

1998 ANNUAL REPORT

Leadership Program for Veterinary Students

CORNELL
UNIVERSITY

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**College of Veterinary Medicine
Cornell University
1998 REPORT**

The Leadership Program for Veterinary Students

The College of Veterinary Medicine at Cornell University invites promising students of veterinary medicine to a ten-week summer program designed to crystallize their interest in a career in research. For some fellows, the program provides their first sustained exposure to medical research. For



Chris Kunze (Kansas State) and Monica Murphy (Minnesota)

others, it builds on earlier experience, nurturing an already-developing interest. Each fellow is assigned a research project in an area of his or her interest. The project enables the fellow to explore a problem, acquire practical experience with investigative methods, and gain insight into the way a research laboratory utilizes its professional and material resources.

The program is open to students who have completed at least one year toward the Doctor of Veterinary Medicine degree. Participants typically rank near the top of their class. The program's emphasis on excellence draws the best from around the world: its nineteen fellows this year represented veterinary colleges in Australia, Canada, Germany, the Netherlands, the United Kingdom, and the United States.

Regardless of background, each fellow is recognized as having the ability and motivation to become a future leader of the veterinary profession or animal agriculture. Experience gained through participation in the program helps clarify and strengthen the individual's commitment to a research career and the advanced training required to reach that goal.



1998 Students at a Glance

<i>STUDENT NAME</i>	<i>HOME COLLEGE</i>	<i>MENTOR</i>	<i>CORNELL DEPT. AFFILIATION</i>	<i>SPONSOR</i>
Bastian, Max	Hannover	Theodore Clark	Microbiology	Merck
Cox, Ian	Bristol	Joel Baines	Microbiology	Wellcome
Crotty, Erin	Cornell	Thomas Divers	Clinical Sciences	NIH/Zweig/Pfizer
Fleischer, Steven	Cornell	Eric Denkers	Microbiology	NIH/Merck
Howard, Tammy	Queensland	James MacLeod	Baker Institute	Simpson/Pfizer/Zweig
Hueffer, Karsten	Hannover	George Lust	Baker Institute	Pfizer
Jenkins-Serrano, Guanina	Cornell	Arleigh Reynolds	Clinical Sciences	NIH/Merck
Klinck, Mary	Atlantic	Susan Suarez	Biomedical Sciences	Gould/Pfizer
Kunze, Christopher	Kansas	Kunal Ray	Baker Institute	NIH/Pfizer
Lenard, Zoe	Sydney	Richard Cerione	Molecular Medicine	USDA/Gould
Liljebjelke, Karen	Georgia	Lorin Warnick and Yrjo Grohn	Diagnostic Sciences	NIH/Merck
Minicucci, Larissa	Cornell	Judith Appleton	Baker Institute	NIH/Merck
Murphie, Amanda	Sydney	Douglas Antczak	Baker Institute	Havemeyer/USDA
Murphy, Monica	Minnesota	Sydney Moise	Clinical Sciences	NIH/Gould/Pfizer
Narayanaswamy, Harish	Tufts	Edward Pearce	Microbiology	NIH/Merck
Nickerson, Kitren	Colorado	Douglas Antczak	Baker Institute	Havemeyer/NIH/Zweig
Shumaker, Amy	Florida	Bendicht Pauli	Molecular Medicine	NIH/Merck
Sparnaay, Anne-Marije	Utrecht	Karel (Ton) Schat	Microbiology	Simpson
Tzannes, Sophia	Sydney	David Robertshaw	Biomedical Sciences	USDA/Simpson

1998 Leadership Program Activities

The Cornell Leadership Program combines independent, faculty-guided research with career counseling, group discussions, professional-skills development workshops and field trips to federal research facilities. Many of the program's modules emphasize student-directed learning and the development of teamwork skills.

Leadership Development

Discussion of the responsibilities of leadership and exercises in leadership are important features of the program. Activities this year included a module that focused on critical thinking and decision-making, modeled on the Public Broadcasting System series, "Ethics in America". A hypothetical problem in animal agriculture was presented to a panel comprised of the fellows and four invited participants, Professor Norman R. Scott, vice president for research and advanced studies at Cornell; Professor Lynn W. Jelinski, director, NYS Center for Advanced Biotechnology at Cornell; Dr. Alex Goudie, senior vice president, Animal Health Discovery, Pfizer, Inc.; and Ms. Suzanne McGregor, assistant regional counsel, U.S. Department of Justice. Each panelist was assigned a role that obliged him or her to make, defend, and in some cases, alter decisions as details of the hypothetical were revealed. Dr. David Fraser, professor of animal science at the University of Sydney, designed the module and served as moderator.



A portion of the Emerging Diseases Workshop was conducted as a videoconference between Cornell and the University of Sydney

Career Exploration

Informal counseling occurs frequently during the ten-week period that the program is in session; but several meetings are convened to explore career options in a more structured setting. This year Dr. Michelle Haven, manager, Animal Health Discovery, Pfizer, Inc., Professor David Fraser, and Drs. Ton Schat and Reinhard Straubinger, both research scientists at Cornell, commented on their own careers and answered student questions about career opportunities for veterinary graduates.

