



NORTHERN ARIZONA
UNIVERSITY

College of Engineering, Forestry & Natural Sciences

Center for Bioengineering Innovation

Insights from Comparative Physiology

FRIDAY, April 22, 2016

FRIDAY'S EVENTS WILL BE LOCATED ON THE NORTHERN ARIZONA UNIVERSITY CAMPUS, IN CLINE LIBRARY (building 28 on this map <https://www2.nau.edu/nau-map/>), room 200, AT 1001 S KNOLES DRIVE, FLAGSTAFF, AZ 86011 (location and parking http://library.nau.edu/general_information/location.html)

8.30-8.40am: Welcome by **Kiisa Nishikawa**

8.40-9am: Doug Stuart--The Early History of Comparative Physiology at the UA, ASU, and NAU

ALLOMETRY

9am: Alice Gibb—Why are there so many small fishes? How scaling affects feeding and locomotion in the Teleostei

9.45am: Jim O'Reilly—Shove It Where the Sun Don't Shine: The Scaling of Burrowing Forces in Caecilians (Amphibia:Gymnophiona)

10.30am: BREAK

10.45am: Stan Lindstedt—On Being the Right Size: Physiological insights in the century since Haldane

ENERGETICS

11.30am: Kevin Conley—Doping for Seniors

12.15pm: LUNCH (provided; RSVP was required)

1.30pm: Hans Hoppeler—From Concentric to Eccentric Work



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MUSCLE PHYSIOLOGY AND APPLICATIONS

2.15pm: Michael Harris-Love—Quantity versus Quality: Can Sonographic Muscle Imaging Change the Sarcopenia Screening Paradigm?

3pm: Break

3.15pm: Paul LaStayo—Sufficiency of Proof: the Positives and Negatives of an Evolving Axiom

4pm: Kiisa Nishikawa—Collaborations in Highly Speculative and Dangerously Fanciful Science

SPEAKERS—Insights from Comparative Physiology

Dr. Kevin Conley has known Stan Lindstedt for 30 years; Dr. Conley works currently as director of the Translational Center for Metabolic Imaging (TCMI) at the University of Washington. He first contacted Stan when he was a graduate student at the University of Wisconsin Madison through a letter inquiring about his experiences as a postdoc in Switzerland, where Stan worked with Hans Hoppeler and Ewald Wiebel at the University of Bern. He and Stan both dissertated on the biophysics of thermoregulation in small rodents, and they both did postdocs in Bern. They later met and collaborated with the Swiss team studying racehorses and steers at the Royal Veterinary Hospital in Uppsala, Sweden (1980s). They found that race horses have suite of muscle properties that permit them to run at frightening speeds on a treadmill. More frightening still was handling the iconic Arizona animal – the western diamondback rattlesnake – to reveal how energy was used by the tailshaker muscle for hours of rattling at rates that exceed racehorse muscle in a 2 minute sprint. Recent studies in the new millennium resolved the classic paradox of positive vs. negative work in muscle contraction (the Fenn Effect). Fittingly, it took studies of an intact system - human hand muscle in vivo - to resolve the paradox first described a century ago in isolated frog muscle. Let us hope for more fun to come...

Dr. Alice Gibb grew up on the Chesapeake Bay and spent her summers on the water. She entered Mount Holyoke College as a Philosophy major, but quickly saw the error of her ways and graduated as a Biology major, with an honors project examining the evolutionary morphology of fishes. Alice attended graduate school in the Ecology and Evolutionary Biology department of the University of California, Irvine, where she conducted research on fish functional morphology in lab of George Lauder and was strongly influenced by the vibrant comparative physiology group. After completing her PhD in 1997, she moved on to an NSF-funded postdoc studying muscle biochemistry in marine fishes with Kathryn Dickson at California State University, Fullerton. In 1999, Alice and her family moved to Flagstaff, where she joined the Biology department at Northern Arizona University as an Assistant Professor. At NAU, she has taught a variety of classes in physiology and



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evolutionary biology, including (notably) Animal Locomotion with Stan Lindstedt. Her research program uses form-function relationships in fishes as an evolutionary framework in which to investigate a variety of topics, including evolution of suction feeding in bony fishes, ecomorphology of the native fish species of the Southwest, and terrestrial behaviors of fish out of water. Her work at NAU has been shaped by her world-renowned colleagues in the comparative physiology cluster within the Biology department, and she is honored and humbled to be invited to speak at the celebration of the life's work of her friend and mentor, Stan Lindstedt.

