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Short Communication

Role of Hedgehog Signalling Pathway in the Maintenance and Regeneration of Adult Tissues

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DESCRIPTION

The Hedgehog signaling pathway is a signaling pathway that provides embryonic cells with the information they have to differentiate properly. Hedgehog signaling proteins are present in various amounts throughout the embryo. This pathway plays a role in adolescence and cancer is one of the diseases associated to the dysfunction of this system. All bilaterians have the Hedgehog signalling pathway, which is one of the major regulators of animal development [1].

The intracellular signalling protein Hedgehog (Hh), which is found in fruit flies of the species Drosophila, provides this pathway. Fruit fly larvae having the Hh gene have been shown to resemble hedgehogs. Drosophila is responsible for forming the structure of the fly body plan. Without Hh protein, the larvae are small, spiky. Embryogenesis and stages of metamorphosis still depending on this protein molecule and this pathway is equally crucial for the development of vertebrate embryos, and evolutionary developmental biology. Recent research indicates that adult stem cells involved in the maintenance and regeneration of adult tissues and are regulated by hedgehog signalling [2].

This pathway has also been associated with the emergence of a few types of cancer. In the absence of Hh, cell-surface transmembrane protein termed Patched (PTCH) and it inhibits the high expression and activity of a Smoothened membrane-spanning receptor [3]. Patched and characterized membrane transport proteins and exhibit sequence similarities.

Extracellular Hh binds and inhibits PTCH, when Hh present, which permits Smoothened to develop and prevent the proteolytic cleavage of the Ci protein. This process most likely involves the direct interaction of smoothened and may involve sequestration of the Ci protein-containing complex to where the steps leading to Ci protein proteolysis are disrupted.

It is unknown how the elevated amounts of Smoothened are caused by Hh binding to Patched. Hedgehog plays a major role in the development of adult appendages as well as in the development of larval body segments [4]. The cell-to-cell signallingprotein Hedgehog can be produced by stripes of cells that produce the transcription factor engrailed during the development of body segments in the developing embryo.

Hedgehog is only able to activate a small fraction of cells next to the engrailed-expressing cells because it is unable to move very far from the cells that synthesize it. Hedgehog functions as a paracrine factor when functioning in this localised form.

After Hh interacts with the receptor protein, only cells on one side of the engrailed-expressing cells are able to respond to Hedgehog. A Drosophila embryo that has been changed to make Hh in every cell reacts by forming a wider band of Wingless-expressing cells in each segment. In a bunch of cells next to the band of Hh-producing cells, the wingless gene has an upstream transcription regulatory region that binds the Ci transcription factor in an Hh-dependent mechanism, increasing wingless transcription. By activating its cell surface receptor, Wingless protein acts as an extracellular signal and patterns the adjacent rows of cells [5].

CONCLUSION

In conclusion, to maintain the bands of engrailed expression, a cell-to-cell signalling protein belonging to the Wnt family is used. A positional signal that provides for the distinct anatomical features along the anterior-posterior axis of the segments and is established by the impacts of Wingless and Hedgehog on other bands of cells in each segment.

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