

4. The role of oxidative stress in setting thermal tolerance limits in *Mytilus*

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Increasing temperatures accelerate the flux through the electron transport chain and thereby increase the production of reactive oxygen species (ROS). We tested the role of temperature in causing oxidative stress in mussel species (genus *Mytilus*) that differ in thermal tolerance by comparing their proteomic response to acute heat stress. A quantitative proteomic analysis, using 2D gel electrophoresis and mass spectrometry, showed that the two congeners, the warm-adapted *M. galloprovincialis* and the cold-adapted *M. trossulus*, show broad similarities in their response to acute exposure to 24 °C, 28 °C and 32 °C and a 24 h recovery at 13 °C (control). However, changes in protein levels suggest that the highest exposure temperature causes a switch from ROS-generating NADH-producing pathways to NADPH-producing pathways that can scavenge ROS in the cold- but not the warm-adapted species. Reduced levels of oxidative stress proteins in the cold-adapted *M. trossulus* accompany these changes, suggesting that a limited response to ROS production may cause these changes. Lower levels of a NAD-dependent deacetylase (sirtuin-2), an indicator of cellular lifespan, in *M. trossulus* suggest that these changes may in part be caused by modifications in the acetylation status of proteins. Additional interspecific differences in levels of proteins involved in molecular chaperoning, proteolysis and cytoskeleton suggest several new hypotheses on cellular processes limiting thermal tolerance.