Celsius–Linné Lectures 2017

Thursday 9 February,
the traditional Celsius-Linné lectures will be held in

THE SVEDBERG HALL (B8)
UPPSALA BIOMEDICAL CENTRE

14.00 – Celsius Lecture
The Remarkable Universality of Nonlinear Dynamics
John Guckenheimer

15.30 – Linné Lecture
Using rabies virus to investigate the Mind-Body Problem
Peter Strick
COELIUS LECTURE
The Remarkable Universality of Nonlinear Dynamics

JOHN GUCKENHEIMER
Professor Emeritus in Mathematics, Cornell University, USA

Dynamical systems theory discovers universal patterns of how things change in time. Its perspective is abstract, but its ability to unite seemingly unrelated phenomena is astounding. I shall introduce the mathematical principles of the subject and give examples from biomechanics, neuroscience and climate science that illustrate the power of these ideas.

Consider human locomotion. The human body resembles an upright, unstable pendulum, but toddlers learn to walk and run without falling down before they learn to talk. We can neither explain this stability nor build legged robots with agility comparable to our own. I shall describe data driven mathematical strategies to understand the dynamics of locomotion that avoid the complexity of our coupled nervous and musculoskeletal systems.

To illustrate how similar dynamical phenomena appear in unrelated systems, I shall compare dynamics in two systems from different disciplines: a neuroscience model and a reduced model for El Nino, the climate phenomenon in the tropical Pacific that affects weather globally. Multiple time scales are key to explaining why the same dynamical patterns are observed in these unrelated systems.

John Guckenheimer is professor emeritus at Cornell University. Bifurcations of dynamical systems has been a central theme in his research. He has studied applications of the theory in physics, chemistry, engineering, neuroscience, ecology and climate science. Together with Philip Holmes, he was awarded the American Mathematical Society Steele Prize for mathematical exposition for their book Nonlinear Oscillations, Dynamical Systems and Bifurcation of Vector Fields. He is a member of the American Academy of Arts and Sciences, a past president of SIAM and a fellow of SIAM, the American Mathematical Society and the AAAS. He was cochair of a National Research Council Committee that produced the 2016 report Analytic Research Foundations for the Next-Generation Electric Grid.

LINNÉ LECTURE
Using rabies virus to investigate the Mind-Body Problem

PETER L. STRICK
Distinguished Professor & Chair of Neurobiology, University of Pittsburgh, School of Medicine, USA

Modern medicine has generally viewed the concept of “psycho-somatic” disease with suspicion, partly because no neural networks were known by which the “mind,” represented in areas of the cerebral cortex, could influence internal organs. We were able to identify the areas of the primate cerebral cortex that communicate with the adrenal medulla, the inner core of the adrenal gland, by using transneuronal transport of rabies virus. The adrenal medulla is an important source of neurochemicals that are responsible for generating the “fight or flight” response to stress. Rabies virus can be used as a tracer because it is able to label networks of synaptically-connected neurons. Using this approach we found that the adrenal medulla is influenced by areas of the cerebral cortex involved in the control of movement, cognition and emotion. This means that mental operations like the preparation to move, internal conflict and strong emotions may have an effect on adrenal function. This circuitry may also be the way in which stress and depression affect organ function and give rise to some forms of psycho-somatic illness.

Peter L. Strick, Ph.D. is the Thomas Detre Professor and Chair at the Department of Neurobiology, University of Pittsburgh. He is also Scientific Director of the University of Pittsburgh Brain Institute, Director of the Systems Neuroscience Institute and Co-Director of the Center for Neuroscience, University of Pittsburgh. He gained a PhD in Anatomy in 1972 from University of Pennsylvania, and then worked at the National Institute of Mental Health and SUNY-Upstate Medical Center before moving to University of Pittsburgh in 2000. Strick’s research focuses on four major areas of brain function: the generation and control of voluntary movement by the motor areas of the cerebral cortex; the motor and cognitive functions of the basal ganglia and cerebellum; the neural basis for the mind-body connection; and unraveling the complex neural networks that comprise the central nervous system. His many major awards include membership of the American Academy of Arts and Sciences (2004) and the National Academy of Sciences (2012).

The Celsius and Linné Honorary Lectures are arranged annually by the Faculty of Science and Technology in memory of Anders Celsius and Carl von Linné (Linnaeus), world-renowned professors of Uppsala University.

Anders Celsius was appointed professor of Astronomy at Uppsala University in 1730 at the age of 28. He established the first professional astronomical observatory in Uppsala around 1740. His scientific activities included work on celestial mechanics, studies on comets and satellites, pioneering contributions to stellar photometry, to geodesy and to geophysics. He discovered that aurorae caused magnetic disturbances and he invented the temperature scale that bears his name. Anders Celsius died in 1744.

Carl von Linné was appointed professor of Medicine at Uppsala University in 1741 at the age of 34. Linne had already in 1735 declared that the two most important tasks in natural history were “classification and naming” (divisio et denominatio). His Systema naturae was published in 1735 at Leiden. Here we meet his permanent contribution to science, the naming practice, the binary nomenclature or binomial system. Linné founded the Royal Academy of Sciences, now responsible for the Nobel Prize awards, and of which he became the first president. He died in 1778.