

Preliminary Project Proposal
ENGN/BIOL 267—Winter 2020
Due: Friday, Feb 07, 5pm

Objective

The purpose of the preliminary project proposal is to stimulate your thinking about specific projects for your bioengineering capstone project and to provide enough context/background for deciding, in consultation with the instructor, a feasible project. As such, you aren't asked to know every last detail, but the more information you can provide, the more meaningful the consultation—and the faster you'll be up and running on a project (6+ weeks seems like along time, but it will go by in the blink of an eye!).

Teams and Topic Selection

Students will collaborate together in *teams of 3 - 6 members*. There should/must be at least 2 teams pursuing each project topic ultimately selected. As one of the main objectives of this course is to stimulate interdisciplinary interaction—a “cross-pollination” of physics, engineering, biology, neuroscience—*each group must contain a mix of majors and/or expertise*.

Project Ideas and Sources of Inspiration

Projects can be in one of two forms: 1) Engineering a new device based on bioinspired engineering principles; or 2) making an original investigation into how something works (for instance, the fundamental fluid mechanics principles governing how dandelion seeds float).

The choice of topics is wide open, so long as it pertains to bioengineering¹ You might be inspired by a Planet Earth, Blue Planet, National Geographic specials, something you read in a journal of science website, some animal/insect/plant about which you've always been curious, by taking a walk in the woods or swimming in a stream. Not to bias anyone, but to throw a few ideas out there that might make for cool projects:

1. Draco lizard inspired gliding robot. Check them out here: <https://www.youtube.com/watch?v=a94DNeLh6r0>. Related, a group recently published a “flying squirrel” robot design here: <https://doi.org/10.1088/1748-3190/ab2ab7>
2. Diving Cape Gannets and hydrodynamics thereof. Check them out in action here: <https://www.youtube.com/watch?v=D8vaF16J87s> Related, a group recently used a 3-D printed model of kingfisher beaks with a droptower and accelerometers to verify the beak design is in fact the best in the biological world: <https://royalsocietypublishing.org/doi/abs/10.1098/rsif.2019.0125>

So, many possibilities, so let the creative juices flow!

In formulating your project, you should know that each project team is allotted (up to) \$100/students to help with the cost of the project. (Big thanks to generous internal grants to W&L and

¹Previous projects have included: stingray-inspired underwater robots, compressible seahorse tails, hybrid insect robots (aka cyborg grasshoppers and cockroaches); solenoid-based circular muscle jellyfish; flexible membrane bat wing; and active electro-sensing fish.

with support of the Physics-Engineering and Biology Departments!). Also, keep in mind that the IQ center (iq.wlu.edu) has some fabulous facilities (3-D printing; high speed video; 3-D motion capture; SEM), all of which are available to you!

Project Outlines

Please describe **at least two** potential research projects. For each, please do the following:

- Provide brief (approximately 1 paragraph) description of the nature of the project. What are you trying to build and/or what research question are you asking?
- Identify at least 2 relevant journal articles (two highly likely candidates may be *Journal of Experimental Biology* and *Biomimetics and Bioinspiration*, or some from the assigned or readings.) Google scholar is your friend here.
- Identify any biological test specimens you may need (if applicable). Also identify potential vendors or field sites for collection.
- Make a (preliminary) bill of materials—i.e, what do you need to implement your project? For instance, do you need to build custom electronics, or mechanical pieces, silicone rubber? Do you need any special materials chemicals? Be sure to include potential vendors of equipment, where possible. The total class budget is \approx 750-1000 dollars. So if there are 3 teams, each one will be allotted between \$250-333.
- Identify any major pieces of laboratory equipment you may need (e.g. SEM, high speed camera, 3-D printer, mechanical or electrical testing equipment, etc.). For each one, specify whether it exists on campus, or if you know of a nearby off-campus facility that may be of use.