


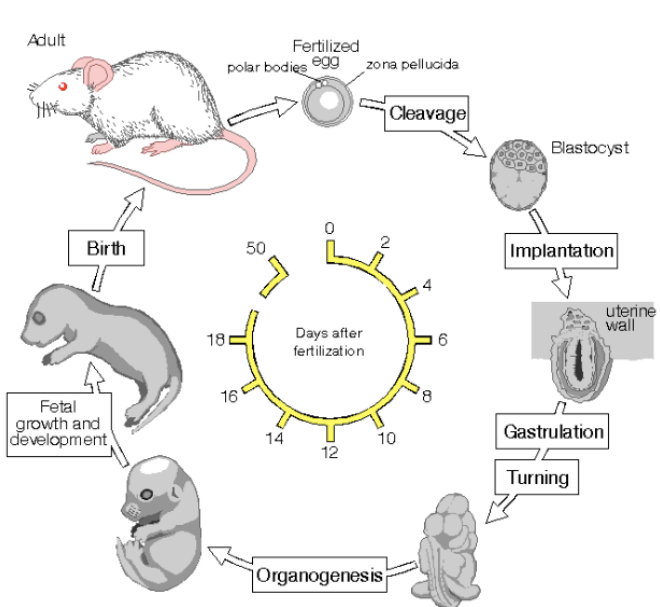
Lecture 1

Lecture Objectives:

- Describe the common stages of development and the main features of each.
- Define the term fate map and describe a method for producing fate maps.
- Describe the sorts of transplantation experiments that can be used to study development.
- Define the terms autonomous specification and conditional specification.
- Describe what happens when early blastomeres of mammalian embryos are separated.

Developmental Biology	<p><i>"Here there is one central field. Development. How the egg turns into the organism. But development ultimately includes all of biology."</i> Sidney Brenner 1979</p> <p>3 Major Approaches to Study Developmental Biology</p> <p><u>Anatomical</u></p> <ul style="list-style-type: none"> - What parts of the embryo form different organs? - What comparisons can we see in the development of different organisms? - What are the changes in tissues in birth defects? <ul style="list-style-type: none"> o environmetn in utero <p><u>Experimental</u></p> <ul style="list-style-type: none"> - How do molecules or processes cause visible changes in embryos? - How do embryonic cells respond to perturbations? - How do cells order themselves into tissues and organs? <p><u>Genetic</u></p> <ul style="list-style-type: none"> - How do genes control development?
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Views of Development

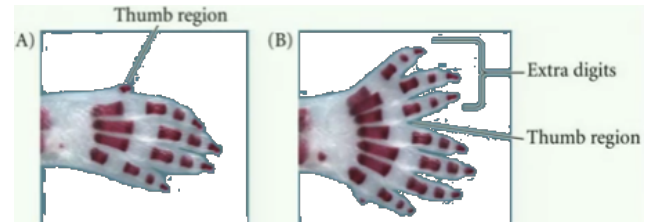
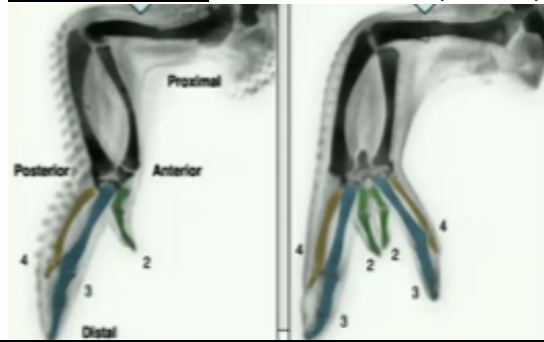
Preformist	<p>A <u>preformed</u> individual (homunculus) is in the sperm head. Was thought that the egg provided the nutrients for the sperm to grow when fertilisation occurred.</p> <p>Based on early observations through microscopes.</p>	
Epigenesis -correct!	<p>All organs are formed "de novo" (from scratch) as the embryo develops. Progressive change in form through development.</p>	

Birth Defects

e.g. Cleft palate – palate fails to completely fuse. A spectrum.
Diplopodia (duplicated foot)

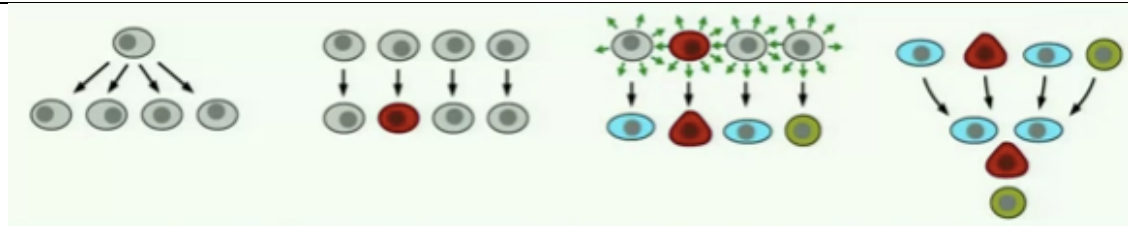


Model Organisms can be used to study development



Universal Mechanisms of Animal Development

KNOW!
Important theme throughout course



Cell Proliferation Cell Specialization Cell Interaction Cell Movement

- Cell proliferation is important for shape. For example, the stomach has a longer portion on the left and a shorter portion on the right. This means more proliferation has occurred on the left.
- Cells interact with other cells and the surrounding environment

