Capturing Student Interest Through Introduction of Faculty-Led Research Projects in the First-Year Labs

• Early engagement in research has been shown to increase student motivation as well as recruitment and retention into STEM fields.

• UROP is great! But is limited in scale (ca ~1500 students/yr).

**Project Goal:** To expose a larger and broader group of students to research at an earlier age through introduction of faculty-led research projects in the 1st year labs.
Project Team and Details

- Funded by HHMI – $1.5 million over five years.

- PI: Deborah Goldberg (EEB)

- Co-PIs: Joanna Millunchick (MSE), John Wolfe (Chemistry), Tim McKay (Physics), Tom Schmidt (EEB & Internal Medicine)

- Research Project Leaders: Stephen Maldonado (Chem 125), Kerri Pratt (Chem 125), Tom Schmidt (Bio 173), Lut Raskin (Bio 173).


- Additional projects and/or lab sections will be added each year to reach a target of 12 sections per course by year five (>960 students/yr).
The Hard Questions

• Can we find research projects that would be appropriate for inexperienced students, but would also allow them to truly make a contribution to that field of research?

• Will these projects fulfill the primary/traditional course goals such that students are able to move on to advanced courses in the field?

• What happens in year two (or three, or four)? Can scientific sustainability be achieved?
The educational objective is to teach basic chemical skills/understanding (e.g. precipitation, stoichiometry, mass measurement, light absorption, electrochemistry) for the stated purpose of learning how to make thin film photovoltaic devices.

- Organometallic perovskite thin film devices can be prepared by simple reactions.

- Assembly of thin film devices is all benchtop and within the capabilities of freshman non-majors (Maldonado has previously taught analogous assembly and testing to 8th graders).

- The research objective is to perform valuable ‘Edisonian’ tests on device permutations of interest to the scientific community. The students will test various formulations. The data will be collected and disseminated.
• **Goal:** Analyze snow samples to examine: 1) the influences of road salts and vehicle combustion on snow collected in Michigan and 2) the impacts of changing sea ice conditions due to Arctic climate change for snow collected in Alaska

• **Laboratory Measurements:** Students will measure snow pH, UV-Visible absorption spectra, and concentrations of inorganic anions and cations

• **Fundamentals:** acids, bases, salts, buffering, solution concentrations

• **Contributions to Original Research:** Assessment of snow chemistry conditions and potential for photochemical reactions impacting atmospheric composition in an urban mid-latitude location compared to the Arctic
Can we use the composition of the gut microbiome to predict the impact of fiber supplementation on butyrate production?

→ Students will characterize their own gut bacteria and measure the activity of their own microbiome

→ Students will examine the influence of dietary fiber supplements on the composition and activity of their microbiome

→ Students can serve a dual role as both researchers and subjects
How does one make year two different (is year one original, but after that is the answer “known” to subsequent students)?

• Research projects will evolve (and end) naturally – just like in our research labs.

• New research projects led by new faculty will be introduced as is necessary or desirable.