods Hole, Massachusetts. The course, taught by Muneoka's future mentor, marked a crucial shift in his academic career.

Almost four decades have passed since Muneoka attended that course, which transformed the way he thought about biology. Today he is an internationally recognized biologist, renowned for findings that have revolutionized the fields of mammalian limb regeneration and wound healing.

"We have been successful in identifying key mechanisms in limb regeneration in those species who are able to do so," Muneoka said. "We have also been able to begin developing a model for this same type of activity in mammalian species."

In Spring 2015, Muneoka will join the faculty of the Texas A&M College of Veterinary Medicine & Biomedical Sciences (CVM) as professor in the Department of Veterinary Physiology & Pharmacology. Together with the Texas Heart Institute and other faculty leaders of the CVM, Muneoka will be part of the Center for Cell and Organ Biotechnology, a collaboration announced in September 2013.

A life-changing course

Having earned a bachelor's degree in biology from Humboldt State University in 1976, Muneoka enrolled in graduate school at the University of Hawaii—but that took an unexpected turn.

Dr. Susan Bryant, an internationally acclaimed expert on cell biology at the University of California, Irvine, taught the embryology course in Woods Hole as a visiting instructor. Fascinated by Bryant's work on limb regeneration in salamanders, Muneoka left the University of Hawaii to join Bryant's lab. She soon became Muneoka's mentor and friend. "We just had a really good connection, and it was

very exciting to be in that kind of relationship and work in science that was engaging for both of us," Bryant said.

Muneoka earned his doctorate in 1983 in developmental and cell biology, and his doctoral dissertation analyzed the similarity between limb regeneration and limb development of salamanders. What he found transformed his perception of regeneration, particularly in mammals.

After earning his doctorate, Muneoka worked in Bryant's lab as a postdoctoral fellow. He shifted his research focus to mammals, particularly to understanding why mammals cannot regenerate like salamanders. His basic idea: Limb regeneration and development share similar processes. "We all go through development to form our limbs and our various structures, and there must be something impeding our ability to revisit that process," Muneoka said. "Salamanders were able to figure it out; they are able to keep that going."

A different approach to regeneration

Muneoka's interest in mammals led him to conduct independent research—this time away from his mentor. In 1986 he joined Tulane University's Department of Cell and Molecular Biology, where he continued to study limb regeneration and wound healing. He has been studying this problem ever since.

Some current approaches to regeneration seek to repair or replace damaged tissue with stem cells. But Muneoka's research focuses on the cellular and molecular factors that can reprogram stem cells to be more embryonic. Doing so may maximize the body's natural potential to regenerate.

Building on previous research in salamanders and on the regenerative responses of mice digits, Muneoka's lab developed a mammalian model for endogenous regeneration. And the development of this mouse model was another pivotal moment in his career.

Regeneration in humans and large animals

In 2004, Muneoka participated in a workshop hosted by the Defense Advanced Research Projects Agency of the U.S. Department of Defense. There he visualized the next step in his research: using his mouse model to try to understand the regenerative properties of humans. "The mouse is pretty different from the human," he said, "but it's certainly more similar than the salamander."

The regenerative responses of mice digits resemble those of human fingertips. However, the small size of mice makes Muneoka's model unsuitable for pre-clinical trials. His challenge now is to move this model closer to humans and large animals.

This challenge does not frighten him. In fact, the complexity of the problem captivates him, even if inducing regenerative responses in large mammals sounds too ambitious. "We're not going to solve this problem in my lifetime, but I hope we make reasonable strides," Muneoka said. "I'm passionate about hopefully contributing something to a very big problem in human health."

Muneoka also explained that regeneration might solve other problems in medicine, since induced regeneration could mobilize cell involvement in healing responses. "As we understand more about regeneration, the treatments of both disease and injuries are going to evolve to a point where we are not going to be doing surgical manipulations," he said.

Renowned findings and public service

Muneoka's findings—which he humbly attributes to the people working in his lab—have won him multiple appointments and recognitions. He has served on the editorial boards of several scientific publications, including the journal, Regeneration. At Tulane, he held the John L. & Mary Wright Ebaugh Chair in Science and Engineering. He also has served on numerous advisory boards and led workshops for such entities as the National Science Foundation and the Environmental Protection Agency.

Muneoka especially cherishes his appointment as a council member at the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), one of the National Institutes of Health. At NICHD, he advises policymakers and scientists on human health research. He had always thought people serving in such advisory councils were quite special. With a laugh, Muneoka joked about his appointment: "When they asked me to be on council, I thought 'well, there must be something wrong with them, because I'm not special enough to do this.'"

Educating future scientists

Muneoka's humility about his expertise also has helped him win the admiration of colleagues and students. Dr. Lindsay Dawson, who attended graduate school at Tulane to work with Muneoka, admires his openness as a mentor and friend.

Now a postdoctoral fellow, Dawson also appreciates Muneoka's creativity in the lab. She has been working with Muneoka for six years, and she has never seen him dictate the research of his students or postdocs. On the contrary, she said, Muneoka always encourages others to think critically and try new methods. "That is huge in science because there is just so much freedom to be creative," Dawson said.

Muneoka encourages this creativity in all of his trainees with the goal of producing better scientists. He said he wants to train the scientists of the future—not robots who can simply follow orders. "I want to train people who can think for themselves, develop new strategies and ideas, and test new hypotheses to continue moving the field," Muneoka said. This was an important lesson he learned from his mentor, Bryant.

Now retired, Bryant looks back at the young Muneoka she met in Woods Hole. She remembers she "loved the way he asked questions about everything. He loves what he does, and that is very infectious to students and faculty," she said. "It's been that way right from the very first."

Muneoka's inquisitive drive continues to extend the impact of his research as he prepares to move to Texas A&M, where he will promote graduate and undergraduate education in multiple academic departments. Members of his and Texas Heart Institute's lab, Dawson included, will join him at Texas A&M's Center for Cell and Organ Biotechnology. Their expertise will likely be transformative for limb regeneration and wound healing, propelling Texas A&M as a national leader in regenerative medicine.