

concepts & mechanisms of development

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mechanisms

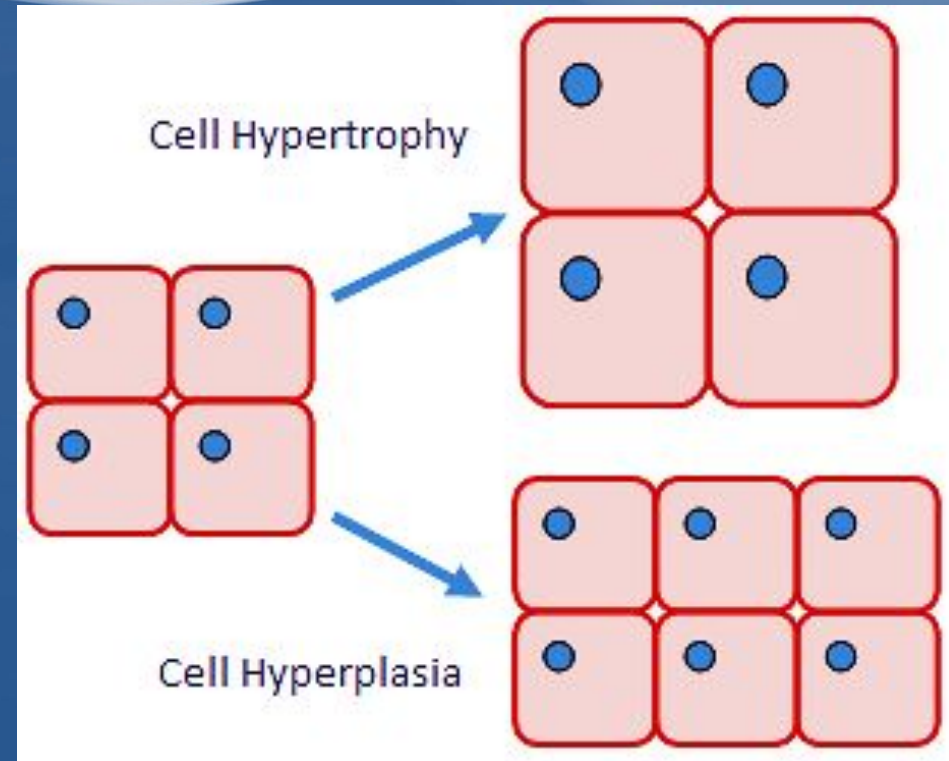


MECHANISMS

- The four developmental processes are all **interrelated** and usually **interdependent** that any genetic or teratogenic insult to these processes may cause a secondary alterations in all of them.
- Interaction between adjacent tissues are also necessary for the subsequent development of one or all of the tissues involved .

