

## Bioinspired Design Final Project (Engn/Biol 267, winter 2020)

*[updated 10 Apr 2020 to highlight requirement of quantitative aspect in reporting]*

The final project is a “Choose your own adventure; then tell us about what you learned while exploring!” The overall trajectory of this project is to: 1) Choose a topic in bioinspired design that you find to be particularly interesting; 2) Study the biology/physiology, physics, and bioinspired human engineered systems; and 3) Develop a brief written and video summary of your chosen system (e.g. similar to articles and videos you might find on popular science websites such as [LiveScience.com](http://LiveScience.com); [Physics Today](http://Physics Today); [medicalXpress](http://medicalXpress), etc.). One or both of these summaries should include quantitative aspects connecting the biology and physics/engineering involved. That is, clearly explain the core principle and then compute some number that helps describe how the system works in physical terms. The level of rigor should be appropriate for a scientist, non-expert—think: future BioE students!

In summary, the goal of this assignment is to provide you with an opportunity to study a species and bioinspired system that you find especially interesting, properly cast in the framework of “how we do bioinspired design.”

### What Ground Your Adventure Must Cover

Your adventure must travel a path that details all the following:

- The intriguing, eye-catching property/behavior of the biological species and what technologies it might inspire. In other words, answer: “Why is this species interesting? Why should anyone care to learn from it?”
- Relevant biological/physiological structures—i.e., the form that leads to function
- First principles of physics involved and how they apply in this situation
- Human-engineered product(s) inspired by the biological species, with emphasis on the essential biological features incorporated and how they were made with human hands and machines.

### Assignment Guidelines

- Can work with up to 2 classmates (max team size = 3)
- Must synthesize (at least) 3 directly relevant journal articles

- Create two summary reports summarizing the 4 bullet points above (from “What Ground Your Adventure Must Cover”)
  - Brief illustrative video (approximately 3 to 5 min)
  - Brief (~1-2 pages) written article, including graphics and embedded videos
  - Apr 20: Live viewing party + Q&A session with the producers
  - Apr 22: Final written and video pieces due

The target audience is science-competent, non-experts in the field (i.e. fellow scientists and engineering who might be cruising the internets for interesting science stories)

### **Topic Selection and Potential Systems to Study:**

You may select a species/topic that is brand new – something we haven’t studied in class. Or you may choose to take a deeper dive into a topic that we have already touched upon in class. The instructor will consult with you before making a final selection; please don’t forge ahead until you get the all-clear for nature and scope of the project. Need some ideas where to start? See “Potential Systems to Study” below:

- [Knifefish](#): active electrosensing organs navigating in optically dark/cloudy marine environments. They are [inspiring cameras](#) to image murky marine environments too.
- [Conch shell](#): crack propagation inspiring armor
- [Mantis shrimp](#) and butterfly eye: inspiring cancer detecting cameras
- [Animal Flight](#): Bioinspired Wings for Miniature Drones
- [Wandering spider](#): vibration sensing organ inspiring the worlds most sensitive strain gauges
- [Marine swimmers](#): [Fluid dynamics](#) of swimming (applied to underwater robots)
- Beaver fur: fluid dynamics applied to textiles in cold marine environments
- Plant-based:
  - [Hogberry](#): inspiring new strain-optical sensors
  - [Cucumber tendrils](#) and [climbing plants](#): the surprising life of plants and the novel mechanical components they are inspiring
- [Bioinspiration and Biomimetics Journal](#): see the latest and greatest papers, and checkout the archives too---so much interesting work in every issue!