Research Report 2009

Improving the Health and Well-being of the Horse

University of Kentucky
Maxwell H. Gluck Equine Research Center
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# Table of Contents

A Letter from the Director 9

About the Gluck Equine Research Center 10-11

**Research and Accomplishments**

- Genetics and Genomics 14-15
- Infectious Diseases and Immunology 16-23
- Musculoskeletal Sciences 24
- Parasitology 25-26
- Pharmacology/Toxicology 27
- Reproductive Health 28-30

Gluck Equine Research Center Grants 32-34

Gluck Equine Research Center Awards 34

**Scientific Publications**

- Books/Chapters in Books 36-37
- Refereed Journal Articles 37-40
- Non-Refereed Journal Articles 40-45
- Seminars and Papers Presented 46-52

Gluck Equine Research Center Donors 53-54
Barry Fitzgerald, a longtime Gluck Equine Research Center faculty member, was memorialized Dec. 17 at the E. S. Good Barn at the University of Kentucky. Fitzgerald died Nov. 24, 2009.

Speakers during the memorial were Mats Troedsson, Peter Timoney, Mandi Vick, Lelia Garrison and David Horohov.

A native of London, Fitzgerald began his career at UK in 1981 as a research associate to Bob Loy. Fitzgerald became a faculty member in 1984. His primary area of research was reproductive physiology.

He obtained his BSc from the University of Nottingham in 1975 and his PhD from the University of Reading in 1979, where he continued as a post-doctoral fellow.

Fitzgerald was the son of the late Patrick Fitzgerald. He is survived by his mother, Peggy Fitzgerald, his sister, Christine Justic, and niece, Hannah Justic.
The genomics group, headed by Dr. Ernie Bailey, saw the results of several years of international collaboration on the equine genome project published in the prestigious journal “Science.”

“The horse genome sequence represents an investment of approximately $15 million, identifies and documents all the genes present in the horse and provides DNA sequences and over one-million genetic variants for use in all areas of equine research,” Bailey said.

According to Dr. Bailey, the “Science” paper on the horse genome is a landmark publication. Co-authors on the article from the Gluck Equine Research Center were Ernie Bailey, Teri Lear, Jamie MacLeod and Stephen Coleman. The horse genome mapping work was originally proposed by Dr. Bailey and conducted by a workshop of international scientists coordinated from the University of Kentucky by Dr. Bailey. Scientists studying many aspects of the horse, including reproduction, infectious diseases and immunology and genetics, have used the information extensively since genome sequencing became available.

Dr. Jamie MacLeod was recently awarded a grant from the National Science Foundation for more than $1 million to further study gene expression in a variety of horse tissues. Other important research grants that were awarded to Gluck faculty members include an NIH grant to Dr. Chuck Issel for the study on Equine Infectious Anemia (EIA); and USDA grants awarded to Dr. David Horohov for his research on equine immunology and to Dr. Daniel Howe for further research on Sarcocystis neurona, the parasite that causes EPM in horses. Well done and congratulations to all!

A groundbreaking event was held Oct. 26 for the new Equine Reproductive Facilities at the University of Kentucky Main Chance Equine Campus. The buildings will have state-of-the-art mare and stallion facilities and modern laboratories to study reproductive problems in horses. The new facilities are the result of successful fundraising by Dr. Ed Squires with generous contributions from horse farm managers and owners and from the veterinary community in Kentucky. This is a great example of how the horse community and the university can work together with a common goal to further our knowledge in equine veterinary science. We are very thankful for the enthusiastic support we have received.

In our ongoing effort to reach out and work with the scientific and veterinary communities, we are in the process of adding adjunct members from other academic and clinical institutions to our faculty. The addition of adjunct faculty will increase opportunities of collaboration and provide access to professional knowledge and clinical material for research projects at the Gluck Center. Research that is conducted at the Gluck Center has a central role in the health and well-being of horses.

For information on the Gluck Equine Research Center and donations to support research, visit our website at www.ca.uky.edu/gluck.

I thank everybody that has contributed to the success of the Gluck Center during the past year. I look forward to sharing future developments at the Gluck Equine Research Center with you.
History
The Maxwell H. Gluck Equine Research Center is the only scientific institute in the United States with nearly all faculty conducting full-time research in equine health and diseases.

Construction began on the 81,000 square foot facility in 1986 and was completed in 1987. The center is named after the late Maxwell H. Gluck, owner of Elmendorf Farm in Lexington. Maxwell Gluck and his wife, Muriel, generously donated $3 million to the University of Kentucky in 1983 for construction of the research facility on the condition the gift be matched by $3 million from the state and $3 million from members of the horse industry.

Research
The mission of the Gluck Center is scientific discovery, education and dissemination of knowledge for the benefit of the health and well-being of horses.

Today, the Gluck Center faculty conduct equine research in six targeted areas: genetics and genomics, infectious diseases and immunology, musculoskeletal science, parasitology, pharmacology/toxicology and reproductive health.

Major research accomplishments of researchers at the Gluck Center has had an international impact on equine research. Some of the major research accomplishments include:

• World Organisation for Animal Health (O.I.E.)-designated world reference laboratory for equine rhinopneumonitis, equine influenza and equine viral arteritis
• Developed six major vaccines to protect against strangles, equine influenza, equine rhinopneumonitis, equine viral arteritis, the shaker foal syndrome (toxoinfectious botulism) and validated field safety and efficacy of equine rotavirus vaccine
• Developed diagnostic serological tests for contagious equine metritis (CEM), Tyzzer’s disease, equine protozoal myeloencephalitis (EPM), equine herpesvirus myeloencephalopathy, strangles and equine viral arteritis
• Developed enzyme-linked immunosorbent assay (ELISA) test for drug detection
• Demonstrated the usefulness of artificial lights and progesterone/estradiol treatments for hastening the onset of the breeding season
• Determined the genetic basis for and developed tests for inheritance of certain color coat traits
• Provided leadership in the sequencing of the complete genome of the horse and structural characterization of horse genes
• Performed the definitive experiments that identified the cause of Mare Reproductive Loss Syndrome
The late Maxwell and Muriel Gluck (top) donated $3 million to the University of Kentucky for construction of the research facility on the condition the gift be matched by the state and members of the horse industry. (Below) James Bassett III, former president of Keeneland, Muriel Gluck and former UK President Otis A. Singletary broke ground for the center in 1985.

Equine Research Hall of Fame

The Equine Research Hall of Fame, established by the University of Kentucky Equine Research Foundation (now the UK Gluck Equine Research Foundation), honors those distinguished researchers who have dedicated their careers to equine science. The Hall of Fame is at the Gluck Center.

On Dec. 1, 1990, 12 scientists became the first inductees into this prestigious hall. Inductees are selected for the honor by an international scientific committee that evaluates the achievements and contributions of eminent researchers who were nominated by their peers and colleagues. The inductees, active, retired or deceased, are individuals from throughout the world who have expanded the body of knowledge of equine science through their contributions to basic or applied research.

The Equine Research Hall of Fame provides a lasting tribute to the most renowned equine researchers in a variety of disciplines and serves as an international forum for honoring outstanding achievements in equine research.

