# Using an Arduino-Controlled Tide Simulator to Selectively Breed Ulva lactuca for Increased Lignin Content

Cooke, Veronica (School: West Salem High School)

Carbon sequestration is a key part of climate change mitigation efforts. Plants naturally pull carbon dioxide from the atmosphere during photosynthesis, but when they decompose, the CO2 is released back into the atmosphere (the carbon cycle). Blue Carbon or BC ecosystems in the ocean break the carbon cycle by producing sediments that naturally sequester carbon. When dead macroalgae are buried in the sediments of BC ecosystems, they are called carbon donors because the carbon in their biomass that was accumulated during photosynthesis is donated to the carbon that has already been sequestered in the BC ecosystem. However, macroalgae often decompose before being buried in the sediments. Therefore, it would be beneficial to produce a strain of macroalgae that is resistant to decomposition. The purpose of this research was to selectively breed Ulva lactuca, also called sea lettuce, to have higher lignin content, making it more resistant to decomposition. To selectively breed the sea lettuce, a tide simulator was engineered because Ulva lactuca produce their reproductive spores or gametes by following tide patterns. 20 individual Ulva lactuca organisms were used in the parent generation, and their lignin content was measured using a phloroglucinol-HCl stain. It was hypothesized that after 15 days in the tide simulator, the sea lettuce would produce spores or gametes. However, it was on the 17th day that all ten of the sea lettuce individuals with the highest lignin content showed signs of reproduction: either developing or empty gametangia or motile gametes. This evidence suggests that the tide simulator was effective in promoting the production of gametes. The gametes from the individuals with the ten highest lignin contents were used to grow the next generation.

**Awards Won:**