Molecular stress response in polar algae

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Geographical and vertical distribution patterns of macroalgae are constrained by abiotic factors such as light, including UVR and temperature. Hence, future global environmental changes could have a significant impact on geographic and vertical distribution patterns, as well as primary productivity. Polar waters are particularly vulnerable to warming but also to ocean acidification due to the increased solubility of CO_2 in cold waters.
Many studies have been conducted on the growth and photosynthetic performance of macroalgae under manifold stresses, yet the involved molecular processes of acclimation and adaption are still poorly understood. To compare molecular acclimation mechanisms in polar macroalgae, gene expression under abiotic stress has been investigated in an Arctic species, *Saccharina latissima*, and an Antarctic species, *Desmarestia anceps*.
Both species response to abiotic stress with a multitude of transcriptional changes, but show different acclimation strategies. Critical components of acclimation mechanisms in *Saccharina latissima* are the differential regulation of photosynthetic components, ROS scavenging and carbohydrate metabolism, *Desmarestia anceps* on the contrary shows a high constitutive expression of the latter. Main components of molecular acclimation mechanisms to light and temperature stress in *Desmarestia anceps* include induction of protein and lipid modification processes for maintaining membrane and protein function. The high constitutive expression of several metabolism types in *Desmarestia anceps* might be due to the strong adaption to cold environments. However, as high constitutive gene expression requires extra energy, this lack of genetic regulation might display a disadvantage with respect to cosmopolitan eurythermic species in near-future scenarios.