Abstract

The *Drosophila* brain develops from neural stem cell like precursors called neuroblasts, which form in a highly stereotyped manner in during embryogenesis. The stereotypy in the formation and specification of embryonic neuroblasts is in part controlled by key developmental patterning genes that initially define the body axes during early embryogenesis. Many of these genes continue to be expressed in neuroblasts later in embryonic and postembryonic brain development, and have functional roles there. In my thesis I have investigated some of these later, complex roles of early patterning genes. I have focussed on two cephalic gap genes *orthodenticle* (*otd*) and *empty spiracles* (*ems*) and have described their role in postembryonic development of the *Drosophila* central and peripheral nervous systems devoted to olfaction.

Specifically, I show the expression and function of *ems* in the development of the peripheral olfactory system. *ems* is expressed postembryonically in a subset of the precursors of the antennal sense organs. I show the genetic cascade that regulates *ems* expression in these precursors; and that a brief pulse of *ems* expression in these precursors has implications for the specification of the sense organs, as well as for the appropriate targeting of neurons that derive from these sense organs. I also uncover an unexpected role for *otd* in the formation of the central interneurons of the olfactory circuitry. I show that the expression of *otd* in a non-olfactory neuroblast lineage is essential for these cells to not participate in the antennal lobe circuitry. Finally, I discuss the similarities in the requirement of *ems* and its vertebrate homologues, *Emx1/2*, in the development of the peripheral and central neurons of the olfactory circuitry in flies and mice. I make similar comparisons in the requirements of *otd* and its vertebrate homologues, *Otx1/2*, in the development of the peripheral and central neurons of the visual circuitry of flies and mice. In the light of these similarities I make some evolutionary considerations.