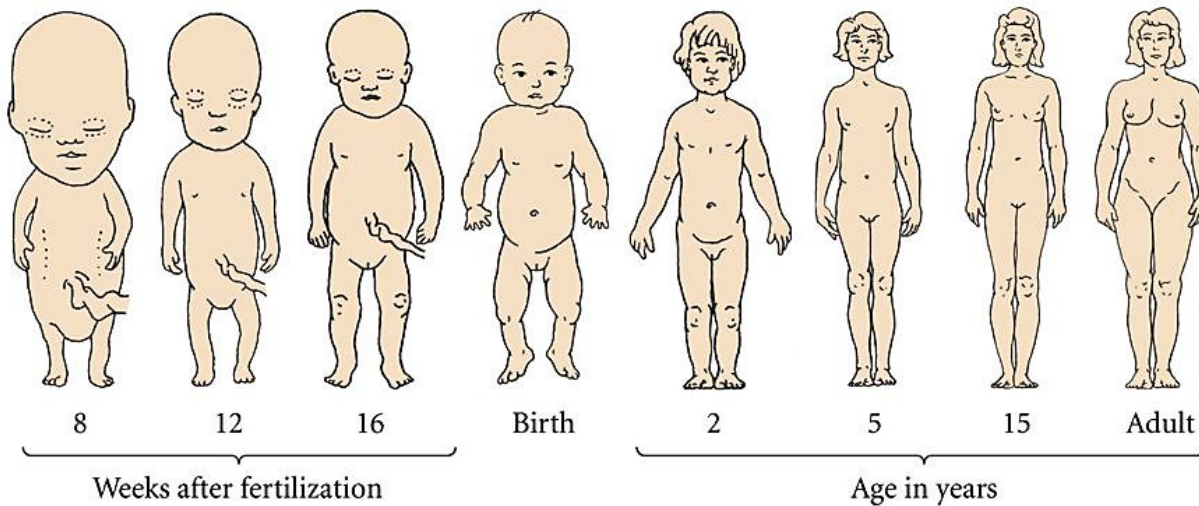
growth

- Increase in the size of a part or the entirety of the organism by increasing cellular size (**hypertrophy**) and/or number of cells (**hyperplasia**).

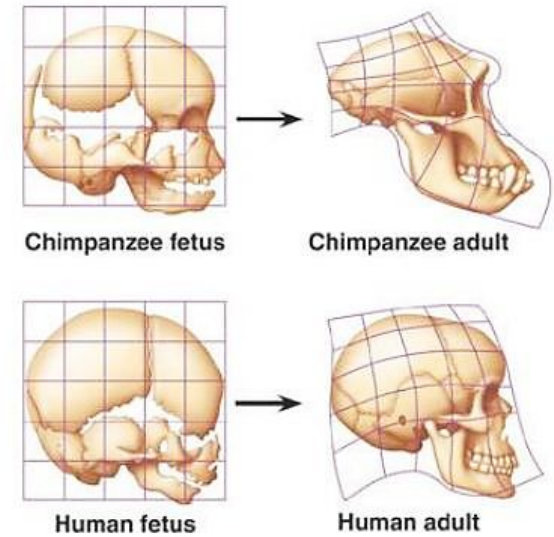


growth

- ALLOMETRIC GROWTH



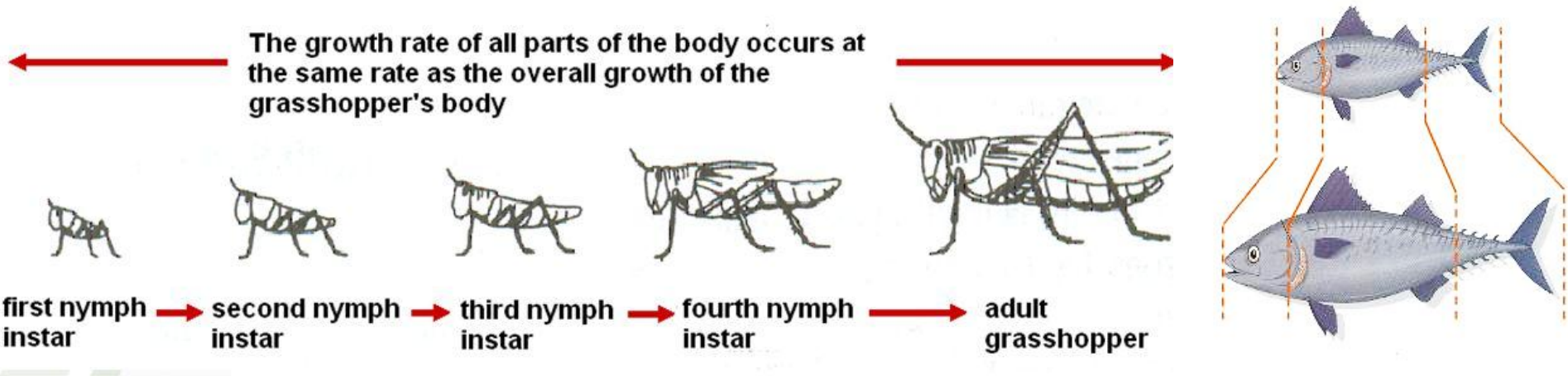
(a) Differential growth rates in a human



