Bioaccumulation and biosorption of Platinum Group Elements by marine macroalgae: Assessing macroalgae as indicators of pollution and for potential recovery of critical elements in estuaries.

Mentor(s)
Kayla Kurtz (Environmental Engineering, URI)

Location
University of Rhode Island

Abstract
This project will design and test a protocol for assessing the abundance of Platinum Group Elements (PGEs)in macroalgal indicator species in the Narragansett Bay Estuary. PGEs (platinum, rhodium, and other related metals) are considered "critical elements", are very rare, and are used in many industrial settings including in electronics, catalytic convertors, and the refining of crude oil (among others). Additionally, they are known environmental pollutants and their entry into waterways via stormwater runoff has been well established. However, our knowledge of the concentration of PGEs in Narragansett Bay estuary waterways, and, in turn, their concentrations in estuarine organisms, is very limited. Recent studies have shown the ability of macroalgae to absorb PGEs (Abdou, et al. 2023; Pinto, et al. 2021; Rauch and Morrison 2008; Turner, et al. 2007). Thus, the ability of macroalgae to accumulate these compounds can make them attractive targets for recovering these very rare, critical elements. Here, we propose using the model species *Ulva* (green macroalgae) and *Gracilaria* (red macroalgae) in the highly urbanized Narragansett Bay Estuary to determine the concentrations of PGEs in Narragansett Bay to: 1) support the Blue Economy in Rhode Island by assessing the capability of local macroalgae to accumulate rare, critical elements; and 2) determine the prevalence of these known environmental pollutants in our waterways. This project will entail field collection of the macroalgae from various locations throughout the Narragansett Bay, laboratory research (with a focus on environmental engineering, marine ecology, and analytical chemistry), data analysis, and science communication.

Project Objectives
Our proposed research plan has two main objectives:

1. Establish the best protocol for determination and quantification of PGEs (platinum and rhodium) from macroalgae in the Narragansett Bay Estuary; and
2. Assess the concentrations of PGEs in macroalgae in this estuary across spatial and temporal frameworks.

For both objectives, we will use the rapidly growing *Ulva* (green macroalgae) and *Gracilaria* (red macroalgae) that occur throughout this estuary (Thornber, et al. 2017) and similar temperate estuaries worldwide. We will utilize the known pollution gradient in Narragansett Bay from North (high) to South (low) to assess the distribution of PGEs from highly impacted areas and their downstream counterparts (Oczkowski, et al. 2018). We will then share the findings of our research with the scientific community via presentations and other science communication tools (e.g., ArcGIS StoryMaps).