BAKER INSTITUTE
FOR ANIMAL HEALTH

WORKING TOGETHER
TO ADVANCE ANIMAL HEALTH

ANNUAL REPORT 2019

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DIRECTOR'S MESSAGE

Dear Friends,

The Baker Institute for Animal Health has a long history of world-class veterinary and biomedical research. We are committed to our research because **we care** about the health and future of our beloved companion animals. We demonstrate this passion and drive through the efforts of every faculty, trainee and staff member alike, making the Baker Institute a special place for **scientific discovery**.

One key to the Baker Institute's success in scientific endeavors is our active promotion of collaborations between our biomedical and veterinary researchers who work together using cutting-edge technologies to solve complex health problems. As a researcher myself, I've learned that teaming up with other scientists who have different approaches and viewpoints than my own is often a great way to push the boundaries of scientific knowledge and discoveries in both animal and human health.

In the following pages, you'll read stories about the collaborative spirit and dedication that exists at the Baker Institute. These long-standing and impactful collaborations are a major force in advancing our mission: **To improve animal health through scientific discovery**.

This has been an exciting past year for the Baker Institute with our research labs obtaining support from numerous sponsors such as the National Institutes of Health, USDA and NASA, just to name a few. Additionally, you'll read about the stellar contributions of two junior faculty members who were recognized at the University level: Dr. Gerlinde Van de Walle, recently promoted to Associate Professor and Dr. Charles Danko, recently named the Robert N. Noyce Assistant Professor in Life Sciences and Technology.

Next year the Institute will be celebrating its 70th anniversary with the 75th following close behind. We are currently planning for these two milestones and look forward to sharing these plans with you as they unfold.

On behalf of everyone at the Baker Institute for Animal Health, thank you so very much for your continued support of our programs. The support you give toward the Institute's mission of discovery is an investment in improving animal and human health, both now and in the future.

Sincerely,

Scott Coonrod, Ph.D.
Interim Director

FACULTY PROMOTIONS

NEW TITLE: DR. CHARLES DANKO, PH.D.

Dr. Charles Danko was recently named the Robert N. Noyce Assistant Professor in Life Sciences and Technology. The new title recognizes the thriving research program he has built at the Baker Institute, which tackles fundamental biological questions by combining computational and molecular biology approaches. The central theme of his work is to understand gene regulation – how and when organisms turn on or "express" the genes in their genome – and what that reveals about how organisms develop and evolve, and the origins of diseases like cancer.

TENURE: DR. GERLINDE VAN DE WALLE, V.M.D., PH.D.

In 2018, Dr. Gerlinde Van de Walle became the Baker Institute's newest tenured faculty member. One focus of her lab is adult stem cells, which reside in the body's tissues and replenish them with new cells. Her group is investigating both their capacity to treat injuries through regenerative medicine and their potential to develop into mammary tumors. Van de Walle is taking a novel approach to mammary cancer by comparing tissues from highly susceptible animals, especially humans, dogs and cats, to ones that rarely get the disease, like horses and cows. She hopes to find out why some large, long-lived animals rarely develop mammary cancer.

Harnessing the power of computational biology in cancer research: A Q&A with Dr. Charles Danko

How did you become interested in mixing computational and molecular approaches?

When I was a grad student I was very interested in computers and the development of algorithms that could be useful for understanding biology. But I recognized fairly early on that you were limited based on what kind of data was available. I didn't want to be limited in my career, so it was a major goal of mine as a postdoc to learn enough molecular biology that I could apply both routinely.

How are you applying these approaches to study colon cancer?

We're collaborating with Dr. Praveen Sethupathy at Cornell. Jon Villanueva, a joint graduate student, is investigating multiple layers of gene regulation in colon cancer to get a better sense for what's driving these changes. He's using cutting-edge organoid models that almost reconstruct the organ system in a petri dish. Instead of a single, flat layer of cells, you have a three-dimensional culture where different kinds of cells are interacting with each other in much the same way as inside a colon. Our collaborators at Weill Cornell Medicine (WCM), Dr. Luke Dow and Dr. Shuibing Chen, have made these organoid cultures from mice and humans. The goal is to integrate data from these cultures with tumor samples from the WCM tissue bank to understand how specific changes in the DNA sequence lead to the dysregulation of pathways that lead to cancer.

And you're also studying an aggressive type of brain cancer, called glioblastoma, through a collaboration with SUNY Upstate Medical University?

We're working with a wonderful lab led by Dr. Mariano Viapiano, a researcher known for his work on the extracellular matrix that holds cells together. We're also working with a surgeon, Dr. Lawrence Chin, who has been a critical resource for providing samples and clinical expertise for the genomic assays that we do.

We are constructing a really large data set using our newly developed ChRO-seq tool, which looks at the location of the enzyme that starts gene expression, genome-wide. Using this tool in a large cohort of patients – we have more than 70 now – we can identify the specific proteins, called transcription factors, which are driving patterns of gene expression in the tumor of that particular patient.

How do you foresee your work being applied in the future for cancer treatment?

We showed in glioblastoma that the activation of specific transcription factors create "signatures" that are really good prognostic indicators – better than people have developed before – that can predict the progression of the disease. I'm really interested in finding similar signatures in colon cancers that correlate with different outcomes for patients. Those signatures could help to decide what treatments patients should receive. We're really eager to figure out how to use those signatures in the clinic.

A new approach to mammary cancer: A Q&A with Dr. Gerlinde Van De Walle

How did you first get interested in mammary cancer?

My interest stems from when I was a veterinary student. When I was working with small companion animals, we heard a lot about mammary cancer and saw many patients. But when I spent my time in the large animal clinic, we never saw any cases. At the time, I didn't really pay that much attention to it, but later on I thought, why don't we see mammary cancer in all our veterinary species?

What are the existing treatment options for mammary cancer in pets?

Up until today, the most commonly used treatment for small companion animals remains surgery. There are other therapies out there, but they're not that frequently used and they're not that effective. So there is a lot of room for improved treatments.

Does your comparative approach represent a shift in the thinking about mammary cancer?

