Gait, posture, pogo-sticks and newfangled neurogenetics: How do legged animals control their locomotion?

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Abstract:

One of the grand challenges for modern science is to understand how animals (including humans!) move. Movement results from the dynamic interaction of many complex, nonlinear constituents: the nervous system, muscles, body, and an often-unpredictable external environment. Yet many animals move quickly through the environment with stability and economy surpassing our technology. This talk will present three threads of research that seek to understand different aspects of legged locomotion control: 1) comparative work in insects, dogs, and the XRL robot aimed at understanding both how and why control strategy varies with body morphology, 2) a dynamical systems approach to understanding gait, that aims to understand how the "fine structure" of experimentally observed quadrupedal gait control reflects constraints such as stability, and finally, 3) recent work that brings the new genetic tools of optogenetics and chemogenetics (DREADDs) to bear on long-standing problems in legged locomotion control, and that is finding application in spinal cord injury.

Biography:

Andrew Spence is an applied physicist by training who leads a research group in animal locomotion. As a group, we are focused on how the nervous and mechanical systems work together to produce movement, taking an integrative approach that combines experimental work with mathematical modeling, novel instrumentation, and some robotics. Andrew did his undergraduate work in physics at UC Berkeley, before doing a PhD in biomedical microdevices at Cornell University. He returned to Berkeley for a postdoc, and worked with Bob Full on the control of many-legged locomotion. Before coming to Temple University, he was a faculty member in the Structure and Motion Laboratory at the Royal Veterinary College, London. Currently his group is focused on the role of constraints (stability, energetics) in shaping quadrupedal gait control, and in applying new neurogenetic techniques to dissect the control of fast legged locomotion, and to better treat spinal cord injuries.