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A proteomic analysis of temperature acclimation and heat stress in blue mussel (*Mytilus*) congeners

The blue mussel *Mytilus galloprovincialis* (M.g.) is invasive along the southern California coast, and has displaced the native *M. trossulus* (M.t.) there. Physiological and biochemical evidence suggest that M.g. may out-compete M.t. due to relative warm adaptation. Here, we use a proteomics approach to examine the cellular responses of gill from the two species to acclimation temperature (7 or 13C) followed by acute heat shock (HS; 32C). Using two-dimensional electrophoresis, in-gel digestion and mass spectrometry, we have found that the two species respond to acclimation and to HS differently. We identified a series of HS protein (HSP) 70 isoforms that are up-regulated significantly (ANOVA; $p < 0.05$) in M.g. after HS, whether acclimated to 7 or 13C. The same isoforms are up-regulated after HS in M.t. acclimated to 7C, but they are not up-regulated after HS in M.t. acclimated to 13C. In acclimated animals that did not experience HS, M.t. acclimated to 13C have higher levels of HSP70s than do M.g. acclimated to 13C. Levels are similar in M.g. acclimated to 7 or 13C, and M.t. acclimated to 7C. We have also identified four HSP24 isoforms in both species, two of which are expressed in a pattern similar to that of HSP70s. The other two HSP24s, while showing up-regulation after HS in M.g. acclimated to 13C, show no response in M.t. to HS at either acclimation temperature. These results suggest that M.g. produces a more robust HS response than M.t. after acclimation to 13C, and that the response of M.t. to acclimation at 7C is in some ways similar to the response of M.g. at 13C. Currently, we are using the expression profiles of HSP70 and HSP24 isoforms in the two species to search for other proteins that also are up-regulated in response to acclimation or HS.

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Silk filaments facilitate larval dispersal through freshwater stream pools

For species that use ambient flow to facilitate dispersal, the heterogeneous nature of the lotic environment can have serious fitness consequences. For non-swimming larvae such as those of the black fly *Simulium tribulatum*, the presence of large regions of slow flow (pools) may impede downstream movement and act as a sink, limiting population size and spatial distributions. Extended time spent in pool habitat increases predation and greatly reduces feeding opportunities. *S. tribulatum* may, however, use silk threads, already known to aid settlement in riffles, to increase their chances of successfully transiting pools by reducing fall velocity and/or increasing the chance of resuspension after deposition. In this study we employ video analysis to determine the fall velocity of larvae both with and without naturally produced silk threads. In addition we measure the drag forces exerted on larvae both with and without silk threads under simulated pool-bed flow conditions using scale models. We find that the presence of silk caused a significant reduction in fall velocity ranging from ~50% for the smallest neonates (0.6mm) to ~20% for the largest (7mm) late-instar larvae. In addition, analysis of the scale models revealed that the presence of silk threads should significantly increase the drag force exerted on larvae already settled to the bed. This drag should increase the chance that larvae are resuspended from the bed, allowing them to continue their downstream transport. The combined effect should be to increase the chances for all larvae to successfully transit unsuitable pool habitat. However, the success rate should be much greater for the youngest/smallest larvae and may be important in determining the spatial and demographic distributions of larval populations.

91.5 FILL, J.F.*; KLUG, P.; SANDERCOCK, B.K.; University of Massachusetts Amherst, Kansas State University; jfill@student.umass.edu
The Influence of Habitat Variation on Snake Body Temperature and Behavior on Konza Prairie

An understanding of how snake behavior is influenced by tallgrass prairie management (burning and grazing) is critical in understanding how these animals will respond to the anthropogenic changes to the ecosystem, and how this may affect their predatory relationship with grassland birds. My objective was to investigate the influence of burning and grazing on snake behavior. To do this I looked at the relationship between snake body temperature and habitat structure resulting from experimental grazing and burning treatments on Konza Prairie. I radiotracked yellow-bellied racers (*Coluber constrictor*) and Great Plains ratsnakes (*Pantherophis emoryi*) on Konza Prairie from June to August, recording body temperature and both watershed (treatment type) and habitat at each location. ANOVA results showed that body temperature differed significantly between species ($P < 0.0001$) and within each species it differed among snakes located in grassland, edge, forest, and shrubby draws (ratsnake: $P = 0.02$ and racer: $P = 0.0036$). Contrary to the expected habitat associations of racers with grassland and ratsnakes with edge (based on preferred body temperature of the species), I found racers using shrubby draws more often in less frequently burned areas while ratsnakes exhibited no outstanding trend. Based on the correlation between body and litter temperatures in the racer ($r^2 = 0.48$) and between body and under-rock temperatures in the ratsnake ($r^2 = 0.50$), I conclude that behavioral use of habitat in the racer is more strongly affected by management due to alteration of substrate by burning. While differences in use of macrohabitats may also be a result of foraging strategy, availability of macrohabitat, or predator avoidance, these results represent a reaction to alteration of the landscape that may have important implications for biodiversity conservation.

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Genetic links? Comparing metabolizing enzymes and efflux transporters in domestic animals

Domestication of large herbivorous mammals has turned a significant part of the world into monocultures of selected monocotyledonous plant species. The basis for selection of these plant species was their nutritional value and the absence of toxic secondary plant metabolites. Several of these secondary plant metabolites, however, fulfill an important role in the mammalian organism as determinants of the gastro-intestinal flora, as natural inducers of protective efflux transporters (ABC transporters) and detoxifying enzymes. Efflux transporters and biotransformation enzymes are highly conserved and expressed in virtually all prokaryotic and eukaryotic organisms. They are closely linked to essential physiological functions including for example the inactivation of endogenous signaling molecules such as hormones and neurotransmitters, thereby fulfilling an indispensable role in the homeostasis. At the same time they are an essential part of the innate defense system against exposure to toxic substances. Both systems reflect species-specific adaptive traits and dietary preferences in the given habitat, resulting in unexpected differences in the expression pattern of transporters and enzymes in apparently related animal species, such as for example the suborder ruminants. Various lines of evidence suggest that in the absence of challenge exerted by diverse secondary plant metabolites in herbivores reduces the competence to cope with accidental exposures to natural toxins, environmental pollutants and even therapeutic agents. At the same time the strategic use of plant extracts or formulations is increasingly recognized as a therapeutic principle to regain homeostasis and to improve the overall resistance of animals to environmental challenges.