GRAYSON-JOCKEY CLUB RESEARCH FOUNDATION

Welfare and Safety of the Racehorse Summit VII

June 28, 2016

Grayson-Jockey Club Research Foundation

Dear Guests:

It is my pleasure to welcome you to the seventh Welfare and Safety of the Racehorse Summit, on behalf of The Jockey Club and Grayson-Jockey Club Research Foundation. We are grateful to Keeneland Association for hosting all of the Summits, one of many illustrations of that unique organization's constant readiness to support the sport of racing through the well-being of horses and jockeys.

Today's presentations represent both a look forward and progress reports on past Summits. You will hear reports on what has been learned from the Equine Industry Database and the Racing Surfaces Testing Lab, both creations growing from the first Welfare and Safety of the Racehorse Summit. It will also highlight efforts on behalf of the health and safety of jockeys.

The underlying purpose of the Summits is, of course, advancement in the processes of promoting equine health and soundness. Everyone involved here is privileged to have in their lives the glorious and somewhat mysterious creatures called the Thoroughbred. But the Thoroughbred is only one of numerous breeds which serve mankind as a race horse. Along with the privilege of connection to these animals comes the opportunity to give back to those which give so much to us.

The Grayson-Jockey Club Research Foundation funds research to benefit horses of all breeds and usage. Today, however, the Summit concentrates on the race horse, while also recognizing that elements of what we discuss here today also can apply to horses of other uses.

Your attendance is testimony to your personal agreement on the importance of protecting horses to our best ability, and we thank you. As we say at Grayson, "Horses strive to be our champions. We can always be theirs."

Sincerely,

Edward L. Bowen
President

AGENDA MORNING SESSION

8:15 AM - 8:20 AM	Welcome & Introduction Donna Brothers
8:20 AM - 8:40 AM	Biosecurity & The Equine Disease Communication Center Dr. Nathaniel A. White II - *Professor Emeritus of Equine Surgery* *Virginia - Maryland College of Veterinary Medicine*
8:45 AM - 9:30 AM	Respiratory & Airway Health Bill Casner - *Thoroughbred Owner and Breeder* Dr. Susan J. Holcombe - *Professor* *Large Animal Clinical Sciences, Michigan State University*
9:35 AM - 9:55 AM	Racing Surfaces Testing Laboratory Dr. Mick Peterson - *Executive Director,* *Racing Surfaces Testing Laboratory* *University of Maine, Libra Professor*
10:00 AM - 10:30 AM	Equine Injury Database Dr. Tim Parkin - *Senior Lecturer* *University of Glasgow, Equine Clinical Sciences*
10:30 AM - 10:40 AM	Coffee Break
10:40 AM - 11:10 AM	Biomarker Research Dr. Christopher E. Kawcak *Professor of Surgery & Director, Equine Clinical Services* *Orthopedic Research Center* *Colorado State University*
11:15 AM - 11:45 AM	Nutraceuticals Dr. Wayne McIlwraith - *Barbara Cox Anthony Endowed* *University Chair in Orthopaedics, Orthopaedic Research Center* *Colorado State University*
11:50 AM - 12:30 PM	Proper Nutrition & Balanced Feed Programs Dr. Robert Coleman - *Assistant Professor Equine Extension* *University of Kentucky* Dr. Laurie Lawrence - *Provost's Distinguished Service* *Professor, Department of Animal and Food Sciences* *University of Kentucky*
12:30 PM - 1:20 PM	Lunch

AGENDA AFTERNOON SESSION

1:25 PM - 2:10 PM — Regulating The Use Of The Crop
Moderator: Sue Finley - *Sr. Vice President & Co-Publisher Thoroughbred Daily News*
Ramón A. Domínguez - *Retired Thoroughbred Horse Racing Hall of Fame Jockey*
Gunnar Lindberg - *Senior Racing Official Alcohol and Gaming Commission of Ontario*
Chris McCarron - *Retired Thoroughbred Horse Racing Hall of Fame Jockey*

2:15 PM - 2:30 PM — Return To Ride Protocols
Dr. Carl Mattacola - *Professor Athletic Training Rehabilitation Sciences, University of Kentucky*

2:35 PM - 3:20 PM — Compounded Medications
Dr. Dionne Benson - *Executive Director and COO Racing Medication Testing Consortium*
Dr. Lynn Hovda - *Chief Veterinarian Minnesota Racing Commission*
Dr. Scott Stanley - *Professor of Equine Analytical Chemistry University of California, Davis*

3:20 PM - 3:30 PM — Coffee Break

3:30 PM - 3:55 PM — American Association Of Equine Practitioners Racing Committee
Dr. Kathleen Anderson - AAEP President and *Owner Equine Veterinary Care*
Dr. Nathaniel A. White II -*Professor Emeritus of Equine Surgery Virginia - Maryland College of Veterinary Medicine*

4:00 PM - 4:50 PM — Lameness Diagnosis - The Importance of the Physical Inspection
Moderator: Edward L. Bowen - *President Grayson-Jockey Club Research Foundation*
Dr. Lawrence R. Bramlage -*Surgeon Rood and Riddle Equine Hospital*
Dr. Kevin Dunlavy - *Managing Partner Kentucky Equine Medical Associates*
Dr. Mary Scollay - *Equine Medical Director Kentucky Horse Racing Commission*

4:50 PM - 5:00 PM — Closing

Donna Barton Brothers

Master of Ceremonies

Donna Barton Brothers was born with racing in her blood. Her mother, Patti Barton, was one of the first half-dozen women to be licensed as a jockey in the United States and was the leading female rider in career wins by the time she retired in 1984. Donna's father, Charlie Barton, was a rough-stock rider on the rodeo circuit and a horse shoer. Both of Donna's siblings, Leah and Jerry, were also professional jockeys. By 1987 when Donna embarked on a career as a jockey, her mother and both of her siblings had retired from the profession.

Between 1987 and 1998 Brothers rode at all levels of racing from Rockingham Park to Churchill Downs to Saratoga. She retired in 1998 as the second leading female jockey in the country by money earned after having won 1,171 races. It was also in 1998 that she began dabbling in on-air horse racing coverage with Television Games Network (TVG), ESPN, and then in 2000 she began working for NBC Sports and has since covered the Kentucky Derby, Preakness Stakes, Belmont Stakes, and Breeders' Cup among many other Thoroughbred races for NBC. Working for NBC, she covered the historic Triple Crown sweep by American Pharoah in 2015.

Donna has also covered the Hambletonian Stakes, the Rolex Three Day Event, the World Equestrian Games, the AQHA World Championship Show, Grand Prix Show Jumping and Professional Bull Riding (PBR) and still covers horse racing for TVG. She was named best sideline sports reporter of 2014 by Sports Illustrated.

Donna is married to former trainer Frank Brothers and both have roles with Starlight Racing, of which Donna was named chief operating officer in 2013.

Dr. Kathleen Anderson

AAEP President
Owner Equine Veterinary Care

Dr. Kathleen M. Anderson grew up in western Canada and received her degree in Veterinary Medicine at the Western College of Veterinary Medicine in Saskatchewan, Canada. Actively involved with horses from childhood she has worked in all facets of the equine industry from event competitor to international competition groom to barn manager and even exercise rider/pony person at Marquis Downs!

Dr. Anderson started practice in 1986 under the watchful eye of long time US Equestrian Team veterinarian Dr. A. Martin Simensen in South Hamilton, MA. The restructuring of Suffolk Downs in 1990 encouraged many to leave New England so she migrated south to the New Jersey racing circuit, Pennsylvania racetracks and Maryland racing.

In 1993 after the birth of her son John, Dr. Anderson settled at Fair Hill Training Center and has actively contributed to the continued success and upgrades at FHTC. Now a mother of two (daughter Quinn was born in 1998) Dr. Anderson enjoys riding, art and music, traveling and being a parent. She is active in many professional roles within the equine industry but her number one interest remains providing excellence in equine veterinary care.

Dr. Anderson was installed as president of the American Association of Equine Practitioners (AAEP) in December 2015. An AAEP member since 1986, Anderson has volunteered as an AAEP On Call representative since 1997. She previously served on the board of directors from 2006-2009; as vice chair of the Racing Committee; as a member of the Foundation Advisory Council; and as a member of the Ethics and Professional Conduct, Finance and Audit, Leadership Development, Membership Development, and Nominating committees.

In addition, she has presented at the AAEP Annual Convention on issues of practice management and care of race and performance horses.

Dr. Dionne Benson

Executive Director and COO,
Racing Medication Testing Consortium

A native of the Twin Cities area of Minnesota, Dr. Benson completed a veterinary internship at the acclaimed Rood and Riddle Equine Hospital in Lexington, Ky. In that position, Dr. Benson rotated through the areas of surgery, anesthesia and medicine, and was responsible for primary patient care. Dr. Benson previously completed a summer research project under Dr. Troy Trumble at the University of Minnesota, in which she designed and executed a clinical study on peri-neural and intra-articular joint blocks.

In addition, Dr. Benson has worked as a veterinary assistant to Dr. V. Don Newcomb at Canterbury Park and as a detention barn technician for the Minnesota State Veterinarian's office.

Prior to her veterinary medicine pursuits, Dr. Benson practiced law for eight years, serving as an adjunct faculty member at the William Mitchell College of Law, and as an attorney for the National Arbitration Forum and at Larkin, Hoffman, Daly and Lindgren, Ltd. in Minneapolis, Minn.

Dr. Benson received her B.S. and D.V.M. from the University of Minnesota, and J.D. from the William Mitchell College of Law.

Dr. Benson has garnered many awards, scholarships and grants, including the ACVS Foundation Student Surgical Proficiency Award for Excellence in Large Animal Surgery (April 2011), Bayer Healthcare Legend Award in Equine Medicine (April 2011), Julie Hanzlik Memorial Scholarship (April 2011), American Livestock / Hiscox Insurance Company / AAEP Scholarship (December 2010), Winner's Circle Scholarship (April 2010), and the Morris Animal Foundation Summer Student Research Grant Recipient (June 2009).

Edward L. Bowen

President, Grayson-Jockey Club Research Foundation

Edward L. Bowen became president of the Grayson-Jockey Club Research Foundation, a charitable organization that funds research on matters of the health and soundness of horses, in March 1994. Prior to accepting the post, Bowen has been a Thoroughbred racing journalist since 1963. He worked the majority of those years for *The Blood-Horse* and was editor-in-chief of that publication from 1987 through 1991. He also has had stints as editor-in-chief of *Thoroughbred Times* and *Canadian Horse* magazine.

Bowen is the author of 19 books on racing, including biographies of Man o'War and Nashua, "The Jockey Club's Illustrated History of Thoroughbred Racing in America," and "Masters of the Turf." He also wrote the script for a one hour television show on Bill Shoemaker, authored John Forsythe's script for the Eclipse Awards dinner annually from 1976-98, and is himself an Eclipse Award winner. He has received the Kentucky Thoroughbred Association's Charles Engelhard Award, National Turf Writers Association Walter Haight Award, Pimlico's Old Hilltopper Award, and the Ocala-Marion County Chamber of Commerce Magazine Award. Bowen is a trustee of the National Museum of Racing and chairman of its Hall of Fame Nominating Committee and president of the American Academy of Equine Art.

Bowen is a former board member of the Thoroughbred Retirement Foundation and a past president of the Thoroughbred Club of America. He attended the University of Florida and the University of Kentucky.

Larry R. Bramlage DVM MS

Surgeon and Partner, Rood & Riddle Equine Hospital

Larry Bramlage is a 1975 graduate of the Kansas State University College of Veterinary Medicine (DVM) and received a Master of Science degree from The Ohio State University in 1978. He holds a Diploma of the American College of Veterinary Surgery (Diplomate ACVS).

Bramlage is an internationally recognized equine orthopedic surgeon. He is a past President of the American Association of Equine Practitioners, and of the American College of Veterinary Surgeons.

In recognition of his dedication and contribution to Thoroughbred racing, Bramlage was awarded the 1994 Jockey Club Gold Medal for contributions to Thoroughbred Racing in the United States. He is also a past chairman of the Research Advisory Committee of the Grayson-Jockey Club Research Foundation and serves on the Board of Directors for that organization.

His additional honors include the 1997 Tierlink Hochmoor Prize for his work regarding the internal fixation of fractures, the 1998 distinguished alumnus award from The Ohio State University, Alumni Fellow Award from Kansas State University, a British Equine Veterinary Association's Special Award of Merit, and the American College of Veterinary Surgeons Legends award for the development of the fetlock arthrodesis procedure for horses in 2009, and the Thoroughbred Club Testimonial Award in 2014.

He has received the American Association of Equine Practioners Distinguished Service Award twice. He was elected to membership in The Jockey Club in 2002 and to Distinguished Lifetime Membership in the American Association of Equine Practioners in 2010.

Bill Casner

Thoroughbred Owner and Breeder

Bill Casner has a lifelong devotion to Thoroughbred racing, and some years after he and partner Kenny Troutt founded Excel Communications they also established WinStar Farm.

Casner now operates individually in the name of Casner Racing. He and Trout bred classic winners Funny Cide, Da 'Tara, and Super Saver and raced Belmont winner Drosselmeyer. Casner is a past chairman of the Thoroughbred Owners and Breeders Association and a founding director of the Race for Education and Kentucky Equine Education Program (KEEP).

He has many other roles in racing including chairmanship of the Welfare and Safety of the Racehorse Summit's Shoeing and Hoof Care Committee.

Dr. Robert Coleman

Assistant Professor Equine Extension
University of Kentucky

EDUCATION

1998 Ph.D., Animal Science University of Alberta
1978 M.S., Animal Science University of Manitoba
1975 B.Sc., Agriculture(Major Animal Science) University of Manitoba

PROFESSIONAL EXPERIENCE
1980 - 1998 Extension Horse Specialist Alberta Agriculture, Food and Rural Development, Edmonton, Alberta
1998 - present Assistant professor, University of Kentucky; Extension, 80%; Teaching, 20%

AREAS OF INTEREST

Equine nutrition Utilization of Forages by the Horse Horse care and management Industry Economics

COURSES TAUGHT

ASC 320 Equine Management ASC 410 The Art and Science of Equine Production

PUBLICATIONS

Purswell, J.L., R.S. Gates, L.M. Lawrence, J.D. Jacob, T.S. Stombaugh, and R.J. Coleman. Air exchange rate in a horse trailer during road transport. Transactions of the American Society of Agricultural and Biological Engineers 49(1):193-201. 2006.
Bob Coleman. 1998. ASC-114 Basic Horse Nutrition.

Ramón A. Domínguez

Retired Thoroughbred Horse Racing Hall of Fame Jockey

Ramón A. Domínguez is a retired Eclipse Award-winning champion jockey in American Thoroughbred horse racing. He began riding horses at age 16 in his native Venezuela in show jumping then turned to riding thoroughbreds in flat racing events at La Rinconada Hippodrome. He emigrated to the United States where he began riding at Florida's Hialeah Park Race Track in 1996.

In 2001 he got his big break by becoming the winningest jockey in the United States. He repeated the feat in 2003, and in 2004 he won the Isaac Murphy Award for having the highest winning percentage among all American-based jockeys.

Domínguez was the regular rider of two-time Eclipse Award-winning turf champion Gio Ponti, whom he has ridden to victories in six Grade One stakes races including Belmont Park's Man o' War Stakes twice, as well as the Arlington Million, Frank E. Kilroe Mile Handicap and Shadwell Turf Mile Stakes twice. His first win in the Breeders' Cup came in 2004 when he rode Better Talk Now to victory in the Breeders' Cup Turf. Domínguez has won six races in a day on three occasions, most recently on July 22, 2012 when he rode six winners from seven mounts at Saratoga Race Course tying the same day win record by a jockey among all New York tracks. He is the second jockey in Saratoga's history to win six races on a single race card. He has also won five races in a day on several occasions at Aqueduct Racetrack, most recently on February 17, 2010 when he won the first five races on the card.

In 2012 Dominguez topped the New York Racing Association (NYRA) riding circuit for the fourth straight year with 322 victories, and was also the winner of the George Woolf Memorial Jockey Award, bestowed by his peers for excellent conduct and given by Santa Anita Park. Domínguez is the recipient of the 2010, 2011, and 2012 Eclipse Award for Outstanding Jockey. In 2012 set a new mark for single-season earnings by a jockey, when his mounts brought home $25,582,252 to shatter the 2003 bar of $23,354,960 set by Hall of Famer Jerry Bailey.

On June 13, 2013, Dominguez announced his retirement due to head injuries suffered in a fall at Aqueduct Racetrack on January 18, 2013.

On April 25, 2016, Dominguez's induction into the National Museum of Racing and Hall of Fame was announced.

Dr. Kevin Dunlavy

Managing Partner
Kentucky Equine Medical Associates

Dr. Dunlavy is the managing partner and co-owner of Kentucky Equine Medical Associates, a six-veterinarian practice providing care for racehorses in Kentucky, Louisiana, Arkansas and Indiana.

Dr. Dunlavy received his degree from Louisiana State University.

Sue Finley

Sr. Vice President & Co-Publisher
Thoroughbred Daily News

Sue Morris Finley spent her childhood commuting to Belmont Park from her home in Weston, Connecticut. A cum laude graduate of New York University with Bachelor's Degrees in French and Journalism, she began an internship in the NYRA press department while still a senior at NYU and accepted a full-time position at the track in her final term.

The daughter of a World War II combat veteran and POW who returned home after the war to teach high school French, she was the recipient of NYU's Founders Day Award as the school's top French student, and earned a scholarship for NYU's Master's program in French. However, the lure of Belmont Park proved to be too great, and she left graduate school after a semester to concentrate on her racing career. She remained at NYRA for eight years, rising to the position of Senior Media Coordinator, and left in 1991 to work as a researcher for ABC's Wide World of Sports. In 1992, she took a job at one of ABC's properties, the American Championship Racing Series, where she served as Director of Administration and Publicity.

In 1993, she and ACRS founder Barry Weisbord took over the production of the Thoroughbred Daily News.

For 12 years, she was the First Vice President of the Thoroughbred Retirement Foundation, a national organization dedicated to the humane retirement of former racehorses, and still chairs their annual fundraiser. She earned a Professional Certificate in fundraising from NYU's George Heyman Center for Philanthropy.

A native New Englander and lifelong Boston Red Sox fan, she lives a stone's throw from the TDN's Red Bank, NJ offices with her two children.