Gluck Equine Research Foundation

The Gluck Equine Research Foundation was formed as a non-profit organization to provide the exchange of information between the Gluck Center and the horse industry and to secure research funds.

Since the Foundation’s inception, it has been highly supportive in raising funds for equine research, endowed faculty positions, and facilities. Funding for graduate student support has allowed Gluck Center faculty to educate the next generation of scientists.

Industry Outreach

Providing research information to the equine community is an important facet of the Gluck Center. Information is shared through the Gluck Center’s website, www.ca.uky.edu/gluck, and three newsletters:

- Bluegrass Equine Digest (monthly)
- Lloyd’s Equine Disease Quarterly
- Research & Service Report (biennially)

Department of Veterinary Science

The Gluck Center is part of the Department of Veterinary Science along with the Animal Genetics Testing and Research Laboratory and the Livestock Disease Diagnostic Center (LDDC).

The mission of the Department of Veterinary Science is to assure the health and viability of animal agriculture through teaching, discovery, research and service.

Faculty in the Department of Veterinary Science frequently collaborate on research projects with faculty in UK’s College of Agriculture and College of Medicine, with veterinarians in central Kentucky and scientists at other institutions.

The Gluck Center is also part of the UK Equine Initiative, an overarching concept for all equine activities in the College of Agriculture. Created in 2005 as a front door to equine programs at UK, the Equine Initiative’s mission is to discover, share and apply new knowledge that will enhance the health, performance and management of horses commensurate with the signature status of Kentucky’s equine industry.
More than 20 faculty at the Gluck Equine Research Center are assisted by students, post docs and visiting scientists in conducting research in the areas of:

Genetics and Genomics
Infectious Diseases and Immunology
Musculoskeletal Science
Parasitology
Pharmacology/Toxicology
Reproductive Health

Some of the world’s top scientists are drawn to the Gluck Center to provide solutions to equine health problems. Gluck Center faculty also respond to some of the equine industries toughest problems.
RESEARCH SNAPSHOT...

- Contracted foal syndrome
- Parrot mouth
- Cytogenetics and infertility
- Swayback
- Dwarfism
- Coat color genetics
- Junctional epidermolysis bullosa (JEB)

Faculty, Students & Research Assistants...

Ernie Bailey, Professor
Debbie Cook, PhD Candidate
John Eberth, MS Candidate

Teri Lear, Associate Professor
Rose McGee, MS Candidate
Judy Lundquist, Research Technician

Kathryn Graves, Assistant Professor
James MacLeod, Professor (See page 24)

Ernie Bailey, PhD
Professor

Education:
PhD – University of California-Davis (Genetics), 1980
MS – University of California-Davis (Comparative Pathology), 1975
BS – University of California-Davis (Genetics), 1973

Interest:
Immunogenetics and genomics—We are interested in the genetic influences on the innate and adaptive immune systems which protect the horse from infectious diseases. Development of the genetic map for horses and investigation of genes involved in the health of the horse such as contracted tendons, extreme lordosis and dwarfism. Color coat variation is also being investigated.

Projects:
- Genomics and gene mapping in horses.
- Hair color patterns among horses.
- Genetic expression in mast cells associated with laminitis.
- Investigation of hereditary aspects of swayback, dwarfism, cataracts and virus susceptibility.

Graduate students focus:
Debbie Cook – swayback
John Eberth – dwarfism

Kathryn Graves, PhD
Assistant Professor

Education:
PhD – Cornell University, 1985
BS – Cook College, Rutgers University, 1980

Interest:
Overseeing a high quality Animal Genetics Testing and Research Laboratory and providing genotyping services to 50 equine registries. In addition, the lab offers
specific tests for color genes and heritable disease mutations.

Projects:
• Develop new DNA-based color tests.
• Candidate gene sequencing to identify causative mutations for heritable diseases.

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Teri Lear, PhD
Associate Professor

Education:
PhD – University of Kentucky (Genetics), 1997
MS – University of Louisville (Cytogenetics/Zoology), 1986
BA - Indiana University Southeast (Zoology/Field Biology), 1975

Interest:
Providing clinical cytogenetics services to the horse industry. Gene mapping and genome evolution. Identifying genes causing inherited diseases such as contracted foal syndrome, lordosis in saddlebreds, dwarfism, parrot mouth, etc. I also provide clinical cytogenetic services to veterinarians in the United States and abroad. This has resulted in the detection of several chromosomal abnormalities.

Clinical Cytogenetics Service: In keeping with the service and outreach mission of the University, I offer clinical cytogenetics service to veterinarians. My laboratory is one of two in the U.S. offering this service. As a result of this service I have identified four different chromosome translocations associated with early embryonic loss in mares (published). Most recently, I identified two rare cases of mosaic autosomal trisomy in two foals with multiple congenital abnormalities (unpublished data). My equine cytogenetic expertise has led to several invitations to submit book chapters or review articles. This work is economically important to the horse industry since it identifies genetic causes of infertility and foal loss.

Projects:
• Lordosis in American Saddlebred Horses.
• Equine Medical Genetics and Cytogenetics.
• Horse Genomics: Linear Mapping and Functional Genomics.
• Behavioral Genomics of the White-Throated Sparrow.
• Identifying the cause of Contracted Foal Syndrome.
• Causes of XY sex-reversal syndrome in horses.
• Identifying mares with chromosome abnormalities causing repeated early embryonic loss.
• Identifying foals with congenital abnormalities and chromosomal aneuploidy.
• Equine headshaking syndrome: genetic or behavioral?

Graduate student focus:
Rose McGee – Disorders of sexual development in horses.

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Horse metaphase chromosomes (the blue sticks, nuclei are round) from a male horse. Green and red spots are horse genes mapping to the terminal end of the X chromosome. Note: Males have one X and one Y chromosome, thus spots only show up on one X and not two as you would see in females with two X chromosomes. (Photo: Teri Lear)
RESEARCH SNAPSHOT...

• Equine rhinopneumonitis
• Equine influenza
• Equine viral arteritis
• Equine infectious anemia
• Equine rotaviral enteritis
• Strangles and other equine streptococcal diseases
• Equine leptospirosis
• Equine clostridial enteritis
• Lawsonia intracellularis enteropathy
• Rhodococcal pneumonia
• Diagnostic test development

• Vaccine development
• Disease surveillance and reporting
• Biosecurity/Disaster preparedness
• The development of immunity in the foal
• The immune response in aged horses
• Identification of vaccine-induced protective immune responses
• Characterization of inflammatory responses in the horse
• Cytokine regulation of immunity in the horse

Faculty, Students & Research Assistants...

