POSTERS

EFFECTS OF ENVIRONMENTAL TEMPERATURE VARIATION AND BDNF MODULATION ON THE SPATIO-TEMPORAL SHOALING BEHAVIOUR OF ADULT ZEBRAFISH (DANIO RERIO) REVEALED BY TWO- AND THREE-DIMENSIONAL ANALYSIS

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Zebrafish (Danio rerio) are highly social animals that exhibit shoaling behaviour, a fundamental component of their ecological adaptation and survival strategy. Shoaling confers multiple advantages including enhanced predator avoidance, improved foraging efficiency, and coordinated collective responses to environmental threats. In our previous work, we demonstrated that both environmental temperature variation [1,4] and genetic modulation of brain-derived neurotrophic factor (BDNF) [5] significantly influence zebrafish brain neurochemistry and behaviour.

In the present study, we extend this line of investigation to the social domain by examining how the same thermal and genetic manipulations affect the spatio-temporal dynamics of shoaling behaviour in adult zebrafish. To achieve this, we employed integrated two- and three-dimensional tracking approaches [6], enabling a detailed and quantitative assessment of group-level organisation and movement patterns. Our findings demonstrate that alterations in protein expression driven by temperature or genotype are reflected in measurable changes in shoaling structure and dynamics. Importantly, these effects are not always predictable from individual-level behavioural phenotypes alone, highlighting the emergent properties of social behaviour and underscoring the importance of multi-scale approaches in behavioural neuroscience.

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References

1. Angiulli E, Pagliara V, Cioni C, Frabetti F, Pizzetti F, Alleva E, Toni M. Increase in environmental temperature affects exploratory behaviour, anxiety and social preference in Danio rerio. Sci Rep. 2020 Mar 24;10(1):5385.
2. Nonnis S, Angiulli E, Maffioli E, Frabetti F, Negri A, Cioni C, et al. Acute environmental temperature variation affects brain protein expression, anxiety and explorative behaviour in adult zebrafish. Sci Rep. 2021 Jan 28;11(1):2521.
3. Toni M, Angiulli E, Miccoli G, Cioni C, Alleva E, Frabetti F, et al. Environmental temperature variation affects brain protein expression and cognitive abilities in adult zebrafish (Danio rerio): A proteomic and behavioural study. J Proteomics. 2019 Jul 30;204:103396.
4. Maffioli E, Angiulli E, Nonnis S, Grassi Scalvini F, Negri A, Fontana M, et al. Environmental temperature variation affects brain lipid composition in adult zebrafish (Danio rerio). Int J Mol Sci. 2024 Sep 14;25:9629.
5. Maffioli E, Angiulli E, Nonnis S, Grassi Scalvini F, Negri A, Tedeschi G, et al. Brain proteome and behavioural analysis in wild type, BDNF and SERT zebrafish mutants reveal anxiety-like phenotypes. Int J Mol Sci. 2022 May 19;23(10):5606.
6. Rosa LV, Costa FV, Canzian J, Borba JV, Quadros VA, Rosemberg DB. Three- and bi-dimensional analyses of the shoaling behavior in zebrafish: Influence of modulators of anxiety-like responses. Prog Neuropsychopharmacol Biol Psychiatry. 2020 Aug 30;102:109957.