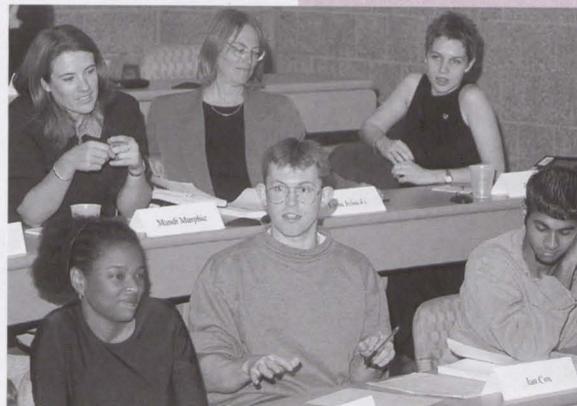
On another occasion, Dr. Gerard Hickey, senior director of basic animal science research at Merck & Co., and Dr. Margaret McCann, research fellow at Merck, discussed careers in industry, comparing research in an academic institution and at a research-intensive pharmaceutical company. Other discussions focused on residency, graduate research training and international service. All were facilitated by Cornell faculty members: Drs. Douglas Antczak, H. Alex Brown, Barry Cooper, Tom Divers, Robert Gilbert, Noa Noy, David Robertshaw, and Ton Schat.



Tammy Howard (Queensland) presents a summary of her research

Ethics

Issues connected with the proper conduct of research are subjects of independent research and group discussion. This year's fellows were provided with videotapes that raised issues concerning confidentiality and the responsibility of scientists to share their findings with colleagues and the public. Dr. Ari van Tienhoven, emeritus professor of animal physiology at Cornell, challenged the students to consider the issues and seek a consensus.



Mandi Murphie (Sydney), Lynn Jelinski (Cornell consultant), Zoe Lenard (Sydney), Monica Mason (Cornell), Ian Cox (Bristol) and Harish Narayanaswamy (Tufts) at the leadership discussion

Emerging Diseases

Emerging infectious diseases are an important aspect of veterinary medicine and the topic of a Leadership Program workshop. This year's workshop was organized by Dr. Robert Shope, professor of pathology, microbiology and epidemiology at the University of Texas, Galveston, and Dr. Colin



Dr. David Fraser (Sydney), moderator of the leadership discussion

Parish, associate professor of virology at Cornell. The fellows chose four diseases from a prepared list. They then divided themselves into groups, conducted library research on the selected diseases and reported back to their colleagues and the two facilitators. A portion of the workshop was conducted as a videoconference with students enrolled in a companion program at the University of Sydney.

On a separate occasion, Dr. Leland (Skip) Carmichael recounted events connected with the discovery of canine parvovirus and the development of methods for detecting the virus and preventing parvoviral disease.

Affiliated Programs

Two affiliated programs have been organized with assistance from the U.S. Department of Agriculture – one at North Carolina State University (NCSU) and one at the University of Sydney (SU). The tripartite initiative fosters student exchanges that enable fellows to conduct research and engage in professional enrichment activities in different institutions in two consecutive years. This year's exchange fellows were Christopher Bradley (Melbourne), Monica Mason (Cornell), Amanda Murphy (SU), Susan Pell (SU), Vanessa Prados-Vallerio (SU), Melinda Story (Colorado State), and Brett Wood (NCSU).

Prizes

At the conclusion of the program, students report on their research activities. A book prize is awarded to the student with the best project as judged by the underlying hypothesis, design of the project, the results and its presentation. Additional prizes are awarded for the best projects in molecular, cellular and integrated biology. This year's prizes were as follows.

Program prize: Christopher Kunze, "Molecular Genetic Studies of PRCD" Book Award: *Genes VI* by B. Lewin

Molecular Biology: Tammy Howard "Chondrocyte Gene Expression" Book Award: *Molecular Biology of the Cell* by B. Alberts et al.

Cell Biology: Larissa Minicucci, "Developmentally Regulated Nematode Proteins" Book Award: *Essentials of Mucosal Immunology* by M.E. Kagnoff and A. Kiyono

Integrative Biology: Sophia Tzannes, "Cardiovascular Adjustments to Exercise" Book Award: *The Camel's Nose* by K. Schmidt-Nielson

FIELD VISITS

Visits to public research institutions are a perennial feature of the Leadership Program. This year's fellows traveled to Washington, D.C. The programs arranged by the host institutions are reproduced below.

