ME 586: Biology-Inspired Robotics
University of Washington, Autumn 2018. Instructor: Dr. Sawyer B. Fuller

Survey and paper preferences.

Please return to instructor by end of second class session

Name: __________________________________________

Part I  Survey to get a sense of the background and level of students in the class. Please mark your answers in the space provided and return to the instructor by the end of the second class session.

1. What is your department? (ME, EE, Aero, etc.) ______

2. Master’s/Ph.D. and year? (M1, M2, Phd1, etc.) ______

3. Put a check mark next to any of the courses you have already taken. Put a “C” if you are currently enrolled in the course:
   ______ ME 373/374 or equivalent (UG): Analysis of spring-mass-damper lumped-parameter dynamics
   ______ ME 471 or equivalent (UG): Feedback control theory
   ______ ME 489/599: Biomechanics of movement
   ______ CSE 571: Probabilistic robotics
   ______ EE 543/544: Kinematics of robot manipulators
   ______ AMATH/CSE 579: Intelligent control through learning and optimization
   ______ BI 427: Animal biomechanics
   ______ CSE/EE 576: Computer vision
   ______ ME599: Advanced Robotics (Instructor: Ashis Banerjee)

4. (optional) Are there specific applications of biology-inspired robot control systems concepts that you are interested in?

Part II  Please indicate the four papers, based on your interests, that you would like to present on by marking an “x” in the spaces below. These papers are available for download in the “files” section of the course’s public website.

   A conceptual investigation about how hard-to-analyze behavior forms the basis of life-like systems.


   How insects regulate their altitude above the ground using vision, without a specific sensor for distance, is not known. This paper suggests a new possible explanation that matches anecdotal evidence for how insects respond to wind.

Robots designed through artificial evolution tend to get stuck at local equilibria, limiting their performance. This paper shows that by “protecting” innovations, allowing them a number of generations to adapt to sudden changes in shape, evolution is enhanced.


Simple behaviors in the honeybee help them navigate between flowers and the hive.


This paper revealed an example of stigmergy: how animals can perform complicated tasks by storing and interacting with information encoded in the environment, e.g. parts of a nest. In concert with a series of reflexive behaviors in the animal, a sophisticated nest is formed.


A canon mounted to the back of a running cockroach reveals that it recovers from perturbation primarily by properties intrinsic to its musculoskeletal system, rather than by feedback from its nervous system.


This paper built on a classic passive dynamic walking robot result to add a more realistic 3D walking gait, partly by using swinging arms.


15. Werfel, Petersen, Nagpal, “Designing collective behavior in a termite-inspired robot construction team,” Science, 2014. Simple rules are downloaded onto a collection of termite robots that encode the design of a construction. Each robot’s interaction with the environment and the portion of the construction that has already been placed determine the shape of the final result.


A simple, reactive model that explains how bacteria can move toward a source of sugar without any sort of high-level controller or knowledge of where it is.


Scaffolding – helping the learning process by starting with a comparable but easier-to-learn initial task – can help learning to walk go faster.

The following require a background in machine learning and probability as is covered in CSE571, ME/EE 549 (Kalman filtering), or ME599 (Advanced robotics). If you request and are assigned one of the papers below, please make sure to skim it early to make sure you will be able to understand it.


This paper uses a rat-inspired minimalist mapping approach to use a single camera to build a topological map and determine where a robot car is in a suburban neighborhood.


Recent results from DeepMind: walking behavior emerges.