Yes, I believe it does. If you look at the field of mammary cancer research, it is primarily mouse models that have been used for many, many years. But there are some researchers who are trying to figure out why huge, long-lived animals like elephants and whales don't get cancer. So a shift toward studying animals that do not get cancer instead of only studying those that do is coming, but it's not general practice today to look across these different animals. That makes it challenging sometimes to get the funding and the recognition that what we are doing can contribute to the field.

What do you hope will be the outcome of this work for human breast cancer?

First and foremost: a better understanding of the disease, and why it does or does not occur. If we look at species that only rarely develop mammary cancer and understand their protective mechanisms, we could potentially turn those mechanisms into additional, novel treatments for breast cancer in humans.

Also, we may be able to identify biomarkers that let us diagnose the disease at an earlier stage than you can currently do with mammograms. Mammograms are very important, but you can only diagnose the cancer when you already have a lump in your breast. If we could identify biomarkers, we could screen people who are at high-risk to develop the disease and detect it at very early stages.

RESEARCH COLLABORATIONS

ROY COHEN, PH.D.

Accelerating stroke diagnosis

Stroke is the leading cause of serious, long-term disability in the U.S., and the second leading cause of death globally. The majority of strokes are caused by blood clots that cut off blood flow to the brain. These ischemic strokes can be treated effectively with drugs – but only if treatment occurs within about four hours of first symptoms. Only a small number of patients receive these drugs because the brain and neurovascular imaging required for diagnosis are not always available in time.

Dr. Roy Cohen is working with colleagues at Guthrie Robert Packer Hospital, a nationally accredited primary stroke center in Pennsylvania, to see if they can diagnose and treat strokes faster. Through a grant from the Cornell Center for Advanced Technology, Cohen's group provided diagnostic kits to the hospital that use "tethered enzyme technology" (TET) he developed with Dr. Alexander Travis. The test uses enzymes attached to nanoparticles to detect a biomarker released during strokes, and reports results within several minutes.

A pilot study gave promising results that the TET diagnostic tool successfully differentiates stroke from other conditions that mimic stroke symptoms. With additional clinical testing, they hope to provide a test that will cut the time and expense of stroke diagnosis and enable more stroke patients to receive treatment before it's too late.

> *"The collaboration with Cornell is essential to increase our knowledge in basic reproductive biology of rare and endangered species. Our joint efforts have already led to breakthroughs that will help to sustain our biodiverse planet."*
>
> -Dr. Pierre Comizzoli

ALEXANDER J. TRAVIS, V.M.D., PH.D.

The epididymis: A missing key to understanding infertility and developing male birth control?

The epididymis is a small, convoluted tube that sits just behind the testes. Researchers have often overlooked this organ, but it plays an important role in fertility. Dr. Alexander Travis is studying the epididymis to understand how it puts the finishing touches on sperm, stores them before release and then activates them to penetrate the egg. A better understanding of the epididymis could help diagnose previously unexplained infertility in men, and allow for the development of a male contraceptive – for humans or animals – with fewer side effects than hormonal birth control.

Travis and Dr. Pierre Comizzoli, a staff scientist at the Smithsonian Conservation Biology Institute (SCBI), have long partnered to develop reproductive technologies to conserve endangered species. Together they oversee the Cornell Smithsonian Joint Graduate Training Program. Their new student, Danielle Sosnicki, is studying a molecule on sperm that potentially could be used as a fertility test for animals ranging from humans to endangered species such as the big cats or black-footed ferrets. She is also studying how this molecule behaves as sperm travel through the epididymis.

Although small, the joint program has been highly successful. The first graduate, Dr. Jennifer Nagashima, worked with Travis and another scientist at the Smithsonian to produce the first puppies born through in vitro fertilization, and now is a postdoctoral fellow at the SCBI.

In the future, these reproductive technologies may enable conservationists to preserve endangered species by moving sperm between animals in fragmented populations and zoos, instead of moving the animals themselves.

JOHN S. L. PARKER, B.V.M.S., PH.D.

How a virus linked to celiac disease evades the immune system

When most people contract reoviruses as children, they experience little more than a mild stomach bug. But if the infection occurs when an infant is switching to solid food containing gluten, it may lead to celiac disease in a small percentage of people.

Dr. John S. L. Parker studies reoviruses to understand the different tactics they use to evade the immune system. He is collaborating with longtime friend, Dr. Terence Dermody, physician-in-chief and scientific director of UPMC Children's Hospital of Pittsburgh, to investigate a previous observation: reoviruses produce a protein that shields its genetic material, RNA, so it won't trigger an immune response from the host cell. Parker's group engineered a reovirus with a defective version of the protein. The modified reovirus functioned normally in cell cultures, but when Dermody's team tested the virus in mice, it no longer replicated effectively in the heart, confirming the protein's importance for infection. Parker's hope is that if we can understand reoviruses' tricks, we could develop a vaccine that would block the infection and potentially prevent celiac disease.

> *"It is an absolute joy to work with John. He brings curiosity, creativity and keen experimental insights to every question he seeks to answer. The work we are doing together has the potential to yield new approaches to developing vaccines to prevent celiac disease. I am very excited about this project."*
>
> – Dr. Terence Dermody

COLIN PARRISH, PH.D.

How do viruses start epidemics when they infect a new host?

When a virus spreads into a new type of animal, often the outbreak fizzles out. But sometimes, the virus adapts and the outbreak develops into a massive epidemic. Dr. Colin Parrish is studying the evolution of viruses, specifically parvovirus and canine influenza virus, in order to understand how they become successful pathogens in new hosts.

For about a dozen years, Parrish has worked with Dr. Edward (Eddie) Holmes, Australian Laureate Fellow and Professor at the University of Sydney. Parrish's group studies different strains of canine viruses as they grow in cell cultures, and also works with Holmes' team to analyze the genetic sequences of the viral strains to piece together how the viruses have changed as they spread in dogs. Together, they can figure out what specific properties have enabled these viruses to colonize and spread within dogs to cause new and far-reaching diseases. They can also use these studies to understand the properties of the viruses to identify changes that have the potential to cause new outbreaks in people or other animals, before they occur.