Dr. Susan J. Holcombe

Professor, Large Animal Clinical Sciences
Michigan State University

EDUCATION

BS, Cornell University, 1985
VMD, The University of Pennsylvania, 1990
MS, The Ohio State University, 1994
PhD, Michigan State University, 1997
Diplomate, American College of Veterinary Surgeons
Diplomate, American College of Veterinary Emergency Critical Care

HONORS AND AWARDS

Committee member, Grayson Jockey Club Research Foundation, 2015
Secretary, 2013 - 2014, Michigan Animal Health Foundation Board of Trustees, 2010 – 2015
Chair, 2013 - 2014, Morris Animal Foundation Large Animal Scientific Advisory Board, 2010 – 2014
SCAVMA Excellence in Teaching Award from the Class of 2016, 2014
Excellence in Teaching Award from the Class of 2014, 2014
Commencement Address Speaker for the MSU CVM Class of 2012, 2012
Pfizer Distinguished Veterinary Teacher Award , 2012
Educator of the Year Award, American College of Veterinary Emergency Critical Care and Merck Animal Health, 2012
SCAVA Excellence in Teaching Award from the Class of 2012, 2010
Welfare and Safety Summit: Environment and Training Practices Committee appointment, The Jockey Club, Lexington, KY, 2010
British Equine Veterinary Association and the Equine Veterinary Journal manuscript award, 2007
Distinguished Honorary Alumnus, College of Veterinary Medicine, Michigan State University, 2006

RESEARCH INTERESTS

Pulmonary health and inflammatory disorders
Upper respiratory function and dysphagia
Sepsis, endotoxemia, and inflammation
Colic

Dr. Lynn Hovda

Chief Veterinarian
Minnesota Racing Commission

Dr. Lynn Hovda is the Director of Veterinary Services with Safety Call International and Pet Poison Helpline (PPH). She is also an adjunct professor at the University of Minnesota College of Veterinary Medicine and the Chief Commission Veterinarian for the Minnesota Racing Commission. Dr. Hovda received a BS in Pharmacy from North Dakota State University and a BS in Veterinary Science from the University of Minnesota. She received a Doctor of Veterinary Medicine degree from the University of Minnesota and followed this with an internship at the University of Georgia and a three year internal medicine residency at the University of Wisconsin-Madison.

Dr. Hovda received a Master of Science in Veterinary Science degree from the University of Wisconsin-Madison and was awarded board certification by the American College of Veterinary Internal Medicine (DACVIM). She holds Pharmacy Board licensure in Minnesota and North Dakota and Veterinary Board licensure in Minnesota, North Dakota, Iowa, and Wisconsin.

She has published scientific articles and book chapters, presented scientific abstracts and invited presentations, and participated in numerous educational proceedings for lay groups. She holds memberships in several professional, scientific, and civic organizations and has served on committees for the American Veterinarian Medical Association, American College of Veterinary Internal Medicine, American Association of Poison Control Centers, Association of Racing Commissioners, and the American Association of Racing Veterinarians. Her educational and research interests include plants and plant related toxicities, pharmaceuticals and pharmacokinetics, prevention and treatment of pesticide and farm chemical related exposures, and race track associated injuries.

When not working, Dr. Hovda lives in rural Minnesota with her family, nine or ten horses, five cats, three dogs, and a herd of goldfish.

Dr. Christopher E. Kawcak

Professor of Surgery & Director, Equine Clinical Services
Orthopedic Research Center
Colorado State University

RESEARCH INTERESTS
Osteoarthritis, Fracture Repair, Gait Analysis, Modeling, Imaging, Developmental Disease, Surgery
Fracture repair
Biomedical Engineering

HONORS AND AWARDS
2007 - Elastikon Equine Research Award, Johnson & Johnson Consumer Products Company to the Grayson-Jockey Club Research Foundation

2003 - Pfizer Award for Research Excellence, Pfizer

1998,1997,1996,1995 - Ken Atkinson Scholarship, College of Veterinary Medicine and Biomedical Sciences, Colorado State University

1996 - Dr. William Riddell Memorial Graduate Scholarship, College of Veterinary Medicine and Biomedical Sciences, Colorado State University

EDUCATION

Ph.D. 1998, Colorado State University - Clinical Science
M.S. 1995, Colorado State University - Clinical Science
B.S. 1988, University of Nevada-Reno - Veterinary Science

Dr. Laurie Lawrence

Provost's Distinguished Service
Professor, Department of Animal and Food Sciences
University of Kentucky

Laurie Lawrence is a Provost's Distinguished Service Professor in the Department of Animal and Food Sciences at the University of Kentucky where she is active in equine nutrition research and teaching. She received a B.S. degree from Cornell University and the M.S. and Ph.D. degrees from Colorado State University. Prior to joining the faculty at the University of Kentucky she served as an Assistant and Associate Professor in Animal Science at the University of Illinois. Her research interests include the nutrient requirements of broodmares and foals; the optimization of forage use in equine diets and interaction between diet and the microbial community of the gastrointestinal tract. She has advised more than two dozen graduate students including many who are currently employed as equinenutritionists in academia and industry.

She is the author of more than 80 refereed research publications, several book chapters and over 100 abstracts, proceedings papers and popular press articles. She is a past-president of the Equine Nutrition and Physiology Society and a past-director of the American Society of Animal Science. In 1998 she received the AFIA Award for research in nonruminant nutrition and in 2015 she received the AFIA Award for equine nutrition research. She has also received the Distinguished Service Award from the Equine Nutrition and Physiology Society, the Great Teacher Award from the University of Kentucky, the Thomas Poe Cooper Award for research in the University of Kentucky's College of Agriculture, and the public service award from the Kentucky Forage and Grassland Council. In 2008, she received the Equine Science Award from the American Society of Animal Science, and in 2011 she was named a Fellow of the American Society of Animal Science. From 2004-2007 she was the chair of the National Research Council committee to revise the National Research Council publication the "Nutrient Requirements of Horses". Dr. Lawrence teaches equine nutrition and equine evaluation to students at the University of Kentucky and serves as faculty adviser to the Horse Racing Club. Her teaching responsibilities have also included Equine Science, Equine Industry Study and Equine Anatomy and Conformation.

Dr. Lawrence serves on the board of the Kentucky Equine Management Internship (KEMI) program which brings college students to Central Kentucky to complete 22 week internships on thoroughbred farms. She also coordinates the visits of French students from the Mastere of Equine Science and Business when they come to Kentucky to learn about the horse industry for 4 weeks each spring. Dr. Lawrence presents numerous invited lectures throughout the U.S. each year and she has been invited to present lectures and/or consult with equine nutritionists in Japan, Australia, Argentina, Canada, Brazil and Dubai.

Gunnar Lindberg

Senior Racing Official
Alcohol and Gaming Commission of Ontario

THOROUGHBRED HORSE RACING STEWARD - ONTARIO RACING COMMISSION, MINISTRY OF FINANCE 2002 – PRESENT
Licensing of individuals and businesses involved in the horse racing industry and Officiate at all thoroughbred racetracks in Ontario. Ensure compliance with the rules of racing by over 6,000 licensees and collaborate with fellow Stewards to conduct daily hearing resolving disputes and enforce Commission bi-laws. Prepare and present case material as prosecutor to defend decisions at appeal tribunals. Several high profile cases successfully defended. Compose legal rulings outlining evidence and reasons for decision.

ADJUDICATOR - THOROUGHBRED RACING INDUSTRY APPEAL BOARD 1998 – 2002
Chaired and collaborated with two panel members at appeal hearings, listening to evidence presented by the accused, counsel and witnesses to arrive at a fair and equitable results. Compose appeal ruling explaining reasons for decision.

WOODBINE ENTERTAINMENT GROUP – SENIOR MANAGER 2001 – 2002
Senior manager of Cash operations with a staff of 50 handling over 3 Million in cash on a daily basis and analyzed operations for a more efficient cash processing system. Performed and coordinated daily operational duties, staffing and budgets.

WOODBINE ENTERTAINMENT GROUP- LIAISON MANAGER 1996 – 2001
Set up and monitored security requirements for 27 Off Track sites, investigated incidents of robbery and theft, working closely with police departments and in house security. Implemented and enforced employee disciplinary actions in accordance with the collective agreement. Prepared annual budgets of over $1 Million.

WOODBINE ENTERTAINMENT GROUP - MANAGER 1993 – 1996
Managed overall operation including budgeting, staffing and reconciliation of the Woodbine racetrack Money room operations.

WOODBINE ENTERTAINMENT GROUP - SUPERVISOR 1992 –1993
Supervised a division of employees and handled all associated customer service.

THOROUGHBRED JOCKEY 1973 – 1991

Director on the Board of the Avelino Gomez Charitable Foundation 1989 – present
Charitable organization with assets of over $200,000, providing aide and guidance to countless individuals and families in times of need.

Dr. Carl Mattacola

Professor & Director of the Rehabilitation Sciences Doctoral Program
University of Kentucky

Dr. Mattacola is a Professor and serves as the director of the post-professional athletic training masters program and the Rehabilitation Sciences Doctoral Program at University of Kentucky. The doctoral program is a multi-disciplinary program consisting of Athletic Training, Communication Sciences and Disorders, Physical Therapy and Occupational Therapy. He received his bachelor's degree in physical education/athletic training from Canisius College in Buffalo, New York. He completed his doctor of philosophy degree in sports medicine and received his masters of education degree, both at the University of Virginia. Dr. Mattacola has held various positions as an athletic trainer and as a professor, including Temple University in Pennsylvania and Hampden-Sydney College in Virginia. He is Editor of the Journal of Sport Rehabilitation.
His research has focused on directing research in the area of functional assessment of human function, postural control, and strength following injury and subsequent surgical procedures. He lives in Lexington Kentucky with wife Kathleen Mattacola.

Chris McCarron

Retired Thoroughbred Horse Racing
Hall of Fame Jockey

Chris McCarron was born in Boston on March 27, 1955 and was introduced to the sport of Thoroughbred racing by his older brother, Greg. Chris McCarron began riding as a professional in 1974 and won the Eclipse Award for Outstanding Apprentice Jockey that year.

McCarron moved his tack to California in 1977 and that year scored the first of his three victories in the Kentucky Oaks. In 1980, he won the Eclipse Award for Outstanding Jockey and the George Woolf Memorial Jockey Award.

McCarron won nine Breeders' Cup races, including five runnings of the Classic. He also won the Kentucky Derby, Preakness Stakes and Belmont Stakes twice each.

Other major wins for McCarron include the Del Mar Oaks (4), Del Mar Futurity (4), Del Mar Handicap (6), Del Mar Debutante Stakes (3), La Jolla Handicap (7), San Bernardino Handicap (6), Clement L. Hirsch Handicap (7), San Felipe Stakes (7), Florida Derby, Eddie Read Handicap, Bing Crosby Handicap, Jockey Club Gold Cup (2), Arlington Million, Fantasy Stakes (4), San Clemente Handicap (5), Hollywood Gold Cup, Woodward Stakes (2), Santa Anita Handicap (3), Haskell Invitational (2), Santa Anita Derby (4), San Diego Handicap (6), Pacific Classic, Canadian International and Japan Cup.

McCarron rode many of the best horses of his era, including John Henry, Alysheba, Precisionist, Lady's Secret, Sunday Silence, Paseana, Tiznow, Touch Gold, Go for Gin and Alphabet Soup.

McCarron led all North American jockeys in earnings in 1980, 1981, 1984 and 1991. He also topped the leaderboard in wins in 1974, 1975 and 1980.

McCarron retired in 2002 with 7,141 wins and purse earnings of $263, 985,905. He served as technical advisor, racing designer and had an acting role in the 2003 film "Seabiscuit." He currently instructs aspiring jockeys at the North American Racing Academy, which he founded to help hone the skills of young riders.

Chris McCarron was inducted into the National Museum of Racing's Hall of Fame in 1989.

Dr. Wayne McIlwraith

Barbara Cox Anthony Endowed University Chair in Orthopaedics, Orthopaedic Research Center, Colorado State University

Dr. McIlwraith is a University Distinguished Professor, holds the Barbara Cox Anthony Endowed University Chair in Orthopaedics and is Director of the Orthopaedic Research Center and the Musculoskeletal Research Program at Colorado State University. He also has an equine referral surgical practice primarily focused in Southern California, consults and does surgery elsewhere in the US and internationally. He is a recognized leader in the field of equine orthopaedic research and surgery. He is Past President of the American College of Veterinary Surgeons, the American Association of Equine Practitioners and the Veterinary Orthopaedic Society.

His research interests include equine orthopaedic surgery and joint disease research including novel treatments for osteoarthritis and articular cartilage repair, mesenchymal stem cell therapies, early diagnosis of osteoarthritis and pre-fracture disease using imaging and fluid biomarkers.

Dr. Tim Parkin

Senior Lecturer and Associate Academic
University of Glasgow

Tim Parkin is Head of the Division of Equine Clinical Sciences and Senior Lecturer in Clinical Epidemiology at the School of Veterinary Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow.

He qualified from the University of Bristol with degrees in Zoology (1992) and Veterinary Science (1998). He immediately took up a position at the University of Liverpool and went on to complete his PhD on the epidemiology of fractures in racehorses in 2002. Since then he has worked on numerous projects with several different racing jurisdictions around the world, including the UK, Hong Kong, Japan, Australia, South America and the USA. He gained his Diploma of the European College of Veterinary Public Health in 2006 and has worked at the University of Glasgow since February 2007.

Parkin has twice been an epidemiological consultant for Racing Victoria Jumps Race Review Committees (2005 and 2008) and is a member of the Equine Injury Database Scientific Advisory Committee in the USA.

Parkin currently serves on: the Veterinary Advisory Committee of World Horse Welfare; the Scientific Advisory Committee of the Petplan Charitable Trust; the Editorial Consultant Board of the Equine Veterinary Journal. He is an Associate Editor for the Journal of Small Animal Practice and is Honorary Secretary of the Executive Council of the European College of Veterinary Public Health. He was President of the Society for Veterinary Epidemiology and Preventive Medicine from 2012 to 2013.

Michael “Mick” Peterson, Ph.D.

Mechanical Engineering Professor, University of Maine

Michael “Mick” Peterson, Ph.D. is a Mechanical Engineering Professor at the University of Maine in the USA and is currently the holds University Trustee Professorship. Dr. Peterson’s research links traditional understanding of engineering mechanics and materials to the biomechanics of animals. His research emphasis is on the manner in which dynamic response can be used to characterize materials. He has been collaborating with the faculty in the College of Veterinary Medicine and Biomedical Sciences at Colorado State University for nearly two decades and is currently a visiting professor in the College of Agriculture, Food and Environment at the University of Kentucky. He has worked on a range of equine and animal biomechanics topics including: the impact of exercise on bone density, the development of biomechanical models, durability of cetacean epidermis, the measurement of inertial properties of the equine forelimb, biomechanics of whale interaction with fishing gear, cetacean acoustic response, marine hydroacoustics and the kinematics of equine gait on treadmills and tracks.

Dr. Peterson greatest passion is for understanding of racing surfaces and equestrian surfaces. Originating in work 20 years ago on a new medical imaging technique this work has gradually grown from an interest in the effect of exercise on bone remodeling to a focus on applying concepts from manufacturing quality control to improved racing surface consistency for the protection of horses and riders. Dr. Peterson collaborated with Dr. C. Wayne McIlwraith at Colorado State University to found the Racing Surfaces Testing Laboratory. The laboratory is a non-profit organization supported by the racing industry which is providing research, testing and materials characterization services for the horse racing industry. Dr. Peterson currently serves as the Executive Director. He has published 80 journal articles, 3 book chapters, 81 conference proceedings, presented 67 additional papers at conferences and has received 6 patents.

Dr. Mary Scollay

Equine Medical Director
Kentucky Horse Racing Commission

A 1984 graduate of the University of Illinois College of Veterinary medicine, Dr. Scollay served for 20 years as an on-track racing regulatory veterinarian, before becoming the Equine Medical Director of the Kentucky Horse Racing Commission in 2008. She is an active member of the American Association of Equine Practitioners and has served the organization in a broad range of roles. She currently serves on the AAEP's Racing Committee and Professional Conduct and Ethics Committee. She is a member of the Racing Commissioners International Regulatory Veterinarians' Committee, the International Group of Specialty Racing Veterinarians and an associate member of the European Horseracing Scientific Liaison Committee. She is a board member of the Racing and Medication Testing Consortium and is seated on its Scientific Advisory Committee. She is a board member of the Racing Surfaces Testing Laboratory and serves as a veterinary consultant to the Jockey Club Equine Injury Database.

Dr. Scott Stanley

Professor of Equine Analytical Chemistry
University of California, Davis

Dr. Scott Stanley is a Professor of Equine Analytical Chemistry at the University of California -Davis, School of Veterinary Medicine. Dr. Stanley has focused his research efforts in the fields of equine pharmacology and analytical chemistry.
He has published more than 100 research papers on drug testing pharmacokinetics, pharmacodynamics, and veterinary pharmaceuticals. His research interests include the application of mass spectrometry for the detection of biomarkers for drugs detection.

Dr. Nathaniel A. White II

Professor Emeritus of Equine Surgery
Virginia - Maryland College of Veterinary Medicine

Dr. White is a professor of surgery at Virginia Tech's Marion duPont Scott Equine Medical Center. After receiving a doctor of veterinary medicine at Cornell University in 1971, he completed an internship and residency in surgery at the University officiation-Davis from 1971 to 1973, and earned master of science in pathology at Kansas State University in 1976. He is a Diplomate of the American College of Veterinary Surgeons (ACVS). Dr. White, who has served on the faculties of both Kansas State University and the University of Georgia, joined the Marion duPont Scott Equine Medical Center in 1985, and held the position of Theodora Ayer Randolph Professor of Surgery at Virginia Tech from 1987 to 2003. He was the Jean Ellen Shehan Professor and Director from 2003-2012 and was named Professor Emeritus in Equine Surgery in September 2013.

A world-renowned expert in colic, Dr. White has authored several books on the topic including Equine Acute Abdomen, and Handbook of Equine Colic as well as the surgical texts Current Techniques in Equine Surgery and Lameness, and Current Practice of Equine Surgery. He has been a director for the ACVS Veterinary Symposium since 1997, and is a past president of the ACVS and of the ACVS Research and Education Foundation. Dr. White is a former director-at-large for the American Association of Equine Practitioners (AAEP) and is currently AAEP President. Dr. White s research interests include pathophysiology of ischemia-reperfusion, epidemiology of colic, abdominal and orthopedic surgery, and treatment of orthopedic diseases. He is a member of the AAEP, the ACVS and the American Veterinary Medical Association.

Biosecurity & The Equine Disease Communication Center

Dr. Nathaniel A. White II
Professor Emeritus of Equine Surgery
Virginia - Maryland
College of Veterinary Medicine

The Equine Disease Communication Center and Biosecurity

Nathaniel A. White and Bailey McCallum

EDCC

The Equine Disease Communication Center (EDCC) works to protect horses and the horse industry from the threat of infectious diseases in North America. The communication system is designed to seek and report real time information about disease outbreaks similar to how the Centers for Disease Control and Prevention alerts the human population for diseases in people. Ultimately frequent and accurate information about disease outbreaks improves horse welfare and helps to prevent negative economic impact that can result from decreased horse use and transport due to a fear of spreading infection and enforced quarantine.

Working in cooperation with state animal health officials and the United States Department of Agriculture, the EDCC seeks information about current disease outbreaks from news media, social media, official state reports and veterinary practitioners. Once information is confirmed, it is immediately posted on the website http://equinediseasecc.org and an email message is sent to all states, horse organizations and the USDA. Daily updates are posted until each outbreak is contained or deemed no longer a threat. Facebook and Twitter are also used to communicate alert information.

Alerts and updates on current disease outbreaks are listed on the alert page http://equinediseasecc.org/outbreaks.aspx and include the date listed, disease name, location and current status (Figure 1). Specific premises are not named, but the general location by town, county and state is listed. When locations, events or horses are at risk they will be listed. Updates will be posted as they are received.