- **United States Army Medical Research Institute for Infectious Diseases**

Colonel Nancy K. Jaax: Ebola Infection: Pathology and Pathogenesis

Dr. Michael Bray: Ebola Infection: Antiviral Therapy

Facilities tour

- **National Institutes of Health**

Dr. Stephen A. Ficca, Associate Director, Research Services: Introduction

Dr. Michael M. Gottesman, NIH Deputy Director for Intramural Research: Welcoming Remarks

Mr. James S. Alexander, Acting Director, Office of Education: Training Opportunities at NIH

Dr. Elise C. Kohn, NCI: Transitional Angiogenesis

Dr. David M. Bodine, Section Chief, NHGRI: Gene Transfer in Hematopoietic Stem Cells

Dr. Lance R. Pohl, Section Chief, Molecular and Cellular Toxicology, NHLBI: Mechanisms of Drug-Induced Toxicities

Dr. Lawrence C. Kingsland, National Library of Medicine: Web-Based Literature Searches

Dr. Michael J. Ackerman, Asst. Director, High Performance Computing and Communication, NLM: The Visible Human Project

Dr. Gregory D. Schuler, NLM: Map of the Human Genome

Dr. Michael J. Ackerman, Asst. Director, High Performance Computing and Communication, NLM: Telemedicine and the Next Generation

- **United States Department of Agriculture Livestock and Poultry Sciences Institute**

Dr. T.J. Sexton, Director, Livestock and Poultry Sciences Institute: Introduction and Overview of the Beltsville Agricultural Research Center

Dr. Linda L. Logan-Henfrey, Animal Production, Product Value & Safety: Emerging Infectious Diseases Affecting Livestock

Dr. John R. Dobrinsky, Germplasm & Gamete Physiology Laboratory: Swine Embryo Preservation and Development

Dr. Albert J. Guidry, Immunology & Disease Resistance Laboratory: Development of a Vaccine to Control Mastitis in Dairy Cattle

Dr. Ted H. Elsasser, USDA – ARS Growth Biology Laboratory: Impact of Disease Stress on Metabolism



Anne-Marije Sparnaay (Utrecht), Alex Goudie (Pfizer consultant) and Christopher Bradley (Melbourne)

Summaries of their research and those of their colleagues are provided in the next section of this report.

Cornell's Partnership with the National Institutes of Health

A unique partnership with the Office of Research Services at the National Institutes of Health allows leadership program fellows to gather at NIH to learn more about the agency's intramural research programs and opportunities for research training. Participants meet with distinguished speakers from:

- Office of Research Services
- Office of Education
- National Cancer Institute
- National Human Genome Research Institute
- National Heart, Lung and Blood Institute
- National Library of Medicine.

Scientific discussions are the order of the day. Topics include angiogenesis, gene transfer, mechanisms of drug-induced toxicities, the Visible Human project, the map of the human genome, telemedicine, and more.



Karsten Hueffer (Hannover) and Kitren Nickerson (Colorado State)



*Dr. Donald F. Smith
(Dean, College of
Veterinary Medicine,
Cornell)*



*Dr. Lance Pohl (National
Heart, Lung and Blood
Institute)*



*Guanina Jenkins-Serrano
(Cornell), Max Bastian
(Hannover), and Dr. David
Bodine (National Human
Genome Research Institute)*



Steve Fleischer (Cornell) and
Erin Crotty (Cornell)



Dr. Jay Dobrinsky, Germ Plasm
and Gamete Physiology
Laboratory, USDA

Cornell Fellows Visit United States Department of Agriculture

The United States Department of Agriculture is both a sponsor and partner in Cornell's Leadership Program for Veterinary Students. Each year Cornell veterinary fellows visit the USDA's Livestock and Poultry Science Institute in Bethesda, Maryland where they learn about research and opportunities for advanced training at the institute.

Participants take part in a series of presentations and discussions organized by the institute's director and scientific staff. Topics include:

- emerging diseases affecting livestock
- swine embryo preservation
- control of mastitis in dairy cattle
- impact of disease stress on animal metabolism.



MAX BASTIAN

SCHOOL OF VETERINARY MEDICINE, HANNOVER

Vaccinology

Effects of coadministered antigens on immune response

Born in 1973 in Tanzania where my parents work as medical doctors I grew up in a small town in the south of Germany. With both my parents being physicians and me spending all my time on horseback, I chose the thing between: Veterinary Medicine. However, during my study I found veterinary practice often unsatisfying and I began to think of alternatives. I did several internships in various research institutes. I became very interested in immunology and especially vaccine development. When I heard of the Leadership Program in Cornell, I applied and luckily was offered to participate in this summer.

Here I was working on the question: Where it is possible to direct the immune response towards a certain target antigen? I used different parasitic antigens that are known to elicit either a TH1 or a TH2 response, as adjuvants and coinjected them into mice, together with the target antigen. Then I investigated the immune response. I looked at the cell populations and the cytokine levels in the regional lymph node, and I took serum to investigate the antibody titers and the isotype pattern. I could show that these were an adjuvant effect with the parasitic antigens and I was able to show that *Schistosoma* eggs induced a TH2 reaction. Unfortunately I couldn't finish all the experiments before the program ended.

However, to work in this very interesting field was so fascinating that I am now strongly considering pursuing this further on.