Sergey Artiushin, Assistant Professor

Udeni Balasuriya, Associate Professor
Pamela Henney, Research Specialist
Yanqiu Li, Postdoctoral Scholar
Zhengchun Lu, PhD Candidate
Kristin Pfahl, MS Candidate
Kathryn Smith, PhD Candidate
Jianqiang Zhang, Postdoctoral Scholar
Undergraduates:
  Jena White
  Gong Seoul
  Bora Nam

Thomas Chambers, Associate Professor
Saikat Boliar, PhD (graduated, 2009)
Stephanie Reedy, Research Specialist
Sanjay Sarkar, PhD Candidate
Ashish Tiwari, PhD Candidate
Liang Zhang, PhD Candidate

Frank Cook, Assistant Professor
Debbie Even, PhD Candidate

Roberta Dwyer, Professor

David Horohov, Professor
Amanda Adams, Postdoctoral Scholar
Alex Betancourt, Research Technician
Chong Liu, PhD Candidate

Allen Page, PhD Candidate
Tracy Sturgill, PhD (graduated, 2009)
Lingshuang Sun, PhD Candidate
Undergraduates:
  Daniel Michler
  Craig Stewart
  Eric Oberst
  Sean Siaens

Charles Issel, Professor
Sheila J. Cook, Research Scientist

David Powell, Professor Emeritus

John Timoney, Professor
Rafaela De Negri, PhD Candidate
Michael Fettinger, Research Technician
Marie-Lucie Styza, Exchange Scholar from France
Sridhar Velineni, Postdoctoral Scholar

Peter Timoney, Professor
Yun Young Go, PhD Candidate
Barry Meade, PhD Candidate
Kathleen Shuck, Research Analyst Principal

Visiting scientists in 2009:
  Fabien Miszczak, MS, BSc (France)
  Kalimuthusamy Natarajaseenivasan, PhD, BSc, MSc (India)

Research Report 2009 • Page 16
Sergey Artuishin, PhD
Assistant Professor

Education:
PhD – Moscow State University (Microbiology), 1981
MS – Moscow Veterinary Academy (Biophysics), 1973

Interest:
Research interests are focused on molecular studies of *Streptococcus equi*, *Streptococcus zooepidemicus*, and *Leptospira interrogans*. *S. equi* causes strangler and *S. zooepidemicus* is responsible for endometritis in mares. Leptospirosis can cause abortion and stillbirth as well as recurrent uveitis (a major cause of equine blindness).

Projects:
• Development of rapid diagnostic assays for identification of bacterial pathogens.
• Study of surface and secreted proteins of Streptococcus as virulence factors and potential protective antigens.
• Analysis of genetic variations in Streptococcus.
• Identification of virulence factors of *S. zooepidemicus* responsible for developing acute infection in dogs and horses.

Udeni Balasuriya, BVSc, MS, PhD
Associate Professor

Education:
PhD – University of California-Davis (Comparative Pathology with special emphasis in molecular virology), 1996
MS – University of California-Davis (Comparative Pathology with special emphasis in diagnostic pathology), 1991
BVSc – Faculty of Veterinary Medicine and Animal Science, University of Peradeniya, Peradeniya, Sri Lanka, 1985

Interest:
The major research focus of my laboratory is to characterize the molecular epidemiology and pathogenesis of equine arteritis virus (EAV) and equine herpesvirus-1 (EHV-1) infections of horses and develop improved recombinant vaccines to prevent infection of horses with these viruses, as well as to develop improved tests to diagnose the infection. In addition, I have established national and international collaborations to facilitate exchange of scientists, reagents and information focused on EAV, EHV-1 and other equine viral diseases. My laboratory also provides a dynamic, first-rate research training environment to develop the next generation of research scientists.

Projects:
• Molecular characterization of equine arteritis virus (EAV) and equine herpesvirus-1 (EHV-1).
• Definitively characterize the molecular epidemiology and pathogenesis of EAV and EHV-1 infections of horses and develop improved recombinant vaccines to prevent infection of horses with these viruses as well as improved tests to diagnose the infection.
• In vitro comparison of antiviral drugs against EHV-1.
• Molecular mechanisms of viral pathogenesis.
• Host-virus interactions (e.g. analysis of individual viral genes/gene products and their interaction with host).
• Development of new diagnostic and vaccine technologies, define the epidemiology and pathogenesis of other important viral diseases of the horse, and the recognition of novel and emerging viral diseases of the horse.
Services:
- Provide assistance with molecular diagnostics (RT-PCR and real-time RT-PCR).
- Testing of clinical specimens submitted to the OIE designated reference laboratory for equine viral arteritis (EVA) at the Gluck Equine Research Center.
- Testing of clinical specimens submitted to the OIE designated reference laboratory for equine influenza at the Gluck Equine Research Center.
- Provide molecular diagnostic reagents to diagnostic laboratories.
- Provide advice on equine viral arteritis to veterinarians and equine industry associates over the phone.

Postdoctoral/Graduate students focus:
Yanqiu Li – Molecular characterization of neurovirulent EHV-1
Zhengchun Lu – EAV attachment and entry and molecular diagnostics
Kristin Pfahl – Development and validation of improved serological assays for EVA
Kathryn Smith – Virulence determinants of EHV-1
Jianqiang Zhang – Molecular characterization of EAV

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Thomas Chambers, PhD
Associate Professor

Education:
PhD – University of Notre Dame (Microbiology), 1982
BS – University of Notre Dame (Pre-Professional Studies), 1975

Interest:
Equine influenza is the leading cause of respiratory disease in Kentucky and the world. My major interest is to study the innate immune responses to the influenza virus and herpes virus. I am also interested in the development of vaccines for influenza and herpes virus. I am involved in infectious disease control and surveillance both nationally and internationally.

Projects:
- Infectious diseases and immunology.
- Testing in equines of a second-generation modified-live virus equine influenza vaccine.
- Testing/validation of second-generation rapid diagnostic tests for equine influenza.
- Testing in equines of novel DNA-based vaccines for equine influenza.
- Testing in equines of new vaccination protocols for equine influenza using an existing commercial vaccine.
- Collaborator on development of the most up-to-date phylogenic description of the strains of equine influenza virus in circulation since 1990.
- Collaborator on development of a new real-time RT-PCR assay for equine influenza.
- OIE International Reference Laboratory for equine influenza.

Graduate students focus:
Sanjay Sarkar – innate immunity to equine viral respiratory diseases
Ashish Tiwari – innate immunity to equine viral respiratory diseases
Liang Zhang – comparative pathogenesis of equine- and equine-2 influenza viruses

PhD Dissertations:

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Infectious Diseases and Immunology
R. Frank Cook, PhD
Assistant Professor

Education:
PhD – University of Warwick (Virology), 1980
BSc – University of Sussex (Biochemistry), 1976

Interest:
My research focuses on Equine Infectious Anemia Virus (EIAV), a virus closely related to HIV in humans. My most recent interests are in the field of vaccine design.

Projects:
• Design of vaccines against all lentiviruses including HIV-1.
• Provide purified antigens for inclusion in commercial USDA-approved test kits.
• Strategies to enhance efficacy of DNA vaccination in the horse (i.e., the use of cytokines to enhance the efficacy of vaccines).
• Molecular epidemiology of equine herpesviruses.
• Genetic basis of differing susceptibility to disease and immune responses to vaccinations.

Graduate student focus:
Debbie Even – Manipulating immune responses to DNA vaccines in the horse.

Robert Dwyer, DVM, MS, DACVPM
Professor

Education:
DVM – Iowa State University, 1985
MS – University of Kentucky, 1990
Diplomate, American College of Veterinary Preventive Medicine, 1993
Board Certified in Epidemiology, ACVPM, 2003

Interests:
Equine preventive medicine and infectious diseases, disease outbreak investigation and epidemiology, biosecurity, disaster preparedness and response, risk reduction to agroterrorism and pre-veterinary advising and undergraduate teaching.