6/2/2016	Equine Herpes viruses	Cooke County, TX	Confirmed case(s) quarantined

Since the two original confirmed EHM positive horses at a Cooke County, TX breeding facility on May 24-25, five additional horses have tested positive for EHM on whole blood PCR. Nasal swabs were also used and four horses tested negative and one tested positive. The newly confirmed horses were surrounding the original cases and isolated at the first sign of fever. None of the newly diagnosed horses have shown any neurological signs. The affected barn has a total of 40 horses and the farm is under quarantine and restricted from movement of animals and semen.

Figure 1: Example of an alert for equine herpes myeloencephalopathy (EHM)

As part of the National Equine Health Plan one of EDCC's goals is to provide information about endemic and foreign diseases. The website has links available for specific information about diseases, vaccination, and biosecurity as well as contact information for state animal health officials and the USDA are available on the website.

The website is open to anyone and anyone can sign up to receive the outbreak alerts at no cost. The initial alert was posted in April of 2015. Since then 198 alerts have been posted with 93 in 2016. There have been 56,440 visits to the website since February 1, 2016. More than 60 percent of the website views were on the alert page. As of June 16, 2016, there were 1056 addresses on the email list and 969 following on Facebook. The call center is scheduled for full operation on July 1, 2016.

The EDCC office is housed at AAEP in Lexington, KY. Staff include the Director (Dr. Nat White), the Communication Manager (Bailey McCallum) and the AAEP Director of Industry Relations (Keith Kleine). The United States Equestrian Federation houses the call center and manages the website. EDCC operations are funded by donations from a wide variety of industry organizations including a cooperative agreement from USDA *(http://equinediseasecc.org/sponsors.aspx).*

BIOSECURITY

A primary EDCC objective is prevention of disease and disease spread by providing information about biosecurity. Biosecurity is defined as any preventive measure designed to reduce the risks for introduction and transmission of infectious disease. Infectious disease caused by bacteria and viruses may be brought to and spread at an equine facility by horses, people, domestic animals other than horses, vehicles, equipment, insects, ticks, birds, wildlife including rodents, feed, waste and water. A biosecurity plan examines and prepares for disease risks inherent when horses commingle and travel. Complete elimination of all disease risks for a horse that has contact with horses outside of its home environment is highly unlikely. Therefore, horse owners must determine the acceptable level of disease risk they are willing to accept for their horse and implement biosecurity measures to reduce disease risk where possible. Implementing biosecurity measures is an important part in protecting the health of the equine industry.

Instituting biosecurity measures for horse can include specific measures for a particular disease and the environment as well as the available level of management. Basic biosecurity is recommended for all stables where horses come into contact with other horses moving from one environment to another. A biosecurity plan should include methods for disinfection, control of horse movement, adequate facilities for isolation and maintenance of quarantine. Horse shows, trail rides, race tracks, sales, and similar events where horses are traveling and mixing with other horses should complete a risk assessment and develop plans for biosecurity prior to the event or as a normal part of operations. The following links provide information to help planning and implementing biosecurity whether at home or on the road.

https://www.cdfa.ca.gov/ahfss/Animal_Health/Equine_Biosecurity.html
http://equineguelph.ca/pdf/infosheets/Beat%20the%20Bugs%20Poster%20Inside.pdf

Respiratory & Airway Health

Panelists:

Bill Casner

Thoroughbred Owner and Breeder

Dr. Susan J. Holcombe

Professor, Large Animal Clinical Sciences

Michigan State University

College of VETERINARY MEDICINE
Michigan State University

MICHIGAN STATE UNIVERSITY

Respiratory and Airway Health

Bill Casner – Thoroughbred owner and breeder
Sue Holcombe - Michigan State University,
Professor, Large Animal Clinical Sciences

College of VETERINARY MEDICINE
Michigan State University

MICHIGAN STATE UNIVERSITY

Objectives – Pulmonary Health

- 1. Convince you that the lung function is imperative to the equine athlete
- 2. Discuss the impact of lung disease on Thoroughbred racehorse performance
- 3. Report on the impact of barn environment on the equine airways
- 4. Describe strategies to combat poor air quality in barns

College of VETERINARY MEDICINE
Michigan State University

MICHIGAN STATE UNIVERSITY

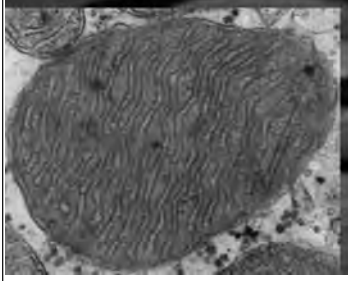
Why do we worry about the airway?

Mitochondria in Horse Muscles

Mitochondria use oxygen to provide energy to muscles.

The horse has more mitochondria in its muscles than most other mammals.

Oxygen consumption by equine muscle >>> oxygen delivery.



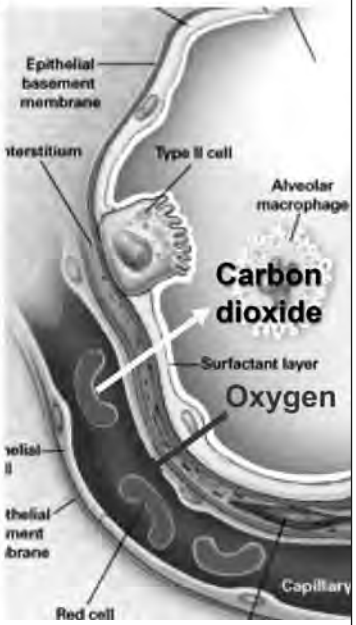
Maximal Oxygen Consumption VO_2max

- Human VO_2max = 80 ml/kg/min
- Horse VO_2max = 200 ml/kg/min

Heart + Lungs + Blood determine oxygen delivery

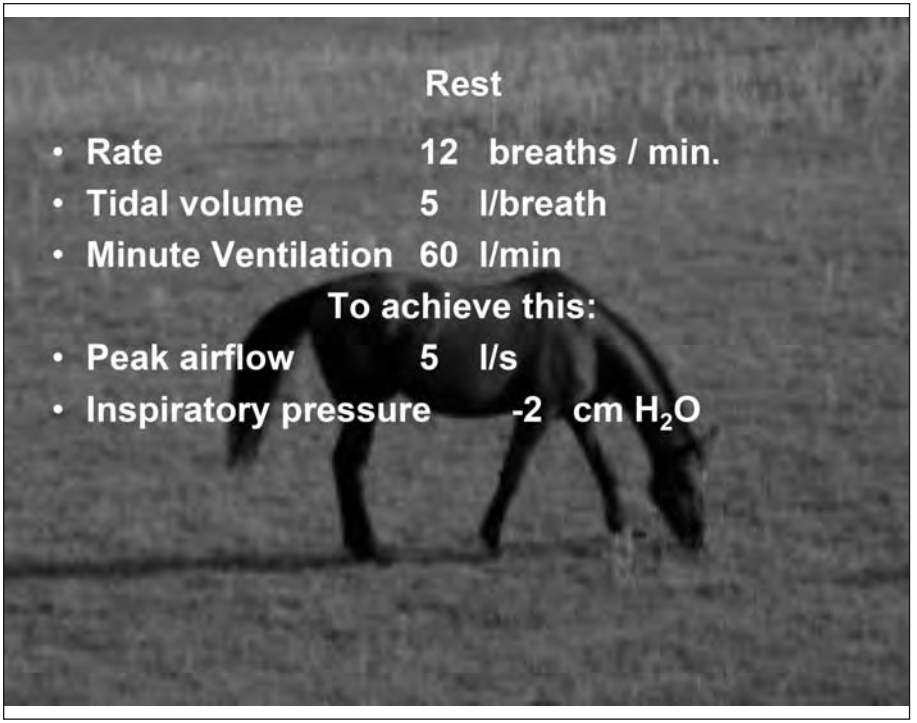
Lung Function

- Gas exchange
  - Diffusion of oxygen from the lung into the blood
  - Diffusion of carbon dioxide from the blood into the lung
- Limited by:
  - Inflammation (IAD)
  - Bleeding (EIPH)



How much does a horse increase its breathing capacity from rest to racing?

- X 2
- X 10
- X 20
- X 30



Rest to Exercise

- Rate 12 < **120** breaths / min.
- Tidal volume 5 < **15** l/breath
- Minute Ventilation 60 < **1800** l/min

To achieve this:

- Peak airflow 5 < **75** l/s
- Inspiratory pressure -2 < **-30 to - 40** cm H_2O

Horse are unique!

http://www.srichinmoycentre.org/public_home/es/centro/running_pavitrata.jpg

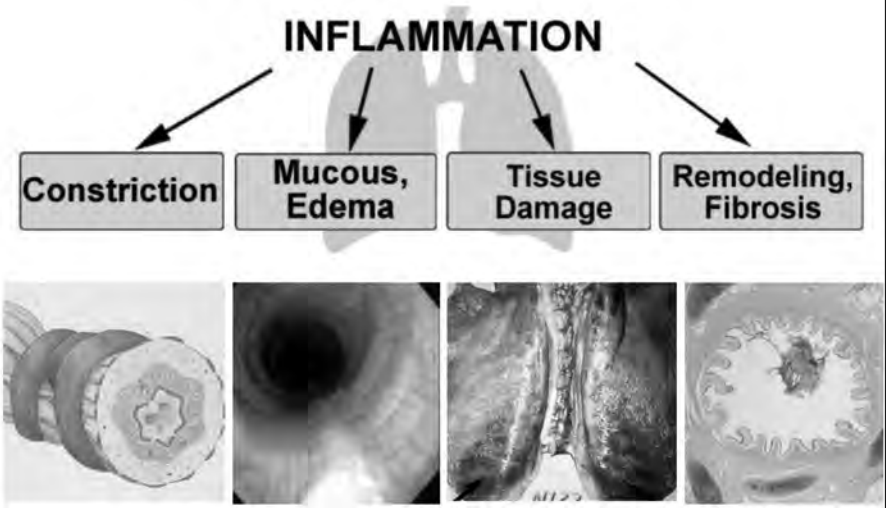
http://www.travelimages.com/PictureOfTheWeek/8HorseGallop.jpg

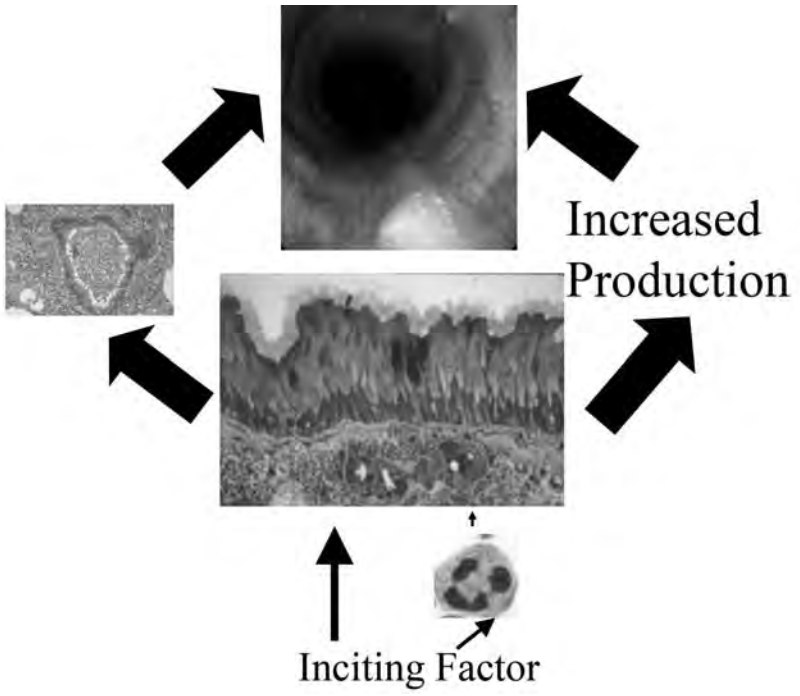
Horses are limited by their lung rather than their heart function.

Significance of Lung Disease

- A small change in lung function can diminish gas exchange and oxygen delivery
  - Not noticeable at rest
  - Influence racing performance
- Not been extensively studied in athletic horses

Inflammation is a key component of respiratory disease.





College of
VETERINARY MEDICINE
Michigan State University

MICHIGAN STATE
UNIVERSITY

Inciting Factors

- Infectious
  - Viruses
    - influenza
    - herpes virus
    - rhinovirus
  - Bacteria
  - Parasites
- Environment
  - allergens
  - particulates/toxins
  - endotoxin
- Genetics
  - determines susceptibility

Inflammatory Airway Disease

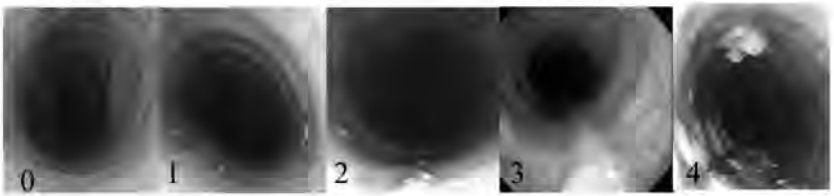
- Diminished racing performance
- Mucus
- Inflammatory cells
- +/- cough
- No fever
- Normal appetite
- Not “sick”

- Prevalence of inflammatory airway disease in racehorses approaches 33%

Effect of tracheal mucus and tracheal cytology on racing performance in Thoroughbred racehorses

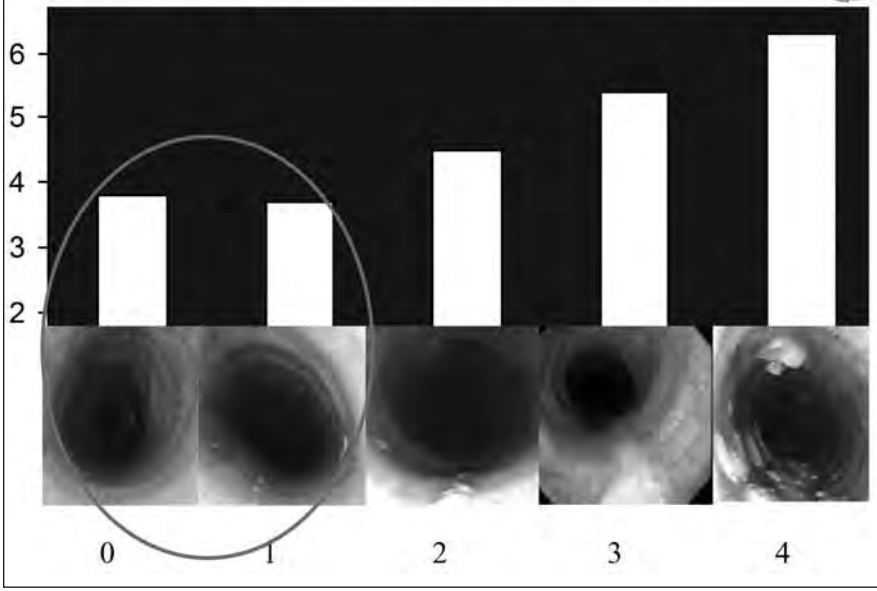
S. J. HOLCOMBE*, N. E. ROBINSON, F. J. DERKSEN, B. BERTOLD†, R. GENOVESE†, R. MILLER, H. DE FEITER RUPP, E. A. CARR S. W. EBERHART, D. BORUTA and J. B. KANEENE

EQUINE VETERINARY JOURNAL



- Horses with a mucus score of **0 - 1** were twice as likely to place better compared to horses with a mucus score of **2 – 4.**
- P = 0.0165 Odds ratio = 0.53
  95% confidence interval (0.32 – 0.89).

Mucus Score vs. Race Place



What causes IAD?

- Environmental conditions
  - Aerosolized particles and gases (i.e. dust and pollution)
  - Fungi, molds, endotoxin, beta –D-glucan, bacteria, mite debris, inorganic dust (heavy metals), and noxious gases (carbon monoxide)

Journal of Veterinary Internal Medicine
ACVIM
Open Access
ACVIM Consensus Statement
J Vet Intern Med 2016;30:503–515
Inflammatory Airway Disease of Horses—Revised Consensus Statement
L.L. Couëtil, J.M. Cardwell, V. Gerber, J.-P. Lavoie, R. Léguillette, and E.A. Richard

J Appl Physiol 102: 1071–1077, 200
First published December 7, 2006; doi:10.1152/japplphysiol.00264.200

Early onset airway obstruction in response to organic dust in the horse

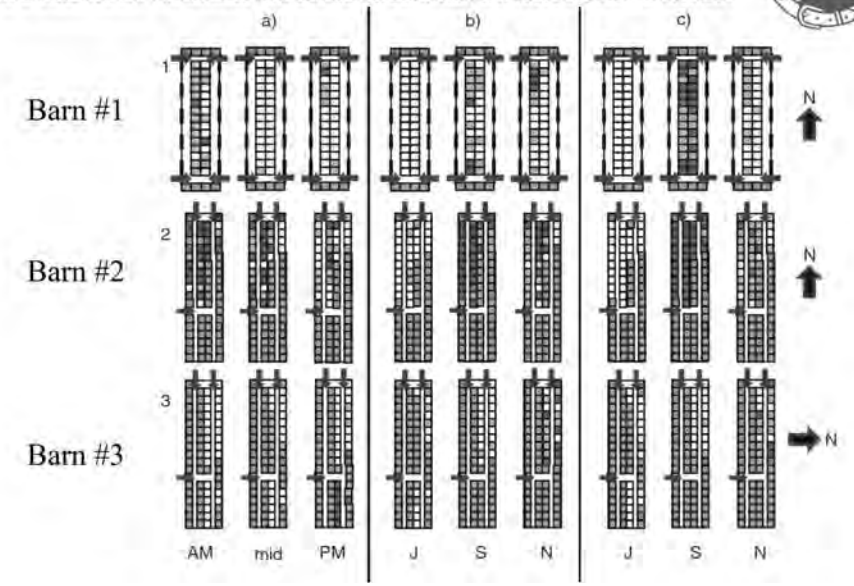
Christopher M. Deaton,[1] Laura Deaton,[1] Eduard Jose-Cunilleras,[1]
Thea L. Vincent,[2] Alan W. Baird,[3] K. Dacre,[4] and David J. Marlin[1]

- Horses breathing dust had increased numbers of cells, increased amounts of histamine, and increased airway resistance within 20 minutes compared to horses breathing fresh air (at rest).

Where is the dust?

Particle mapping in stables at an American Thoroughbred racetrack

M. L. MILLERICK-MAY*, W. KARMAUS[†], F. J. DERKSEN, B. BERTHOLD[‡], S. J. HOLCOMBE and N. E. ROBINSON



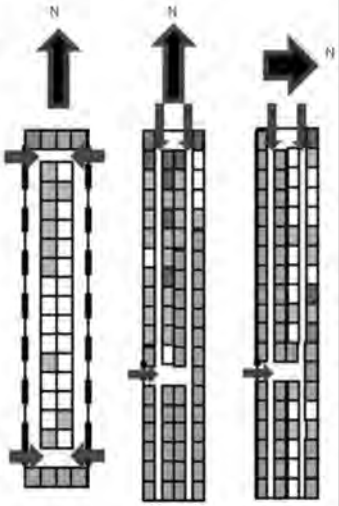
Local airborne particulate concentration is associated with visible tracheal mucus in Thoroughbred racehorses

M. L. MILLERICK-MAY*, W. KARMAUS[†], F. J. DERKSEN, B. BERTHOLD[‡], S. J. HOLCOMBE and N. E. ROBINSON

Department of Large Animal Clinical Sciences, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, USA
[†]Arnold School of Public Health, Columbia, South Carolina, USA
[‡]Cleveland Equine Clinic, Ravenna, Ohio, USA

*Correspondence email: melissa.may@hc.msu.edu; Received: 26.07.11; Accepted: 24.02.12

- Tracheal mucus was associated with
  - Stable
  - Stall
  - Month
  - Particulate matter



Highest Particulate

- 1. Morning (cleaning and feeding)
- 2. Enclosed barns with closed doors
- 3. Feeding hay from nets hung outside the door
- 4. Continuously raking isles throughout the day

Summary

- 1. **Pulmonary health is essential**. Small changes in lung function have consequences for race horses.
- 2. **Mucus matters.** Horses with no tracheal mucus placed better in races compared to horses with small to moderate amounts of tracheal mucus.
- 3. **Breathe clean air**. Tracheal mucus is a hallmark sign of inflammatory airway disease that is caused by environmental contaminants.