> *"In the best collaborations the whole is greater than the sum of the parts. We have that here. The great thing about collaborating with Colin is that he gives my analytical studies a real world perspective."*
>
> – Dr. Edward Holmes

LUIS SCHANG, M.V., PH.D.

Zika investigation helps understanding of microcephalies

In 2015, Zika virus emerged in the Americas and by 2016, Brazil had reported a spike in babies born with microcephaly, a condition characterized by a small head size with a range of associated major neurological problems. The spike was soon linked to the spread of Zika virus, but exactly how the virus caused microcephaly remained a mystery.

Dr. Luis Schang was studying Zika and, with collaborator Dr. Michael Weinfeld of the University of Alberta, other viruses. In 2016, Weinfeld pointed out that an enzyme that repairs damaged DNA is linked to microcephaly and herpes simplex virus-1 replication in certain brain cells. With Weinfeld's expertise, Schang's lab group found that Zika virus, which kills off the cells that make new neurons, moves this enzyme away from damaged DNA, and DNA damage accumulates in these neuron-generating cells when grown in culture.

> *"The possibility of a common pathway for microcephaly induced by mutation in a DNA repair gene and by a virus is intriguing. Science is always exciting when interdisciplinary teams address major issues."*
>
> – Dr. Michael Weinfeld

The mechanism that they discovered has implications beyond Zika. Understanding how microcephalies occur is essential for eventually preventing these serious neurological defects, which occur during pregnancy in animals and humans. One of the next steps is to see if similar DNA damage occurs in the developing neurons in animals and humans with Zika-induced microcephaly.

SCOTT COONROD, PH.D.

Finding better ways to diagnose and treat hemangiosarcoma

Each year, thousands of dogs receive a possible diagnosis of splenic hemangiosarcoma, a malignant overgrowth of cells that arise from the lining of blood vessels. Even with surgery to remove this common tumor, most dogs live only a few months because the cancer has already spread. Additionally, sometimes the mass appears to be hemangiosarcoma, but is a relatively harmless growth called a hyperplasia. Better diagnostic tests are needed that can identify these tumors before they spread, and differentiate malignant from benign masses in the spleen.

> *"Our hope now is to begin using the information that we are obtaining from our genome-wide screens to begin to develop new, more effective, diagnostics and therapies for canine hemangio-sarcoma."*
>
> – Dr. Charles Danko

To better understand the molecular features of hemangiosarcoma, Dr. Scott Coonrod teamed up with Dr. Charles Danko and the Cornell University Hospital for Animals. Using hemangiosarcoma and hyperplasia samples from patients at the hospital, Coonrod and Danko are using genome-wide sequencing technologies to identify molecules that are overproduced in these tumors, compared to hyperplasias and healthy tissues. Initial findings suggest that molecular features can differentiate hemangiosarcoma from hyperplasias and normal tissue. Additionally, while preliminary, they have found that several molecules overproduced by hemangiosarcoma tumor tissue enter the blood stream. The molecules potentially could act as biomarkers to screen high-risk dogs for hemangiosarcoma and to differentiate malignant from benign masses during diagnosis. Long-term, they hope to identify drugs that target these cancer-associated molecules to slow tumor growth.

CHARLES DANKO, PH.D.

How changes in gene regulation fuel animal evolution

> *"This project has great potential to make important progress on one of the deepest and most profound questions in biology: how does gene expression evolve? There's no one I'd rather work with on these questions than Charles. He is a fantastic collaborator – bright, inquisitive, creative, tireless and unfailingly generous with his colleagues."*
>
> – Dr. Adam Siepel

All mammals – whether hamsters, dogs, or humans – share most of the genes in their genomes. What makes animals different is how they each regulate when those genes are turned on and to what extent they are expressed. Dr. Charles Danko, in collaboration with Dr. Adam Siepel of Cold Spring Harbor Laboratory, is looking for big changes in gene expression that occurred in the evolution of nine mammal species. Specifically, they're using advanced sequencing technologies and computational analyses to analyze five different ways that organisms regulate gene expression. They have received a $2.7 million grant from the National Institutes of Health for this work.

The research will enable them to identify important differences between the species, which resulted from evolutionary pressures. For example, they discovered that compared to other primates, humans produce fewer molecules on the surface of our cells that the anthrax bacterium uses to start an infection. We likely lost those molecules when we started raising cattle and sheep, because these animals are natural carriers of anthrax.

DOUGLAS F. ANTCZAK, V.M.D., PH.D.

How do isolated Icelandic horses maintain diverse immune function genes?

Viking settlers first brought horses to Iceland in the late 9th century for sheep herding, farming and transportation. They bred a unique Icelandic horse that is small, hardy, and due to its isolation, almost completely disease-free. Dr. Douglas Antczak wanted to know how this isolation, and the possibility for inbreeding, had impacted a set of genes called the major histocompatibility complex (MHC). These genes code for proteins on the surface of cells that detect and signal the presence of foreign pathogens, such as bacteria and viruses.

Antczak worked with Dr. Bettina Wagner, Chair of the Department of Population Medicine and Diagnostic Sciences at the Cornell University College of Veterinary Medicine, and Dr. Vilhjálmur Svansson of the Institute for Experimental Pathology at the University of Iceland, to detect different MHC types from more than 150 Icelandic horses. They discovered that the horses had surprisingly diverse MHC types, which is beneficial for fending off disease. They suspect that a natural process called recombination, where genes on two different chromosomes swap pieces of DNA, may be responsible for generating so much variation in this isolated population of horses.

> *"Increased travel between countries and growing popularity of the Icelandic horse offers a threat to this unique status. The finding of high immunological variability within the Icelandic horse breed is reassuring. It suggests that the Icelandic horse population has a greater chance of withstanding introduction of new devastating pathogens."*
>
> – Dr. Vilhjálmur Svansson

GERLINDE VAN DE WALLE, D.V.M., PH.D.

Do microRNAs play a role in mammary cancer in cats?

Just like humans develop breast cancer, cats develop mammary tumors at alarming rates. Not much is known, however, about why cats are susceptible or what the underlying factors are behind the disease. With funding from the Cornell Feline Health Center, Dr. Gerlinde Van de Walle is investigating one possible suspect: microRNAs. In healthy tissue, these short strands of RNA help cells control what kinds of proteins they make. But scientists increasingly are recognizing that when microRNA regulation goes amiss, they play a role in the development of certain diseases, such as cancer.

