How visual systems are adapted to their environments

Supervisory team:
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Project description:
Vision is the principal sensory modality used by the majority of animals to access information about the environment. While there are many specific examples of how visual systems show distinct adaptations to light environments, one of the biggest questions in the field of vision science has remained unanswered for the last 60 years. Why have very different spectral and polarization sensitivities and different acuities evolved in animals that occupy very similar light environments and show similar behaviours?

We have recently developed a new method for understanding the fitness consequences of different adaptations in different visual systems. This provides a new way of answering this major question and goes beyond the current state-of-the-art approaches. Using the foundations of information theory, we can determine the reliability of visual information based on an animal's visual system and link this to their neurophysiological and behavioural ecology.
This PhD therefore has significant scope for new discoveries and will have plenty of opportunities to be tailored to the PhD student's interests, particularly around the type of animals, habitat and light environments to be studied. For example, an exciting direction would be working on coral reefs to understand the diversity of different fish visual systems compared to cephalopods and crustaceans that they cohabit the reef with. Similarly, studying the adaptations to the visual cues that animals use for navigation would provide a genuinely new understanding of matched filter design and why small differences in spectral sensitivities have been selected for in closely related animals.

The PhD will be based in the Ecology of Vision Group at the University of Bristol with access to a number of our established field sites around the world, including the Great Barrier Reef and the French Pyrenees. An exciting part of this work will be undertaking field-based spectral and polarization light measurements, providing detailed information on both temporal and spatial variations in the light environments. Analyses will then be able to be completed in Bristol.

A valuable outcome of this work centers on our changing planet. Changes to an animal's visual environment, due to climate change or anthropogenic sensory pollutants, can have significant consequences for animal survival. This study will be a foundation for understanding the resilience of visual systems to changing light environments.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.