Investigation of UV reflectance patterns off the scales of *Carrasius Auratus* as an important factor for female mate choice.

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Normally, steroid hormones have been understood to affect behaviour by turning genes on and off. A simple illustration of this is puberty. A rise in steroid hormone levels in teenagers during puberty changes the way boys interact with and perceive girls. This method of action is very slow and typically takes a few hours or days in Goldfish but can take up to several years in other species (as is the case with teenagers and puberty). Recently, a rise in steroid hormone levels has been seen to change cell structure and behaviour in as little as a few minutes in several species including rats, birds and fish\(^1,2,3\). This effect is too quick to be a genomic mechanism and is indeed unaffected by chemicals that prevent genes from being activated.

It is thought that high levels of hormone may be affecting sensory processing in Goldfish precipitating heightened behavioural responses to sensory stimuli. However, the external triggers that cause this rise in hormone levels are unknown. In other words, what cues in the mating environment cause the surge of internal hormone levels in the fish? What aspects of the opposite sex are they paying attention to? We do know that Goldfish can see the primary colours and also have a type of cone cell in their eyes that is maximally sensitive to ultraviolet (UV) light (356nm)\(^4\). Goldfish do not really change colour with age or sex so it is thought that the UV reflectance patterns off their scales is what the fish use to distinguish one another and hence is what they would pay attention to in a reproductive situation.

My summer was spent exploring this idea. Old research in the Thompson lab showed that males were much more reflective than females hence we performed behavioral approach tests in which females are presented with a UV reflective male and a non-UV reflective male. The latter case is created using a plexiglass stimulus chamber that cuts off all UV light. Both the ambient light and chemical conditions were varied. We found that in an unaltered chemical environment, there is no significant preference shown regardless of light intensity. There is also no significant preference when the test fish were *either* injected with lutalyse (*a* chemical that induces high levels of circulating hormone – mimicking reproductive situations) prior to testing or exposed to the male pheromone Androstenidione (AD) during the test. However females that underwent both *pre*-test lutalyse injections and pheromone exposure during the test showed a significant preference for the UV reflective male at lower ambient light intensities. Goldfish are known to mate early in the morning under lower light intensities, thus these results suggest that UV reflectance patterns off the scales of sexually mature males may be an important visual cue for female mate choice in a natural setting.

However ‘lower intensities’ simply implied a low power output setting on the bulbs used. In an attempt to be quantitatively rigorous about connecting the Goldfish’s behaviour to the wavelengths they perceived, I worked with Prof. Msall of the Physics department to perform spectroscopy measurements on the light source at different power outputs. Spectroscopy will provide a comprehensive list of wavelengths present in the light and their relative intensities at a particular output setting. Performing these measurements on the bulbs we used to perform behavioural experiments will provide a much clearer understanding of the role of UV reflectances with regard to mate choice.

Unfortunately, I was unable to complete this part of the project in the allotted time as calibration of the equipment turned out to be quite a struggle. However I intend to complete the work in the fall and once complete we will be able to more rigorously corroborate or debunk the hypothesis that UV reflectance patterns are an important visual cue with regard to mate choice.
Works Cited:

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