Van de Walle has teamed up with microRNA expert Dr. Praveen Sethupathy at the Cornell University College of Veterinary Medicine to investigate microRNAs in cat mammary tissue. First they will examine the activity and regulation of microRNAs in healthy tissues, looking specifically at stem cells, which can give rise to tumors in mammary tissues. Once they understand patterns of microRNA regulation in healthy tissue, they can identify the changes that lead to mammary tumors in cats.

> *"This collaboration is a wonderful example of the exciting cross-disciplinary research that is possible at Cornell. With the university-wide focus on 'One Health,' the emphasis at the College of Veterinary Medicine on comparative biology and medicine, and the support of the Feline Health Center, we are well positioned to better understand the contribution of microRNAs to both feline and human mammary cancer."*
>
> – Dr. Praveen Sethupathy

DEGREES CONFERRED

Heather Callaway, Ph.D. '18

"Parvovirus Capsid Structure, Ligand Binding Interactions, and Endogenous Viral Elements."

Dr. Hallaway is currently a postdoctoral researcher at Scripps Institute in La Jolla, California.

Rebecca Harman '92, MS '11, Ph.D. '18

"The Equine Mesenchymal Stromal Cell Secretome as a Therapy for Cutaneous Wounds."

Dr. Harman is continuing her research as a Research Support Specialist in the Van de Walle lab at the Baker Institute.

Melissa Ledet, Ph.D. '19

"The Mammary Gland in Health and Disease."

Dr. Ledet returned to her hometown of Baton Rouge, Louisiana and currently leads a community cancer outreach program and coordinates science fair programs in local high schools.

Matthew Pennington, Ph.D. '18

"Repurposing Raltegravir for the Treatment of Feline Herpesvirus (FHV-1) Ocular Infection."

Dr. Pennington is currently a postdoctoral researcher studying adenovirus infections at Harvard University.

TRAINEE ACHIEVEMENTS

Left to right: Joy Tomlinson, Mridismita Saikia, Rebecca Harman, and Shao-Pei Chou. Missing: Tin Yi Chu.

Dr. Rebecca Harman's presentation on "Equine mesenchymal stromal cell-derived PAI-1 and tenascin-C promote wound healing" earned best oral presentation at the 2018 North American Veterinary Regenerative Medicine conference.

Graduate student **Shao-Pei Chou**'s presentation "Decoding the 2% Difference That Makes Us Human" earned her second place at the fifth annual Three Minute Thesis (3MT) competition. She joined other Cornell winners to compete in the inaugural Ivy+ 3MT competition, held in April at the United Nations.

3MT challenges research degree students to present a compelling story on their dissertation or thesis and its significance in just three minutes, in language appropriate to a non-specialist audience. The first 3MT competition was held in 2008 at the University of Queensland, Australia, and has since been adopted by more than 600 graduate schools in at least 65 countries.

Tin Yi Chu, a graduate student in Charles Danko's lab was selected as a recipient of the Hsien Wu and Daisy Yen Wu Scholarships. This faculty-nominated scholarship is granted to Ph.D. students who have demonstrated exceptional academic ability and performance.

Dr. Mridismita Saikia's talk, "Exploring cell type specific transcriptomic differences in human islets at single cell resolution" won second place in the Prodo Laboratories sponsored Best Talk prize at the 27th Boston Ithaca Islet Club Meeting held this year in Icahn School of Medicine at Mount Sinai, N.Y. in May.

Joy Tomlinson, D.V.M. '10, was part of a team that clinically proved that an off-the-shelf cryotherapy device is effective in treating equine laminitis, a painful inflammatory condition of the hoof. This research was included in the 2018 Kester News Hour at American Association of Equine Practitioners in 2018 as one of the year's most important findings in equine medicine.

Tomlinson also received a 5-year National Institutes of Health K08 Mentored Clinical Scientist Research Career Development Award. The project, titled "Comparative animal models of viral hepatitis", will study non-human primate hepacivirus and equine parvovirus pathobiology in horses.

Two of **Dr. Tomlinson**'s publications on Theiler's disease were featured as two of the most important papers of the year in the "Best LAIM Papers of the Year" talk at the American College of Veterinary Internal Medicine annual forum in June 2019.

NUMBERS AT A GLANCE

4 STUDENTS **EARNED DOCTORAL DEGREES** *while working in Baker Institute labs*

29 **TRAINEES** *working in labs throughout the Institute*

- **16** *Graduate Students*
- **3** *Research Associates*
- **8** *Postdoctoral Associates*
- **2** *Visiting Scholars*

13 **NATIONAL INSTITUTES OF HEALTH** *Awarded Grants*

9 **LABS**

31 **PEER-REVIEWED PUBLICATIONS** *from Baker Institute Researchers*

Marine Bazin

Current College: University of Hannover
Mentor: Gerlinde Van de Walle

Honoria Brown

Current College: University of Cambridge
Mentor: Charles Danko

Jessica Kohs

Current College: Freie Universität Berlin
Mentor: Scott Coonrod

Lawrence Noble

Current College: University of Queensland
Mentor: Colin Parrish

Leadership program for veterinary students builds pipeline to careers in research

To continue meeting the challenges to animal health posed by emerging pathogens and understudied diseases, we need scientists who are committed to conducting cutting-edge veterinary research. Few veterinarians, however, pursue a career outside of the clinic. To help meet this need, Dr. John S. L. Parker has spent 10 years serving as the director of the Cornell Leadership Program for Veterinary Students, helping future veterinarians to develop careers in research and discovery.

The program provides veterinary students with a 10-week summer research experience in labs at the Baker Institute and Cornell University. Students also participate in career development activities and receive career counseling on the many opportunities available to them. Veterinary researchers are in great demand in biomedical research, the pharmaceutical industry, public health agencies and at universities, where they are needed to teach the next generation of students.

