In silico **modelling of the evolutionary capabilities and constraints of pigment pattern formation in the diverse teleost genus, *Danio***

Lead Supervisor: Prof Robert Kelsh, Department of Biology & Biochemistry

Project description:

Evolution is popularly believed to be a gradual process typified by slow morphological change. In fact, the rate of change is highly variable, and can sometimes be very fast indeed. How are such rapid changes in morphology achieved? Pigment patterns are biologically vital for both camouflage and sexual signalling, yet can differ markedly between sister species (those species pairs with the most recent divergences). We have developed a biologically realistic in silico representation of pigment stripe formation in the vertebrate developmental model zebrafish, Danio rerio. Our computer model successfully simulates the patterns seen in wild-type fish (stripes), but also patterns in fishes with a number of mutations (thinner/thicker stripes and a diversity of spot patterns). Other species of Danio show a rich variety of other pigment patterns, and we believe that these have all evolved by modifying an otherwise conserved pattern formation process. Comprehensive exploration of our in silico model to simulate such changes will allow comparison of the model's outputs to the patterns seen in real fish. Thus, we will identify the likely cellular bases for pattern diversification.

Candidate:

Applicants should hold, or expect to receive, a First Class or high Upper Second Class UK Honours degree (or the equivalent qualification gained outside the UK) in a relevant subject. A master's level qualification would also be advantageous. They should be excited by the prospect of utilising an interdisciplinary approach to explore a fundamental question in evolutionary biology.

Applications:

Informal enquiries should be directed to Prof Robert Kelsh, bssrnk@bath.ac.uk.

Formal applications should be made via the University of Bath's online application form.

On the application form, please ensure that you quote 'Evolution Education Trust' in the Finance section and the supervisor's name and project title in the 'Your research interests' section. Should you wish to be considered for more than project, quote the projects in order of preference and upload a separate personal statement relevant to each one.

Please see our Doctoral College website for more information on how to apply for a PhD at Bath.

Application deadline: 30 April 2019.

Interviews will take place in Bath on 14 June 2019.

Anticipated start date: 30 September 2019.

References:
Owen, J., Kelsh, R.N. and Yates, C.A. *A quantitative modelling approach to in vivo zebrafish pigmentation patterning.* In prep.

Quigley, I.K., et al., (2004) *Pigment pattern evolution by differential deployment of neural crest and post-embryonic melanophore lineages in Danio fishes.* Development 131, 6053-6069

Mort, R.; Ross, R.; Hainey, K.; Harrison, O.; Keighren, M.; Landini, G.; Baker, R.; Painter, K.; Jackson, I. & Yates, C. (2016). *Reconciling diverse mammalian pigmentation patterns with a fundamental mathematical model.* Nat. Commun., 7, 10288