Managing Airway Inflammation by Treating the Problem – The Environment

Problems with Stables

- 1. Ceilings over the stalls
- 2. Storage lofts above the stalls
- 3. Poor ventilation
  - Ammonia
  - Dust
    - Fungi
    - Bacteria
    - Metals
- 4. Years of accumulated pathogens

Clean and Disinfect Stalls

- 1. Power-wash stalls prior to horse occupancy
  - Remove all organic debris
  - Wash stalls with soap
  - Disinfect with chlorine bleach
- 2. Fog stalls twice per week

Bedding

- Wood shavings
- Not saw dust or straw
- Pricing is similar

Hay

- Cooked or processed to reduce dust and eliminate pathogens
- Hay Cooker - $2500.00

Thanks
Questions?

BARN MANAGEMENT PRACTICES FOR OPTIMAL EQUINE RESPIRATORY HEALTH

THE PROBLEM

HORSES AT THE TRACK AND AT MANY TRAINING FACILITIES LIVE IN DUSTY STALLS THAT HAVE ACCUMULATED DECADES OF PATHOGENS INCLUDING BACTERIA, VIRUSES, BIOFILMS, FUNGI AND MOLDS

ANOTHER PROBLEM

ACCUMULATED MUCK IN FRONT OF THE STALLS OFFERS ANOTHER CHALLENGE TO AIR QUALITY ESPECIALLY WHEN THE MUCK TRUCK COMES TO PICK IT UP

PREVENTION

- THERE ARE FOUR MAJOR FACTORS WITH OPTIMIZING AIR HYGEINE
- VENTILATION BEDDING FORAGE CONTAMINATION

WINSTAR TRAINING BARN

PREFERRED BEDDING

SHAVINGS

WOOD PELLETS

FEEDING HAY

HAY NETS ARE TRADITIONAL AND LOOK GOOD LINING A SHED ROW BUT ARE NOT IN THE BEST INTEREST OF A HORSES RESPIRATORY HEALTH

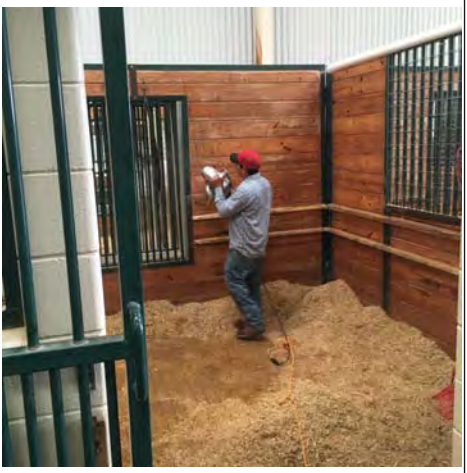
A COMMONLY AGREED ON ALTERNATIVE IN VETERINARY LITERATURE IS FEEDING HORSES HAY ON THE GROUND

COOKING HAY

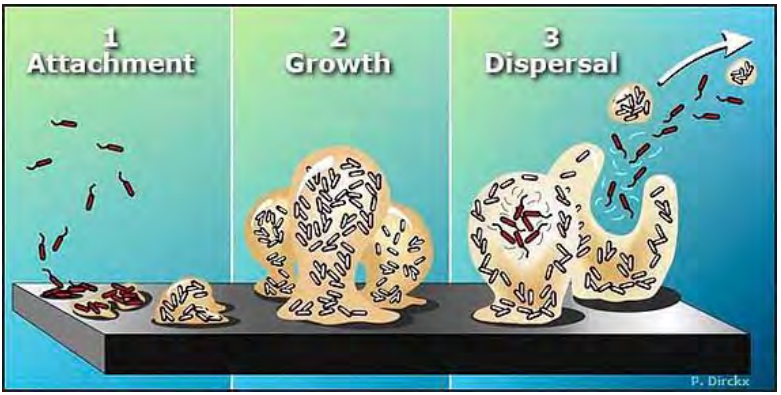
HAY STEAMERS ARE AND EFFECTIVE WAY OF DIMINISHING DUST AND KILLING BACTERIA, FUNGAL SPORES AND MOLD IN THE HAY

FOGGING STALLS

FOGGER



BIOFILMS



BIOFILMS ARE ANY GROUP OF MICRO-ORGANISMS IN WHICH CELLS STICK TO EACH OTHER AND THESE CELLS CAN ADHERE TO ANY SURFACE IN THE STALL

NOVEL ANTI-MICROBIAL

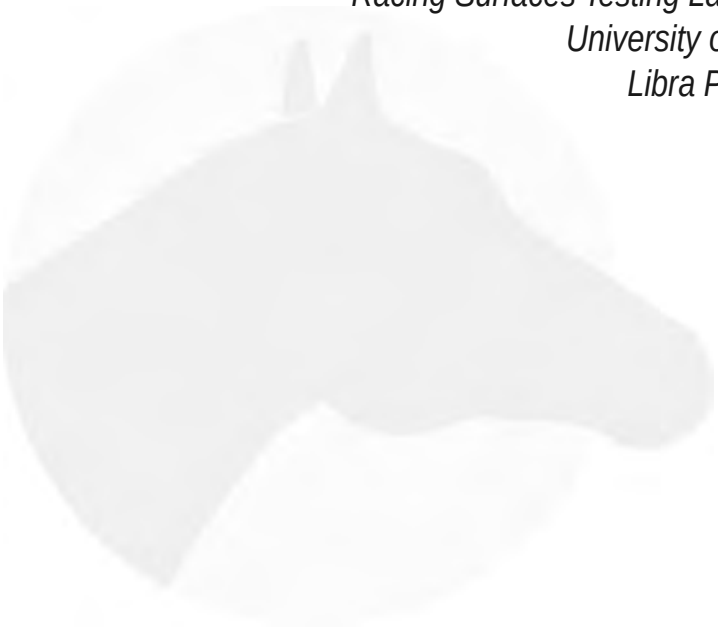
CERAGYN STALL GUARD IS PART OF A FAMILY OF NEW ANTI-MICROBIAL KNOWN AS CSA'S

NEBULIZER

ANOTHER TOOL FOR MANAGING IAD

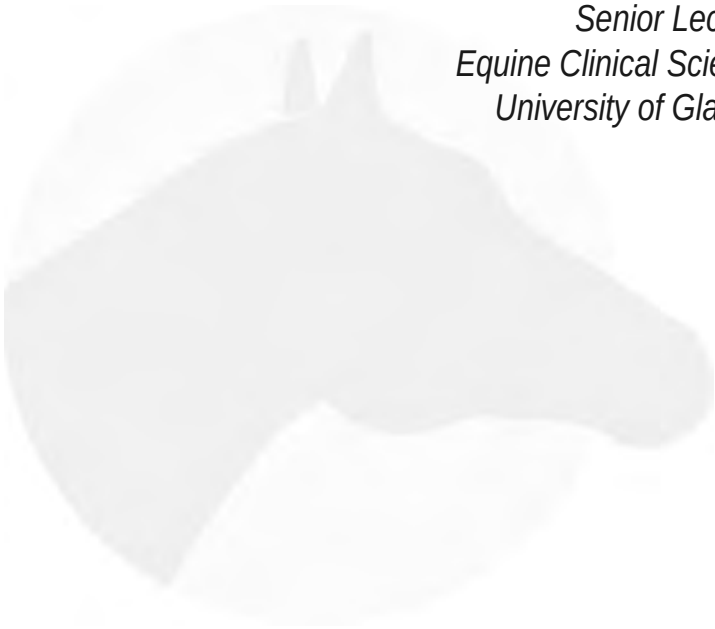
Racing Surfaces Testing Laboratory

Dr. Mick Peterson
Executive Director,
Racing Surfaces Testing Laboratory
University of Maine,
Libra Professor



Equine Injury Database

Dr. Tim Parkin
Senior Lecturer,
Equine Clinical Sciences
University of Glasgow



Equine Injury Database: Fatal Injuries Decline by 14 Percent

An analysis of data from the Equine Injury Database, comparing 2015 statistics with figures from 2014, has shown a 14 percent decrease in the frequency of fatal injury, it was announced today by The Jockey Club.

Across all surfaces, ages, and distances, the fatality rate dropped from 1.89 per 1,000 starts in 2014 to 1.62 per 1,000 starts in 2015. The overall fatality rate of 1.62 per 1,000 starts is the lowest since the Equine Injury Database started publishing annual statistics in 2009.

Dr. Tim Parkin, a veterinarian and epidemiologist from the University of Glasgow, who serves as a consultant on the Equine Injury Database, once again performed the analysis.

“We’ve seen a significant decrease in the number of fatalities and that is certainly very encouraging,” Parkin said. “We will continue to examine data and look for trends, but the wide-ranging safety initiatives embraced by tracks, horsemen, and regulators in recent years have very likely played a role in the reduction of injuries and fatalities.”

The fatality rates associated with each racing surface were as follows:

- On turf surfaces, there were 1.22 fatalities per 1,000 starts in 2015, compared to 1.75 in 2014.
- On dirt surfaces, there were 1.78 fatalities per 1,000 starts in 2015, compared to 2.02 in 2014.
- On synthetic surfaces, there were 1.18 fatalities per 1,000 starts in 2015, compared to 1.20 in 2014.

Fatality rates based on distance and age were also released today.

An analysis of 2015 race distance statistics shows that shorter races (less than 6 furlongs) were again associated with higher injury rates versus middle distance races (6 to 8 furlongs) and long races (more than 8 furlongs). This has been consistent each year over the seven-year span.

Two-year-olds continued the trend of having the lowest rate of catastrophic injuries while 3-year-olds had a lower rate of catastrophic injuries than horses 4 years old and older.

The statistics are based on injuries that resulted in fatalities within 72 hours from the date of the race. Summary statistics are subject to change due to a number of considerations, including reporting timeliness. A graph depicting all updated statistical data pertaining to surface, distance, and age is available at *jockeyclub.com/pdfs/eid_7_year_tables.pdf.*

"When we first starting collecting data in 2007, we realized that the more data we obtained and analyzed, the more we would learn," said Dr. Mary Scollay, the equine medical director for the Commonwealth of Kentucky and a consultant to the EID. "These improving fatality rates are clear evidence that we can move the needle and that the efforts of so many are truly bearing fruit."

"This database was created with the goal of improving safety and preventing injuries, and we are now doing that thanks to the participation and cooperation of so many racetracks," said James L. Gagliano, president and chief operating officer of The Jockey Club. "We applaud all tracks that have contributed data to this project, and we are especially grateful to those who have chosen to make their statistics publicly available on the EID website."

A list of racetracks participating in the Equine Injury Database and detailed statistics from those tracks that voluntarily publish their results can be found at *jockeyclub.com/default.asp?section=Advocacy&area=11.*

Throughout the course of 2016, racetracks accounting for 96% of flat racing days are expected to contribute data to the EID.

The Equine Injury Database, conceived at the Grayson-Jockey Club Research Foundation's first Welfare and Safety of the Racehorse Summit, was launched by The Jockey Club in July 2008 and seeks to identify the frequencies, types, and outcomes of racing injuries using a standardized format that generates valid statistics, identifies markers for horses at increased risk of injury, and serves as a data source for research directed at improving safety and preventing injuries.

The Jockey Club, founded in 1894 and dedicated to the improvement of Thoroughbred breeding and racing, is the breed registry for North American Thoroughbreds. In fulfillment of its mission, The Jockey Club, directly or through subsidiaries, provides support and leadership on a wide range of important industry initiatives, and it serves the information and technology needs of owners, breeders, media, fans and farms. It is the sole funding source for America's Best Racing, the broad-based fan development initiative for Thoroughbred racing. You can follow America's Best Racing at *americasbestracing.net.* Additional information is available at *jockeyclub.com.*

Supplemental Tables of Equine Injury Database Statistics for Thoroughbreds

(January 1 through December 31 for each year listed)

Surface

	2009			2010			2011			2012			2013			2014			2015			2009-2015		
	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts
ALL	790	395897	**2.00**	727	387671	**1.88**	713	379285	**1.88**	709	369565	**1.92**	643	339104	**1.90**	583	308923	**1.89**	484	299121	**1.62**	**4649**	**2479566**	**1.87**
Turf	88	45456	**1.94**	81	50701	**1.60**	77	50054	**1.54**	94	53991	**1.74**	71	51463	**1.38**	88	50366	**1.75**	68	55558	**1.22**	**567**	**357589**	**1.59**
Dirt	617	293306	**2.10**	585	286584	**2.04**	586	283531	**2.07**	570	271851	**2.10**	524	248418	**2.11**	455	225201	**2.02**	383	215512	**1.78**	**3720**	**1824403**	**2.04**
Synthetic	85	57135	**1.49**	61	50386	**1.21**	50	45700	**1.09**	45	43723	**1.03**	48	39223	**1.22**	40	33356	**1.20**	33	28051	**1.18**	**362**	**297574**	**1. 22**

Distance

	2009			2010			2011			2012			2013			2014			2015			2009-2015		
	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts
<6F	198	93542	**2.12**	212	94462	**2.24**	203	93872	**2.16**	208	88536	**2.35**	195	81555	**2.39**	167	73964	**2.26**	133	71572	**1.86**	**1316**	**597503**	**2.20**
6F-8F	441	225902	**1.95**	389	217885	**1.79**	380	215327	**1.76**	381	214525	**1.78**	357	192245	**1.86**	316	176962	**1.79**	274	173584	**1.58**	**2538**	**1416430**	**1.79**
>8F	151	76453	**1.98**	126	75324	**1.67**	130	70086	**1.85**	120	66504	**1.80**	91	65304	**1.39**	100	57997	**1.72**	77	53965	**1.43**	**795**	**465633**	**1.71**

Age

	2009			2010			2011			2012			2013			2014			2015			2009-2015		
	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts	Fatal injuries	Starts	per 1000 starts
2 years	48	34228	**1.40**	46	30830	**1.49**	36	30035	**1.20**	38	27316	**1.39**	39	23904	**1.63**	31	23219	**1.34**	28	23511	**1.19**	**266**	**193043**	**1.38**
3 years	235	119588	**1.97**	213	118875	**1.79**	224	113039	**1.98**	201	108545	**1.85**	167	96925	**1.72**	169	81310	**2.08**	122	81342	**1.50**	**1331**	**719624**	**1.85**
4+ years	507	242081	**2.09**	468	237966	**1.97**	453	236211	**1.92**	470	233704	**2.01**	437	218275	**2.00**	383	204394	**1.87**	334	194268	**1.72**	**3052**	**1566899**	**1.95**

Pdf version available online at jockeyclub.com/pdfs/eid_7_year_tables.pdf.

Participating Racetracks or Associations

Participants designated with an * have made summarized fatality statistics available. These statistics include fatal injuries of Thoroughbreds that occurred during a race as reported by veterinary officials and includes Thoroughbreds that succumbed to a race-related injury within 72 hours after the race day. Some racetracks provide information for Quarter Horses and other breeds; however, statistics released by The Jockey Club are for Thoroughbreds only.

Ajax Downs
Alberta Downs
Albuquerque Downs
*Aqueduct (through 12/31/15)
Arapahoe Park
Arlington Park
Assiniboia Downs
Atlantic City
Bay Meadows
*Belmont Park (through 12/31/15)
Belterra Park
Beulah Park
Calder
Canterbury Park
Central Wyoming Fairgrounds
Charles Town
Chippewa Downs
Churchill Downs
Colonial Downs
Columbus
Crooked River Roundup
*Del Mar (through 12/31/15)
*Delaware Park (through 12/31/15)
Delta Downs
Eastern Oregon
Ellis Park
Emerald Downs
Energy Downs
Evangeline Downs
Fair Grounds
Fair Meadows @ Tulsa
Fair Play Park
Fairmount Park
Fairplex
*Ferndale (through 12/31/15)
Finger Lakes
Fonner Park
Fort Erie
*Fresno (through 12/31/15)
Gillespie County Fair
*Golden Gate (through 12/31/15)
Grande Prairie
Grants Pass
*Gulfstream Park (through 12/31/15)
Harney County
Hastings Park
*Hawthorne (through 12/31/15)
Hialeah Park
*Hollywood Park (through 12/31/11)
Hollywood Gaming at Mahoning Valley Race Course
*Betfair Hollywood Park (through 12/31/13)
*Hoosier Park (TB) (through 12/31/12)
*Hoosier Park (QH) (through 12/31/12)
Horsemen's Park
*Indiana Downs (TB) (through 12/31/15)
*Indiana Downs (QH) (through 12/31/15)
*Keeneland (through 12/31/15)
Kentucky Downs
*Laurel (through 12/31/15)
*Lone Star Park (through 12/31/15)
Les Bois Park
Lethbridge
Lincoln Race Course
Louisiana Downs
Los Alamitos
Manor Downs
Marquis Downs
Meadowlands
Millarville
Monmouth Park
Mountaineer Park
National Steeplechase Association
ND Horse Park
Northlands Park
Oak Tree
*Oak Tree at Pleasanton (through 12/31/15)
Parx Racing
Penn National
*Pimlico (through 12/31/15)
*Pleasanton (through 12/31/13)
*Portland Meadows (through 12/31/15)
Prairie Meadows
*Presque Isle Downs (through 12/31/15)
*Remington Park (through 12/31/15)
*Sacramento (through 12/31/15)
Sam Houston
*Santa Anita (through 12/31/15)
*Santa Rosa (through 12/31/15)
*Saratoga (through 12/31/15)
Solano
*Stockton (through 12/31/15)
*Suffolk Downs (through 12/31/14)
Sunland Park
SunRay Park
Sweetwater Downs
Tampa Bay Downs
Thistledown
Tillamook
Timonium
Turf Paradise
*Turfway Park (through 12/31/15)
Will Rogers Downs
*Woodbine (through 12/31/15)
Wyoming Downs
Yavapai Downs
Zia Park

Biomarker Research

Dr. Christopher E. Kawcak
Professor of Surgery
& Director, Equine Clinical Services
Orthopedic Research Center
Colorado State University

Colorado State University

Biomarker Research

Chris Kawcak DVM, PhD, Diplomate ACVS and ACVSMR
Professor and Iron Rose Ranch Chair, Equine Orthopaedic Research Center, Colorado State University

Colorado State University

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Biomarkers

(National Institutes of Health)

"a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention."