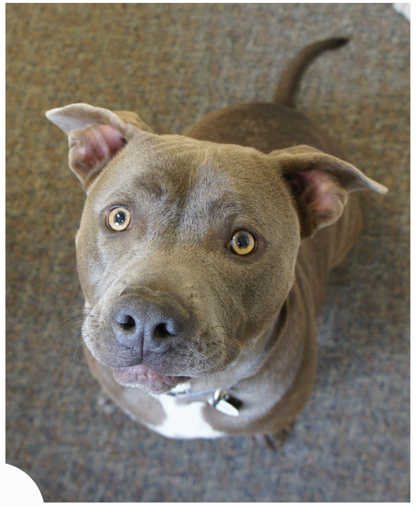
"There is a fairly significant shortage of veterinarians who go on and do a Ph.D. or go into veterinary research," said Parker. As a result, there are several problems that veterinarians encounter frequently, such as chronic renal failure in cats and canine cancer, which a handful of researchers are studying. "It's important that people within the veterinary profession are actually working on problems in veterinary medicine," he said.

More than 680 veterinary students from the U.S. and abroad have participated in the Leadership Program since its inception 30 years ago. About one third complete a Ph.D. after the program and many have gone on to hold faculty positions at veterinary schools, to join diagnostic and pharmaceutical companies and to work as government scientists and epidemiologists.

In July, this year's cohort of students attended the National Veterinary Scholars Symposium held at Tufts University, where they had the opportunity to present their work at poster sessions, hear talks from prominent veterinary researchers and to network with research-minded people like themselves. "It's a really great opportunity for participants to get together with a large number of students from other universities," said Parker. "They suddenly realize that they're not so unusual."

The program receives financial support from several generous private donors, from the European institutions that send their students and also from the National Institutes of Health (NIH). "NIH funds us because it recognizes the national need," said Parker. "The U.S. needs more highly trained veterinarians with advanced scientific skills to fill these jobs. We're trying to do our job to try to rectify that."

DONOR HIGHLIGHT



KEITH RICHTER ’78, D.V.M. ’81

Love of animals and basic science converge at the Baker Institute

In Keith Richter’s almost 40-year career as a veterinarian, he has helped build several companion animal-focused specialty hospitals. As the hospitals grew, so did his interest in the power of basic research to improve the lives of animals, and his commitment to the work of the Baker Institute. Richter now serves as Chair of the Advisory Council and is excited about the potential for future collaborations between Baker scientists and clinicians at the network of hospitals he helped found, Ethos Veterinary Health.

Richter completed his undergraduate and veterinary degrees at Cornell University, and so he became involved with Baker’s Clinic Memorial Giving Program soon after setting up his first clinic, the Veterinary Specialty Hospital of San Diego, in the 1990s.

Then Richter co-founded a second hospital in San Diego, followed by a reference laboratory, and then two hospitals in Hong Kong. In 2015, Richter’s San Diego healthcare facilities merged with clinics in Denver, Chicago and Boston to form Ethos Veterinary Health. “By coming together we were able to support a science-based mission,” said Richter. “It’s something we would never have been able to do on our own as a single practice.” Now they have 21 locations stretching from the Northeast to Hawaii.

As Richter advanced in his own career as a veterinary gastroenterologist, writing manuscripts, book chapters and teaching at Cornell University, he became more involved in the work of the Baker Institute. In 2013, he joined the Advisory Council, and in 2019 became its Chair, where he hopes to advance partnerships between Baker scientists and Ethos veterinarians. “What Ethos is good at is identifying unmet needs and executing clinical trials,” he said, “but we don’t have a wet lab and we don’t have scientists like at Baker.”

For example, Ethos Discovery, an affiliated non-profit research organization, is in talks with Dr. Scott Coonrod about sharing samples of canine hemangiosarcoma, a common and deadly cancer of the walls of blood vessels. The network of clinics would also be well positioned to validate any new diagnostic tests that Coonrod develops.

Richter retired from Ethos earlier this year but is still active on its board. He lives in San Diego where he can often be found at Padres baseball games, or spending time with his two dogs; a pit bull named Mr. Piggy, and an Irish water spaniel named Bloopis. Richter also has a female rescue cat, Melvin.

WAYS YOU CAN HELP

Improving Animal Health Together: The Baker Institute Legacy Walk

The faculty, trainees and staff at the Baker Institute have worked hard for decades to improve the health and well-being of dogs, horses and other companion animals, and our work continues in new and groundbreaking directions today. You can help pave the way for future discoveries at the Baker Institute with a donation for a custom brick inscribed to memorialize or pay tribute to a cherished pet or special animal lover. Your brick will be placed in a unique patio situated on the beautiful grounds of the Baker Institute for Animal Health.

Take a Seat at the Baker Institute

Another way you can support our efforts to improve animal and human health is by making a gift for a lecture theatre chair at the Institute. For a pledge of $2,000 payable over 1 – 4 years, your name or message of choice will be permanently engraved in one of the 100 seats in the Thaw Charitable Trust Lecture Theatre. Our lecture theater regularly hosts lectures, seminars and continuing education for veterinarians and members of the scientific community.

To reserve your personalized brick or to sponsor a seat, please contact us at BakerInstitute@cornell.edu or 607.256.5600.

PAST TRAINEE HIGHLIGHTS

DANIELLE BUTTKE, D.V.M. '09, PH.D. '10

Answering the call when outbreaks strike at national parks

If a disease outbreak occurs in any of the more than 400 national parks, battlefields or seashores in the U.S., only two epidemiologists handle the outbreak, and one is former Baker graduate student Dr. Danielle Buttke. As the One Health Coordinator for the National Parks Service in Fort Collins, Colorado, Buttke works halftime as an epidemiologist responding to public health problems and halftime as a wildlife veterinarian, working with all kinds of animals, from black-footed ferrets to Florida panthers.

"I love working for the National Park Service and knowing that what we're doing is trying to preserve these treasures for the next generation," said Buttke.

Buttke was a dual-degree student at Cornell University who completed her D.V.M. in 2009 and her Ph.D. with Dr. Alexander Travis in 2010. She was attracted by Travis' focus on wildlife conservation and for her graduate work she studied lipids in the cell membrane of sperm that act like scaffolding for molecules necessary for communicating with an egg. "I loved the Baker Institute," said Buttke. "Being able to ride my bike up that hill felt like I was going home."

