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Unraveling the Roles and Dysregulation of Adult Hippocampal Neurogenesis: Implications for Regenerative Processes and Pathological Conditions

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Abstract

The hippocampus is the only known brain region where physiological neurogenesis continues into adulthood across mammalian species and in humans. However, disease and injury can change the level of adult hippocampal neurogenesis, which plays an important role in regulating cognitive and emotional abilities. Alterations in hippocampal neurogenesis can mediate treatment of mental illness or affect the brain's capacity for repair and regeneration. In the present review, we evaluate how adult neurogenesis contributes to the repair and regeneration of hippocampal circuitry in the face of diseases and injuries. We also discuss possible future directions for harnessing adult neurogenesis for therapeutic use.

Introduction

The grownup Genius has lengthy been regarded restricted in its regenerative ability in contrast with different organs or tissues in the body. For most of the twentieth century, it was once believed that neurogenesis ceased after development [1]. However, in 1962, Altman1 injected person rats with radioactive thymidine to label replicating cells and then confirmed that mitotically lively progenitors stay in the person rat talent and provide start to new neurons. A collection of subsequent research over a long time confirmed that person neurogenesis exists in almost all mammals,2 along with humans.3, four Under ordinary conditions, excessive ranges of neurogenesis manifest in two person rodent regions: the subventricular sector of the lateral ventricles and the dentate gyrus of the hippocampus. Of the two regions, the dentate gyrus of the hippocampus is the solely location succesful of neurogenesis underneath basal prerequisites throughout mammalian species, along with human beings (Figure 1). This region's living neural stem cells can generate useful new neurons and glia in response to pathologic and pharmacologic stimuli, retaining each community plasticity and tissue homeostasis, with viable for restore and regeneration on sickness and injury [2-6].

Figure1. Adult neurogenesis regions. Adult neurogenesis is constrained in unique intelligence areas in human beings and mice. Left panel: Human person neurogenesis takes place below basal prerequisites in the hippocampus (red) and the striatum (green). Right panel: Murine person neurogenesis happens in the hippocampus (red) and the subventricular quarter (purple). The hippocampus serves as the solely intelligence location the place grownup neurogenesis is conserved throughout mammalian species. Adult hippocampal neurogenesis has been functionally linked to learning and memory and emotional processing, such as stress and depression. In addition, hippocampal neurogenesis is highly regulated by the local and extrinsic environment. Stress suppresses neurogenesis through the corticosteroid and hypothalamic-adrenal axis. In turn, the level of neurogenesis also affects animals' sensitivity to stress. We will discuss both the positive and negative relationships among neurogenesis, postinjury repair, and neural disease development [7,8].

Regenerative processes: Adult hippocampal neurogenesis holds promise for regenerative medicine and neural repair. The continuous generation of new neurons provides a substrate for neural plasticity and adaptability, enabling the brain to integrate new experiences and information. Studies have shown that environmental enrichment, physical exercise, and cognitive stimulation can enhance neurogenesis, highlighting the potential for lifestyle interventions to promote brain health and resilience against age-related cognitive decline [9].

Furthermore, recent findings suggest that manipulating neurogenic processes may facilitate recovery following brain injury or neurodegenerative diseases. Preclinical studies utilizing animal models have demonstrated that enhancing neurogenesis can improve cognitive function and promote functional recovery in conditions such as stroke, traumatic brain injury, and Alzheimer's disease. These findings underscore the therapeutic potential of targeting adult hippocampal neurogenesis in regenerative approaches for neurological disorders [10].

Pathological conditions: Conversely, dysregulation of adult hippocampal neurogenesis has been implicated in the pathogenesis of various psychiatric and neurological disorders. Chronic stress, a known suppressor of neurogenesis, has been linked to the development of mood disorders such as depression and anxiety. Moreover, alterations in neurogenic processes have been observed in psychiatric conditions like schizophrenia and bipolar disorder, highlighting the complex interplay between neurogenesis and mental health [11].

Conclusion

The roles and dysregulation of adult hippocampal neurogenesis are multifaceted, encompassing both regenerative processes and pathological conditions. Understanding the intricate molecular and

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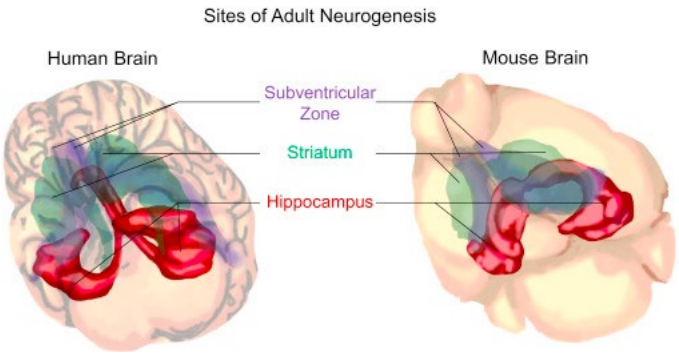

Figure 1: neurogenesis underneath basal prerequisites throughout mammalian species.

cellular mechanisms underlying neurogenic regulation is crucial for developing targeted interventions to harness the regenerative potential of the adult brain and mitigate the impact of neurological and psychiatric disorders. Future research aimed at unraveling the complexities of neurogenesis holds promise for advancing therapeutic approaches to promote brain health and resilience across the lifespan.

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Conflict of Interest

None

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