- Adaptive vs pathologic process
- Diagnosis
- Monitoring of therapy
- Catastrophic injury prevention-an indication unique to horses

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

2005

2009

Havemeyer Foundation

2014

Colorado State University

Equine Veterinary Journal ISSN 0425-1644
DOI: 10.1111/evj.12339

Science in brief: report on the Havemeyer Foundation workshop on equine musculoskeletal biomarkers - current knowledge and future needs

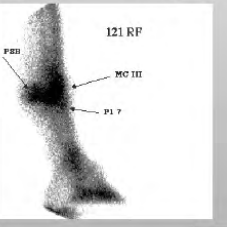
C. W. McIlwraith and P. D. Clegg†
Gail Holmes Equine Orthopaedic Research Center, Colorado State University, Fort Collins, USA
†Department of Musculoskeletal Biology, Institute of Ageing and Chronic Disease, University of Liverpool, Chester, UK.

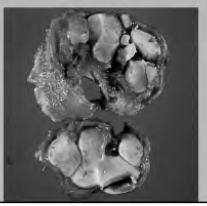
The authors would like to thank Christopher Little, Sheila Laverty, David Frisbie, Mark Vaudin, Stina Ekman, Eva Skiöldebrand, Joanna Price, Christopher Riley, Christopher Kawcak, Roger Smith for assistance in writing this paper. The meeting was also attended by Troy Trumble, Jack Quinn, Elwyn Firth, Chris Riley and John Kisiday as well as prominent experts from the human biomarker research field Robin Poole, Dick Heinegård, Bruce Caterson and Virginia Byers Kraus. A full report for the meeting can be found at http://csu-cvmbs.colostate.edu/documents/research-equine-musculoskeletal-biomarkers-white-paper.pdf

ORTHOPAEDIC RESEARCH CENTER

Clinical Injuries

Colorado State University





ORTHOPAEDIC RESEARCH CENTER

Colorado State University

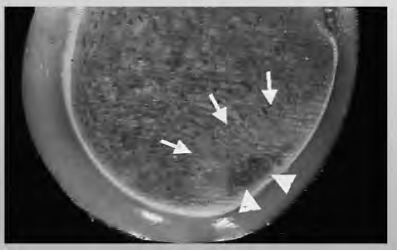
Articular Fractures of Metacarpophalangeal (fetlock) Joint

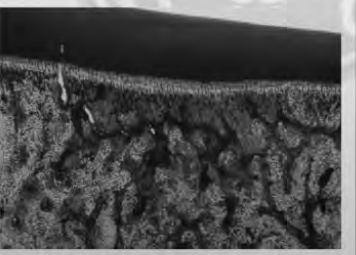
Courtesy LR Bramlage DVM

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Subchondral bone disease precedes articular fractures





Norrdin et al Bone 1999

Orthopaedic Research Center

Colorado State University

Biomarkers

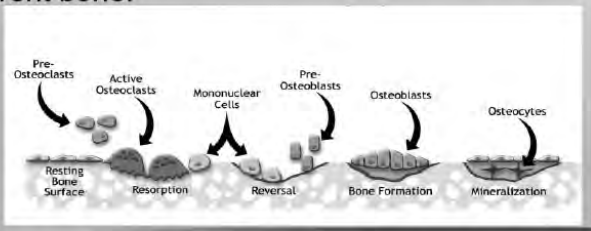
- Fluids
  - Blood
  - Synovial Fluid
  - Urine
- Imaging
  - Structure
  - Physiologic response to adaptation or disease
- Movement
  - Inertial Measurement Units

Orthopaedic Research Center

Colorado State University

Normal Response to Repetitive Loading

- Normal remodeling cascade
  - Relatively rapid resorption followed by relatively delayed bone formation.
  - Creates reversal lines that form strong integration with parent bone.

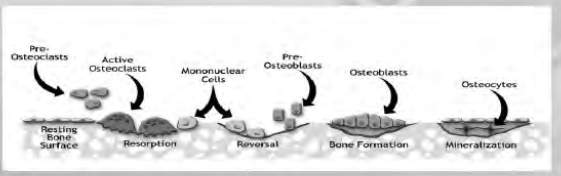


Orthopaedic Research Center

Colorado State University

Factors That Can Influence Response to Loading

Microdamage



Inappropriate Training
Too High
Too Low

Inappropriate Bone Formation

Inappropriate Mineralization

Orthopaedic Research Center

Colorado State University

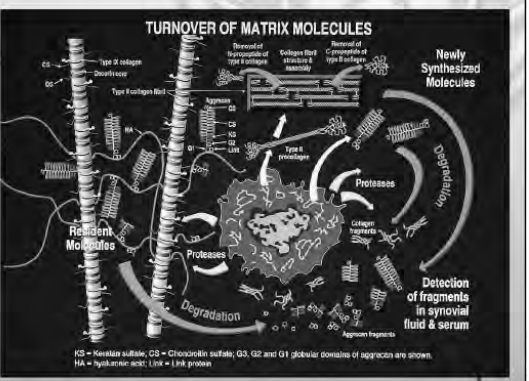
Need to understand normal adaptive changes

ORTHOPAEDIC RESEARCH CENTER

Fluid Biomarkers

Colorado State University

- Direct or indirect indicators of abnormal skeletal turnover
- Often molecules that are the normal products and byproducts of metabolic processes occurring within the skeletal tissues
- Concentrations may increase or decrease



Courtesy Poole 2000

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

First Study of Prediction of Disease in Horses - SF Biomarker

Changes with Osteochondral Fragmentation

- TP significantly higher (p=0.0001)
- CS846 significantly higher (p=0.0290)
- CPII not significantly higher (p=0.0653)
- KS not significantly higher (p=0.2841)
- WBC not significantly higher (p=0.3425)

Measurement of synovial fluid and serum concentrations of the 846 epitope of chondroitin sulfate and of carboxy propeptides of type II procollagen for diagnosis of osteochondral fragmentation in horses

David D. Frisbie, DVM, MS; Christopher S. Ray, DVM, MS; Mirela Ionescu, MSc; A. Robin Poole, PhD, DSc; Phillip L. Chapman, PhD; C. Wayne McIlwraith, BVSc, PhD

Am J Vet Res 1999

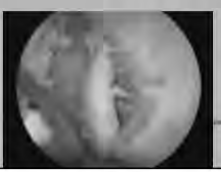
Orthopaedic Research Center

Colorado State University

Serum Concentrations of CS Epitope 846 & CPII in Horses with Osteochondral Fragmentation

- CS 846 + CPII concentrations were significantly higher in horses with OC than in control (KS not)
- CS 846 + CPII concentrations not linearly related to grade of OC but significantly higher with grade 1 & grade 2 OC
- 79% correct in estimating presence of osteochondral fragmentation based on serum CS 846 & CPII

Frisbie et al. Am J Vet Res 1999;60:306-309



Orthopaedic Research Center

Colorado State University

Biomarkers Change with Exercise

- Need to differentiate from disease in equine athlete

OsteoArthritis and Cartilage (2003) 11, 760–765

doi:10.1016/S1063-4584(03)00152-3

Osteoarthritis and Cartilage

International Cartilage Repair Society

OARSI Osteoarthritis Research Society International

Significant exercise-related changes in the serum levels of two biomarkers of collagen metabolism in young horses

R. C. Billinghurst D.V.M., Ph.D. Associate Professor†*, P. A. J. Brama D.V.M., Ph.D. Assistant Professor‡, P. R. van Weeren D.V.M., Ph.D. Professor‡, M. S. Knowlton B.S. Research Associate† and C. W. McIlwraith B.V.Sc., Ph.D. Professor†

† *Department of Clinical Sciences, Colorado State University, Fort Collins, CO 80523, USA*

‡ *Department of Equine Sciences, Faculty of Veterinary Medicine, Utrecht University, The Netherlands*

Orthopaedic Research Center

Colorado State University

Differentiation of Biomarker Changes with Exercise versus Disease

- Treadmill study
- Horses with exercise alone and horses with exercise plus osteochondral fragmentation model of OA

Osteoarthritis and Cartilage (2008) 16, 1196–1204

doi:10.1016/j.joca.2008.03.008

Osteoarthritis and Cartilage

International Cartilage Repair Society

OARSI Osteoarthritis Research Society International

Changes in synovial fluid and serum biomarkers with exercise and early osteoarthritis in horses

D. D. Frisbie D.V.M., Ph.D., Dr., F. Al-Sobayil B.V.Sc., Ph.D., Dr., R. C. Billinghurst D.V.M., Ph.D., Dr.*, C. E. Kawcak D.V.M., Ph.D., Dr. and C. W. McIlwraith B.V.Sc., Ph.D., D.Sc., Professor

Orthopaedic Research Center, Colorado State University, 300 West Drake, Fort Collins, CO 80523, United States

Serum Biomarkers - Exercise and OA

- Concentration of serum CS846, CPII, GAG, osteocalcin, C1,2C and Col I increased with exercise
- For each of these biomarkers, there was also a statistically significant increase in levels in OA-affected horses compared to exercise-alone horses
- Six SF & serum biomarkers were useful in separating early experimental OA from exercise alone but SF CTX1 and serum Col CEQ & CTX1 were not

Prospective collection of serum samples to examine prediction of injury with biomarkers

- 2-3 year old racing Thoroughbred in training/racing in Southern California

Serum biomarker levels for musculoskeletal disease in two- and three-year-old racing Thoroughbred horses: A prospective study of 130 horses

D. D. FRISBIE*, C. W. McILWRAITH, R. M. ARTHUR, J. BLEA, V. A. BAKER and R. C. BILLINGHURST

Equine vet J. (2010) 42 (7) 643-651
doi: 10.1111/j.2042-3306.2010.00123.x

Colorado State University

Prospective collection of seven biomarkers

- 238 racing TBs
- Exit criteria were lack of training for > 30 days, or completion of 10 study months
- Horses with solitary MS injury & completion of >2 months training were analyzed
- Musculoskeletal injury
  - Intraarticular fragmentation (IAF)
  - Tendon or ligamentous injury (TL)
  - Stress fracture (SF)
  - Dorsal metacarpal disease (DMD)

Orthopaedic Research Center

Results

Colorado State University

- 59 horses sustained single injury
- 71 acted as untreated controls
  - 16 (27%) IAF
  - 17 (29%) TL
  - 7 (12%) SF
  - 19 (32%) DMD
- Comparisons entry or injury time NSD
- There were significant changes seen in biomarkers based on injury incurred when longitudinal samples were assessed

Orthopaedic Research Center

Results

Colorado State University

- Controls showed longitudinal increase in GAG & decrease in OC
- IAF showed decrease in CS 846 & an increase in OC & CTX-1 compared to controls
- TL horses demonstrated decrease in GAG & increase in CTX-1
- SF horses showed increase in CTX-1
- DMD showed decrease in CS 846 & GAG as well as increase in OC & CTX-1
- Based on serum biomarkers collected prior to injury, horses could be correctly identified as injured or noninjured 73.8% of the time

Orthopaedic Research Center

Colorado State University

Other Molecular Markers of Musculoskeletal Disease

- 2005 Colorado State University Study
- Examined the differential expression of ~3100 equine gene sequences using Affymetrix GeneChip (1st Gen)
  - –RNA from the peripheral blood of horses using the OA fragment model at
    - Day 0
    - Day 7
    - Day14 (2 weeks post OA induction)
    - Day 42
    - Day 70
  - –Found 22 genes with a upregulated expression profile that matched those of serum biomarkers

Orthopaedic Research Center

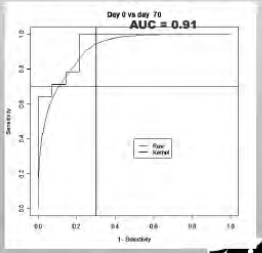
Colorado State University

Molecular Markers of Musculoskeletal Disease

- Six Genes Used for Day 0 to Day 70 ROC Analysis

Sensitivity	Specificity	Success	Genes					
0.972	0.882	0.943	BM781378_unkn	WBC032E04	WBC026F09	WBC003G03	WBC009B11	WBC419
0.972	0.882	0.943	WBC419	BM781378_unkn	WBC003G03	WBC026F09	WBC012E07	WBC032E04
0.972	0.882	0.943	BM781165	WBC003G03	WBC026F09	WBC419	BM735265	WBC018F02

Currently completing study in reining horses



D Frisbie et al. 2005 A Diagnostic Test for Equine Osteoarthritis Using Peripheral Blood Molecular Biomarkers Evaluated In an Experimental Model AAEP 2005

ORTHOPAEDIC RESEARCH CENTER

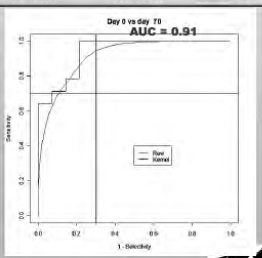
Colorado State University

Molecular Markers of Musculoskeletal Disease

- Six Genes Used for Day 0 to Day 70 ROC Analysis

Sensitivity	Specificity	Success	Genes					
0.972	0.882	0.943	BM781378_unkn	WBC032E04	WBC026F09	WBC003G03	WBC009B11	WBC419
0.972	0.882	0.943	WBC419	BM781378_unkn	WBC003G03	WBC026F09	WBC012E07	WBC032E04
0.972	0.882	0.943	BM781165	WBC003G03	WBC026F09	WBC419	BM735265	WBC018F02

Currently completing study in reining horses



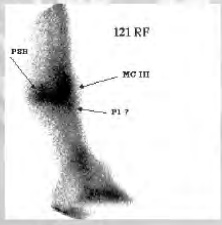
D Frisbie et al. 2005 A Diagnostic Test for Equine Osteoarthritis Using Peripheral Blood Molecular Biomarkers Evaluated In an Experimental Model AAEP 2005

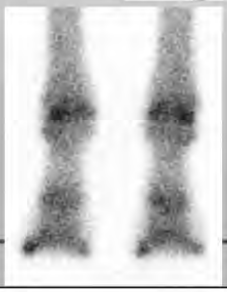
ORTHOPAEDIC RESEARCH CENTER

Colorado State University

NUCLEAR SCINTIGRAPHY

- Need to interpret in face of normal remodeling / modeling response
- Often most sensitive method of characterizing problem since physical bone changes may not be apparent





ORTHOPAEDIC RESEARCH CENTER

Bone Sclerosis

Colorado State University

ORTHOPAEDIC RESEARCH CENTER

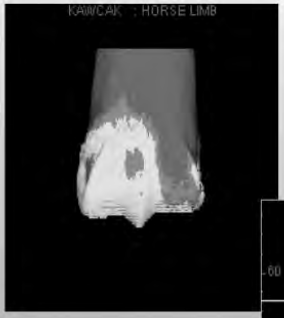
Colorado State University

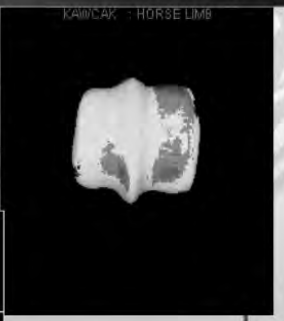
COMPUTED TOMOGRAPHY

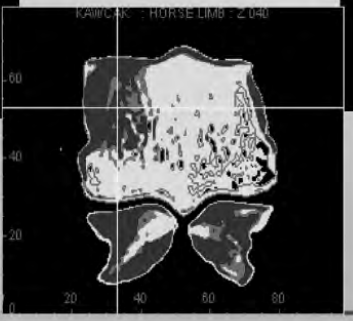
- High resolution
- Reformat into any plane
- Contrast CT
  - Venous
  - Arterial
  - Intraarticular
    - Plane contrast
    - Gadolinium

ORTHOPAEDIC RESEARCH CENTER

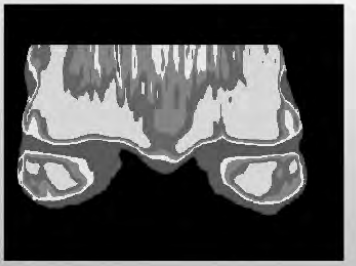
Colorado State University

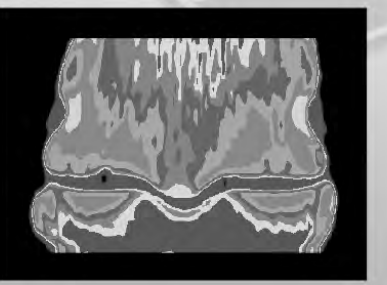




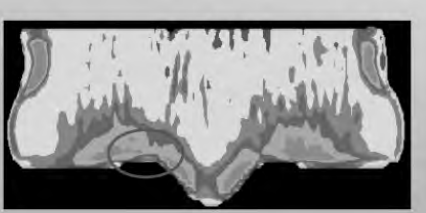


ORTHOPAEDIC RESEARCH CENTER



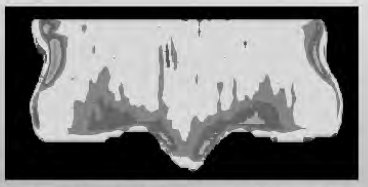


- Density gradient between axial condyle and abaxial aspect of the sagittal ridge
  - Area involved in condylar fractures

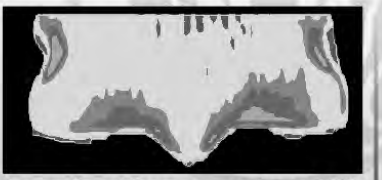


General density patterns

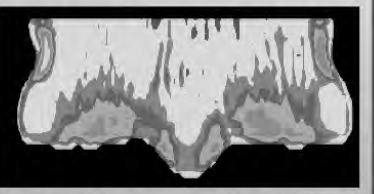
Colorado State University



Exercised horse – palmar 30°



Exercised horse – palmar 30°

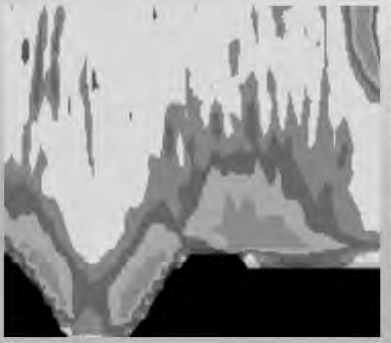


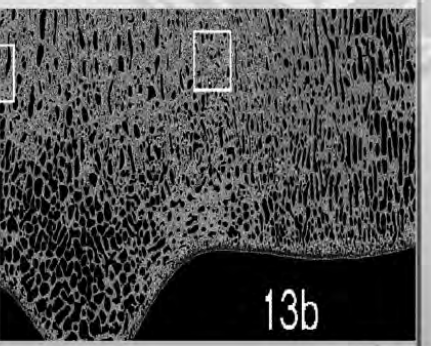
Control horse – palmar 30°

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Can we detect this change in bone character?