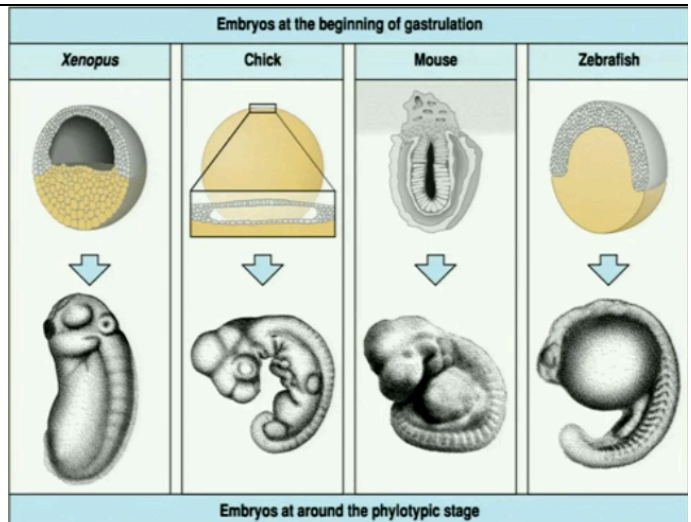
Xenopus = frog

Morphologically, the chick embryo develops as a disc initially so it's similar to the human

In all the animals, we can see that there is:

- a definite head and tail
- somites (segmentation)
- limbs
- some conserved signals to direct development

Mouse similar to human in that they develop a placenta



Stages of Animal Development

KNOW!

“Cricket Players at the MCG”

Cleavage Divisions:

- Egg gets divided into a number of small cells but the overall size stays the same
- Not much movement

Pattern Formation:

- Preceded by a change in gene expression as pattern is determined by which genes are expressed when
- Establishment of body plan
- Axes specification of germ layers

Morphogenesis:

- Change in form (e.g. gastrulation, neurulation)

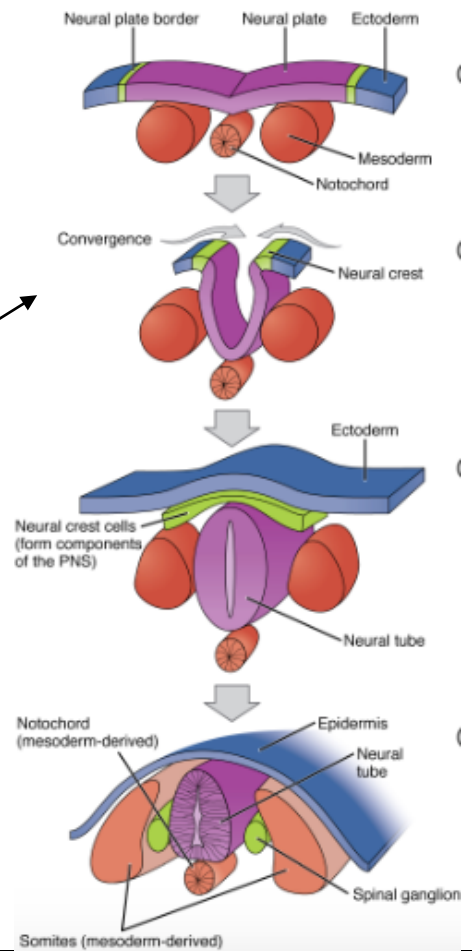
Cell Differentiation:

- Cell become structurally and functionally different from each other

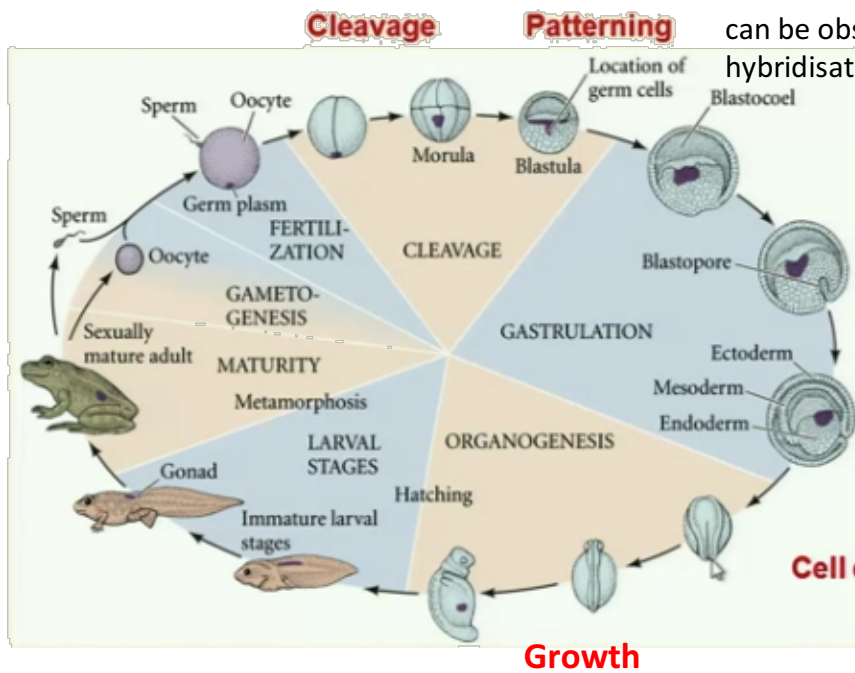
Growth:

- Increase in body size

in situ hybridisation allows us to identify the patterning which cannot be identified with microscopy alone



Embryogenesis of the Leopard Frog *Rana pipiens*



can be observed through *in situ* hybridisation

Morphogenesis

migration through the blastopore

Cell differentiation

Growth