IAN COX

UNIVERSITY OF BRISTOL

Molecular Virology

Herpes Simplex Virus Assembly

I am a final-year student at the University of Bristol School of Veterinary Science in the U.K. For many years I have had a profound interest in natural history and an awareness of the importance of scientific endeavor. This was confirmed to me when I undertook an intercalated degree in microbiology.

The Leadership Program offered me a chance to undertake high-level scientific research within the surrounds of a prestigious academic institution, and thus, as well as providing useful contacts for the future, allowed me to train in modern molecular research techniques.

My work has focused on herpes simplex virus, the causative agent of cold sores. I used a technique called PCR-based mutagenesis to analyze structure/function relationships within minor capsid proteins involved in viral assembly and DNA packaging. This involved creating altered forms of viral genes and seeing if they would allow viral growth; if the mutation is precisely targeted, the postulated structural significance of specific genetic motifs can then be confirmed or rejected.

I think that the program has provided me with experience of planning and managing a research project and an increased awareness of both the value and limitations of molecular techniques. The many discussions and seminars have also provided useful information on career options available and how to achieve them.





ERIN CROTTY

CORNELL UNIVERSITY

Pathogenesis

Equine Motor Neuron Disease

My lifelong love of horses led me to Cornell. Earlier this year I completed my first year in the DVM program. Anxious to explore some of the many possibilities this field offers, I was delighted to take part in the Leadership Program.

I spent my summer working on Equine Motor Neuron Disease (EMND) under the mentorship of Dr. Thomas Divers. Believed to be an oxidative disorder related to vitamin E deficiency, EMND causes degeneration of lower motor neurons and subsequent muscular atrophy. Similar to Amyotrophic Lateral Sclerosis (Lou Gehrig's disease), EMND is being used as a model for this disease. Using blood from research horses and affected horses from Brazil, I analyzed the activity of superoxide dismutase 1 (SOD 1), a free-radical scavenging enzyme previously found to have abnormal activity in affected horses. I also helped perform glucose absorption tests on research horses to analyze their intestinal absorption, which is also abnormal in affected individuals. The disease is fascinating not only for what we have to learn about it, but also for what we have to learn from it and its implications in human medicine.

After completing my veterinary education, I would like to work in equine private practice before continuing on a residency in large animal internal medicine and possibly a Ph.D. My interests include clinical research, international work and teaching.

STEVEN FLEISCHER

CORNELL UNIVERSITY

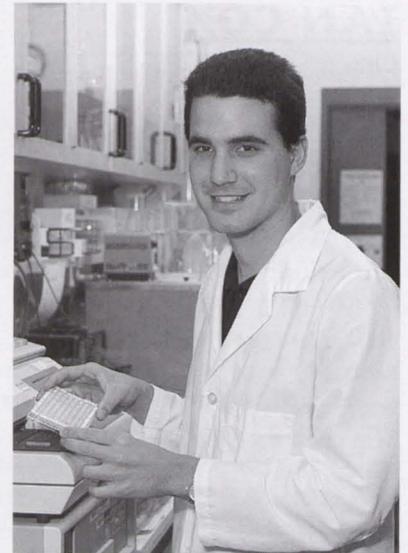
Immunology

*Host Immunity to *Toxoplasma gondii**

Having grown up on a small farm in New Jersey I have always maintained an interest in veterinary medicine, however, my interests in research and immunology led me to apply for the Leadership Program. For the duration of the program I was in the laboratory and under the guidance of Dr. Eric Denkers performing research in a fairly new area of immunology, the CD1 molecule.

My project was to determine if the CD1 molecule could act as a receptor for macrophage activation. In order to find out, I collected macrophages from two types of mice: CD1 $-/-$ (knockout mice lacking the gene encoding CD1) and B6129 (wildtype control). The cells were then cultured in a 96 well plate, washed with sterile physiological saline, and incubated overnight with culture media and stimuli. The main stimuli employed were lipopolysaccharide (LPS) and anti-CD1 antibody. The harvested supernate was then analyzed for cytokine production via enzyme linked immunosorbent assays (ELISAs) and reverse transcription polymerase chain reaction (RT PCR). The protein analysis results from the ELISAs specific for the cytokines TNF-alpha and IL-12 differed. Both the wildtype and knockout mice macrophages exhibited similar TNF-alpha production, but the IL-12 results revealed less production of this cytokine among the knockout macrophages than the wildtypes. RT PCR results confirmed these results. This suggests TNF-alpha production may be independent of CD1, however, IL-12 may be influenced by a possible receptor role of CD1.

The Leadership Program provided a valuable research and laboratory experience. The time spent in this program will definitely impact my future career decisions.





TAMMY HOWARD

UNIVERSITY OF QUEENSLAND

Molecular Biology

Fibronectin Dimerization

My motivation to join this program was to better inform myself concerning a possible career choice in research. I wanted to gain an appreciation of veterinary research, explore the possible career opportunities available to me as a graduating veterinarian and to spend the summer with a group of people who share a common interest in animals and research.

