Glial influences on neural stem cell development: cellular niches for adult neurogenesis

Dengke K Ma, Guo-li Ming and Hongjun Song

Institute for Cell Engineering, Departments of Neurology and Neuroscience, Johns Hopkins University School of Medicine, Baltimore, MD 21205, USA

Available online 6 September 2005.

Neural stem cells continually generate new neurons in very limited regions of the adult mammalian central nervous system. In the neurogenic regions there are unique and highly specialized microenvironments (niches) that tightly regulate the neuronal development of adult neural stem cells. Emerging evidence suggests that glia, particularly astrocytes, have key roles in controlling multiple steps of adult neurogenesis within the niches, from proliferation and fate specification of neural progenitors to migration and integration of the neuronal progeny into pre-existing neuronal circuits in the adult brain. Identification of specific niche signals that regulate these sequential steps during adult neurogenesis might lead to strategies to induce functional neurogenesis in other brain regions after injury or degenerative neurological diseases.

Article Outline

Introduction
Potential roles of astroglia in the neurogenic niches for adult neurogenesis
Cellular niches for NSCs and neurogenesis in adulthood
Regulation of adult NSC proliferation and cell fate specification
Regulation of neuronal migration and nerve guidance
Regulation of neuronal maturation and synaptic integration
Conclusions
References and recommended reading
Acknowledgements
References