

Potential Projects 2017-18

Note: Keep in mind, **all** your projects will involve technology, mentors, lab and/or field work, and a product for science fair by Jan/Feb 2017. No one is expected to have experience or know how to use the technology described below before you start in September. You are expected to have done background research and have an understanding as to other research that has been done in the area of interest and how your question can lead to additional information in the scientific/engineering fields.

1. **FlowCam** – FlowCam allows you to filter, sort, and characterize aquatic water samples (fresh or salt water.) The imaging can be used to create libraries of reference for organisms located in our local water sources as well as being ideal for studies related to larvae, zooplankton, phytoplankton, HABs, dinoflagellates, diatoms, algae.
2. **QwikLite and Dinoflagellates** – Dinoflagellates, single-celled phytoplankton, are one of the most important organisms in the ocean. Qwiklite technology is one of the most important instruments in our lab. For several years, it has been a work-horse for allowing us to analyze bioluminescence (light produced by living organisms – yes, dinoflagellates). These projects involve various species of dinos, maintaining cultures in the lab, and the analysis of light production in response to exposure to metals, toxins, environmental variables.
3. **CDOM, chlorophyll, fluorescence for Stream/River Studies** – For several years we have been involved with Potomac River and local stream analysis. Last year, a new outreach was started in collaboration with Bowdoin College in Maine. Sam Hoegle, TJ grad and current junior at Bowdoin, is including us in her and her professor's NASA funded study related to measuring colored dissolved organic matter in local streams. The stream last year was Scott's Run in Great Falls. We would like to continue the study this year as well as expand the study to include more sites/more streams. Our probes and meters for analysis come from **Turner Designs**. We can analyze, just like the universities, using our probes which can be taken right into the field for analysis. This is a great way to have your data applicable to a larger, long term study, that you could even continue in college. We are really just at the starting stages for this so it's a great baseline study. We want to include new sites this year. You must be willing to go into the field, miss some school (if needed) and Skype with Sam once a month. Great project for partners of two or three.
4. **Autonomous Underwater Vehicles - AUVs** – This project has been evolving over several years. Typically this project has a mentor in the class working with the students. This is a design/engineering/application project. You will learn skills such as how to design using a CAD program, print a design using a 3-D printer in our lab, and build an underwater autonomous vehicle to collect data. (I personally went to an AUV jubilee in Ocean Springs Mississippi this summer and will be presenting on that when we return.) This project typically involves attending poster presentations locally at professional conferences and may involve a trip to Rutgers University to visit the COOL room in New Jersey as a field trip. This is a perfect group project or several group projects. AUV data is also remotely available by satellite. Data already available for analysis! Each year between seven and ten students are involved in this effort.

5. **Pyroscience** – is a new technology that allows you to measure responses of living organisms as measured by use of oxygen/carbon dioxide production. Using fiber optic technology, it has important applications in microprofiling, respirometry, and photosynthesis research. Using the Picolo2, it would be ideal for metabolism studies of small invertebrates such as anemones, worms, oysters, microbial mats or activity in a stratified water column.
6. **Aquaculture - Oysters** – They are one of the most studied and ecologically important invertebrates in the bay. There is no lack of information on this keystone species that exists along both the East and West coast. We were successful last year in growing them from 1mm larva. Any project with oysters involves culturing the algae to feed them as well. We have four species of algae growing in the lab now. A former TJ grad has a separate document related to ideas for projects.
7. **CAPMON – Computer Assisted Physiological Monitoring** – This is an instrument that was developed to measure the heart rate of invertebrates such as mussels and crabs. It translates the movement of hemolymph into heartbeats/min.
8. **SONAR, VIDEORAY, DJI Drone** – These pieces of technology have great imaging capabilities. They are used in the field and data is analyzed on the computer. Although they (SONAR and VideoRay) can be used from a dock, a boat would be the only way to access sites for some project work. Boats are possible as long as the date can be arranged. The drone can only be used in certain locations due to FAA restrictions. We had a great project last year looking at oyster reefs in the Delaware Bay using the SONAR for analysis of shape as well as biodiversity.
9. **PCR – Biotechnology in Marine Biology** – We have a new PCR for those interested in working in the field of molecular ecology. One example of how we have used this in the past is the detection of *Wolbachia*, a bacterial parasite, we discovered in aquatic macroinvertebrates. Discover the microbes within. There are lots of links to interesting questions related to *Wolbachia*. Lot's of Darwinian types of questions can be investigated by the well -designed science project.
10. **Aquaculture- Coral** – Last year we started a project on coral growth. We were successful with soft corals. This is may be continued this year but only with a project that maintains the same set up as last year. Only projects related to enhancement of corals are possible. This requires culturing the food to feed the corals as well (brine shrimp).

Please note:

- It may have occurred to you by now, that many of the ideas overlap and can use multiple technologies for analysis. For example, you can image water samples as well as do DNA analysis on them.
- You may also be aware of many other subjects that we have investigated. Aiptasia, jellyfish polyps, shrimp, barnacles, pollen, meteorology, oil spill spectral analysis, etc. Oceanography and Geophysical Systems are very interdisciplinary fields of study. Some of you have already written to me with very specific ideas and mentors that you are working with. Those with summer mentors and projects are encouraged to continue those and build on them. Partner

projects are encouraged but groups cannot be larger than three individuals. **Partners must be in the same class period.**