(b) Comparison of chimpanzee and human skull growth

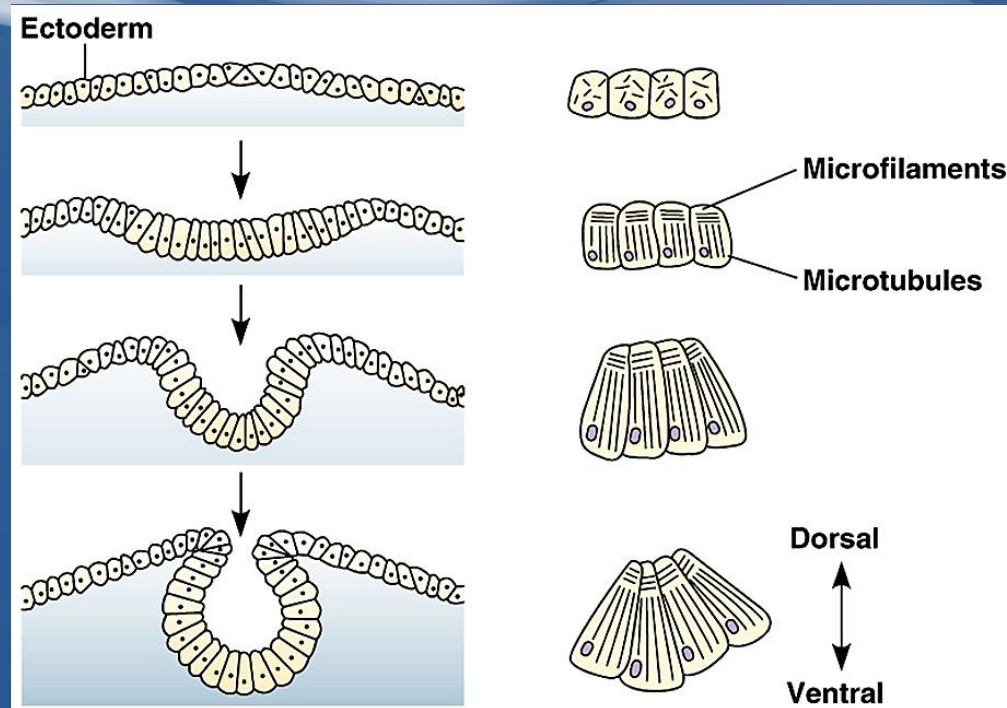
growth

- ISOMETRIC GROWTH



MORPHOGENESIS

- The mechanism by which tissues and organs are shaped.