As a student, she had no idea this job with the National Parks Service even existed, but through networking opportunities afforded by her work at Baker, and an epidemic intelligence service fellowship at the Centers for Disease Control and Prevention, eventually she landed at her current position.

"I still daydream about coming back to the Baker Institute in some capacity," said Buttke. "It has definitely been really important for making the connections that have allowed me to get here today."

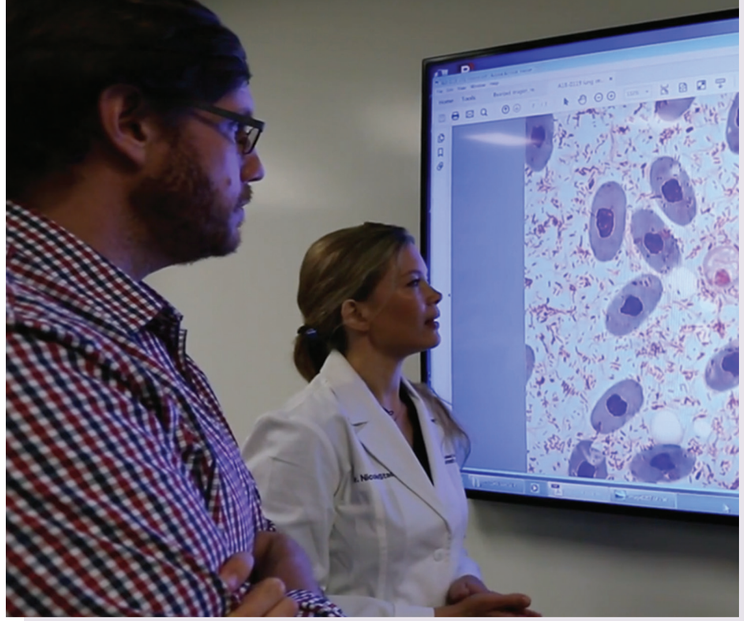
Danielle Buttke, D.V.M., Ph.D., M.P.H., DACVPM

CDR, United States Public Health Service

One Health Coordinator

Biological Resources Division/ Wildlife Health Branch and Office of Public Health

National Park Service



Robert Ossiboff, D.V.M., Ph.D., DACVP

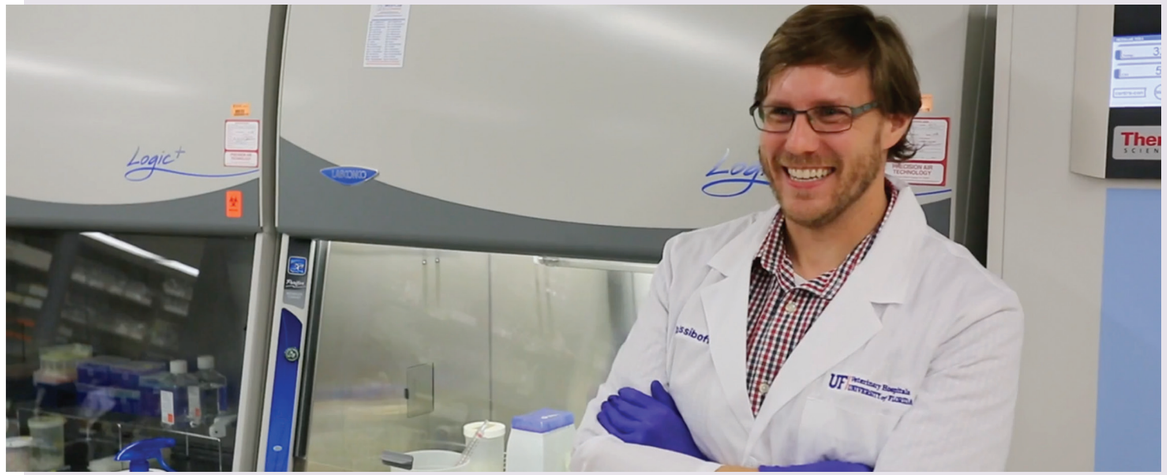
Clinical Assistant Professor

Aquatic, Amphibian, and Reptile Pathology | ZooMed Diagnostic Laboratory

Department of Comparative Diagnostic and Population Medicine

College of Veterinary Medicine

University of Florida



ROBERT OSSIBOFF, PH.D. '08, D.V.M. '10

Finding a passion for research to improve reptile health

Dr. "Oz" Ossiboff got his first taste of research as a summer student in Dr. John Parker's lab through the Leadership Program for Veterinary Students. Ossiboff enrolled the previous year as a veterinary student at Cornell University, but after that summer, he was hooked. He applied for the dual degree program, completed his Ph.D. in Parker's lab studying feline caliciviruses, and now is a clinical assistant professor at the University of Florida (UF) in Gainesville, where he researches emerging diseases in reptiles and amphibians.

"My time with John made me realize the importance of infectious disease research," said Ossiboff. "There are 18,000 species of reptiles and amphibians and we know so little about their diseases and what that means for conservation."

After completing an anatomic pathology residency, diagnostic research fellowships, and a position at the University of Illinois at Urbana-Champaign, Ossiboff joined UF in 2017. He is investigating a group of emerging viruses that infect snakes and designing diagnostic tests to differentiate two types of chytrid fungi that can be deadly for amphibians. He is also developing several reptile cell lines for use in disease research. Ossiboff has even worked with four students through a program similar to the Leadership Program at his university.

Regarding his time at Baker, Ossiboff said that he enjoyed escaping "up on the hill." "It was a great group of researchers and graduate students that I have maintained personal and professional connections with to this day."

BICKNESE PRIZE WINNER
LAUREN CHOATE | DANKO LAB

Bicknese Prize furthers a career in medical genetics

Lauren Choate, a Ph.D. student in the lab of Dr. Charles Danko is this year's recipient of the Bicknese Prize. The award supports a woman scientist-in-training during a key point in her career development, and allowed Choate to explore a potential career as director of a clinical molecular diagnostics laboratory, where she would oversee medical genetic testing and conduct research in human genetics.