Projects:
• Consultations for veterinarians, farm managers and horse owners.
• Biosecurity plan development for veterinary and farm facilities.
• AAEP on-call media veterinarian for infectious disease issues.
• Instructor for a national extension program, “Strengthening Community Agrosecurity Plans.”
• Co-editor of Lloyd’s Equine Disease Quarterly.
• Planning section chief for a national Incident Management Type II team (disaster response team).
David W. Horohov, PhD
William Robert Mills Chair & Professor

**Education:**
Professor of Veterinary Immunology, Louisiana State University, 1988-2003
PhD – University of Tennessee, 1985
MS – Purdue University, 1981
BS – Pennsylvania State University, 1978

**Interest:** My group continues to investigate the immune responses of horses to various infectious diseases. We are also interested in infections that occur later in the life of the foal, such as *Lawsonia intracellularis*, and age-related changes in the immune function in older horses. We also collaborate with other groups to study the characterization of cell-mediated immune responses in EIA-infected and vaccinated horses, vaccination of foals against equine influenza virus, further investigations into parasite immunology and the characterization of inflammatory responses to exercise.

**Projects:**
- Underlying immunological basis for the susceptibility of foals to infection with *Rhodococcus equi*, a cause of pneumonia in foals less than 3 months old.
- Investigating the underlying molecular mechanism for low levels of interferon-gamma, a cytokine that plays a central role in resistance to *R. equi* and other pathogenic organisms. (Tracy Sturgill and Linshuang Sun)
- Infections that occur later in the life of the foal, such as *Lawsonia intracellularis*, the causative agent for equine proliferative enteropathy (EPE). (Allen Page and Amanda Adams)
- Role of nutritional supplements in restoring immune function in aged horses. (Amanda Adams)
- Older horse immune function. Collaborating with Kristine Urshel, UK Department of Animal Science, who is interested in the effect of aging on protein metabolism in horses, and Nicholas Frank, University of Tennessee, who is interested in metabolic syndrome in horses. Frank’s group is also interested in obesity-related inflammatory changes and their role in the induction of metabolic disease in the horse.
- Interactions between adipocytes and the immune system. (Amanda Adams and Barry Fitzgerald)
- Cell-mediated immune responses in EIA-infected and vaccinated horses. The goal will be to identify immunological responses that may be important in controlling viral replication and disease. (Chong Liu, in collaboration with Charles Issel at the Gluck Center and Ron Montelaro at Pittsburgh)
- Other collaboration projects include: vaccination of foals against equine influenza virus with Thomas Chambers at the Gluck Center; parasite immunology with Gene Lyons at the Gluck Center; and characterization of inflammatory responses to exercise with Ken McKeever, at Rutgers University. Our goal is to identify immunological markers for exercise-induced inflammation in the horse and to determine if these correlate with the risk of injury in the performance horse.

**Postdoctoral/Graduate students focus:**
Amanda Adams – Aged horses and obesity
Chong Liu – Cell mediated immunity to EIAV
Allen Page – *Lawsonia intracellularis* infection and immunity
Lingshuang Sun – Regulation of interferon in foals

**PhD Dissertations:**
Charles Issel, DVM, PhD  
Wright-Markey Chair in Equine Infectious Diseases

Education:
Diplomate – American College of Veterinary Microbiologists, 1976
PhD – University of Wisconsin (Veterinary Science), 1973
MS – University of Wisconsin (Veterinary Science), 1971
DVM – University of California–Davis, 1969
AB – University of California–Berkeley (Zoology), 1965

Interest:
Our research, continuous since 1974, involves equine infectious anemia from A to Z. We are working with the national and international veterinary community to develop and implement sensitive, specific and practical diagnostic tests for EIA to complement the “Coggins” test in effective control programs. At the same time we are studying the intricacies of the EIA virus (EIAV), a lentivirus, in an attempt to define the genetic and antigenic variations in this highly mutable agent and how it impacts protective immunity, i.e., vaccine design and efficacy. This work is valuable in its own right as well as being of comparative value as a model for AIDS.

Projects:
• Improve diagnosis and control of EIA.
• Develop effective vaccines against EIA.
• Provide high quality reagents for use in testing for diseases.
• For more information on EIA please see our website at: http://dept.ca.uky.edu/eia/.

David Powell, BVSc, FRCVS  
Professor Emeritus

Education:
FRCVS – Royal College of Veterinary Surgeons, 1979
BVSc – University of Bristol, 1965

Interest:
My primary interest is investigating disease outbreaks as an epidemiologist. Publication of the Equine Disease Quarterly has also been my responsibility for the past 20 years.

Projects:
• Equine disease surveillance, including monitoring the incidence of equine herpes virus abortion, West Nile infection, vesicular stomatitis and influenza.
• Investigating the etiology of acute outbreaks of upper respiratory disease.
Education:
PhD – National University of Ireland, 1969
MS – University of Wisconsin, 1967
MVB, MRCVS – University College, Dublin, 1965
BSc – University College, Dublin (Biology), 1961

Interest:
Focus is on equine infectious disease caused by streptococci, leptospira, salmonella and clostridia. Ultimate goals include development of improved vaccines, diagnostics and design of strategies effective in management of outbreaks and detection of infected horses.

Projects:
• Identification and regulation of virulence factors of *Streptococcus zooepidemicus* from acute equine and canine pneumonias.
• Wildlife source(s) of the specific genotype of *Leptospira interrogans* serovar Pomona responsible for equine abortions in Kentucky.
• Development of novel modalities for intranasal vaccination of horses against strangles.
• Rapid diagnostic assays for *Streptococcus equi* and *Leptospira interrogans* in equine clinical specimens.
• Development of protocols for prepartum immunization of mares for prevention of neonatal enterocolitis caused by clostridia and salmonella.
• Role of bacteriophage in virulence and evolution of *Streptococcus equi*.
• Identification of proteins of *Leptospira interrogans* induced following ocular and placental infection of the horse.
• Interaction of *Streptococcus equi* with the equine tonsillar complex.

Postdoctoral/Graduate students focus:
Rafaela De Negri – Streptokinases of *Streptococcus equi* and *zooepidemicus*
Marie-Lucie Styza – Detection of serum antibodies specific for *Clostridium difficile*
Sridhar Velineni – Regulation of virulence in *Streptococcus zooepidemicus*

A scanning electron micrograph (left) shows adherence of *Streptococcus equi*, the cause of equine strangles, to stratified squamous epithelium of the equine lingual tonsil. The photo (right) shows *S equi* within the epithelium of the nasopharyngeal tonsil of a horse three hours after infection. (Photos: John Timoney)
Peter Timoney, MVB, PhD, FRCVS
Frederick Van Lennep Chair in Equine Veterinary Science,
OIE Designated Specialist on Equine Viral Arteritis

Education:
FRCVS – Royal College of Veterinary Surgeons, 1978
PhD – University of Dublin, 1974
MS – University of Illinois, 1966
MVB – National University of Ireland, 1964

Interests:
Among the diseases of major interest are equine viral arteritis (EVA), contagious equine metritis (CEM) and equine rhinopneumonitis. Also, development of strategies for reducing the risk of global spread of infectious diseases through international trade.

