Improving Coccolithophore (Emiliania huxleyi) Tolerance to Ocean Acidification Through Artificial Directional Selection

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Ocean acidification is the increase in acidity of ocean waters due to the absorption of CO2 from the atmosphere. This negatively impacts many marine organisms, especially those that build calcium carbonate structures, including coccolithophores. Coccolithophores are unicellular calcifying phytoplankton that contribute greatly to the global carbon cycle through carbon sequestration. Due to ocean acidification adversely affecting coccolithophores' calcification and development, the goal of this experiment is to push coccolithophores to become more adapted to acidified ocean conditions. It was hypothesized that they could be artificially bred for tolerance. This was done through maintaining coccolithophore cultures, and gradually increasing the acidity. Tolerance was assessed through transferring coccolithophores to new pHs (control 8.15, 7.5, and 6.83), and measuring relative performance and growth. It was found that in the 7.5 cultures, the artificially selected coccolithophores grew and calcified more than the control cultures. They also performed better than the controls in the 6.83 cultures. This supports the hypothesis by suggesting that the selected coccolithophores are better adapted than the controls to more acidic conditions. It was also found that the selected coccolithophores are less tolerant of typical ocean pH than more acidic pH. This study is significant because it predicts coccolithophores' roles in future oceanic conditions. Because coccolithophores are likely able to adapt to ocean acidification, their globally important roles in biogeochemical processes will further aid in removing carbon and storing it in the deep ocean, lessening the negative effects of ocean acidification, and positively impacting the environment.

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