

## Developmental Genetics;

▪ the study of how genes control development  
Genes controlling development are so important that they are conserved throughout evolution

- segmentation
- sex determination
- cellular differentiation and determination
- induction and morphogenesis
- intracellular signal transduction
- body patterning
- imprinting and epigenetics

Why are we interested?

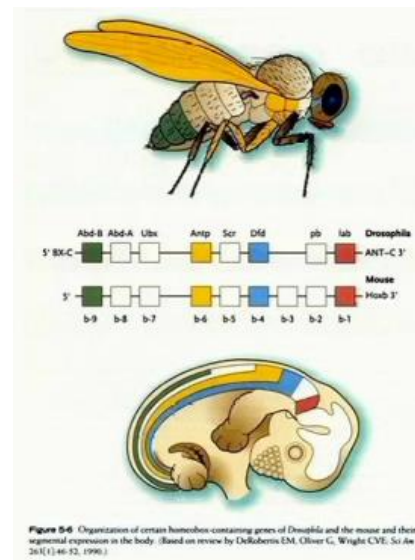
- medical benefits;
  - identify and potentially correct genetic defects in developing embryos (eg. folate and neural tube defects)
  - improvements in cancer detection and treatment through understanding of genes involved in cell growth
  - IVF
  - stem cells to treat degenerative conditions (eg. nerve damage)
  - new chemical/biological agents, eg. hormonal contraceptives
- agricultural benefits
  - genetic testing for selective breeding
  - transgenics and cloning to provide superior livestock or tissues/organs for transplantation

How is developmental genetics researched?

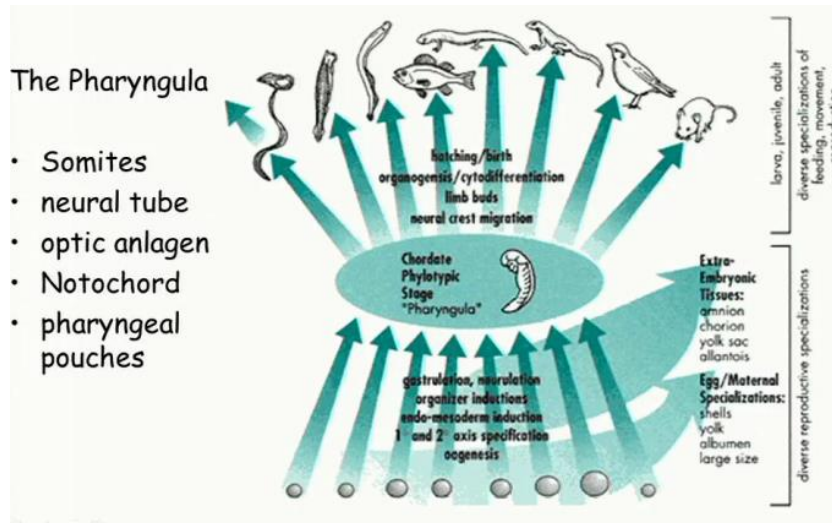
- comparative embryology
- molecular, cellular and genetic analysis of developmental processes
- analysis of the genomic sequence and gene expression patterns of genes from related species

Comparative Embryology;

- at what developmental stage do we find species-specific characters?
  - morphology and homology → what characters are shared by many taxa?
  - phylotypic stage → all vertebrate embryos appear similar during the phylotypic stage of development
  - specialisation → less general characters develop from more general characters
- \* “ontogeny recapitulates phylogeny” = development from common ancestors is reflected in the embryological development



## The developmental hourglass;

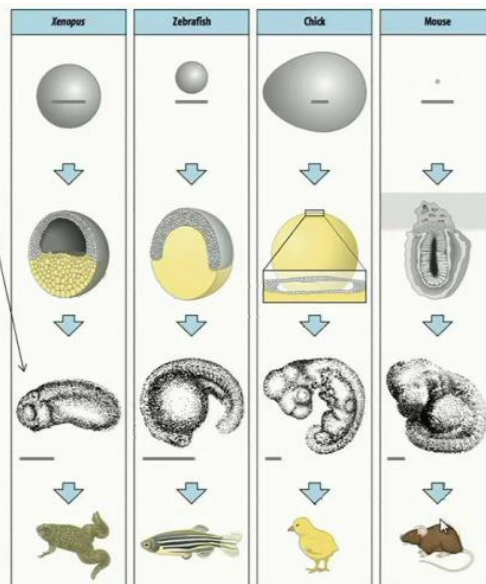


## The Phylotypic stage:

All vertebrate embryos pass through a Phylotypic stage

This is the stage at which the common vertebrate body plan is most obvious

**Caution:** Recent studies using more powerful microscopes have shown that differences exist even at the phylotypic stage



## 5 stages of embryogenesis;

1. **Cleavage** – egg gets divided into a number of cells
2. **Differentiation** – cells become structurally and functionally different from each other ie. specification of germ layers
3. **Pattern Formation** – body axes established
  - segmentation of mesoderm and neural tube
  - establishment of body plan
4. **Morphogenesis** – change in form of whole embryo and development of specialised tissues and organs
5. **Growth** – increase in body size