Projects:
• Studies on the mechanism of establishment and persistence of equine arteritis virus in the reproductive tract of the stallion.
• Characterizing the site(s) of localization of equine arteritis virus in the carrier stallion.
• Investigating the variation in virulence among naturally occurring strains of equine arteritis virus.
• Developing a less costly, more rapid diagnostic test for EVA.
• Developing a second generation marker vaccine for EVA/equine arteritis virus infection.
• Developing a more rapid and reliable diagnostic test for detection of Taylorella equigenitalis.
• Improving control and prevention strategies for contagious equine metritis (CEM).
• Study of the epidemiology of Taylorella asinigenitalis in horses and non-horse equids.

Services:
• Responsible for operation of the OIE Reference laboratory for equine viral arteritis at the Gluck Equine Research Center.
• Provision of EVA diagnostic reagents to diagnostic laboratories, nationally and internationally.
• Provide consultation for veterinarians and members of the horse industry on various equine infectious diseases, including EVA, equine rhinopneumonitis, contagious equine metritis and equine piroplasmosis.
• Co-editor of the Lloyd’s Equine Disease Quarterly.
• Provide quarterly reports to the International Collating Centre, Animal Health Trust, Newmarket, UK, on equine infectious disease occurrences in the United States.

Graduate students focus:
Yun Young Go – Molecular characterization of EAV and host virus interactions
Barry Meade – Comparisons of the transmission dynamics of disease outbreaks attributable to neuropathogenic and non-neuropathogenic strains of EHV-1 in closed populations
RESEARCH SNAPSHOT...

- Osteoarthritis
- Articular cartilage maturation and repair

- Wobbler Syndrome
- Tendons and ligaments

Faculty, Students & Research Assistants...

James MacLeod, Professor
Stephen Coleman, PhD Candidate
Rebekah Cosden, PhD Candidate
Lauren Detlefsen, MS Candidate

Jennifer Janes, PhD Candidate
Kadie Vanderman, MS Candidate
Wenying Zhu, PhD Candidate

Education:
Fellowship – University of Pennsylvania (Endocrinology & Genetics), 1992
PhD – University of Pennsylvania, 1990
VMD – University of Pennsylvania, 1984
BS – University of Delaware, 1980

Interest:
The laboratory studies biological and biomedical aspects of the musculoskeletal system, with an emphasis on the growth and maturation of articular cartilage, the development of osteoarthritis, repair of articular lesions and the effects of anti-inflammatory medications. Experiments are conducted primarily on a cellular and molecular level. In addition to articular cartilage, recent projects have been initiated on tendons, cervical stenotic myelopathy (Wobbler Syndrome), and broad analyses of the equine transcriptome.

Projects:
- Articular cartilage maturation.
- Articular cartilage repair.
- Intra-articular glucocorticoid therapy.
- Tendon maturation.
- Wobbler syndrome (cervical stenotic myelopathy).
- Horse genomics: gene expression.

Graduate students focus:
Stephen Coleman – equine transcriptome
Rebekah Cosden – articular cartilage maturation and repair
Lauren Detlefsen – tendon maturation and response to biomechanical stress
Jennifer Janes – pathogenesis of cervical vertebral stenotic myelopathy
Kadie Vanderman – chondrocyte cell biology
Wenying Zhu – osteoarthritis and intra-articular glucocorticoid therapy
RESEARCH SNAPSHOT...

- Helminths, including life cycles, prevalence and control
- Equine protozoal myeloencephalitis
- Parasite resistance

Faculty, Students & Research Assistants...

Daniel Howe, Associate Professor
Sriveny Dangoudoubiyam, Postdoctoral Scholar
Ablesh Gautam, PhD Candidate
Michelle Yeargan, Research Specialist

Eugene Lyons, Professor
Sandra Collins, Senior Laboratory Technician
Sharon Tolliver, Research Specialist

Visiting Scientists in Howe’s laboratory:
Armando Hung, PhD (Peru)
Adolfo Paz Silva, PhD (Spain)
Ivan Francisco Vazquez, BVM (Spain)

Visiting Scientists in Lyons’ laboratory:
Martin Nielsen, DVM, PhD (Denmark)
Mariana Ionita, PhD, DVM (Romania)
Tetiana Kuzmina, PhD (Ukraine)

Daniel Howe, PhD
Associate Professor

Education:
PhD – Purdue University (Molecular Parasitology), 1992
MS – Western Illinois University (Biology/Parasitology), 1990
BS – Western Illinois University (Biology), 1988

Interest:
Molecular studies of protozoan parasites – The primary research goal is to obtain a better understanding of the parasite *Sarcocystis neurona*, the primary cause of equine protozoal myeloencephalitis (EPM). Studies are ongoing to determine the genome sequence for *S. neurona*. Other interests include the development of improved serum assays for EPM diagnosis. Additionally, we are investigating approaches to develop an effective vaccine against EPM.

Projects:
- Characterization of novel genes and antigens from the parasite *Sarcocystis neurona*.
- Development of a serologic assay for diagnosis of EPM and to develop a vaccine for EPM.
- Sequencing and annotation of the *S. neurona* genome.

Graduate student focus:
Ablesh Gautam – Characterization of the SnSAG family of surface antigens in *Sarcocystis neurona*

Eugene Lyons, PhD
Professor

Education:
PhD – Colorado State University (Parasitology), 1963
MS – Kansas State University (Parasitology), 1958
BS – South Dakota State University (Wildlife), 1956

Interest:
Parasitology: Control and transmission of internal parasites of horses. Nearly all dewormers currently on the market were tested for efficacy on internal
Fluorescently-labeled *Sarcocystis neurona* parasites (green) adjacent to the infected cell’s nucleus (blue). *(Photo: Dan Howe)*

Bot (Gasterophilis intestinalis) insect larvae of horses. First, second and third instars found in the mouth and/or stomach (on left) and first instar in an egg attached to a horse hair (on right). *(Photos: Gene Lyons)*
RESEARCH SNAPSHOT...

- Therapeutic medication regulation
- Establishing world wide reference standards for therapeutic medications, dietary and environmental substances.
- Developing novel ELISA-based forensic tests
- Development of specific and sensitive tests to detect ergot alkaloids (associated with fescue toxicity and other diseases)
- Development of novel therapies for infectious and other diseases

Faculty, Students & Research Assistants...

Thomas Tobin, Professor
Charlie Hughes, Research Associate
Job Tharappel, Research Associate

Julio Gutierrez, Postdoctoral Fellow
Elizabeth Armstrong, Student assistant
Gabrielle Herrensmith, Student assistant

Education:
Ph.D. – University of Toronto (Pharmacology, 1970
M.Sc. – University of Guelph (Pharmacology), 1966
MVB – University College, Dublin, 1964

Contributions:
1983: Regulatory threshold for furosemide.
1985-Present: About 100 ELISA tests for equine medications, licensed to Neogen Corp.
2003: US Copyright on unique biological mechanism of MRLS.

Projects:
- Ongoing research on certified reference standards and internal standards licensed to Neogen Corp.
- Creation of ELISA tests for drug detection and certified reference standards for therapeutic medication regulation.
- Developing animal models of ocular, fetal and central nervous system parasitic disease and demonstrating the therapeutic efficacy of specific chemotherapeutics.
- Develop improved assays for ergot alkaloid analysis, the group of toxins involved in fescue toxicosis.