I spent the summer at the Baker Institute working with Dr. Jamie MacLeod, his research focus is the pathogenesis of articular disease in horses and dogs. My project was directed at studying the dimerization patterns of different fibronectin isoforms. The research involved using molecular biology techniques and cell culture.

The opportunity to work at Baker was my greatest experience from the program, it's a fantastic place to be part of both motivating and supportive but also a warm, relaxed atmosphere to work in. To be surrounded by some legends in veterinary research was an honor and an inspiration.

KARSTEN HUEFFER

SCHOOL OF VETERINARY MEDICINE, HANNOVER, GERMANY

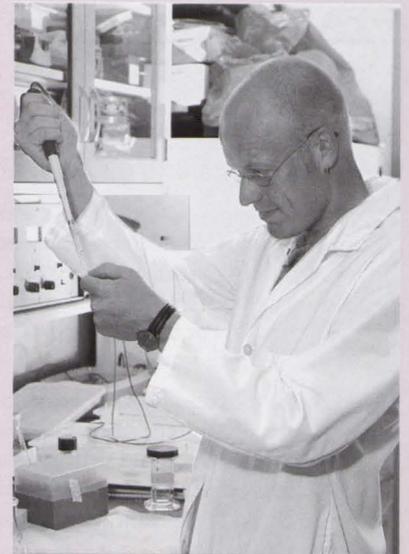
Cell Biology

Apoptosis in canine chondrocytes

I am in my final year of vet course at the School of Veterinary Medicine, Hannover, Germany. A professor of mine told me about the Leadership Program for Veterinary Students, so I applied in order to learn how research in veterinary medicine is conducted and something about career opportunities after my graduation next winter. Another reason for me to apply was the opportunity to meet veterinary students from all over the world and so establish contacts to different fields of interest and geographic locations.

During the program I worked in the laboratory of George Lust, whose research focuses on hip dysplasia as a model for osteoarthritis. My aim during the program was to establish a method to detect apoptosis (programmed cell death) in an in vitro model for osteoarthritis, in which cultured cartilage is loaded with mechanical pressure and then cultured for different times. During my experiments I discovered that progress in science is not always smooth. There are often unexpected problems.

Within the group we managed to get to know each other well. The various workshops gave me the opportunity to see my career possibilities from different angles which helped me to decide what to do after graduation. I now wish to pursue graduate work leading to the Ph.D. degree.





GUANINA JENKINS-SERRANO

CORNELL UNIVERSITY

Metabolism

Effect of Glycerol Ingestion on Total Body Water

I am a second-year student of veterinary medicine at Cornell University. Having grown up, in part, in developing countries, I am interested in finding ways to use my DVM towards improving conditions in these nations. I am also very interested in animal nutrition. I joined the Leadership Program because I felt it would allow me to explore careers in veterinary medicine outside of clinical practice, possibly leading to work overseas.

This summer I had the pleasure of working with Dr. Arleigh Reynolds and Kim Snedden. My project was to evaluate the effect of glycerol ingestion on the hydration status of sled dogs working in a warm environment. A group of ten dogs were evaluated for total body water by means of deuterium oxide dilution technique. This parameter was measured before and after the animals were treated with water or glycerol solution administered via stomach tube. Additionally, the dogs were subjected to an exercise regimen. They were also tested for several parameters such as creatine kinase to insure their overall health.

The Leadership Program has given me the opportunity to better understand the challenges of doing research as well as the satisfaction that can be derived from this work. The program has opened my eyes to various routes by which I can pursue my goals for the future and given me the criteria with which to evaluate them.

MARY KLINCK

ATLANTIC VETERINARY COLLEGE

Theriogenology

Sperm binding to oviduct epithelium

As a first-year student at the Atlantic Veterinary College, last winter, my career plans were not very well defined. I was quite certain that I did not wish to go into private practice upon completion of my DVM, and I was particularly interested in equine medicine. Research seemed a definite option, as I had enjoyed working in an organic chemistry laboratory the summer before I entered veterinary school. For this reason, the Cornell Leadership Program appeared to me to be a great opportunity to gain some experience in veterinary research.

My project involved adding sugars to bull sperm with the prospect of prolonging their survival. Previous work done in the laboratory had revealed that the sperm bind to fucose on the epithelium lining the oviducts and that this contributes to the formation of a reservoir, from which sperm are released near ovulation. Bound sperm live longer than do free sperm; therefore, our hypothesis was that the addition of the sugar to bull sperm should extend viability.

I very much enjoyed my time in the laboratory; it provided a completely new perspective of research for me. The exposure, in the Program, to people from varied backgrounds (my peers, as well as those invited to speak to us) made me aware that there is a multitude of career opportunities for people with veterinary degrees. The Program was a wonderful experience for me.