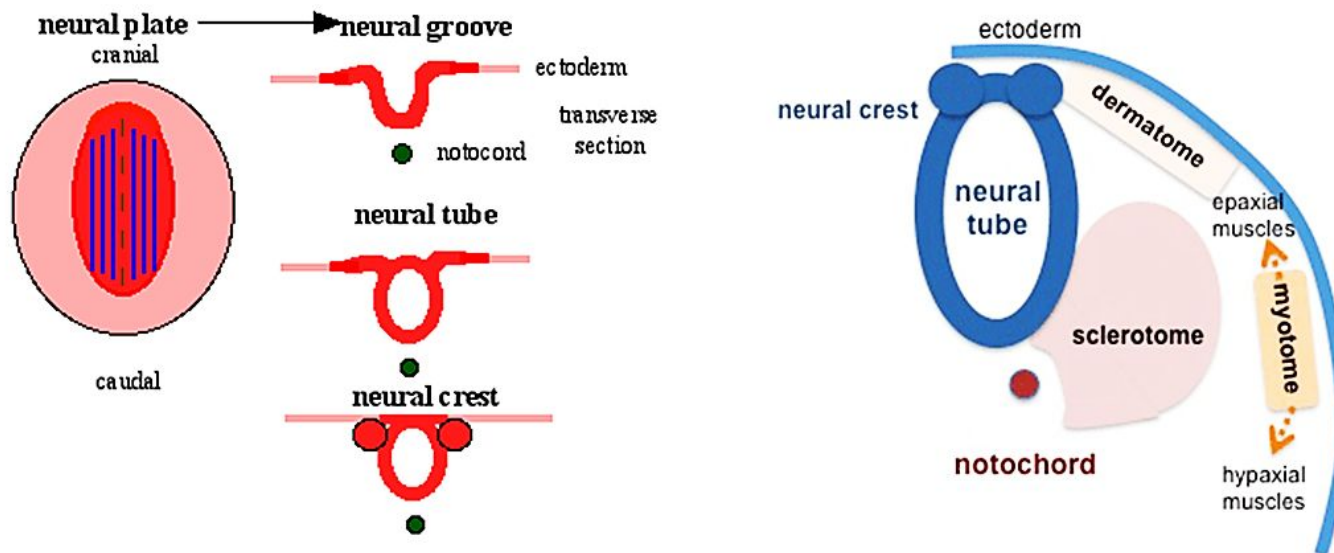
MORPHOGENESIS

- Examples:
 - Kinking and looping of the intestines
 - Compartmentalization of the complex stomach
 - Regression of the primitive streak
 - Closure of the neural tube

PATTERNING

- process whereby embryonic cells organize into tissues and organs
- ensures that tissues and organs develop in the correct place and orientation within the body

