

Targeted Project / AY 2023 -2024

Neural crest cell evolution in cichlid fishes

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Research area: Evolutionary and developmental biology

Project outline:

Multiple vertebrate morphologies derive from the neural crest (NC), a cell population that migrates to different embryonic regions and differentiates into different cells and tissues (e.g. craniofacial skeleton and pigment cells). Most work has focused on the mechanisms associated with the emergence of these vertebrate innovations. The subsequent evolution and diversification of the NC, including its role in generating diversity between closely related species has received less attention. Here, we will uncover the genetic and development mechanisms underlying variation in neural crest cell behavior in Malawi cichlid fishes.

Malawi cichlids are a hyperdiverse vertebrate group (~850 species) and despite their close relatedness (0.2% nucleotide divergence), they show extreme morphological diversity akin to a “mutagenetic screen”. We have recently shown that *sox10* expression – a NC migration marker – varies dramatically between species, suggesting that NC variability in early embryogenesis underlies craniofacial and pigmentation diversity in closely related species. Furthermore, we found that several genes involved in NC development show signatures of divergent selection across the Malawi radiation.

To identify genes and developmental processes associated with NC divergence, we will: a) generate *sox10*:GFP reporter lines in two divergent cichlid species to compare NC migratory patterns in vivo; and b) perform comparative single cell transcriptomics and chromatin accessibility assays to uncover which NC cellular derivatives and regulatory modules are diverging between closely related species. Taken together, this project will uncover genetic, cellular and developmental mechanisms underlying the evolution of neural crest cells in one of the most diverse vertebrate groups.

BBSRC DTP main strategic theme: Understanding the rules of life

BBSRC DTP secondary strategic theme: Transformative technologies, Bioscience for an integrated understanding of health