CHRISTOPHER KUNZE

KANSAS STATE UNIVERSITY

Molecular Genetics

Molecular Genetic Studies of PRCD

I am a third-year student at Kansas State University, in Manhattan, Kansas. I came to the Leadership Program with the goal of broadening my research experience.

I worked at the Baker Institute in the Aguirre lab under the supervision of Dr. Kunal Ray. My project involved using molecular genetics to examine various breeds of dog for an inherited eye disease known as progressive rod cone degeneration (prcd). The goal of my project was to examine various breeds of dogs to determine whether they could potentially be affected with prcd.

The work was based on the concept of identity by descent (IBD) which can be easily used in inbred populations, such as pure bred dogs, where there is commonly a founder effect. The work involved extraction of genomic DNA from dogs of different breeds, amplification of a specific gene (CG1) tightly linked to the prcd locus, and characterization of intragenic markers by restriction enzyme digestion and polyacrylamide gel electrophoresis. The project was successful and accomplished the goals we had in mind. I truly want to thank Kunal Ray, everyone in the lab and Dr. McGregor for all of this success.

The program was valuable in helping me identify what I would like to do with my veterinary education. After graduation, I hope to pursue a clinical residency and become board certified in a specialty that will allow me to combine research with clinical work and teaching.

ZOE LENARD

UNIVERSITY OF SYDNEY

Signal Transduction

Protein interactions in a signalling pathway

Normal cells function by responding to external stimuli and interacting with their environment. Cancer cells are differentiated by their lack of response to their environment, leading to uncontrolled growth. The growth and differentiation of cells is controlled by the signal transduction pathways within a cell, or a series of messages which is sent through the cell. When the signal transduction pathways go wrong, uncontrolled cellular growth will occur, leading to the formation of cancer.

I was working with genes that are part of this regulatory network. I cloned a gene called Cool 2, which was known to bind to a kinase called Pak. I was looking for other binding partners for Cool 2. I found that it bound to a 95 kD protein. The lab had found that Pak also bound to a 95 kD protein. The next question was to determine if Pak and Cool were binding to the same 95 kD protein, or a different one.

I investigated this by incubating Pak in the mammalian cell lysate, knowing that it would pull out all of the p95. I then incubated Cool 2 in the same lysate. The result was that Cool 2 did not bind to anything, indicating that it normally binds to the same 95 kD protein that Pak does.

The implications for discovering the exact signal transduction pathways are important for understanding the action of cancer at a molecular level, and treating it within the whole body system of an animal.

I was born with an interest in a career in veterinary science. My immediate goals are to specialize in small animal medicine, and become involved with research.





KAREN A. LILJEBJELKE

UNIVERSITY OF GEORGIA

Epidemiology

Penicillin residues after subconjunctival injection

I received a B.S. in Plant Biology from Cornell University in 1985, and a M.S. in Botany from Washington State University in 1987. I have worked as a research technician for several years. I am currently a junior at the University of Georgia College of Veterinary Medicine.

As a Merck Foundation fellow in the Department of Population Medicine and Diagnostic Sciences I developed my interests in food safety and public health. My faculty mentors were Drs. Grohn and Warnick. The goal of my research project was to determine at what time after administration into the bulbar conjunctiva penicillin enters the milk. Once published, this research could serve as a guideline for use by dairy farmers.

This program is a great opportunity. I participated in interesting and relevant research, engaged in rewarding personal and professional interactions with veterinary students from other states and countries, and engaged in discussions with faculty from different departments. Representatives from industry and government spoke about the variety of careers available to veterinarians in science. Having the resources to develop my career strategy has been the most valuable aspect of the leadership program for me.

LARISSA MINICUCCI

CORNELL UNIVERSITY

Cell Biology

Developmentally regulated nematode proteins

Because of the diversity in veterinary medicine, I wanted to begin my third year of veterinary school at Cornell with a working knowledge of opportunities for veterinarians. The Leadership Program allows a student to do just that—explore the options.

While working in Dr. Judy Appleton's lab, I had the chance to investigate interactions between host cell proteins and the glycoprotein antigens of *Trichinella spiralis*, a parasitic nematode. The worm has been found to invade epithelial cells as well as muscle and fibroblast cells. During these interactions, excretory/secretory antigens are often deposited. While these antigens initiate an immune response in the host, it is unknown how or if they interact with the cell itself. Using a cDNA bacteriophage library made from feline fibroblast cells, I worked to detect binding between *Trichinella* antigens and cat cell proteins. While several host proteins were identified as potential binding targets, utilizing this method, cytochrome C oxidase polypeptide was perhaps the most promising find. Further studies will investigate this probable link.

The Leadership Program exposed me to cross-cultural perspectives in veterinary medicine that were intellectually stimulating and informative. More importantly, though, it helped me to solidify my interest in basic research and has allowed me to see the benefit of integrating clinical and research-based pursuits.





AMANDA MURPHIE

UNIVERSITY OF SYDNEY

Molecular Genetics

Characterization of microsatellites in the horse genome

I will graduate from the University of Sydney this December. The Leadership Program was a unique experience to expand my knowledge of career opportunities in veterinary medicine.