Postdoctoral/Graduate students focus:
- Relationships between medication or medication residue concentrations and pharmacological effects in the contexts of resulting therapeutic responses and/or the regulatory significance of medication residues with respect to competitive events.

Rompun®, the widely used short acting equine tranquilizer is detected in equine urine as 4-hydroxyxylazine, a Rompun® metabolite fragment. We have synthesized 4-hydroxyxylazine (above) for use as a regulatory standard. This X-ray crystallograph definitively establishes the identity and structure of our reference standard. (Photo: Thomas Tobin)
RESEARCH SNAPSHOT...

- Causes, diagnosis and treatment of embryonic and fetal loss in mares
- Early embryonic development
- Uterine infection
- Nutritional affects on reproduction
- Stallion behavior
- Diagnosis and treatment of fertility problems in stallions
- Fescue toxicosis

Faculty, Students & Research Assistants...

Barry Fitzgerald, Associate Professor
Karen McDowell, Associate Professor
Ed Squires, Professor
    Sydney Hughes, MS Candidate
Tom Swerczek, Professor
Mats Troedsson, Professor
    Kirsten Scoggin, PhD, Senior Scientist

Claudia Klein, PhD Candidate
Lynda Miller, PhD Candidate
Ana Gabriella Toro, MS Candidate
Elizabeth Woodward, PhD Candidate

Visiting Scientists:
    Mette Christoffersen, DVM (Denmark)
    Morten Møller Petersen, DVM, PhD, Dipl. ACT (Denmark)
    Goo Jang (Korea)

Barry Fitzgerald, PhD
    Associate Professor

Education:
Postdoctoral Fellow – University of Kentucky Department of Veterinary Science, 1981–1984
Postdoctoral Fellow – University of Reading, 1979–1981
PhD – University of Reading, 1978
BSc – University of Nottingham, School of Agriculture, 1975

Interest:
Early fetal loss in mares exposed to infected fescue pastures. Specifically the inflammatory response of mares consuming endophyte-infected fescue seed. Also the prevention of placentitis-induced labor in mares.

Projects:
- Mechanism of early fetal loss in mares exposed to endophyte-infected fescue.
- Obesity and insulin-resistance in horses.
- Inflammatory cytokines and placentitis.
Karen McDowell (left) and Elizabeth Moore, an Agricultural Biotechnology student, use a doppler ultrasound to look at blood flow in horses in an endophyte-infected fescue study.

Projects:
- Vascular changes associated with consumption of endophyte-infected fescue.
- In vitro assessment of ergot alkaloids, receptor agonists and receptor antagonists on equine peripheral and central arteries.

Karen McDowell, PhD
Associate Professor
Education:
NIH Postdoctoral Fellow – Colorado State University (Physiology), 1987
PhD – University of Florida (Animal Science), 1986
MS – University of Tennessee (Animal Science), 1980
BS – University of Tennessee (Animal Science), 1976

Interest:
Determining causes of reproductive losses in mares, including maternal-embryo or maternal-fetal interactions, mare reproductive loss syndrome, and most currently, effects of endophyte-infected fescue on pregnant mares. Overall goal is to enhance pregnancy maintenance in mares.

Projects:
- Vascular changes associated with consumption of endophyte-infected fescue.
- In vitro assessment of ergot alkaloids, receptor agonists and receptor antagonists on equine peripheral and central arteries.

Ed Squires, PhD, Dipl. ACT (hon.)
Professor, Executive Director of the Gluck Equine Research Foundation and Director of Advancement and Industry Relations
Education:
DACT (hon.) – 2003
PhD – University of Wisconsin, 1974
MS – West Virginia University, 1971
BS – West Virginia University, 1969

Interest:
Improving the reproductive efficiency of both mares and stallions, hormonal control of the cycle and development of reproductive techniques. Sydney Hughes (MS student) is conducting two projects: 1) investigating the viability, economic value and performance of offspring from mares that were treated for placentitis during late gestation; and 2) the effect of age, season and status of the mare (barren, maiden, foaling) on dystocia (difficult births).

Projects:
- Developing diagnostic tests for semen evaluation.
- Control of Contagious Equine Metritis (CEM) in semen.
- Enhancing sexual behavior in stallions.
- Early pregnancy losses in mares.
- Endometritis – role of nitric oxide.
- Hormonal management of mares.
- Improving fertility of frozen semen.

Graduate students focus:
Sydney Hughes – Reproductive problems in late pregnancy mares
Mats Troedsson, DVM, PhD, Dipl. ACT, Dipl. ECAR  
Professor, Director of the Gluck Equine Research Center, and Chairman of the Department of Veterinary Science  

Education:  
Dipl. ECAR – 2002  
Dipl. ACT – 1993  
PhD – University of California – Davis, 1991  
DVM – Royal Veterinary College (Stockholm, Sweden), 1975  

Interest: Equine reproductive health and biology. 1) The interaction between spermatoza and the uterine immune system with a particular note on its role in breeding-induced endometritis. 2) The role of seminal proteins in fertility. 3) Claudia Klein (PhD student) is using a genomic approach to study the interaction between the mares’ uterus and the early conceptus during the critical time of pregnancy recognition. 4) Diagnostics and treatment of high-risk pregnancies.  

Projects:  
• Interaction between semen and the uterine environment in horses.  
• Identification of seminal plasma proteins that affect fertility.  
• Sperm surface proteins.  
• Development of improved extenders for cooling and freezing semen.  
• Early pregnancy recognition and losses.  
• Inflammation of the uterus – role of nitric oxide and inflammatory cytokines.  
• Causes, diagnostics and control of high-risk pregnancies.  
• Control and diagnosis of Contagious Equine Metritis (CEM).  

Graduate students focus:  
Claudia Klein – early pregnancy recognition/genomics  
Lynda Miller – sperm surface proteins  
Ana Gabriella Toro – uterine pathology/biopsies  
Elizabeth Woodward – endometritis  

Tom Swerczek, DVM, PhD  
Professor  

Education:  
PhD – University of Connecticut (Comparative Pathology), 1969  
MS – University of Connecticut (Nutritional Pathology), 1966  
DVM – Kansas State University, 1964  
BS – Kansas State University, 1962  

Interest: Nutritional Pathology. Factors that cause abortion in mares, including climatic and environmental changes that induce stress to pasture forages. Drought, excessive rainfall, frosts and freezes can induce nutrient imbalances.  

Projects:  
• Evaluation of bacterial endophytes of grass-and-legume forages as emerging causes of reproductive loss in horses.  
• Develop diagnostic tests for tissues and blood to aid in diagnosis of fetal loss.  

Reproductive Health
Gluck Equine Research Center

Competitive Grant Funding

Non-Competitive Grant Funding

Awards

The mission of the Gluck Center is scientific discovery, education and dissemination of knowledge for the benefit of the health and well-being of horses.
Funding is important to equine research. The faculty at the Gluck Equine Research Center was successful in obtaining several competitive and non-competitive grants in 2009, some of which were multi-year grants.