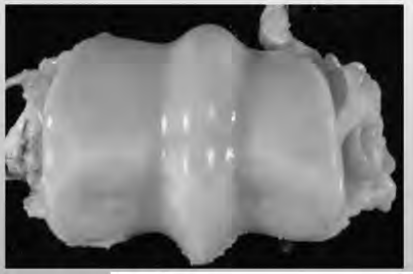




ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Shape Variability



LAMENESS—RACING

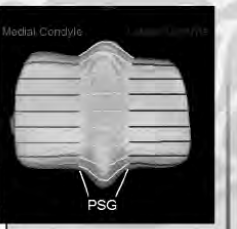
Effects of Third Metacarpal Geometry on the Incidence of Condylar Fractures in Thoroughbred Racehorses

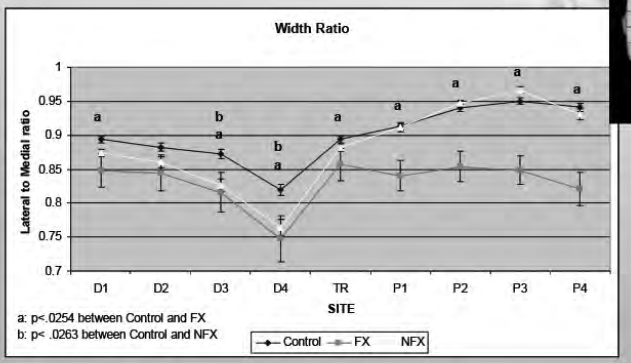
Chris E. Kawcak, DVM, PhD, Diplomate ACVS; Chelsea A. Zimmerman, BS; Katrina L. Easton, BS; C. Wayne McIlwraith, BVSc, PhD, DSc, FRCVS, Diplomate ACVS; and Tim D. Parkin, BSc, BVSc, Diplomate ECVPH, MRCVS

ORTHOPAEDIC RESEARCH CENTER

Results

Colorado State University

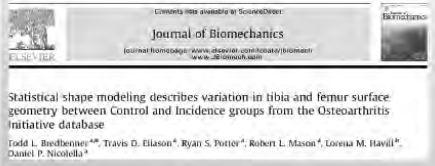




ORTHOPAEDIC RESEARCH CENTER

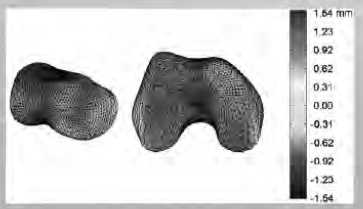
Statistical Shape Modeling

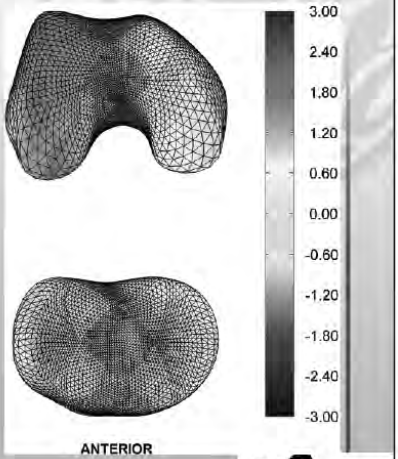
Colorado State University



Statistical shape modeling describes variation in tibia and femur surface geometry between Control and Incidence groups from the Osteoarthritis Initiative database

Todd L. Bredbenner[a,*], Travis D. Eliason[a], Ryan S. Potter[a], Robert L. Mason[a], Lorena M. Havill[b], Daniel P. Nicolella[a]





ORTHOPAEDIC RESEARCH CENTER

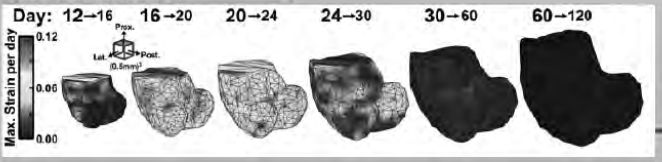
Fracture Risk Discriminators based on Statistical Shape and Density Modeling of the Proximal Femur

[1]Todd L. Bredbenner, [1]Ryan S. Potter, [1]Robert L. Mason, [2]Lorena M. Havill, [2]Eric S. Orwoll, and [1]Daniel P. Nicolella for the Osteoporotic Fractures in Men (MrOS) Study

Colorado State University

Structural and Functional Maturation of Distal Femoral Cartilage and Bone During Postnatal Development and Growth in Humans and Mice

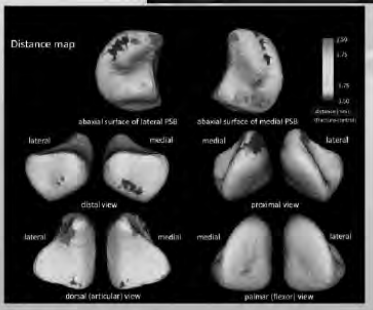
Elaine F. Chan, MS[a], Ricky Harjanto, BS[a], Hiroshi Asahara, MD, PhD[b], Nozomu Inoue, MD, PhD[c,d], Koichi Masuda, MD[e], William D. Bugbee, MD[f], Gary S. Firestein, MD[g], Harish S. Hosalkar, MD[h], Martin K. Lotz, MD[g], Robert L. Sah, MD, ScD[a,i,*]



ORTHOPAEDIC RESEARCH CENTER

Recent statistical shape model (SSM) study of horse proximal sesamoid bones

- Related fracture risk to bone geometry in forelimbs of Thoroughbred racehorses
- Created average surfaces (gray)
- Colors show locations of differences between fracture group and control group
  - Red up to 3.5mm prominence of fracture group
  - Blue up to 3.5mm prominence of the control group

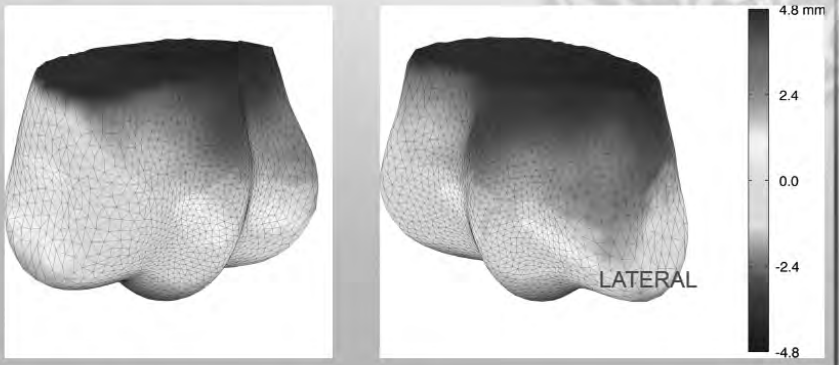


Journal of Orthopaedic Research
Volume 30, Issue 8, pages 1277-1284, 17 JAN 2012

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Statistical Shape Model Example



ORTHOPAEDIC RESEARCH CENTER

Colorado State University

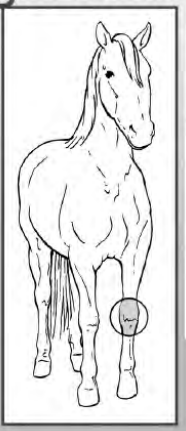
Statistical Shape and Trait Modeling

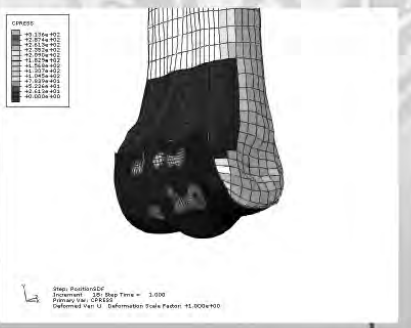
- Allows investigation of the importance of variation in a broad range of measurable or estimable musculoskeletal traits, as well as the interaction between traits
  - Example applications (cross-sectional or longitudinal studies)
    - Prediction of likelihood of onset of MCP osteoarthritis
    - Prediction of metacarpal fracture
    - Determination of developmental effects
  - Example traits
    - Bone geometry and overall BMD distribution (i.e. SSDM)
    - Limb / Joint alignment
    - Cartilage thickness
    - Compositional, microstructural, and material properties of bone, cartilage, ligaments, tendons, etc…

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

Pathogenesis - Modeling





ORTHOPAEDIC RESEARCH CENTER

Market Factors

Colorado State University

- Cost
  - Low cost for repeated use
- Ease of use
- Development
  - Relatively small market limits development of novel biomarkers
    - Imaging and fluid markers
- Objective data to verify use
  - Large clinical studies
  - Limited funding opportunities

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

EQUINE VETERINARY EDUCATION
Equine vet. Educ. (2008) **20** (2) 93-98
doi: 10.2746/095777308X272085

93

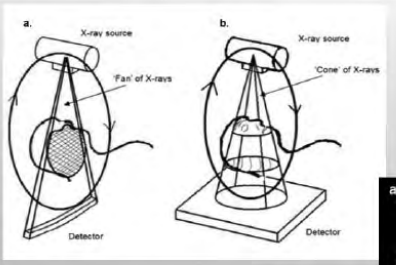
Original Article

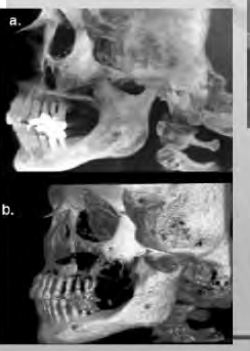
A technique for computed tomography (CT) of the foot in the standing horse

F. G. DESBROSSE, J.-M. E. F. VANDEWEERD*, R. A. R. PERRIN, P. D. CLEGG†, M. T. LAUNOIS, L. BROGNIEZ AND S. P. GEHIN

ORTHOPAEDIC RESEARCH CENTER

Colorado State University

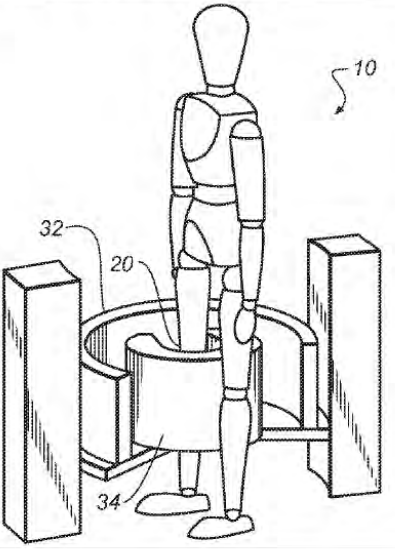




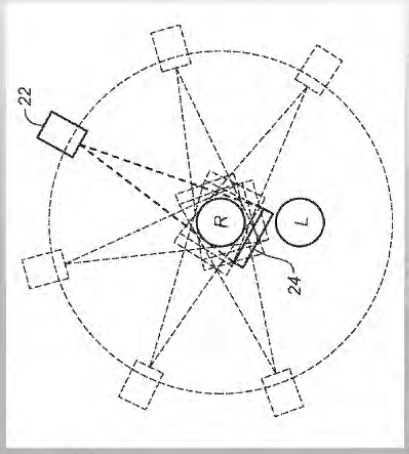
ORTHOPAEDIC RESEARCH CENTER

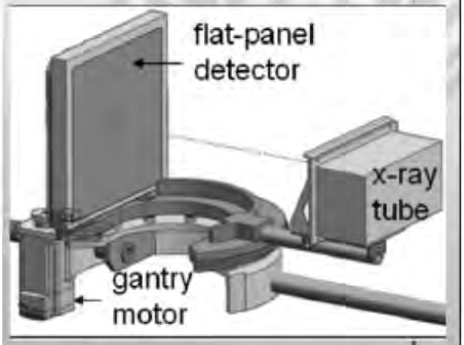
Standing CBCT

Colorado State University



ORTHOPAEDIC RESEARCH CENTER


22
R
L
24


flat-panel
detector
x-ray
tube
gantry
motor

Philips vs CBCT

Colorado State University

Philips .08 bone window

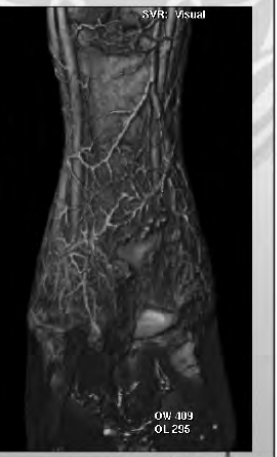
Cbct hann .03 bone window

Orthopaedic Research Center

Colorado State University

Orthopaedic Research Center

Colorado State University



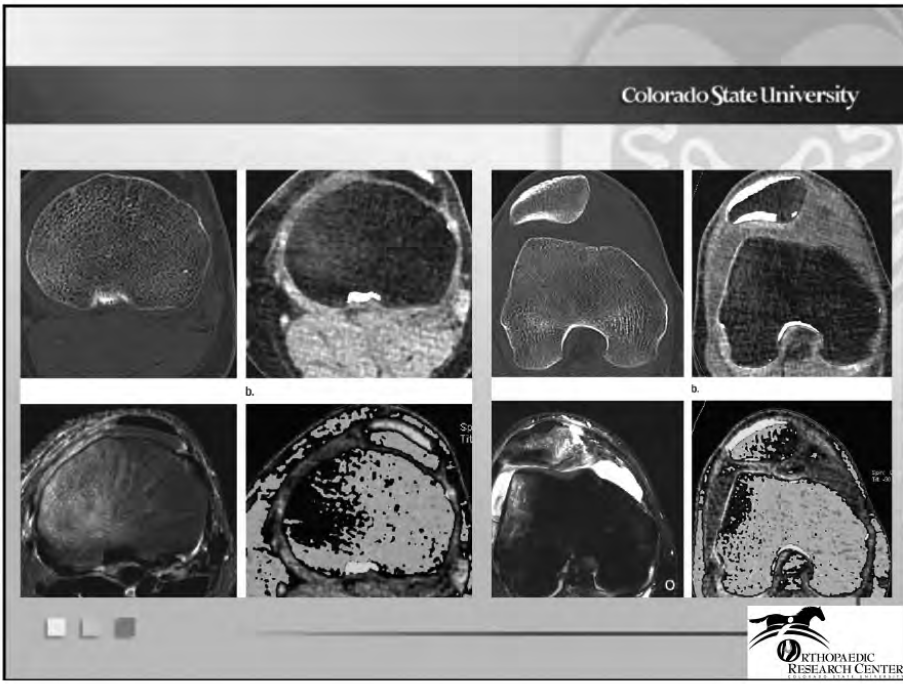
Orthopaedic Research Center

Dual Energy CBCT

Colorado State University

Orthopaedic Research Center


Colorado State University
2
1
1
2
1
2 3 4
2
1
Fig. 4
Fig. 5
Fig. 6
ORTHOPAEDIC
RESEARCH CENTER

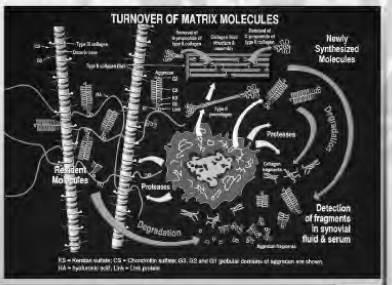

Colorado State University
b.
b.
ORTHOPAEDIC
RESEARCH CENTER

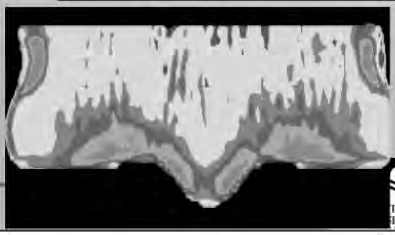
Development of a biomarker sample bank

It was agreed by the Havemeyer group that this should be a major priority. While Biobanking is emerging as an important research tool in the human field, it is now also gaining momentum in veterinary medicine [12,13]. A Biobank is a repository of biological material that has been collected and stored in a standardised fashion and whose phenotype, origin, date of collection and location can be easily determined [13]. These specimens can be stored at one or more site and distributed to the Biobank users based on preset guidelines. Not only sample collection and storage methods but also data recording (quality, completeness, consistency) relating to samples at different storage sites must be harmonised [14,15] and a powerful informatics programme that permits efficient and reliable management of all the Biobank's specimens is essential for its success [15]. A key element of a Biobank is that all necessary legal and ethical permissions are in place to allow appropriate use of materials for research purposes. This is obviously complicated in the case of an international Biobank where different legislative frameworks and cultural issues may have an impact [16].

A Vision We Have at CSU ORC

- Screening of horses with serum biomarkers
- Imaging of horses at risk
  - Nuclear scintigraphy
  - CT
  - MRI





Acknowledgements

Colorado State University

- College Research Council, CVMBS, Colorado State University.
- Lufkin Foundation
- Grayson Jockey Club Research Foundation.
- Horseracing Betting Levy Board, UK.
- Global Equine Research Alliance
- Marilyn Simpson Trust
- Southern California Equine Foundation
- Chalk Racing – Rick Westerman
- Jeff Seiwerdsen and I-STAR Lab
- Carestream Health
- Todd Bredbenner

Carestream

The I-STAR Lab
Imaging for Surgery, Therapy, and Radiology

SwRI

Orthopaedic Research Center

Nutraceuticals

Dr. Wayne McIlwraith
Barbara Cox Anthony Endowed University Chair in Orthopaedics, Orthopaedic Research Center Colorado State University

Nutraceuticals (Oral Joint Supplements)

Wayne McIlwraith BVSc, PhD, DACVS, DACVSMR

University Distinguished Professor
Barbara Cox Anthony Chair in Orthopaedics
Director of Orthopaedic Research Center

Colorado State University

Seventh Welfare and Safety of the Racehorse Summit

Keeneland, Lexington, KY

June 18, 2016

Colorado State University

Welfare and Safety of the Racehorse Summit

Orthopaedic Research Center

Disclosures

- Consultant for Arthrex & PulseVet
- Shareholder in Advanced Regenerative Therapies (ART)
- Director ANZAC
- Research funding from
  - IDEXX
  - Bayer
  - Luitpold
  - Arthrex
  - Orthogen
  - PulseVet
  - VetStem
  - Merial
- Other research funded by independent agencies

Osteoarthritis (OA)

- Single most common lameness in horses
  - Clegg & Booth *Practice* 2000
- Horse population in US estimated $7.3 million & therefore millions of horse have this debilitating condition
- OA similarly important in humans affecting at least 20 million Americans with incidence expected to double over next in next 2 decades

Colorado State University

Orthopaedic Research Center

Osteoarthritis (OA)

- Oral joint supplements (OJSs) are a common choice of clients and have been perceived as a benign treatment for OA in horses
- The high prevalence of combined with the lack of a definitive cure for OA has probably contributed to the popularity of OJSs

Colorado State University

Orthopaedic Research Center

Stages of OA in a High Motion Joint

Normal Joint

Colorado State University

Orthopaedic Research Center

Stage 1 OA

- Synovitis and no morphologic change in articular cartilage

Colorado State University

Orthopaedic Research Center

Stage 2 OA

- Synovitis less acute
- Morphologic damage in articular cartilage commencing

Colorado State University

Orthopaedic Research Center

Stage 3 OA

- Synovitis chronic
- Morphologic damage in articular cartilage severe

Colorado State University

Orthopaedic Research Center

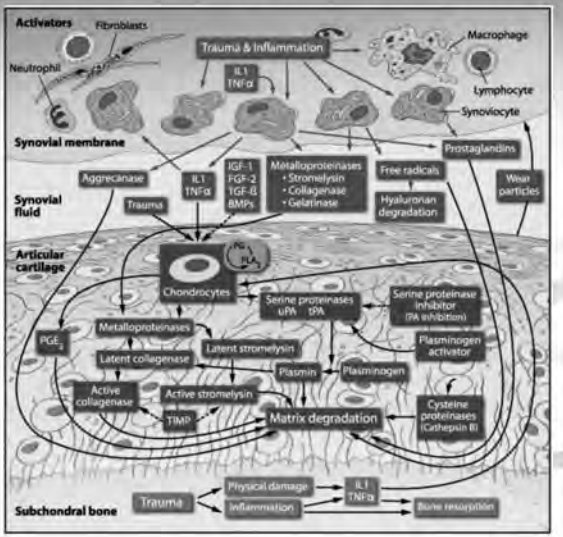
Stage 4 OA

- Synovitis chronic
- Full thickness loss of articular cartilage

Colorado State University

Orthopaedic Research Center

Factors Involved in Degradation of Articular Matrix



Colorado State University

Orthopaedic Research Center

Goal of treatment in all traumatic joint entities

- Return the joint to normal as quickly as possible
- Prevent the occurrence or reduce the severity of OA

