A Genetic Analysis of Solar-Powered Sea Slugs

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Elysia crispata, commonly known as the Lettuce Sea Slug, is a member of Sacoglossa- a superorder of marine gastropods that separate chloroplasts from consumed algae, gaining the ability to photosynthesize. Several species, like E. crispata, can maintain functioning chloroplasts for extended periods; however, the mechanics behind the extended retention are unknown. The leading theories are sacoglossans a) perform lateral gene transfer with the algae, or b) possess adaptations to protect chloroplasts from overexposure to light, like non-photochemical quenching (NPQ). The goal was to determine if sacoglossan sea slugs utilize lateral gene transfer or NPQ to maintain chloroplasts for extended periods through genetic analysis. The genes CemA and PsbO were sought as evidence of lateral gene transfer. PsbS was sought as evidence of adaptations intended to reduce light damage. DNA was extracted from E. crispata and Ulva lactuca (an algae eaten by E. crispata), and the desired genes amplified using polymerase chain reaction (PCR). Agarose gel electrophoresis was run on the PCR products and with a color gradient, the results were compared against negative controls, consisting of all PCR components but the DNA template. Neither visual nor numerical analysis of electrophoresis revealed a significant difference between the negative control and the CemA and PsbS samples, indicating that the specific sequences of CemA and PsbS are present in neither sample. Differentially encoded genes that carry out the same processes could still be present in either sample genome. DNA extraction yield and DNA stain sensitivity were low. These limitations may have impacted results.