Competitive Grant Funding


Dwyer, R.M. 2008-2009. CSREES/EDEN. Strengthening Community Agrosecurity Planning (SCAP) grant. PI: A. Husband. Collaborators B. Dictson (NMSU), B.A. Dictson (NMSU), J. Witte (NMSU), R. Yeargan, M. Newman, R. Dwyer. (Dwyer was involved in the organization of a 2.5 day workshop, writing the Power Point and instructor notes for one section and editing the entire program. She also taught the course in the eastern U.S. in 2009.) $38,500.


Howe, D. 2009-2012. USDA/CSREES. Genome Sequence for the apicomplexan _Sarcocystis neurona_. Principal Investigator, $500,000.


**Competitive Grant Funding**


**McDowell, K.J.** July 26-Aug 7, 2009. University of Kentucky College of Agriculture Research Activity Award for travel to and participation in the Gamete and Embryo Molecular Biology Training Course in Philadelphia, PA, presented by the Primate Embryo Gene Expression Resource (PREGER), the Fels Institute for Cancer Research and Molecular Biology, and Temple University School of Medicine. $4,615.


**Timoney, J.** 2009-2011. USDA (pending). Identification of surface and secreted proteins of *Streptococcus equi* with potential in vaccine development, Principal Investigator (Sergey Artiushin (Co-PI)), $354,192.


**Non-Competitive Grant Funding**


**Chambers, T.** 2009-2010. Intervet/Schering-Plough Inc. Does vaccination of very young foals with FluAvert in the presence of maternal antibodies protect them from infection? Principal Investigator, $47,697.

**Dwyer, R.M.** 2009. Lloyd’s of London. Equine Disease Quarterly, $45,000.

Awards


**James MacLeod.** (Stephen Coleman) Neal A. Jorgenson Award for Bioinformatics. Award given for the best student abstract in the area of bioinformatics at the Plant & Animal Genome international meeting.

**James MacLeod.** (Jennifer Janes) American Association of Equine Practitioners Past Presidents’ Research Fellow, October 2009.

**John F. Timoney.** (Pawan Kumar) IAVA Silver Jubilee Award and Medal for the first paper in Biotechnology including stem cell technology. *Int. Congress of Veterinary Anatomy*. Lucknow, India, November 2009.

**Peter Timoney.** Induction into the University of Kentucky Equine Research Hall of Fame, Oct. 25.

Scientific Publications

Books/Chapters in Books

Refereed Journal Articles

Non-Refereed Articles

Presentations/Meetings Attended
Research results conducted by the faculty at the Gluck Center was published in various forms throughout 2009, including books or chapters in books, refereed journal articles and non-refereed articles.

Books/Chapters in Books


Refereed Journal Articles


Refereed Journal Articles


Refereed Journal Articles


Refereed Journal Articles


Non-Refereed Articles


Non-Refereed Articles


Chambers, T.M. 2009. Why take nasal swabs? Equine Disease Quarterly 18(2)


Non-Refereed Articles

of 16th international conference of Racing Analysts and Veterinarians, Antalya, Turkey.


Non-Refereed Articles


Troedsson, M.H.T. 2009. Cryopreservation of equine embryos with the Equine Embryo Direct Transfer (dt)
Non-Refereed Articles


Faculty at the Gluck Equine Research Center are frequent travelers. They are guest speakers at veterinary conferences and meetings locally, nationally and internationally in their respected fields throughout the year. This is where the faculty traveled in 2009.

INTERNATIONAL


Ernie Bailey. Havemeyer Meeting on Horse Genomics, Newmarket, UK, July 23-25 (Chair session; Presentation “Adventures with PLINK”)


David W. Horohov. “Immune response of aged horses -- Is older better?” and “Immunology of the foal -- what we know and don’t know.” DLT Smith Lectures at Western College of Veterinary Medicine, University of Saskatchewan, Canada, April 13-14.


David W. Horohov. “Immunosenescence and Inflammaging.” 2009 ACVIM Forum & Canadian Veterinary Medical Association Convention, Palais Des Congres, Montreal, Quebec, June 3-6.

David W. Horohov. “Specific and innate immunity in the equine lung.” World Equine Airway Symposium, Bern, Switzerland, Aug. 4.


Daniel K. Howe. “Equine protozoal myeloencephalitis caused by the protozoan pathogen Sarcocystis neurona.” Presentation to Peru Army Officers and Veterinary Staff, Lima, Peru.


Edward L. Squires. Golburn Valley Equine Clinic, Invited speaker, Sheparaton, VC, Australia, June 24-July 3.


Peter J. Timoney. "Protecting against equine diseases in a changing international environment and equine viral arteritis," (Conference co-organizer, presenter and workshop chair), Padua, Italy, June 10-12.

Peter J. Timoney. College of Veterinary Medicine, National University, Seoul, Korea.


Peter J. Timoney. Korean Racing Authority, Stud Farm and Training Centre, Jeju Island, Korea.

Thomas Tobin. “Equine Medication Regulation.” Guest lecture at University College, Dublin, Ireland, Nov. 7.


Ernie Bailey. University of Iowa, “Genetics Dis-
Research Report 2009 • Page 48

Presentations/Meetings attended

Ernie Bailey. Equine Science Society, Keystone, Colorado, May 28-31. (Section chair; co-author with students on two presentations on lordosis and dwarfism)


Udeni Balasuriya. 52nd Annual AAVLD/USAHA Meeting, San Diego, Oct. 7-14.


David W. Horohov. “Effect of Age on Equine Influenza Vaccination.” University of Tennessee-Knoxville, April 27.


David W. Horohov. “Equine vaccination,” Louisiana Veterinary Medical Association, Shreveport, Louisiana, Sept. 27.


Daniel K. Howe. “Improvement of enzyme-linked immunosorbent assays based on Sarcocystis neurona surface antigens (SnSAGs) for equine antibody detection” (with abstract coauthor Michelle Yeargan). Also served as the Presiding Officer for the meeting. Annual Midwestern Conference of Parasitologists, Delaware, Ohio. June 4-6.

Daniel K. Howe. “Molecular characterization of Sarcocystis neurona and what it can reveal about Equine Protozoal Myeloencephalitis.” Purdue University School of Veterinary Medicine, Department of Comparative Pathobiology, West Lafayette, Ind.


Gene Lyons. “Hookworms (Uncinaria spp.) in Pinnipeds with notes on Biology of Northern Fur Seals.” Annual Midwestern Conference Parasitologists (AMCOP), Ohio Weselyn University, Delaware, Ohio, June 4-6.


Karen McDowell. Gamete and Embryo Molecular Biology Training Course presented by the Primate Embryo Gene Expression Resource (PREGER), the Fels Institute for Cancer Research and Molecular Biology and Temple University School of Medicine, Philadelphia, Penn., July 26-Aug. 7.


John Timoney. “Genomes of Streptococcus equi and zoopidemicus: Rosetta stones for strangles vaccine improvement?” 5th International Veterinary Vaccines and Diagnostics Conference, Madison, Wisc., July
John Timoney. “Genomes of Streptococcus equi and zooepidemicus: Rosetta stones for strangles improvement?” Department of Veterinary Molecular Biology, Montana State University, Bozeman, Mont., Oct. 13.

