UNDERSTANDING THE INTERACTIONS OF DIET AND LIGHTING ON FROGS AND THEIR SYMBIOTIC BACTERIA TO IMPROVE EX SITU HUSBANDRY OF AMPHIBIANS

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Abstract

Amphibians are undergoing massive population declines in the wild, in part due to infectious diseases including chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (Bd). In response, amphibian populations are being maintained in ex situ breeding programs while viable treatments for chytridiomycosis are developed. One potential action involves the use of symbiotic bacteria from the skin of amphibians; however multiple factors likely affect the success of such probiotic applications. Disturbances in the natural microbiota of amphibians may alter individual susceptibility to pathogens and disrupt any probiotic treatments that may have previously been applied. Studies have found wild populations of amphibians show large variation in bacterial communities according to host species and location, thus conservation efforts may require baseline data for specific species and populations. The bacterial community of an individual is influenced by its biotic and abiotic environment, and amphibians in the wild receive relatively high exposure to bacteria through environmental and conspecific interactions. Conversely, the captive environment likely provides lower environmental heterogeneity and reduced conspecific interactions, potentially resulting in lower exposure to bacteria. Therefore there may be species- and institution-specific responses of the amphibian microbiota to the captive environment. Varying dietary and environmental conditions provided in captivity may also lead to differences in the microbial community, potentially leaving captive amphibians with compromised immunity to infectious diseases, such as the fungal pathogen *Batrachochytrium dendrobatidis* (Bd), which could be particularly significant for populations intended for reintroduction. The development of treatments against Bd will need to consider a range of complexities regarding the microbial ecology of symbiotic bacterial communities on the skin of amphibians, particularly in the context host-microbe-environment interactions. The purpose of this research was to determine the impact of husbandry practices on symbiotic bacterial communities of frogs maintained at Chester Zoo and the University of Manchester. Specifically, the research aimed to:

1) investigate the effect of a carotenoid-rich diet on symbiotic bacterial communities of red-eyed tree frogs, and

2) assess the effects of varying ultraviolet light provision and calcium diets on growth, body condition and symbiotic bacterial communities of red-eyed tree frogs.

No effects of either UV treatment or calcium diet on growth or body condition of frogs were found. Specific dietary conditions (carotenoid availability) in captivity were found to alter the

symbiotic bacterial communities associated with the frogs' skin, whereas others (UV and calcium availability) have no effect although subsequent to the UV boost, frogs had a significantly greater fungal load in comparison to frogs that were not UV-boosted (Antwis et al., 2014a; 2014b). Thus, feeding and UV provision may influence the successful establishment of probiotics and affect the suitability of captive populations for reintroduction into the wild. In summary, host-microbe-environment interactions were identified pertinent to developing treatments for Bd and chytridiomycosis. At Chester Zoo, by gut-loading their cricket prey items, frogs are fed a carotenoid-enriched diet to enhance the skin color and promote species richness and abundance of cutaneous bacterial community. Boosting baseline UV light provision had no effect on growth, breeding success or symbiotic bacterial communities in these two species, and this costly addition to husbandry protocols has been stopped. Whether these bacterial changes increase susceptibility of amphibians to infectious disease is unknown and warrants further study.

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Literature Cited

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