Research Plan

Outline:

How do organisms achieve motor control? Organisms can use a combination of muscle synergies and neural control.

* How can one explore motor control? Using *Blaberus Discoidalis*.
  + By measuring kinematic data of a *Blaberus*, one can quantify findings.
* Degrees of Freedom Problem may possibly be solved through dimensionality reduction.
  + Multiple, redundant muscles can be grouped together to achieve a specific goal.

Work of Nikolai Bernstein, who pioneered the field of biomechanics

“Insects Running on Elastic Surfaces”

“Mechanical Aspects of Legged Locomotion Control”

“Mechanics of Six-Legged Runners”

To achieve a movement, there are many ways to produce the same movement. The Degrees of freedom problem arises as a result of the numerous methods an organism has to move a certain way. For example, Bernstein observed how trained blacksmiths produce similar movements of the hammer, but different blacksmiths use different movements of their arms. The muscular construction of many organisms is redundant, but the redundancy serves to provide many ways for the brain to move. How does the brain choose which muscles to activate?

When local perturbations arise, the muscles in a limb compensate for this disturbance by moving another muscle. Redundancy proves useful in such a regard, because a specific movement can be achieved despite the presence of noise. Does the preservation of movement arise out of local variables, such as the physical properties of the limb, or external control, such as the brain obtaining feedback and responding likewise?

Goal: Obtain kinematic data from *Blaberus Discoidalis* moving through a glass box.

* These data will serve to provide a basis for creating a robotic testing platform.
  + Data will be used to corroborate robotic movement with actual roach.
* These data will help answer how *Blaberus* solves the DOF problem.
  + Analyzing how *Blaberus* moves from one point to another will provide crucial information regarding how its individual components produce an overall movement.