John Timoney. “Genomes of Streptococcus equi and zooepidemicus: Rosetta stones for strangles improvement?” College of Veterinary Medicine, University of Minnesota, St. Paul, Minn., Oct. 21.

John Timoney. “Strangles Control and Management.” College of Veterinary Medicine, University of Minnesota, St. Paul, Minn., Oct. 21.

John Timoney, Mike Fettinger, Mike Donahue and Sergey Artiushin. “Identification of Leptospira interrogans serovar Pomona type kennewicki in specimens from horses and wild animals.” 90th Annual Meeting of Conference of Research Workers in Animal Diseases, Chicago, Dec. 7.


Peter J. Timoney. USDA-APHIS-VS CEM Training Course, Honalee, PC, Portland, Ore.

Peter J. Timoney. One Hundred and Thirteenth Annual Meeting of the United States Animal Health Association, San Diego.

Peter J. Timoney. 55th Annual Convention of the American Association of Equine Practitioners, Las Vegas.


Thomas Tobin. Paper presentation on Regulatory Thresholds For Therapeutic Medications. Attendance at Racing Medication and Testing Consortium meeting, Chicago, September.

Thomas Tobin. “Thresholds: How We Got To Where We Are, and Where We Are Heading.” National HBPA Summer Convention, Shepherdstown, W. Va., July 1.


Ernie Bailey. “Status of the equine genome project, and how these discoveries will benefit veterinary medicine.” Central Kentucky Equine Veterinary Meeting, Lexington, June 22.


Edward L. Squires. Central Kentucky Veterinary Conference, Co-program chair, speaker, Lexington, KY.


Peter J. Timoney. “Contagious equine metritis and African horse sickness.” 2009 Annual Meeting of the
Presentations/Meetings attended


Peter J. Timoney. USDA, VS, Eastern Regional Area Epidemiologist Officer Training Conference, Frankfort.


PLATINUM

Ashford Stud
Albert and Lorraine Clay
Darley at Jonabell Farm
Estate of Hilde R. Shapiro
Flaxman Holdings Limited
Hagyard Foundation
Horsemans’s Benevolent & Protective Association
Geoffrey C. Hughes Foundation Fellowship
Mr. G. Watts Humphrey, Jr.
Indiana Horsemans’s Benevolent & Protective Association
Kentucky Thoroughbred Owners and Breeders, Inc.
Lloyd’s Underwriter Funds
The R. D. & Joan Dale Hubbard Foundation
Mt. Brilliant Family Foundation
Oxley Foundation
Pfizer Animal Health
Shadwell Farm, Inc.
University of California

GOLD

Adger Bloodstock Co.
Dr. William D. Fishback, Jr.
Juddmonte Farms, Inc.
Dr. Kevin B. Pfiester
Dr. W. Thomas Riddle
Dr. Walter W. Zent

SILVER

American Quarter Horse Association
Blood-Horse Publications
Dr. Stuart E. Brown II
Butler Animal Health Supply
Dr. Nancy Marguerit Cox
Ms. Adele B. Dilschneider
Dr. Edward H. Fallon
Dr. Luke Fallon
Fasig-Tipton Company, Inc.
Fort Dodge Animal Health
Ms. Clay Hancock
Hancock Farm, Inc.
Helen Andrews Foundation
Ms. Louise Ireland Humphrey
The Klein Family Foundation, Inc.
KY Thoroughbred Farm Managers Club
Ms. Kristina G. Lu and Mr. Peter Morresey
Misdee Wrigley Charitable Foundation, Inc.
Dr. Janice Spencer Murray
Mr. Mac Murray
The Roemer Foundation
Mr. Daniel M. Rosenberg
Dr. Edward L. Squires
Thoroughbred Charities of America, LTD.
Mats H. Troedsson DVM
Winter Quarter Farm
Albert A. & Bertram N. Linder Foundation, Inc.
Alex Boone Charitable Trust
Mrs. Elisabeth H. Alexander
Miss Jane Atkinson
Mr. Walter T. Bates
Ms. Breana R. Beck
Ms. Katrina H. Becker
Bel-Mar Farm
Binns Real Estate Services, LTD
Mr. Samuel A. Boone
Caldara Farm
Dr. Domenic J. Catton
Clarkland Farms
Nancy M. Cole DVM
Dr. H. Steve Conboy
Mr. Kyle W. Cooper
Mrs. Evelyn T. Courtney
Mr. Robert E. Courtney Sr.
Mr. John C. Darsie
Mr. and Mrs. Jonathan K. Davis
Ms. Rachel Deemer
Delaware Standardbred Owners Association
Denali Stud
Dietrich & Company Equine Insurance, Inc.
Ms. Susan Donaldson
Dr. Daryl G. Easley
Dr. Claire Latimer Embertson
Dr. Rolf M. Embertson
Equine Breeding Research & Development Council
Mrs. Priscilla R. Fallon
Mr. Mac Fehsenfeld
Mrs. Betsy Fishback
Dr. Darrilyn G. Fraser
Futurity Hill Farm
Ms. Jeanne M. Gabrish
Generation Next
Kelly G. Geoghegan
Mr. Philip B. Geoghegan
Mrs. Ann E. Greely
Mr. John J. Greely III
Ms. Helen K. Groves
Mrs. Lucy Young Hamilton
Mr. William Hamilton
Mrs. Frances Hartwell
Mr. John A. Henderson, Jr.
Mrs. Martha K. Hoff
Mr. Timothy Holekamp
Mr. and Mrs. Steven A. Holland
Ms. M. LaDona Hudson
Mr. Stanley H. Jones
Justice Real Estate, Inc.
Ms. Mary Ann Jubin
Ms. Lori A. Hubbard-Kiley
Mr. Thomas Michael Kiley
Kirk Horse Insurance
Robert A. Leonard DVM
Mr. Eugene Levey
James E. Lewis DVM
Mr. and Ms. Frank Luongo
Ms. Anne D. Mainolfi
Ronald McAnally Inc.
Mr. L. Pope McLean
Mr. Tim McMurry
Mr. and Mrs. Jon K. Mott
Mott Thoroughbred Stables, Inc.
Mrs. Betty W. Mullen
Nebraska Horseman’s Benevolent &
Protective Association
Mr. Nick Nicholson
Nicholson Insurance Agency
Mrs. Susan S. Nicholson
Nuckols Farm, Inc.
Ms. Julia N. Offutt
Paradise Productions, LLC
Mr. and Mrs. John E. Patchet
Mr. J. Michael Paulson
Ms. Theresa A. Pratt
PRO Thoroughbred Enterprises LLC
Ms. Susan E. Raczkowski
Robert & Beverly Lewis Family Foundation
Roseglade Farm
Mr. Lloyd Schwartz
Sequel Bloodstock
Mr. Thomas E. Shartle
James L. Slaughter, DVM
Dr. Johnny M. Smith
Ms. Andrea Spohr
Summerhill Farm
Mr. Jack R. Swain III
Ms. Rea Swan
David Switzer
Ms. Kay L. Switzer
Dr. Peter J. Timoney
Ms. Diana C. Tuppy
Mr. J. David Whitehouse
Mrs. Susan C. Whitehouse
Mr. and Mrs. James A. Winn
Bernard T. Vertuca, DVM
Woodstock, LLC
Dr. Patricia L. Ziefle