Abstract

New neuron formation in the adult brain was an interesting finding that extended the knowledge about brain plasticity. In 1966 Joseph Altman reported the incorporation of tritiated thymidine to neural cell DNA. This finding indicated the proliferation event in the adult brain. After twenty years of this finding, new information was generated that confirmed the new neuron formation in the adulthood. In this review, we will mention different aspects of the new neuron formation process called neurogenesis, as well as some of the factors that modulate such process, citing the information already known about the neuronal development stages that take place for the new neuron formation in the hippocampus. Finally, we will review some evidence about the neurogenic process in depression and in neurodegenerative diseases, as well as the possible role of the new neurons when they are integrated into the neuronal network. In the adult brain there are two regions where new neuron formation process takes place: the olfactory bulb and the hippocampus. New neurons are derived from neural stem cells, which reside in the subventricular zone of the lateral ventricles and in the subgranular zone of the dentate gyrus. Neural stem cells may proliferate and generate the rapid amplifying progenitor and neuroblast populations. These populations will migrate and differentiate in neurons to finally be integrated into the neuronal network. In the adult brain, neural stem cells have radial glial features expressing specific markers as the glial fibrilar acidic protein (GFAP), as well as the un-differentiated cell marker nestin. This characteristic makes suitable neural stem cells identification. Thus, the new neurons can be identified by both the specific marker expression and by electrophysiological properties. The different cell development stages during the neurogenic process have been characterized in the subventricular zone as well as in the subgranular zone of the dentate gyrus. In addition to the radial-glia features, neural stem cells show a slowly dividing ratio and once the neural stem cells divide by asymmetric division a rapid amplifying progenitor population is generated. In the hippocampus, phenotype analysis had allowed cell classification in three different types according to the kind of protein marker expression. These progenitors are generated during the expansion phase by symmetric cell division. Type 2a and 2b present short neuritic processes parallel to the granular cell layer and the...

Keywords

Hippocampus, neurogenesis, stem cells, depression, neurodegeneration.