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Function of microRNA-9 for the development of chick midbrain

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Neuronal networks form during embryonic development through the generation of a sophisticated pattern of CNS regions, neurones and their axons. Intricate molecular networks tightly control these processes. MicroRNAs (miRs) are small non coding RNAs and form a new layer of regulating gene and protein expression in the developing and adult brain and in many other organ systems. They have been shown to be involved in almost all neural events - proliferation, neurogenesis, dendritic morphogenesis, axonal growth and synaptic plasticity. There is accumulating evidence that miR malfunction contributes to neural and behavioural disorders and neurodegenerative diseases. However, how miRs influence different aspect of brain development is only just unravelling.

We investigated expression and function of miR-9 for chick midbrain development by analysing regional gene expression and neuronal differentiation in the chick embryo. Our analysis showed a dynamic pattern of miRNA9 expression. Early in development, miRNA9 is diffusely expressed in the entire brain (embryonic day 2) and becomes more restricted to specific areas of the CNS in later stages (E3-E6). MiR-9 gain of functions studies in the mid-hindbrain boundary (MHB) showed premature neural differentiation and often evoked smaller brains. Our results so far suggest that miRNA9 is important for the early maintenance of the MHB and growth of the midbrain similar to it's role in zebrafish (Leucht et al. 2008, Nat Neurosci).