I spent the summer working in Dr. Douglas Antczak's lab at Baker Institute, characterizing 18 microsatellite loci in the horse. Dr. Antczak's work on microsatellite loci is a major contribution to an international collaboration to map the horse genome. A microsatellite is characterized in order to determine its value as a marker loci. This was established using a polymerase chain reaction (PCR) technique to amplify the region of the DNA which contained the microsatellite locus of interest. The PCR products were then electrophoresed on an Applied Bio-systems 310 Genetic Analyzer. The alleles were sized using Genescan and Genotyper software. I defined 12 microsatellites to be polymorphic and these will now be further analyzed before being designated as marker loci on specific chromosomes in the horse.

The program has given me excellent insight into the world of research. The generous and endless advice provided by a diversity of people in the program has determined the path I wish my career to follow: to gain clinical experience through internship and residency programs in equine medicine and ultimately end up in equine research.

MONICA MURPHY

UNIVERSITY OF MINNESOTA

Cardiology

Patterning Before Ventricular Tachycardia

I spent a fascinating year working in biological research before beginning veterinary school. After one year at the College of Veterinary Medicine at the University of Minnesota, I became eager to combine my growing knowledge of veterinary medicine with my continuing interest in research science. I was fortunate to be accepted into the 1998 Summer Leadership Program at Cornell, which offered just such an opportunity.

I spent the summer working in the laboratory of veterinary cardiologist, Dr. Sydney Moise, in the Department of Clinical Sciences at Cornell. My research focused on an inherited cardiomyopathy in boxers. I examined 24-hour ECG recordings of affected dogs for patterns preceding arrhythmic events. My objective was to determine what events or conditions might lead to the onset of abnormal rapid ventricular contractions. I was particularly interested in ECG patterns which might implicate sympathetic nervous system involvement, since boxers most often experience symptoms during episodes of exercise and stress.

My experience at Cornell has acquainted me with the challenges and frustrations of laboratory research, but also with the thrill which accompanies discovery. (Even little discoveries! Even near discoveries!) I feel very lucky to have been placed in Dr. Moise's lab, where clinical and research sciences were simultaneously emphasized. I hope to carry some of Dr. Moise's abundant energy and enthusiasm for science, medicine and life in general back to Minnesota.





HARISH NARAYANASWAMY

TUFTS UNIVERSITY

Molecular Parasitology

Schistosoma mansoni Type I Receptor

I am entering my third year at Tufts University this fall and am beginning to explore career options. The Leadership Program presented me with an opportunity to immerse myself in all aspects of research, including hands-on bench work as well as getting familiar with industry and academia.

Having had an interest in parasitology, it was ideal for my summer project to focus on an aspect of *Schistosoma mansoni*, a parasite that infects over 200 million people worldwide. My project focused on a receptor on the worm's surface that had been discovered and characterized by a former Leadership Program participant, Stephen Davies, who continued on to finish a Ph.D. in the Pearce lab, where I worked. I tackled the task of trying to express the receptor protein in a bacterial system so that it could be purified and antibodies subsequently made against it. This would aid with further experiments and possibly elucidate some of the worm's reactions to host as it is a signaling receptor.

The program was valuable to me for a few reasons. The various discussions regarding career development and Ph.D. planning were extremely informative as these are becoming important areas as I get further along in my veterinary education. Most importantly, working in the Pearce lab with dedicated researchers helped me in problem-solving and acquiring an accurate representation of what a career in research involves.

KITREN NICKERSON

COLORADO STATE UNIVERSITY

Immunology

Maternal Anti-Fetal Immune Responses

This fall I start my second year of veterinary school at Colorado State University. Prior to vet school, I earned a Master's degree in Equine Reproduction at CSU. My interest in equine reproduction motivated me to further my equine research experience by participating in the Leadership Program.

This summer I worked in Dr. Antczak's lab with Dr. Paige Adams. I studied the survival and differentiation of trophoblast cells from a day 33 pregnancy in an ectopic site, the vulvar mucosa. The purpose of such a transplant was to develop a potential *in vivo* model of pregnancy that would allow less invasive study of trophoblast cells. Biopsies of the transplanted trophoblast cells were taken 7, 14, 21 and 28 days after the transplant. I used immunohistochemical staining to determine that the cells had survived for 14 days after the transplant, and had stimulated an immune response similar to that seen in a normal pregnancy. However, the cells were destroyed by day 21, which is earlier than what occurs in normal pregnancy. Dr. Adams will continue to work on identifying the factors that are important for trophoblast cell survival.

The Leadership Program exposed me to more laboratory techniques and experimental procedures. Most importantly, it has helped me focus my goals and determine the best way to go about achieving them. My plans for the future include an internship in equine practice, followed by a residency in Theriogenology.