In other words:

- Reduce pain and minimize progression of joint deterioration
  - **Symptom modifying OA Drugs (SMOADs)**
  - **Disease modifying OA drugs (DMOADs)**
- Timely removal of osteochondral fragments, fixation of IA fractures, accurate diagnosis of ligamentous & meniscal injuries & appropriate treatment of OCD entities are also critical treatments to prevent OA

Colorado State University

Orthopaedic Research Center

We Evaluate Effectiveness of Treatments using Two Criteria with *in vivo* Studies

- Symptom modifying effects (SMOADs)
  - Improvement in clinical signs
- Disease modifying effects (DMOADs)
  - Proof that progressive OA disease is modified
- Ideally we want both but second is critical and valuable

Colorado State University

Orthopaedic Research Center

Treatments of Traumatic Arthritis & OA Evaluated in Controlled Studies

- Physical therapy and rehabilitation
- Extracorporeal shock wave therapy
- NSAIDs
- IA corticosteroids
- IA HA
- IV HA
- Oral HA
- IA PSGAG
- IM PSGAG
- IM Pentosan polysulfate
- **Oral joint supplements (nutraceuticals)**
- Anti-cytokine therapy (protein or gene therapy)
- Platelet rich plasma
- Mesenchymal stem cells

Colorado State University

Orthopaedic Research Center

Nutraceuticals (Oral Joint Supplements)

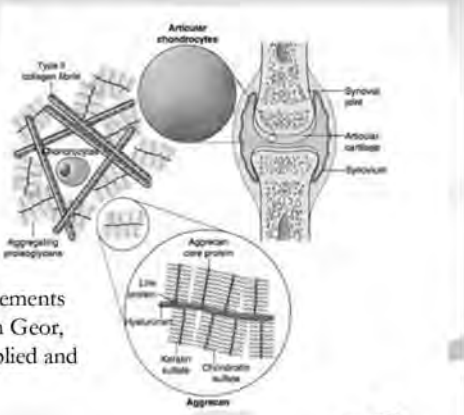
- Where do they fit in all this?
  - Not usually prescribed specifically by a veterinarian
  - Common choice of clients & have been perceived as a benign treatment for OA in horses
    - Trumble TN.The use of nutraceuticals for osteoarthritis in horses. *North Am Vet Clin Equine Pract* 2005

Colorado State University

Orthopaedic Research Center

Critical Components of Articular Cartilage Also Need to be Maintained

- Type II collagen
- Extracellular matrix
  - Proteoglycans
  - Water



McIlwraith CW (2013) Oral joint supplements in the management of osteoarthritis In Geor, Harris & Coenen et al (eds)Equine Applied and Clinical Nutrition

Colorado State University

Orthopaedic Research Center

Oral Joint Supplements (OJSs)

- High prevalence of OA in combination with lack of definitive cure has probably contributed to popularity of OJSs
- Most popular types of nutritional supplements for horses (half of all equine supplements sold in US)
- Estimated that 49% of all horse owners use
  - Packaged Facts 2008 www.packaged facts.com/pet-supplements-market-c1641

Colorado State University

Orthopaedic Research Center

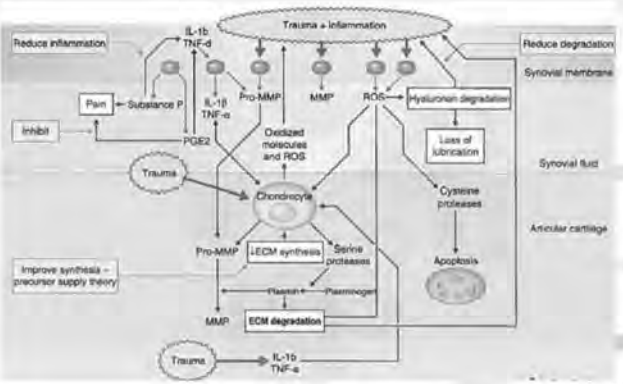
Indications for Oral Joint Supplements

- OJSs are fed to horses for one of two purposes:
  - To treat lame horses and make chronically unsound horses sound..this use is flawed because often the source of lameness is never diagnosed when the owner or trainer elects to use supplements without consulting a veterinarian
  - OR
  - To prevent/delay the development of joint problems..hard to prove/disprove but is basis for high use of im Adequan® & iv Legend® as well as OJSs

Colorado State University

Orthopaedic Research Center

Mechanisms for development of OA & possible mechanisms of action for OJSs in mitigating these processes – mainly derived from in vitro data



McIlwraith CW (2013)

Colorado State University

Orthopaedic Research Center

Types of Oral Joint Supplements

- Majority include glucosamine (GU) and/or chondroitin sulfate (CS) along with other added ingredients
- May also contain additional ingredients including manganese, vitamin C, hyaluronic acid or HA, polyunsaturated fatty acids (PUFAs), rare earth minerals, unsaponified avocado soy (ASU), green lipped muscle (Perna canaliculus), cetylmyristoleate, methylsulfonylmethane, & various herbs - with exception of last two (no good equine documentation) we will discuss these various products

Colorado State University

Orthopaedic Research Center

Oral nutraceuticals-marketing with little control is a issue

- Inappropriate advertising is an issue
- Some FDA letters but 'joint formula' & 'promoting joint health' insinuate therpeutic effects

Colorado State University

Orthopaedic Research Center

Oral Joint Supplements

- None of the oral supplements or oral nutraceuticals are licensed
- Most products include glucosamine and/or chondroitin sulfate along with other added ingredients
- Initial products for horse:
  - CS product from bovine trachea (Flex-Free®
  - Complex of GAGs and other nutrients from the sea mussel *Perna canaliculus* (SynoFlex®)
- Cosequin® - combination of glucosamine (GU), CS, manganese, and vitamin C
- Number of other products followed simulating Cosequin®

Colorado State University

Orthopaedic Research Center

In vitro dose titration studies of GU & CS alone & in combination with equine cartilage explants

- Decreased GAG loss into medium with higher doses of GU, CS and GU+CS
- Intermediate doses enhanced GAG synthesis and total cartilage GAG content
  - Dechant, Baxter, Frisbie et al *Equine Vet J* 2005

Effects of glucosamine hydrochloride and chondroitin sulphate, alone and in combination, on normal and interleukin-1 conditioned equine articular cartilage explant metabolism

J. E. DECHANT*, G. M. BAXTER, D. D. FRISBIE, G. W. TROTTER and C. W. McILWRAITH

Equine Orthopaedic Research Laboratory, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, Colorado 80523, USA.

Colorado State University

Orthopaedic Research Center

Same dosages tested on IL-1 conditioned explants

- No treatment effects for GU or CS alone
- Protective effect for GU+CS for total GAG release into the media
- How does it relate to concentrations achieved with oral administration?

Effects of glucosamine hydrochloride and chondroitin sulphate, alone and in combination, on normal and interleukin-1 conditioned equine articular cartilage explant metabolism

J. E. DECHANT*, G. M. BAXTER, D. D. FRISBIE, G. W. TROTTER and C. W. McILWRAITH

Equine Orthopaedic Research Laboratory, Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, Colorado 80523, USA

Colorado State University

Orthopaedic Research Center

What about absorption compared to in vitro levels that are efficacious?

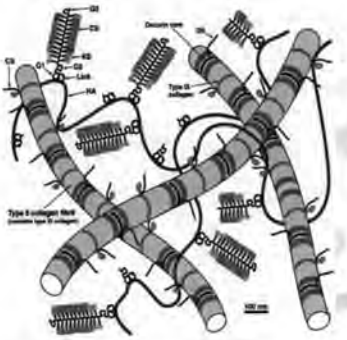
- Chondroitin sulfate - yes - low molecular weight CS (0.80 kD) absorbed to a greater degree than GU; absorption may be influenced by MW
  - Du et al *Biopharm Drug Dispos* 2002
- Glucosamine - not in sufficient levels
  - Laverty et al *Arthritis Rheum* 2004
- Still does not prove effectiveness in the horse

Colorado State University

Orthopaedic Research Center

Serum GAG & HA levels Do Not Reflect Absorption as has been Claimed

- Both marker of inflammatory joint disease



Colorado State University

Orthopaedic Research Center

Clinical Trials

- In a review of 15 in vivo equine studies, authors signaled an encouraging trend: manufacturers of these products are investing in research, but most do not meet a quality standard that provided sufficient confidence in the results reported. Consequently, the overall level of evidence for in vivo demonstration of efficacy is weak.
  - Pearson & Lindinger *Equine Vet J* 2009

Colorado State University

Orthopaedic Research Center

Glucosamine/chondroitin Arthritis Intervention Trial (GAIT)

- Knee pain
  - Placebo
  - GS
  - CS
  - GS+ CS
  - Celecoxib
- 1583 randomized & 1258 (80%) completed study
  - No significant improvemen in knee pain versus placebo was seen in supplement group but improvement with celecoxib
  - In subset with moderate to severe knee pain some improvement seen
  - Clegg et al N Engl J Med 2006

Colorado State University

Orthopaedic Research Center

Sasha's Blend

- NZ green-lipped mussel, shark cartilage, abalone & a lipid extract from *Biota orientalis* Sasha's EQ Powder (SEO)
- Decreased IL-1βinduced PGE2 *in vitro*
- Evaluated by feeding horses SEO at different doses with placebo group & injected one carpus with IL-1β& one with saline.
- SEO significantly inhibited increased PGE2 & GAG levels with IL-1β
  - Pearson et al 2007

Colorado State University

Orthopaedic Research Center

Oral Hyaluronan

- Anecdotal support for effectiveness
- A number of products (two developed by veterinarians)
  - Conquer®
  - Lubrisyn®
- Anecdotal reports of benefit in OA

Colorado State University

Orthopaedic Research Center

Evidence for efficacy of oral hyaluronan

- Oral HA (Conquer™) given after arthroscopic surgery for tarsocrural OCD
  - 27 joints (24 yearlings) treated with 100 mg orally for 30 days postop
  - 30 joints (24 yearlings) treated with placebo orally for 30 days
  - Blinded examiner scored effusion at 30 days (grade 0-5)
- Mean 30 day effusion score treated group 0.67 in treated group and 2.05 in placebo group ($p<0001$)
  - Bergin et al Equine Vet J 2006; 38:375-378

EQUINE VETERINARY JOURNAL
Equine vet. J. (2006) **38** (4) 375-378

Oral hyaluronan gel reduces post operative tarsocrural effusion in the yearling Thoroughbred

B. J. BERGIN[1], S. W. PIERCE, L. R. BRAMLAGE and A. STROMBERG[2]

Rood and Riddle Equine Hospital, PO Box 12070, Lexington, Kentucky, 40580-2070, USA. [2]Department of Statistics, University of Kentucky, Lexington, Kentucky 40506-0027, USA

Colorado State University

Orthopaedic Research Center

Extract of Green-lipped Mussel (*Perna canaliculus)*

- Randomized, double-blinded placebo controlled study in horses with clinical cases [chronic fetlock lameness (OA)]
- 19 treated & 20 placebo – 56 days
- Significant reduction in severity of lameness ($p<0.001$), reduced joint pain ($p<0.014$), & improved response to joint flexion ($p<0.001$)
  - Cayzer, Hedderly & Day *Equine Vet J* 2012; 44:393-398

Colorado State University

Orthopaedic Research Center

Avocado Soy Unsaponified (ASU)

- Vetoquinol ASU studied in equine OA model
- First well controlled equine study demonstrating a positive effect with an oral nutraceutical
  ➔disease-modifying effects
- Controlled studies in humans also positive

Evaluation of avocado and soybean unsaponifiable extracts for treatment of horses with experimentally induced osteoarthritis

Christopher E. Kawcak, DVM, PhD; David D. Frisbie, DVM, PhD; C. Wayne McIlwraith, BVSc, PhD; Natasha M. Werpy, DVM; Richard D. Park, DVM, PhD

Colorado State University

Orthopaedic Research Center

Equine Study with ASU (Luxovan®)

- Two treatment groups (8 horses in each)
- Osteochondral fragment model
- Gp 1 : ASU with sweet feed. Administered orally once a day from day 0-72
- Gp 2 : Sweet feed. Administered orally once a day from day 0-72

Evaluation of avocado and soybean unsaponifiable extracts for treatment of horses with experimentally induced osteoarthritis

Christopher E. Kawcak, DVM, PhD; David D. Frisbie, DVM, PhD; C. Wayne McIlwraith, BVSc, PhD; Natasha M. Werpy, DVM; Richard D. Park, DVM, PhD

AJVR

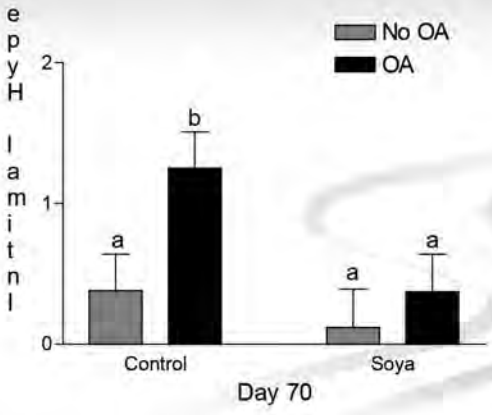
Outcome Parameters

- Lameness - pre- & post-flexion every 2 weeks
- Radiographs prior to surgery & at study conclusions
  - Changes in subchondral bone & osteophytosis
- Synovial fluid once a week
- Serum once a week
- Treadmill exercise days 15 - 72 (5 days a week : 2 minutes trot, 2 minutes gallop, 2 minutes trot)
- Gross necropsy
- Histopathology
  - Synovial membrane
  - Articular cartilage
- Articular cartilage biochemistry
  - GAG content
  - GAG synthesis

Colorado State University

Orthopaedic Research Center

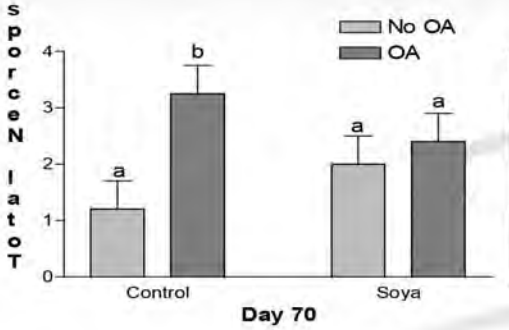
Intimal Hyperplasia



Colorado State University

Orthopaedic Research Center

Cartilage disease score

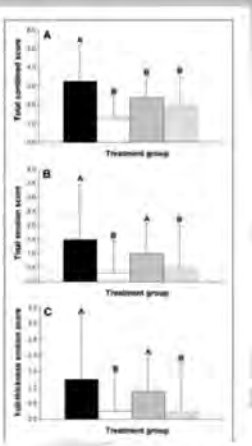


Colorado State University

Orthopaedic Research Center

ASU in the Horse

- Significant reduction in severity of articular erosion & synovial hemorrhage compared to placebo-treated horses
- Significant increase in articular cartilage glycosaminoglycan synthesis compared to placebo treated horses



Colorado State University

Orthopaedic Research Center

Other companies have product with ASU (different than Vetoquinol product)

Colorado State University

Orthopaedic Research Center

Polyunsaturated Fatty Acids (PUFAs)

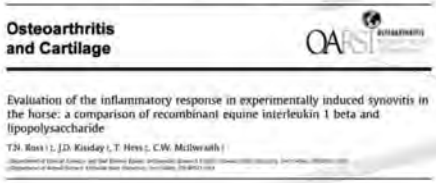
- Omega-3 (n-3) PUFAs contain α-linolenic acid that is desaturated in body to produce eicosapentaenoic acid & docosahexaenoic acid analogs of arachidonic acid
- Found in oily fish & fish oils
- Decrease production of inflammatory cytokines, prostaglandins, aggrecanases, thromboxanes, leukotrienes, reactive oxygen species

Colorado State University

Orthopaedic Research Center

Aggrecanase is an important target in joint inflammation

- reIL-1βin carpal joints
- Expression of deleterious mediators



Osteoarthritis and Cartilage

OARS

Evaluation of the inflammatory response in experimentally induced synovitis in the horse: a comparison of recombinant equine interleukin 1 beta and lipopolysaccharide

T.N. Ross †‡, J.D. Kisiday ‡, T. Hess ‡, C.W. McIlwraith †

Colorado State University

Orthopaedic Research Center

PUFAs in Equine Joint Inflammation

- Lower expression of aggrecanase-1 in inflamed synovial membrane
- Modest decrease in activity..real therapeutc value still to be proven

Animal Physiology and Animal Nutrition

DOI: 10.1111/jpn.12359

ORIGINAL ARTICLE

Influence of an *n-3* long-chain polyunsaturated fatty acid-enriched diet on experimentally induced synovitis in horses

T. N. Ross-Jones[1], C. W. McIlwraith[2], J. D. Kisiday[2], T. M. Hess[1], D. K. Hansen[1] and J. Black[1,2]

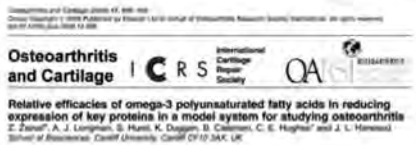
[1] Department of Animal Science, Colorado State University, Fort Collins, CO, USA, and
[2] Orthopaedic Research Center, Department of Clinical Sciences, Colorado State University, Fort Collins, CO, USA

Colorado State University

Orthopaedic Research Center

PUFAs have been incorporated into some OJSs

- Rare earth minerals
- Omega 3 fatty acids
- Scientific support for n-3 fatty acids
  - Inhibit aggrecanase
  - Inhibit COX2 & 5- lipooxygenase
  - Inhibit autocrine synthesis of IL-1 & TNF-α
- A different type of nutraceutical
- Getting studied in horse


Osteoarthritis and Cartilage

ICRS International Cartilage Repair Society

OARSI

Relative efficacies of omega-3 polyunsaturated fatty acids in reducing expression of key proteins in a model system for studying osteoarthritis

Colorado State University

Orthopaedic Research Center

Cetyl Myristoleate (CM)

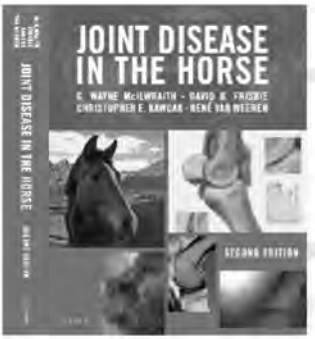
- Another fatty acid..ester of myristoleic acid
- CM mat act by inhibitiob of 5-lipooxygenase pathway
- Product containing CM, GU, MSM & hydrolyzed collagen (Myristol™) evaluated in blind controlled study with 39 horses
- Myristol group improved significantly more than placebo group in AAEP lameness score, VAS, response to flexion, lameness after flexion