Choate's research at Baker focuses on how gene regulation has evolved in humans and related species. The work combines her interests in genetics and computer analysis tools to yield insights into how chromosomes are folded into the nucleus and how humans evolved to avoid anthrax infection. "The Danko Lab was a perfect fit for me. I could not find a more supportive advisor than Charles," she said.

In July, Choate attended the Society of Molecular Biology and Evolution Conference in Manchester, UK, where she presented her work and talked with other scientists about primate evolution. Choate had planned to use the Bicknese funds to attend the meeting, but won the Walter M. Fitch Travel award from the society, which covered her costs.

So instead, Choate used the prize to visit medical genetics departments at hospitals. She shadowed medical geneticists and laboratory directors and learned about available diagnostic testing and the process of explaining test results to clinicians and patients.

Joanne Bicknese, '75, D.V.M. '78, established the Bicknese Family Prize in 2005 in honor of her parents, Helen and Louis Bicknese, and her aunt and uncle, Grace and Carl Bicknese.

"I would like to thank Joanne Bicknese for setting up this prize," said Choate. "It has given me the freedom to explore career options and has played an invaluable role in my career development."

DAVERSA SCHOLARSHIP WINNER
MALGORZATA RYCHLOWSKA PH.D. | SCHANG LAB

Daversa scholarship leads to promising new collaboration to study Zika virus

When Dr. Malgorzata Rychlowska joined the lab of Dr. Luis Schang to study Zika virus in 2016, scientists had just announced that Zika causes the babies of infected women to be born with microcephaly, a condition characterized by an abnormally small head and a variety of neurological problems. In just three years working as a research associate, she has progressed towards an explanation for how Zika causes microcephaly. Now, through an intensive course on Zika and other mosquito-borne diseases, made possible by the Daversa Scholarship, Rychlowska will be able to advance her work through a new collaboration with a prominent physician and Zika expert she met at the course.

In her work in Schang's lab, Rychlowska is working with lab cultures of human neural stem cells, which divide rapidly to build the brain during fetal development. She discovered that once Zika infects the neural stem cells, the virus sequesters a cellular enzyme needed to repair damaged DNA, so the chromosomes continually accumulate errors as cells divide. The damaged cells undergo abnormal cell division and ultimately stop dividing and die. Inside the fetus, this process would prevent the brain from reaching its full size.

Using funds from the Daversa Scholarship, Rychlowska travelled to Cuba for two weeks in August, where she attended the 16th International Course on Dengue, Zika and other Emergent Arboviruses, held at the Institute of Tropical Medicine in Havana. Through the course she met Dr. Kleber Luz, an infectious diseases specialist at the Federal University of Rio Grande do Norte in Brazil, who was the first physician to report the outbreak in Brazil in 2015, and among the first to link Zika to a rise in cases of microcephaly.

Luz agreed to collaborate by providing patient samples so that Rychlowska can look for the same growth abnormalities that she observes in her cell cultures. If she finds them, the results would support her idea that one of the mechanisms behind Zika virus-induced microcephaly is the prevention of DNA repair, and the resulting abnormalities in cell division and death of neural stem cells. The project is so promising that they have received support for the work through the National Institute of Neurological Disorders and Stroke.

"This project is so exciting because every week you discover something new," said Rychlowska. "It constantly challenges your knowledge and makes you really evolve and expand as a scientist."

Ms. Maria Daversa and her husband David Gulley established the Daversa Family Scholarship Fund to memorialize Rayne, their seven-year-old German shepherd who succumbed to a massive stroke in July 2007. The couple first came into contact with the Baker Institute for Animal Health after finding out that their veterinarian had made a contribution in Rayne's name to the Institute, and Ms. Daversa was excited to learn that the Institute's mission aligned closely with her own sentiments. The endowed scholarship that they created funds the pursuit of knowledge for scientists in training.

"I would like to thank them for choosing me for this amazing scholarship," said Rychlowska. "This unique opportunity to start a new collaboration between a research lab at Cornell and a Brazilian clinic was made possible because of their support. I do believe that collaboration with Dr. Luz, who is one of the most recognized physicians in the field, will bring exciting new findings and open possibilities for future projects."

BEYOND THE LAB

From pioneering advances in genetic research to new treatment strategies for infectious and inherited diseases that afflict animals, researchers at the Baker Institute regularly share their research results with both their peers in the scientific community and the public at large.

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** One of two papers voted as the most important papers of the year in the "Best LAIM Papers of the Year", talk at the American College of Veterinary Internal Medicine (ACVIM) annual forum in Phoenix, AZ, June 2019.*

Legend: Bold denotes Tenured Track Faculty | Underlined denotes Other Institute Member

ACTIVE GRANTS

* Collaborations

Antczak Lab

Harry M. Zweig Memorial Fund
Functional Gene Annotation in the Horse
* Charles Danko – Baker Institute

Grayson-Jockey Club Research Foundation
Cytotoxic T-Cell Immunity to Equine Herpesvirus Type 1
* Nikolaus Osterrieder – Freir Universität Berlin
* Rebecca Tallmadge Ingram – Cornell University, Clinical Sciences

Parker Lab

NIH (Department of Health & Human Services)
Mechanisms of Virus-Mediated Compartmentalization of the Host Translational Machinery
* Iwijn De Vlaminck – Cornell University, Meinig School of Biomedical Engineering

NIH (Department of Health & Human Services)
Graduate Training Program in Comparative Medicine

NIH (National Institute of Allergy & Infectious Disease)
Droplet-Assisted RNA Targeting by Single-Cell Sequencing to Dissect the Single-Cell Heterogeneity of RNA Virus Infection

Danko Lab

NIH (Department of Health & Human Services)
Mapping RNA Polymerase in Tissue Samples with ChRO-seq
* Kwak Hojoong – Cornell University, Molecular Biology and Genetics

NIH (National Human Genome Research Institute)
Evolution of Chromatin Architecture and Transcriptional Regulation in Mammals
* Adam Siepel – Cold Spring Harbor Laboratory