Patterning

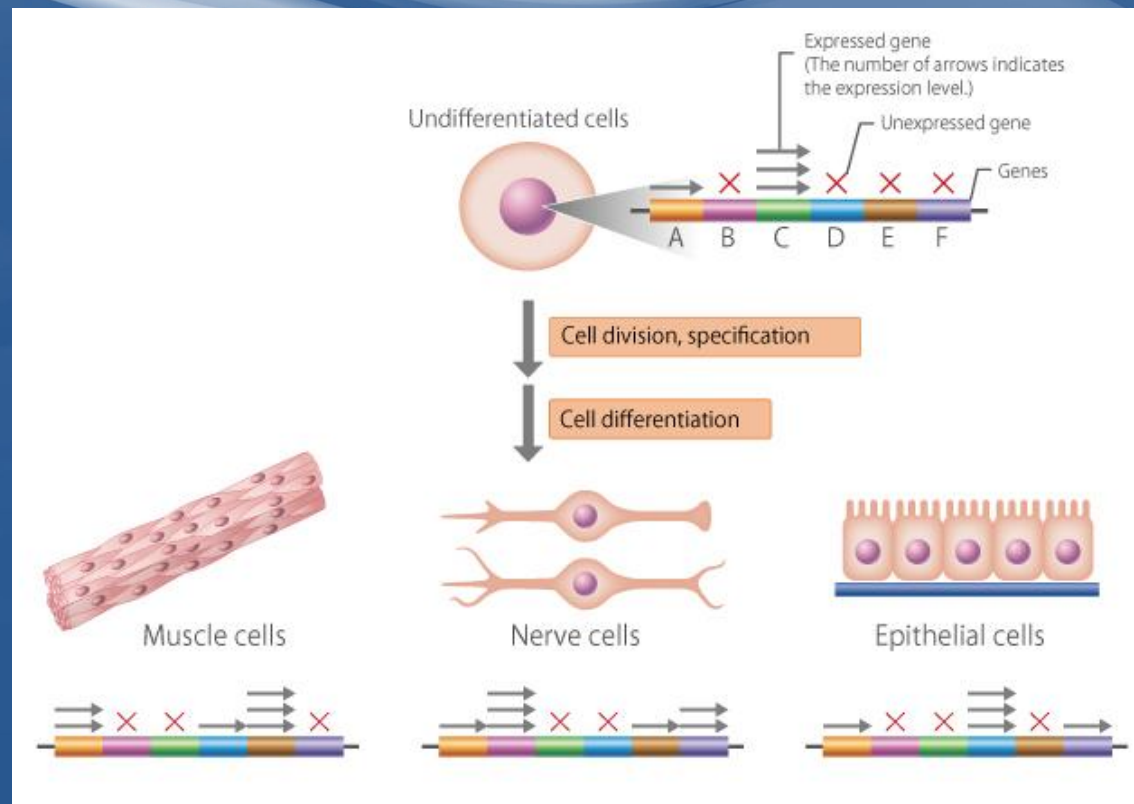


Neural tube patterning

Somite patterning

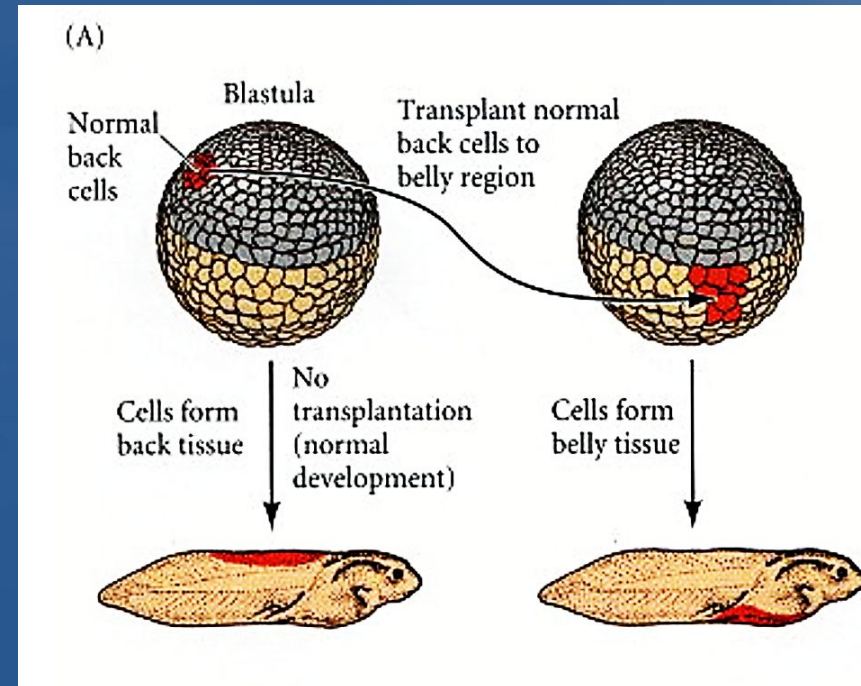
CYTODIFFERENTIATION

- The process whereby specialized cell types develop from less specialized.



CYTODIFFERENTIATION

- An event preceding cell differentiation. is **CELL COMMITMENT.**
 - May be divided into a labile, reversible phase referred to as **cell specification** followed by an irreversible one called **cell determination.**



CYTODIFFERENTIATION

- For instance, in the **cleavage stage**, each of the blastomeres are capable of forming a complete embryo (each cells are equipotent); in the **morula stage** when some blastomeres are experimentally altered in position, the cells will develop in accordance to its new position.

CYTODIFFERENTIATION

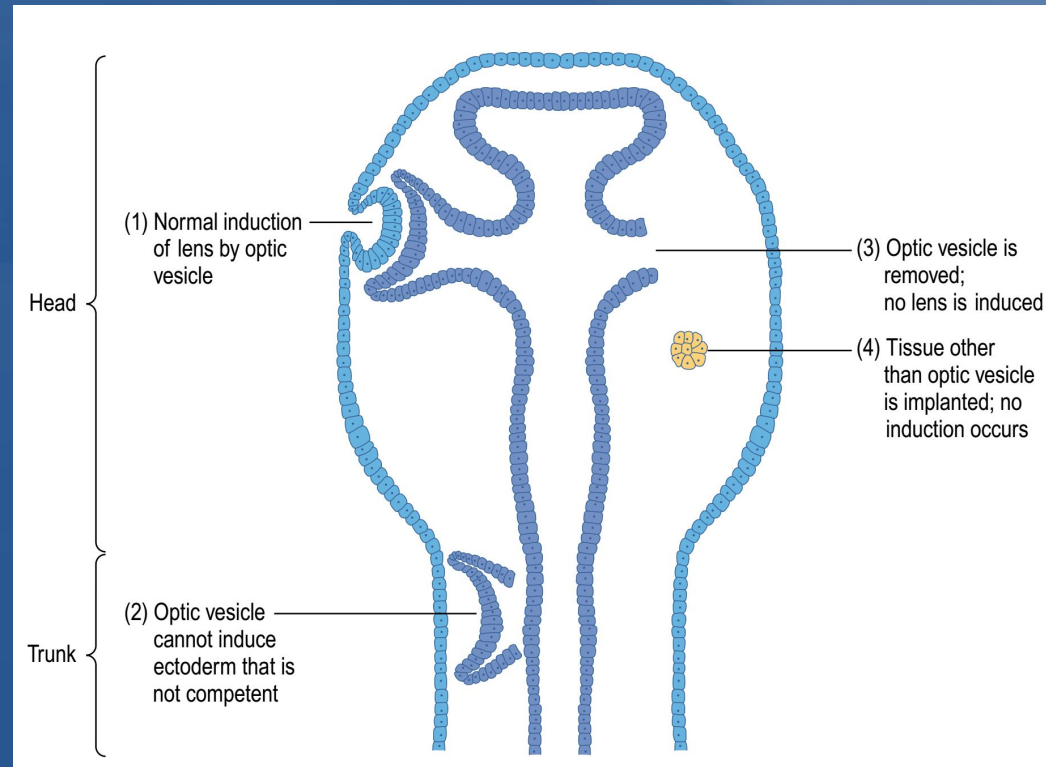
- In **early blastocyst**, cells in the inner cell mass can differentiate into trophoblast but the trophoblast lost its capacity to be a part of the inner cell mass; in **expanded blastocyst**, the ICM also cannot form into trophoblast.

