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SESSION C. Room: Theatre Cerise 16.20-17.20 hrs

Determining physiological responses of mussels (Mytilus edulis) to hypoxia by combining multiple sensor techniques

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Intertidal bivalves survive longer without oxygen when aerially exposed during low tide than when submerged in hypoxic water. To understand this, we combined three biosensors to continuously monitor responses of individual blue mussels (*Mytilus edulis*) to aerial exposure in simulated low-tide conditions and during aqueous hypoxia. A valve sensor, heart rate monitor, and an in-shell oxygen microsensor simultaneously recorded behavioural and physiological responses. During aerial exposure, all individuals immediately closed their valves, rapidly depleted in-shell oxygen, and decreased their heart rate. This suggested a shift to anaerobic metabolism and reduced activity to save energy and survive in-shell anoxia during 'low tide' conditions. At the onset of hypoxic (<1mg/L oxygen) water, however, all mussels fully opened their valves, with 75% of the individuals increasing valve activity for at least one hour, possibly in an attempt to collect more oxygen by increasing filtration activity. Only 25% of the mussels closed their valves after about 40 minutes of aqueous hypoxia, shifting to the energy efficient strategy used during aerial exposure. As most individuals remained open during hypoxia, a mussel does not appear to need to close its valve to begin the transition to anaerobic metabolism. Responses to aerial exposure was uniform across individuals, whereas inter-individual variation was high for aqueous hypoxia. Differences in energy expenditure during these different types of exposures likely explains why most mussels can survive longer during exposure to air compared to aqueous hypoxia, a situation that could occur under situations of elevated temperature in waters with high nutrient loads.