NASA (National Aeronautics & Space Administration)
Pol II Pausing as a Milestone on the Road to Complex Animals
* Athula Wikramanayake – University of Miami
* Cesar Arenas-Mena – City University of New York, College of Staten Island

Coonrod Lab

New York State Department of Health
Histone Citrullination in Estrogen Receptor Signaling and Breast Cancer
* Charles Danko – Baker Institute

Research Grants Program in Animal Health
Novel Biomarkers for Canine Hemangiosarcoma

Breast Cancer Coalition of Rochester
Role of PAD2 in ER-DNA Binding and Endocrine Resistance

Travis Lab

NIH (National Institute of Child Health & Human Development)
Membrane Lipid Regulation of Calcium Channels in Sperm
* Roy Cohen – Baker Institute
* Polina Lishko – The Regents of the University of California, Berkeley

Cornell Tech Acceleration and Maturation
Tethered Enzyme Technology Biosense for Nucleic Acid Polymers (TET-NA)
* Roy Cohen (PI) – Baker Institute

Parrish Lab

NIH (Department of Health & Human Services)
Structural Controls of Functional Receptor and Antibody Binding to Viral Capsids
* Susan Hafenstein – Penn State University

NIH (Department of Health & Human Services)
The Evolutionary and Biological Bases of Host Switching in Viruses
* Eddie Holmes – University of Sydney, Australia

NIH (National Institute of Allergy & Infectious Disease)
Effects of Common Sialic Acid Modifications on Virus Binding and Infection
* Susan Daniel – Cornell University, Chemistry and Chemical Biology

Tait Wojno Lab

NIH (National Institute of Allergy & Infectious Diseases)
Role of the Prostaglandin D2 Receptor CRTH2 in Helminth-Induced Type 2 Inflammation in the Intestine
* Charles Danko – Baker Institute

NIH (National Institute of Allergy & Infectious Diseases)
The Notch Signaling Pathway Regulates Basophil Responses during Helminth Infection

Westie Foundation of America, Inc.
Mechanisms of Allergic Disease in the West Highland White Terrier

Van de Walle Lab

USDA (National Institute of Food and Agriculture)
The Antimicrobial Properties of Mesenchymal Stromal Cells as a Biological Alternative to Conventional Antibiotics in Veterinary Medicine
* Bettina Wagner – Cornell University, Population Medicine and Diagnostic Sciences

NIFA Federal Capacity Funds (U.S. Department of Agriculture)
The Bovine Mammary Stem Cell Secretome: A Novel Approach to Treat Mastitis

Rockefeller University
Characterization of Recently Discovered Liver-Tropic Viruses in Horses
* Thomas Divers – Cornell University, Clinical Sciences

Harry M. Zweig Memorial Fund
The Mesenchymal Stem Cell Secretome Against Equine Herpesvirus Type 1 Infections
* Bettina Wagner – Cornell University, Population Medicine and Diagnostic Sciences

Cornell Feline Health Center
The Use of Povidone-Iodine Ophthalmic Compositions as a Broad-Spectrum Therapy for Ocular Infections in Cats

NIH (National Institute of Allergy & Infectious Diseases)
Comparative Animal Models of Viral Hepatitis
* Joy E. Tomlinson (PI) – Baker Institute

Schang Lab

NIH (National Institute of Neurological Disorders and Stroke)
Menage A Trois - Zika Virus, DNA Damage Responses and Microcephaly; Is PNKP the Molecular Link?
* Rychlowska Malgorzata – Baker Institute

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July 1, 2018 - June 30, 2019

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South Wilton Veterinary Group
South Windsor Veterinary Clinic
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Farmington Veterinary Clinic
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We wish to express our gratitude to all who contributed this past year. While space prevents us from listing all names, please know that your support is deeply appreciated.

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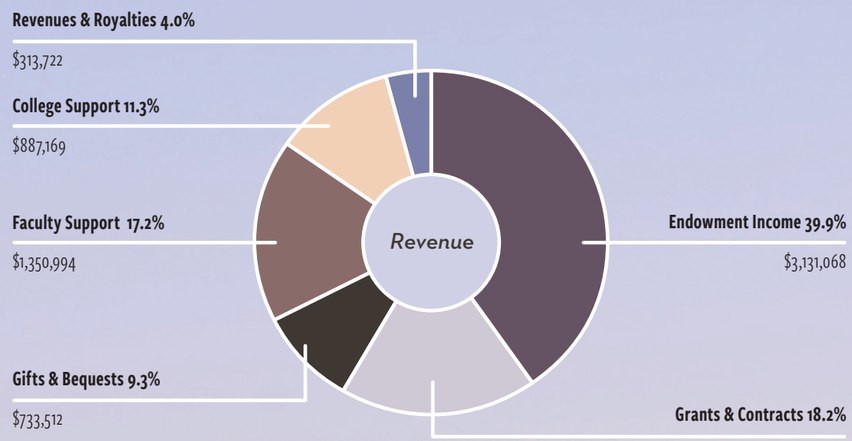

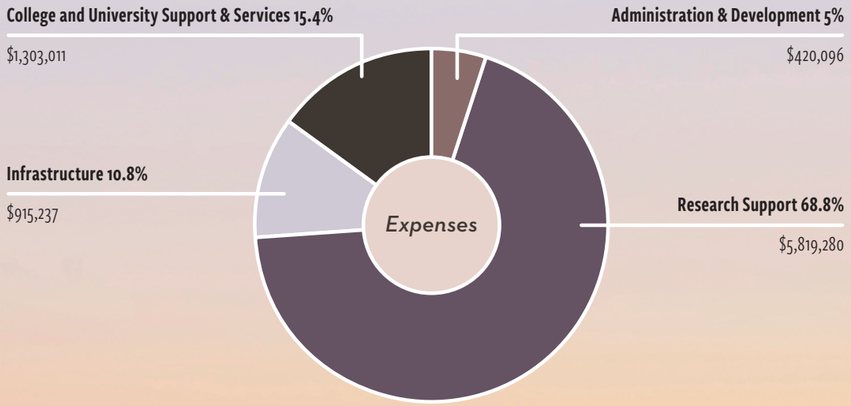

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