Tissue interaction

- The process by which tissue interact with other tissues in the body.
- Occurs by **induction**
 - Interaction at close range between two or more cells

Tissue interaction

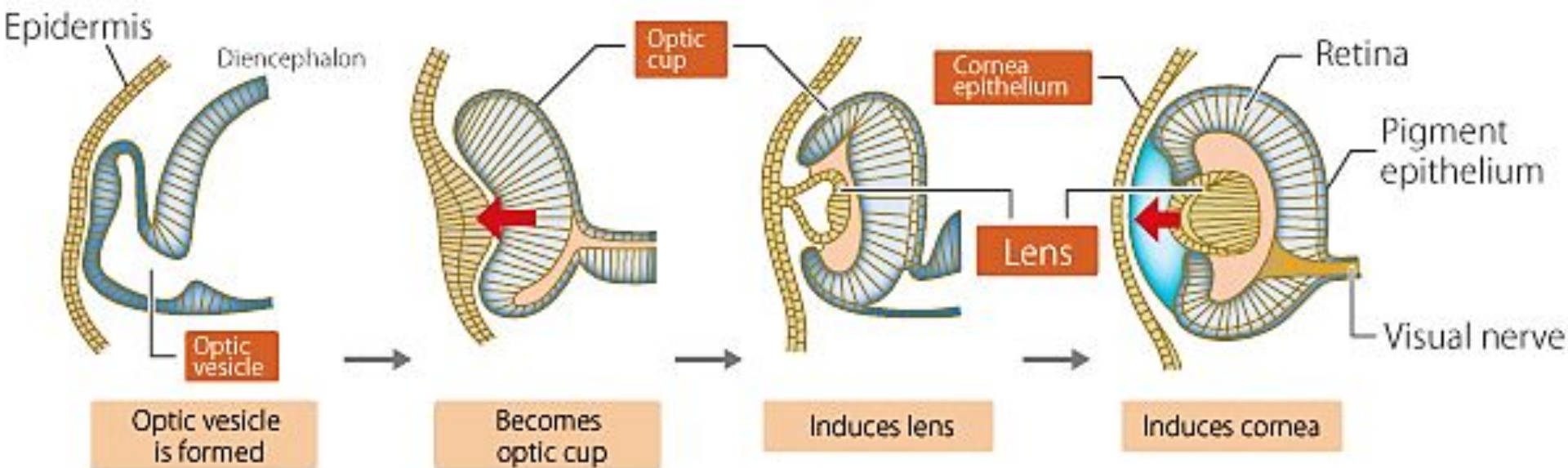
- **Inducing cell/s**
 - The group that controls the differentiation of the other group
- **Induced cell/s**
 - The dependent group



