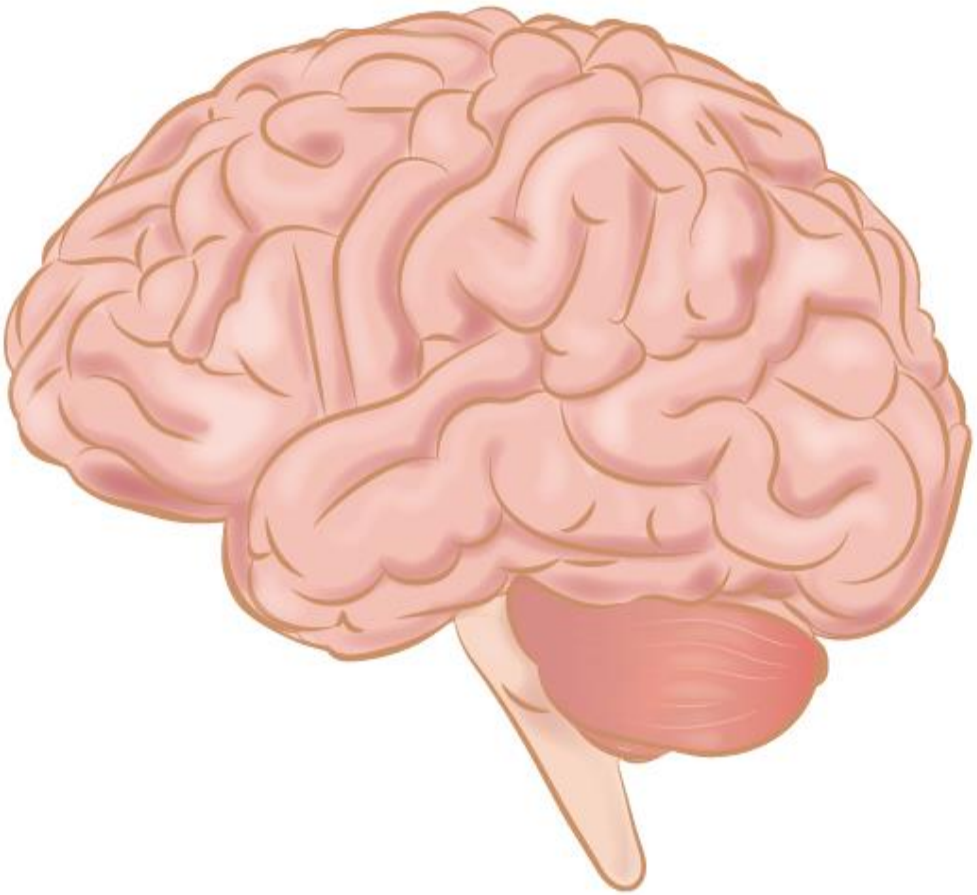
DBT-CDFD team studies cell death of neural stem cells in developing brain

New Delhi, Oct 06: How does a single cell zygote develop into an entire organism is one of the central questions in developmental biology. Organisms with bilateral body symmetry (including humans) are characterized by a head to tail axis of the body and a complex central nervous system (CNS), both of which are determined by a family of conserved Homeotic genes.



The CNS of an organism includes the brain and the spinal cord. Reproducibility of their size and shape is critical for the normal development of an organism. Neural stem cells (NSCs) in the CNS divide continuously to give rise to various cell types including neurons and glia. The coordination of proliferation, differentiation and cell death of NSCs is tightly regulated during the development of the CNS. Dysregulation of any of these cellular processes may

result in developmental disorders like microcephaly, brain tumours or post birth behavioural defects. Programmed cell death of NSCs is an important phenomenon employed to prevent the generation of unwanted cells during CNS development.

Using fruit fly as a model to understand the intricacies of normal brain development, researchers at DBT-CDFD, Hyderabad, along with others, have delineated the molecular mechanisms by which NSCs in the developing brain undergo programmed cell death. However, it is yet to be understood as to how NSCs in different regions of the brain undergo programmed cell death at same or different times of development. Moreover, it is not yet known if all NSCs use the same factors to undergo programmed cell death and if they indeed use similar factors, what is the underlying logic for the precise execution of cell death.

In a new study, a team from the Centre focused on two adjacent regions of Drosophila spinal cord which harbours neurons important for mating behaviour. They found that programmed cell death of the NSCs in these two regions use common factors but seems to have evolved different strategies to execute cell death of NSCs. One region use increase in expression of resident homeotic gene (abd-A) to execute the neural stem cell death; while the more terminal region keeps the resident homeotic gene expression (Abd-B) constant but instead utilize increasing levels of another transcription factor (Grh) and increase in Notch signalling to cause the NSC death, thereby restricting the number of neurons produced in both these regions.

Reference: Asif Bakshi, Rashmi Sipani, Neha Ghosh and Rohit Joshi. “Sequential activation of Notch and Grainyhead gives apoptotic competence to Abdominal-B expressing larval neuroblasts in Drosophila Central nervous system.” PLoS Genetics (2020).

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