Colorado State University

Orthopaedic Research Center

Further Reading

- McIlwraith CW, Frisbie DD, Kawcak CE & van Weeren PR Joint Diseases in the Horse 2nd ed Elsevier 2015



Colorado State University

Orthopaedic Research Center

Proper Nutrition & Balanced Feed Programs

Panelists:
Dr. Robert Coleman
Assistant Professor Equine Extension
University of Kentucky

Dr. Laurie Lawrence
Provost's Distinguished Service Professor,
Department of Animal and Food Sciences
University of Kentucky

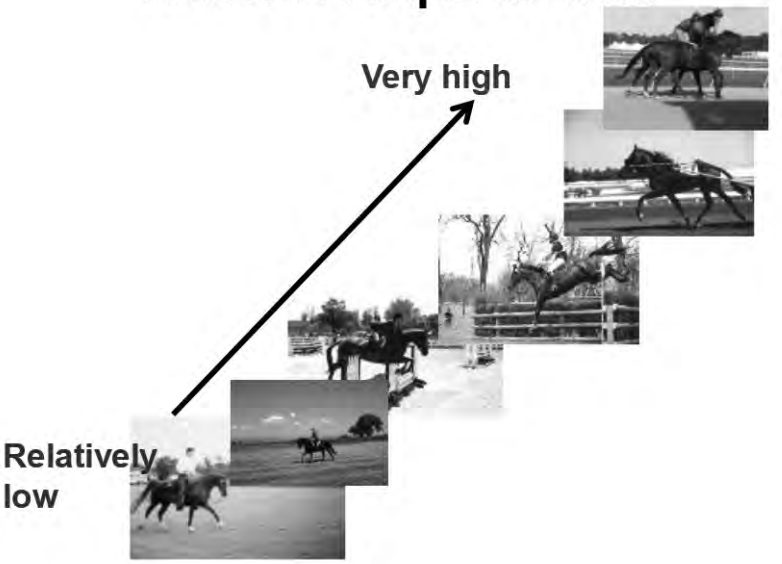
Nutritional Management of Race Horses

Laurie Lawrence, Ph.D.
Department of Animal and Food Sciences
University of Kentucky

Considerations

- Meet nutrient requirements
- Maintain normal GI tract

Nutrient Requirements



Meeting Nutrient Needs

Relatively easy! Mostly forage, some concentrate

More difficult! Must have very good forage; must feed more concentrate

Feeding the Racehorse

- Excellent quality hay
  - Low dust
  - High nutrient density
- Commercially manufactured fortified concentrate
- High level of feed intake

Feeding the Racehorse

- Excellent quality hay
  - Low dust
  - High nutrient density
- Commercially manufactured fortified concentrate
  - Formulated for performance horses
  - **Usually cereal-grain based**
- High level of feed intake
  - **Depends on a healthy GI tract**

The Equine GI tract

1. Mouth
2. Stomach
3. Small intestine
4. Large Intestine (hindgut)
   - Cecum
   - Colon
   - Rectum

GI Tract: *1. The Mouth*

Lips:

Select feeds

Teeth:

Crack hard seeds

Reduce particle size

Saliva

wets the food
contains some enzymes
contains some buffers

More saliva…more buffers

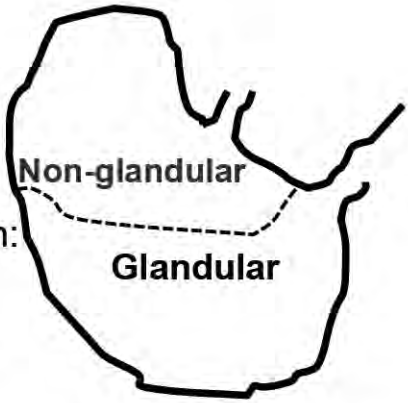
More chewing more saliva
what food causes more chewing?

GI tract: ***2. The Stomach***

Several characteristics are important to GI health

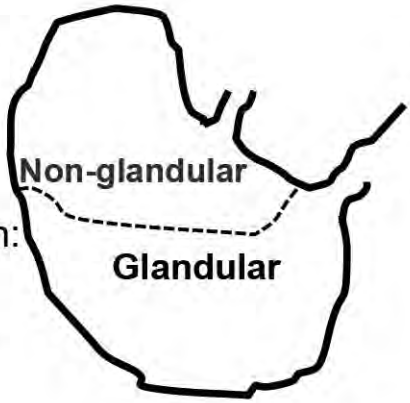
Gastric Anatomy

- Glandular portion:
  - Acid secretion
  - Enzyme secretion
  - Coated in mucus
  - Bicarbonate
- Non-glandular portion:
  - Lower levels of protective mucus, bicarbonate



Gastric Anatomy

- Glandular portion:
  - Acid secretion
  - Enzyme secretion
  - Coated in mucus
  - Bicarbonate
- Non-glandular portion:
  - Lower levels of protective mucus, bicarbonate



The Stomach

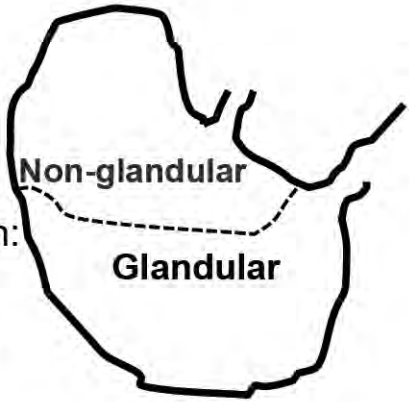
Constant secretion of gastric acid

The Stomach

Some microbial fermentation of carbohydrates

Gastric Anatomy

- Glandular portion:
  - Acid secretion
  - Enzyme secretion
  - Coated in mucus
  - Bicarbonate
- Non-glandular portion:
  - Lower levels of protective mucus, bicarbonate



The Stomach

Gastric ulcers are common in race horses

Contributing factors?

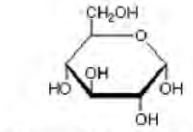
- Long intervals between meals
- Less hay, more concentrate (less chewing; more microbial fermentation of carbohydrates)

GI Tract. *3. The small intestine*

Enzymatic digestion of protein, fats and starch….but there can be limitations.

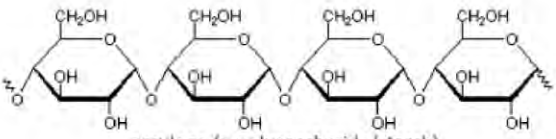
What is starch?

- A storage carbohydrate in grains and seeds



glucose (a monosaccharide)

A polysaccharide of many glucose units



amylose (a polysaccharide/starch)

Starch digestion in the small intestine

Small amounts of starch are well digested but large amounts of starch are not

Some starch sources are more digestible than others.

Grinding grains makes the starch more digestible.

.

GI tract: *4.The Large Intestine*

A diverse microbial ecosystem:

ferment fiber (from forage)

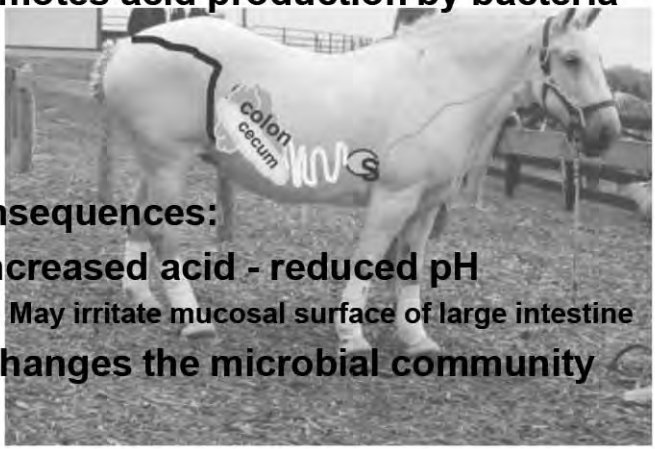
produce products useful to horse

The Large Intestine

Starch that is not digested in small intestine reaches the large intestine

Concerns with starch in the LI

- **Promotes acid production by bacteria**



- **Consequences:**
  - **Increased acid - reduced pH**
    - **May irritate mucosal surface of large intestine**
  - **Changes the microbial community**

Role of the Gastrointestinal Microbial Community

- **Digests substrates otherwise not useful to horse, synthesizes some vitamins**
- **Pathogen defense**
  - Beneficial organisms compete with pathogens
    - *Substrates, binding sites on the GI mucosa*
  - Beneficial organisms may produce compounds to impair the growth of pathogens

Which horses eat the most starch?

Mostly forage, some concentrate

Even with very good forage must feed larger amounts of concentrate (and starch)

Feeding Strategies for Race Horses

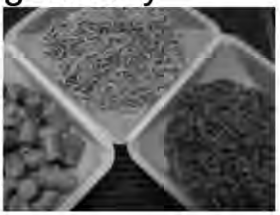
- Replace some starch with fat
  - fat contains more than twice as many digestible calories as starch
  - reduce cereal grain in mix and increase vegetable oil
  - horses digest fat well, but at high levels of inclusion, palatability may decrease.

Feeding Strategies for Race Horses

- Replace grain with highly digestible fiber in concentrate (beet pulp/soy hulls)
  - weight for weight, beet pulp has ~ 90% of the digestible calories of oats
  - replace some cereal grains with fiber *and* fat; get similar DE content as in traditional mix, but less total starch
  - feeds with more fiber may increase chewing

Feeding Strategies for Race Horses

- Use starch sources that are well digested in the small intestine
  - There are differences among grains
    - Oats better than corn
  - Processing affects starch digestibility
    - Processed better than whole
    - But processing may affect chewing



Feeding Strategies for Race Horses

- Divide daily concentrate into several small meals instead of 2 big meals
  - Starch in small meals is digested better than starch in large meals
  - Reduces the interval between meals and prevents long period of empty stomach

Feeding Strategies for Race Horses

- **Use very good quality hay**
  - Early maturity; more digestible calories, more palatable
  - With better hay, less concentrate will be needed!
  - With more hay, horses will spend more time chewing.
  - More hay, more continuous food in stomach

Feeding the Race Horse

- Maintaining a normal GI tract
  - Promotes efficient digestion of nutrients
  - Maintains feed intake
  - Enhances pathogen defenses

Regulating The Use Of The Crop

Panelists:

Moderator: Sue Finley
Sr. Vice President & Co-Publisher
Thoroughbred Daily News

Ramón A. Domínguez
Retired Thoroughbred Horse Racing Hall of Fame Jockey

Gunnar Lindberg
Senior Racing Official
Alcohol and Gaming Commission of Ontario

Chris McCarron
Retired Thoroughbred Horse Racing Hall of Fame Jockey

Return To Ride Protocols

Dr. Carl Mattacola
Professor Athletic Training Rehabilitation Sciences
University of Kentucky

Compounded Medications

Panelists:

Dr. Dionne Benson
Executive Director and COO
Racing Medication Testing Consortium

Dr. Lynn Hovda
Chief Veterinarian
Minnesota Racing Commission

Dr. Scott Stanley
Professor of Equine Analytical Chemistry
University of California, Davis

American Association Of Equine Practitioners Racing Committee

Panelists:

Dr. Kathleen Anderson

AAEP President and *Owner*

Equine Veterinary Care

Dr. Nathaniel A. White II

Professor Emeritus of Equine Surgery

Virginia - Maryland

College of Veterinary Medicine

Lameness Diagnosis - The Importance of the Physical Inspection

Panelists:
Moderator: Edward L. Bowen
President
Grayson-Jockey Club Research Foundation

Dr. Lawrence R. Bramlage
Surgeon
Rood and Riddle Equine Hospital

Dr. Kevin Dunlavy
Managing Partner
Kentucky Equine Medical Associates

Dr. Mary Scollay
Equine Medical Director
Kentucky Horse Racing Commission

Industry Initiatives Descriptions and Websites

Industry Initiatives
(Found via jockeyclub.com Advocacy/Promotion tab)

Welfare and Safety of the Racehorse Summit
Thoroughbred Safety Committee
Horse Racing Reform
America's Best Racing
Equine Injury Database
Jockey Health Information System

NTRA Safety and Integrity Alliance – ntraalliance.com
Racing Officials Accreditation Program – horseracingofficials.com
Racing Medication & Testing Consortium – rmtcnet.com

Aftercare Initiatives
Tattoo Identification Services
Thoroughbred Connect
Thoroughbred Incentive Program
Thoroughbred Aftercare Alliance

Below is a brief overview of each of the above programs:

The Welfare and Safety of the Racehorse Summit, coordinated and underwritten by Grayson-Jockey Club Research Foundation and The Jockey Club and hosted by Keeneland Association, was held for the first time in October 2006. The two-day workshop, which brought together a wide cross-section of the breeding, racing and veterinary community, was designed to improve safety and soundness for the Thoroughbred racehorse.

The summit was historically held every two years since 2006 and in 2015 went to an annual schedule.

During the original summit, committees were formed and began working on various aspects of Thoroughbred welfare and safety. These committees include On-Track Injury Reporting, Education and Licensing, Shoeing and Hoof Care, Racing Surfaces, Durability, Race Conditions and Racing Office, and Health and Medical Records.

Among the major accomplishments that have evolved from the previous four summits are the Equine Injury Database; the Jockey Injury Database; the Racing Surfaces Testing Laboratory, which provides science-based testing of racing surfaces to enhance safety for horse and rider; a uniform trainer test and study guide; the racing surfaces white paper and publication of educational bulleting for track maintenance; the publication of stallion durability statistics; the hoof DVD, available in English and Spanish; a model rule banning toe grabs greater than 2 mm and elimination of all traction devices on front shoes approved and passed in August 2008; and the movement by state racing commissions to create regulations that void the claim of horses suffering fatalities during a race.

Thoroughbred Safety Committee

The Thoroughbred Safety Committee, which issued its first set of recommendations in June 2008, continues to issue recommendations and is a standing committee of The Jockey Club.

The Thoroughbred Safety Committee was created in May 2008 to review every facet of equine health and to recommend actions the industry can take to improve the health and safety of Thoroughbreds.

The committee convenes to discuss myriad safety issues with a cross section of industry representatives, including jockeys, trainers, veterinarians, chemists, pedigree experts, handicappers, owners, breeders, blacksmiths, racing commissioners, racetrack executives and geneticists.

Committee members are Stuart S. Janney III (chairman), John Barr, James G. (Jimmy) Bell, Dr. Larry Bramlage, Christopher J. McCarron, C. Steven Duncker, Dell Hancock and Dr. Hiram C. Polk Jr. Each is a member of The Jockey Club.

Horse Racing Reform is a national movement of veterinarians, breeders, trainers, owners, bettors, and fans for uniform medication, testing and safety regulations that will provide for safer competition for both human and equine.

America's Best Racing is a multi-media new fan development and awareness-building platform, initiated by The Jockey Club, designed to increase the profile and visibility of North America's best Thoroughbred racing events, with a primary focus on the sport's lifestyle and competition.

EQUINE INJURY DATABASE
A Safety Initiative of The Jockey Club

The Equine Injury Database™ is the Thoroughbred industry's first national database of racing injuries and seeks to identify the frequency, types and outcome of racing injuries using a standardized format that will generate valid statistics, identify markers for horses at increased risk of injury, and serve as a data source for research directed at improving safety and preventing injuries. The Equine Injury Database is funded entirely by The Jockey Club, through its commercial subsidiaries InCompass Solutions Inc. and The Jockey Club Technology Services Inc., as a service to the industry.

NTRA SAFETY & INTEGRITY ALLIANCE

The health and safety of our human and equine athletes and the integrity of our sport are horseracing's top priorities. To accomplish these important priorities, the National Thoroughbred Racing Association ("NTRA") has organized the NTRA Safety and Integrity Alliance ("Alliance").

Alliance membership includes racetracks, owners, breeders, horsemen, jockeys, sales companies, veterinarians, racing fans, breed registries and the associations that represent these stakeholders who agree to uphold and support the goals and objectives of the Alliance ("Members"). The Alliance's purpose is to establish standards and practices to promote safety and integrity in horseracing and to secure their implementation. Alliance Members individually and collectively are committed to ensure that the sport of horseracing is pursued in a manner consistent with high ethical standards and compliance with applicable laws and regulations.

The NTRA Safety and Integrity Alliance is a standing organization whose purpose is to establish standards and practices to promote safety and integrity in horseracing and to secure their implementation.

JOCKEY HEALTH INFORMATION SYSTEM
A Safety Initiative of The Jockey Club

The Jockey Health Information System™ (JHIS) is a central database that stores jockeys' current medical records so that they are immediately available to medical personnel at racetracks in the event of injury.

The JHIS debuted at Keeneland's 2008 fall meeting. There are no fees for a track or jockey to participate. The creation and development of the JHIS featured collaboration among InCompass Solutions, Inc., The Jockey Club Technology Services Inc., the Jockeys' Guild, Keeneland Association and Dr. Barry Schumer, Keeneland's medical director, who developed the original concept and consulted on the project.

The JHIS is a module of the InCompass Race Track Operations software. To access and use the JHIS module, a jockey must be at least 18 years of age, have a valid e-mail address and obtain a user name and password from InCompass.

The Racing Medication and Testing Consortium develops, promotes and coordinates, at the national level, policies, research and educational programs that seek to ensure the fairness and integrity of racing and the health and welfare of racehorses and participants. In doing so, it protects the interests of the racing public.

The Racing Officials Accreditation Program accredits and provides continuing education to all racing officials, stewards and judges in the horse racing industry. By doing so ROAP is enhancing the image and upholding the integrity of horse racing at all levels. ROAP is a collaborative effort of many organizations representing all types of racing.

To encourage the retraining of Thoroughbreds into other disciplines upon completion of careers in racing or breeding, in 2012 The Jockey Club launched the Thoroughbred Incentive Program (T.I.P.). T.I.P. offers sponsorship for Thoroughbred-only classes and divisions, high point Thoroughbred awards at open horse shows and competitions, a Thoroughbred of the Year Award and a Young Rider of the Year Award.

ThoroughbredConnect

Connecting Thoroughbreds with Their Futures

Thoroughbred Connect™ is a free online service designed to assist with placement of Thoroughbreds following the conclusion of their racing or breeding careers.

A component of The Jockey Club's Interactive Registration™, Thoroughbred Connect enables Registry customers to express their willingness to be contacted by the possessor of a horse in the event the horse is in need of placement. Those interested in providing assistance or aftercare have the ability to attach their name and contact information to the electronic records of Thoroughbreds within The Jockey Club's database using Thoroughbred Connect.

Similarly, a person who is seeking placement for a Thoroughbred in his possession can log into Thoroughbred Connect and request the contact information attached to the horse. The possessor of the horse may then contact that prospective owner directly to perform due diligence and discuss potential arrangements to transfer the horse.

The Thoroughbred Aftercare Alliance (TAA) is an organization designed to serve as both the accrediting body for aftercare facilities that care for Thoroughbreds following the conclusion of their racing careers and a fundraising body to support these approved facilities.

The TAA will accredit aftercare facilities based on a Code of Standards covering operations, education, horse management, facility services and adoption policies. Simultaneously, the TAA will raise funds on behalf of accredited facilities via institutional contributions that are to be directed 100% to program services rather than to fundraising or general administrative costs.