

# Lecture 22: Morphogenesis

the combination of biological processes that causes an organism to develop its shape.

signalling pathways control:

Intrinsic Growth Signals

signals within a tissue that control its own growth rate and signal. different tissues develop needs both

Extrinsic Growth Signal

signals from another tissue controls rate and size of a tissue. (helpful for scaling)

Things that affect tissue size: a rate of proliferation + cell death

Bone Growth:

Zones of proliferation and post-mitotic growth at the same time

Chondrocytes: hypertrophic chondrocytes → post-mitotic (towards the end of long bones) → early in develop. it is more like cartilage and calcifies later.

Why?

Hedgehog is a ligand (secreted protein)

attaches to receptor called Patched

turns on/off transcription

All affected by Ihh (Indian Hedgehog) (depends on what concentration of Indian Hedgehog)

High levels → Activates PRRP → proliferative chondrocytes

Low levels →

Tetrapod: Any organism with four limbs.

Hox Genes in humans: Anterior-Posterior Identity Proximal-Distal Axis.



Loss of HoxD13 → snakes them more like zeugopod and less like autopod.

BMP signalling is on ventral side → promotes ventral identity

engrailed 1 → Wnt → Lmx1 (transcription factor) → Dorsal identity.

thus BMP inhibits dorsal activity.

Loss of engrailed? → more dorsal identity → double nails. Human Nail Patella Syndrome (LMX1 mutant) → no nails → no kneecaps.

ZPA (Zone of Polarizing Activity) decides thumb or pinky (A/P) → organizing center → five feedback b/w ZPA and AER

Humans have 3 types of Hedgehog → Indian Hedgehog → Sonic Hedgehog → Desert Hedgehog.