Tissue interaction

- **Competence**

- The ability to respond to a specific inductive signal



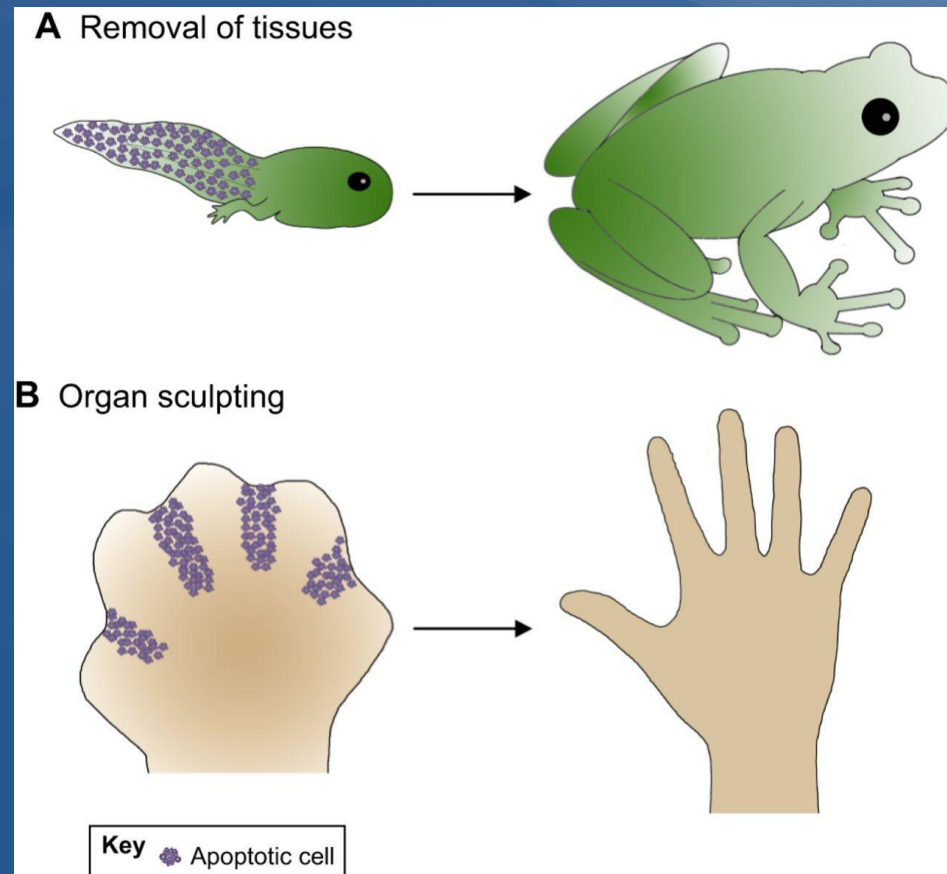
Tissue interaction

Some epithelial-mesenchymal interactions

Organ	Epithelial component	Mesenchymal component
Cutaneous structures (hair, feathers, sweat glands, mammary glands)	Epidermis (ectoderm)	Dermis (mesoderm)
Limb	Epidermis (ectoderm)	Mesenchyme (mesoderm)
Gut organs (liver, pancreas, salivary glands)	Epithelium (endoderm)	Mesenchyme (mesoderm)
Pharyngeal and respiratory associated organs (lungs, thymus, thyroid)	Epithelium (endoderm)	Mesenchyme (mesoderm)
Kidney	Ureteric bud epithelium (mesoderm)	Mesenchyme (mesoderm)
Tooth	Jaw epithelium (ectoderm)	Mesenchyme (neural crest)

APOPTOSIS

- Genetically programmed death of cells for the normal development of tissues/ organs
- **Caspases**
 - The principal intracellular mediators of apoptosis.



Congenital Malformations

- Are defects or abnormalities which appear at birth caused by errors arising during development
- Defects expressed at a later time in life are also considered congenital

Causes:

- **Intrinsic or hereditary factors-** carried in the genes which are either caused by a single or multiple genes Ex.
- **Extrinsic or non-hereditary factors-** exposure to medications, chemicals, and viruses

end... *Thank you!*