

BEHAVIOURAL PHENOTYPES: ASSOCIATED LIFE-HISTORY TRAITS AND ENVIRONMENTAL EFFECTS ON DEVELOPMENT

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Abstract

It is widely documented that non-human organisms express individual differences in behavioural patterns. For example individuals can be categorised as bold or shy and when these individual behavioural differences are consistent through time, they are termed behavioural types (BTs). In recent years research has identified that BTs often correlate across contexts/situations and these correlations are referred to as behavioural syndromes. Behavioural types and syndromes (i.e. personality) have also been implicated as major factors shaping population dynamics and the ability to buffer environmental disturbance. Recent theoretical predictions have proposed that BT variation may be underpinned by life-history strategies; however, these predictions have been little studied to date. Moreover, little research has focused upon environmental influences and the ontogeny of personality.

In this thesis I use the Mangrove killifish (*Kryptolebias marmoratus*), a naturally occurring clonal vertebrate, as a model organism. This species presents a powerful tool providing the ability to replicate within and between isogenic genotypes in a controlled manner. Moreover the natural clonality expressed by this species permits environmental effects upon BT plasticity and BT-life-history interactions to be investigated within a developmental framework. In chapter 2, I present microsatellite genotyping results which show that the founding individuals used to propagate a laboratory population at The University of Exeter represent 20 genetically distinct homozygous genotypes.

I additionally address five research questions exploring genotypic, environmental, and developmental effects upon three commonly studied BTs (exploration, boldness and aggression): Firstly; I ask do adult hermaphrodite and secondary males exhibit personality i.e. repeatable BT expression? In chapter 3, I present results showing that both of the sexes express short term personality. Moreover, I show that that genotype is an important factor influencing BTs expressed, regardless of sex, indicating underlying genetic control. Secondly I ask; does genotype level life-

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history variation underpin personality trait variation during ontogeny? In chapter 4, I show considerable developmental plasticity in behavioural expression between genotypes but not life-history and I find limited behaviour-life-history relationships during development. Thirdly I ask; does the rearing environment influence life-history and behavioural plasticity? In chapter 5, I show that in comparison to a control treatment, the presence of conspecifics during ontogeny results in an average reduction in behavioural scores; however, life-history was unaffected. In addition, I show that development in a low food environment lowered average exploration and growth rate but had no effect on boldness or aggression. Furthermore, fish exposed to a predation risk simulation during ontogeny exhibited similar behavioural scores as the control, yet this treatment generated BTs i.e. personality. My fourth question asks; does the parental rearing environment (utilised in chapter 5) influence behavioural expression in the next generation? In chapter 6, I show that transgenerational effects of each parental rearing environment influenced life-history but had a minimal effect upon behaviour in the next generation. Finally I ask; does kin or familiarity influence plasticity in associations and aggression? In chapter 7, I show that genotypes have the ability to discriminate kin and familiars and modulate aggression and association accordingly.

These results support the concept that developmental and environmental induced plasticity may be more important than life-history in shaping behaviour. Furthermore, although adults exhibit personality and genotypic effects appear important, genotype interacts with environmental/experiential influences to differentially shape behavioural plasticity during ontogeny. I suggest that theoretical predictions regarding life-history may be insufficient to explain the complexity of animal personality in this species. I discuss these results within developmental and epigenetic frameworks with reference to the ecological significance of these patterns within this species and the animal kingdom as a whole.

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