AMY SHUMAKER

UNIVERSITY OF FLORIDA

Oncology

Transfection of Endothelial Cells

I have just completed my first year of veterinary school at the University of Florida. I have always found research intriguing and challenging and was excited to find a program such as the Leadership Program at Cornell that encouraged such leanings for veterinary students.

The first half of my project involved immortalizing a short-lived human lung endothelial cell line via co-transfection with CMV-Tag, which is believed to inhibit antiproliferative genes, and pc DNA 3.1. The latter contains a neo gene that confers resistance to neomycin. Cells expressing both these plasmids were cultured in the presence of neomycin. Those that survived were considered to be immortalized clones. The second portion of my project involved overexpressing DPP IV, a cell adhesion molecule found to adhere to blood-borne metastatic breast cancer cells, in the endothelial cell line. This was achieved by transfecting the cell line with a DPP IV - containing plasmid. Immunofluorescence and flow cytometry were used to detect overexpression. The creation of an immortalized cell line that overexpresses DPP IV can be used as an in vitro model to study breast cancer metastasis.

Participating in the Leadership Program has proven to be a tremendous opportunity for me. It has opened a door to the vast career choices available to me as a veterinarian. Although my career path has still to be determined, this summer has strengthened my desires to pursue a career in research.

ANNE-MARIJE SPARNAAY

UNIVERSITY OF UTRECHT

Molecular Virology

Proliferation of a continuous quail cell line

After I finished the fourth year of vet school in Utrecht, the Netherlands, I obtained a master's degree in veterinary research. I developed an ELISA test for the detection of antibodies to equine arteritis virus. There I received wonderful supervision from a postdoc who graduated from Cornell University. While talking with Dr. Amy Glaser I got more and more interested in this world-famous veterinary institution. The Leadership Program gave me the opportunity to see the place that I had heard so much about.

This summer I worked in a poultry virology laboratory. The goal of my project was to create a recombinant Marek's disease virus. However, due to technical problems I was not able to pursue this. Therefore, three weeks before the end of the program I redirected my project to investigate an observation that I made earlier. While I was working with a transfected quail fibroblast cell line, I observed a difference in growth pattern and metabolic activity, in comparison to wild type cells. My supervisor, Dr. Ton Schat, gave me the freedom to look at this detail and to design my own experiments. Although I was not able to prove my hypothesis, it was great fun to introduce new techniques in the laboratory. I appreciated the support I got from specialized people.

After a clinical rotation program of eighteen months I will get my DVM degree. Although we discussed many aspects of careers this summer, I still have not decided what I want to do in the future.





SOPHIA TZANNES

UNIVERSITY OF SYDNEY

Exercise Physiology

Cardiovascular response to exercise

I am a student from the University of Sydney, where I am currently in my fourth year of the veterinary science program. Exposure to work involving exotic animals enhanced my desire to obtain research experience, and from this my interest in participating in the Leadership Program evolved.

Throughout the program I worked with Dr. Robertshaw and Dr. Rawson, investigating the regulatory role of the autonomic nervous system on the cardiovascular response to exercise in sheep, notably in the control of blood flow to the exercising limbs and in the redistribution of blood from the central core to skeletal muscle and skin.

The sheep were trained to run on a treadmill at 60% of their maximum aerobic capacity, both with and without a complete chemical autonomic blockade. The parameters measured, which included hindlimb blood flow, mean arterial pressure, heart rate and rectal temperature, enabled an investigation of the role played by the autonomic nervous system.

The program gave me an incredible opportunity to open my eyes to the possibilities facing a veterinarian. The chance to listen to and meet a diverse selection of leaders in the profession was invaluable. My research experience was inspirational and exciting, and I deeply appreciate the guidance I received. In addition, the fellowship that was gained amongst the group was an important part of the program.

Comments by Leadership Program alumni

“I feel I am much more research oriented than I was a year ago and I attribute that to the positive experience of the program.”

—Susan L. Schaefer, Assistant Professor of Small Animal Surgery at Kansas State University, 1990 Leadership Program, University of Wisconsin

“I still think the Leadership Training Program shaped my whole DVM career path!”

—Johanna S. Sherrill, Resident in Zoological and Conservation Medicine at the National Zoological Park, 1992 Leadership Program, University of Georgia

“Not only did I find the work completely fascinating and absorbing, but the enthusiasm, dedication and vision of my mentor were an inspiration to me.”

—Stephen J. Davies, Postdoctoral Research Associate, University of California at San Francisco, 1992 Leadership Program, University of Bristol

“The Leadership program gave me an opportunity to gain research experience. Although I had strongly suspected I was interested in research even before coming to vet school, I had not had the chance to work in a lab until then.”

—Antonia Jameson, 4th year veterinary student, 1996 Leadership Program, Cornell University

“In retrospect, the Leadership Program created so many ideas and possibilities that it effectively removed any limitations I may have had.”

—Jonathan Happold, Final-year veterinary student, 1997 Leadership Program, University of Sydney



Rebecca Tallmadge, leadership program coordinator

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