Dr. Michael Harris-Love is an Associate Clinical Professor in the Department of Exercise and Nutritional Sciences at George Washington University, and the Associate Director of the Human Performance Research Unit within the Clinical Research Center at the DC Veterans Affairs Medical Center (DC VAMC). Additionally, he is the Director of the Muscle Morphology, Mechanics, and Performance Laboratory (3MAP Lab) and Deputy Director of the Rehabilitation Research Post-Doctoral Fellowship at the DC VAMC. Dr. Harris-Love conducted undergraduate research on the effects of trunk exercise on respiratory muscle function as an Arizona/NASA Space Grant intern with Dr. Stan Lindstedt, and obtained his Baccalaureate degree in Exercise Science from Northern Arizona University in 1995. He later earned his Masters of Physical Therapy degree from the Mayo School of Health Sciences in Rochester, MN and doctorate in Health Sciences from the University of Indianapolis, followed by a K30 post-doctoral fellowship at Georgetown University/Children's National Hospital. Dr. Harris-Love's previous clinical positions were at the Mayo Clinic (Rochester, MN) and the National Institutes of Health, which involved patient care in the areas of geriatrics and autoimmune muscle disorders. He has previously served as a U.S. Bone and Joint Decade Young Investigator Fellow, and a Butler-Williams Scholar with the NIH National Institute on Aging. Dr. Harris-Love's laboratory group has a general research interest in muscle plasticity in response to exercise, normal aging, and chronic disease. His current work is funded by a 5-year VA/ORD/RR&D grant and includes the development of sonographic methods for sarcopenia and myosteator screening.

Dr. Hans Hoppeler was born 1948 in Switzerland; he is married, has four adult children, and lives in Bern. He studied Medicine at the University of Bern. He worked as an MD at the Hospital of Burgdorf for three years before taking up an academic career. His main research interests are focused on the plasticity of skeletal muscle tissue from the molecular to motion as well as on the design of the respiratory system. He has authored or coauthored over 300 publications which have been cited over 10,000 times. He is a member of the Leopoldina and the Swiss Academy of Medical Sciences. He is an honorary member of the Swiss Society of Sports Medicine and of Swiss Othopedics. He retired from active academic duties in 2014 but has maintained his position as an Editor-in-Chief of the Journal of Experimental Biology.

Paul LaStayo, PhD, PT is a Professor in the Department of Physical Therapy at the University of Utah where he balances teaching, clinical research, and patient care. While in Flagstaff, concepts in design physiology and functional morphology in the Lindstedt lab



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supplanted him from full-time clinical practice long enough to complete his PhD in Biology in 2000. Following a postdoctoral experience at the University of Arizona and time spent on the physical therapy faculty at NAU, Dr. LaStayo landed in Salt Lake City, UT. Along with his colleagues in engineering, orthopaedics, geriatrics, oncology, and the health sciences at the University of Utah, Dr. LaStayo explores ways to pragmatically use exercise to address muscle, mobility, and metabolic challenges facing adults as they age and experience physical challenges. Locomotor muscle structure-function and how eccentric muscle countermeasures impact muscle and whole body movement have been a focus of his NIH-funded research. As healthcare systems and economics evolve, however, so too does Dr. LaStayo as a physical therapist. Optimizing clinical outcomes and monitoring healthcare-related costs in the acute and post-acute care settings and training the next generation of clinician-scholars now occupy increasing amounts of his energy. Time spent outdoors and travelling, however, with his wife, grown children, grandchildren, and labradoodle remains a priority.

Dr. Stan Lindstedt is Professor Emeritus and former Regents' Professor of Biology at Northern Arizona University. Dr. Lindstedt earned his BS from the University of Southern California in 1970 and his PhD from the University of Arizona in 1976. He received an NIH Individual Postdoctoral Fellowship to the University of Arizona School of Medicine and an NSF Postdoctoral Fellowship to the University of Bern in Switzerland. He worked at both the University of Wyoming and Harvard University before joining Northern Arizona University. He serves on the editorial board of the *Journal of Experimental Biology*, and he previously acted as Associate Editor of *Exercise and Sports Science Reviews* and as an editorial board member for the *American Journal of Physiology*. The American Physiological Society awarded Dr. Lindstedt the Krogh Distinguished Lectureship in 2013, and he has served as both Inaugural President of the Arizona Physiological Society and President of the Comparative Physiological Section of the American Physiological Society.

Dr. Kiisa Nishikawa is a Regents' Professor in the Department of Biological Sciences and Director of the Center for Bioengineering Innovation at Northern Arizona University. She received her Ph.D. in Zoology from the University of North Carolina. She was a postdoctoral fellow in the Department of Anatomy and Neurobiology at Dalhousie University and a Miller Postdoctoral Fellow in the Museum of Zoology at the University of California at Berkeley. Her research interests include evolution of brain and behavior, biomechanics, muscle contraction, and neuromuscular control of ballistic movements. She is grateful for the privilege of being Stan Lindstedt's colleague in the Biology Department at NAU since 1989. For nearly 20 years, Kiisa has worked with Stan to develop a new model of muscle contraction that incorporates an active role for the giant titin protein. The "winding filament" hypothesis suggests that titin is engaged mechanically in skeletal muscles through calcium-dependent binding of the N2A region to thin filaments, after which the cross-bridges wind the PEVK region upon the thin filaments. Current research is focused on three related projects. The first project tests predictions of the winding filament hypothesis experimentally, using the *mdm* mutation in mice as a model system for *in vitro* studies of muscle physiology and *in vivo* studies of movement. The second project is a



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multidisciplinary collaboration among biology, biochemistry and nano-engineering to investigate interactions among N2A, calcium, calcium binding proteins, and actin using techniques of molecular biology and atomic force microscopy. The third project is also multidisciplinary, combining biology and mechanical engineering to emulate biological actuation in human engineered devices.

Dr. James O'Reilly pursued his undergraduate studies at the University of Michigan, where he was introduced to vertebrate anatomy and biomechanics working in the laboratory of Carl Gans. He earned his MS and PhD at Northern Arizona University, where he studied the physiology and evolution of goal directed movements in amphibians under the mentorship of Kiisa Nishikawa and Stan Lindstedt. He was the recipient of the 1995 Scholander Award for best student poster at the annual meeting of American Physiological Society and was an alternate for the Miller Postdoctoral Fellowship at the University of California in 1997. He was awarded the Darwin Postdoctoral Fellowship at the University of Massachusetts in 1998 where he worked in the laboratory of Elizabeth Brainerd. After 4 years as an Assistant Professor at the University of Miami, he moved to the University of Chicago in 2005 where he joined the teaching faculty at the Pritzker School of Medicine teaching human anatomy, histology and physiology. During his time at Pritzker, he was the 5-time recipient of the L.D.H. Wood Pre-Clerkship Teaching Award. In 2015, he moved to the new Cleveland Campus of Ohio University's Heritage College of Osteopathic Medicine where he is a lecturer in the basic sciences for first and second year medical students.

Dr. Cecil Schwalbe is an Ecologist Emeritus with the U. S. Biological Survey and affiliate faculty in the School of Natural Resources and the Environment at the University of Arizona. Following a tour in Vietnam, he received a BA in mechanical engineering from Rice University, an MS from Washington State University and a PhD from the University of Arizona. He met Stan Lindstedt in graduate school at UA in 1973, where they became fast friends. He began his professional career as the first State Herpetologist with the Arizona Game and Fish Department in 1984. He was lured back to UA to establish an applied research program on amphibians and reptiles of the Southwest. He and his graduate students have conducted conservation-relevant research on many species of amphibians and reptiles, some even on sea turtles in Mexico and Japan. Much of his early research was on the ecology of the desert tortoise. His later work focused on the conservation of our native frogs. He has served on many recovery and conservation teams for vulnerable species. He strongly believes in scientists communicating their findings to the public. He and his graduate students have worked with local, state, national and international media, including Arizona Public Media, National Geographic, BBC, Discovery Channel, NPR and others. He continues giving presentations to the public and classes at UA. He is also co-teaching classes with his wife Carol in the new Science Journalism Program she created in the UA School of Journalism. He spends his leisure time photographing wildlife that visits their backyard pond near Saguaro National Park.

Douglas G. Stuart, PhD and DSc (hc), Regents Professor Emeritus of Physiology, has promulgated interdisciplinary biomedical teaching and research since joining the



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physiology faculty at the University of Arizona (UA) in 1967. First, with colleagues in anatomy and neurology, he pioneered an interdisciplinary neuroscience course for first-year medical students and graduate students when few such approaches were evident in medical education in the USA or abroad. Next he played a leading role in 1970s-1996 strategies to bring interdisciplinary invertebrate neurobiology, a learning and memory group, and biomedical engineering to the UA. In 1980-1983, he led the charge for a university-wide neuroscience group, which effort was followed by recommending in the late 1980s that his own department of physiology, which he headed at that time, to convert its PhD program into a university-wide physiological sciences program, the first such conversion in the USA. He was a co-founder, former director (1982-2003), and now the archivist (2002-present) of an informal, NIH-funded (1987-2003) statewide predoctoral and postdoctoral interdisciplinary program in movement neuroscience. This program continues to strengthen ties between the physical- and life sciences, and between the Barrow Neurological Institute in Phoenix, Arizona State University, Northern Arizona University (NAU), and the UA. He has a particular interest in NAU, which he first visited in the early winter of 1968, and where he has given many lecture and seminars, and has had many close colleagues from 1967 to the present.