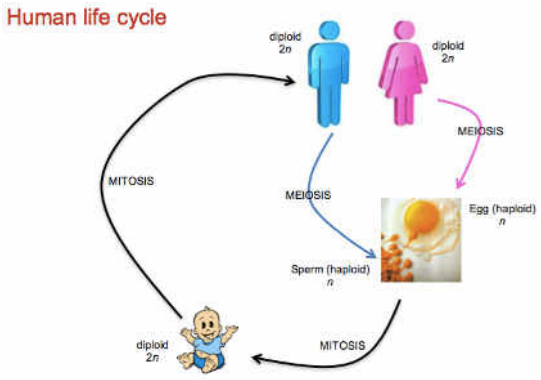
Lecture 3 &4 : Embryology 1 & 2

Why study Embryonic development?

- To understand adult anatomy
- Can inform us when things go wrong: eg. birth defects, cancer
- Provides information about lots of issues: eg. reproduction, birth defects, contraception, stem cells

Birth Defects (congenital diseases):

- Birth defects can also be called Congenital diseases
- They can be structural or functional defects (eg. metabolic disorder)
- It is a condition present at/ before birth (regardless of cause)
- Causes of disease can be from some/ all of:
  - Genetic
  - Infectious
  - Nutritional
  - Environmental
- Happens in around 3% of live birth

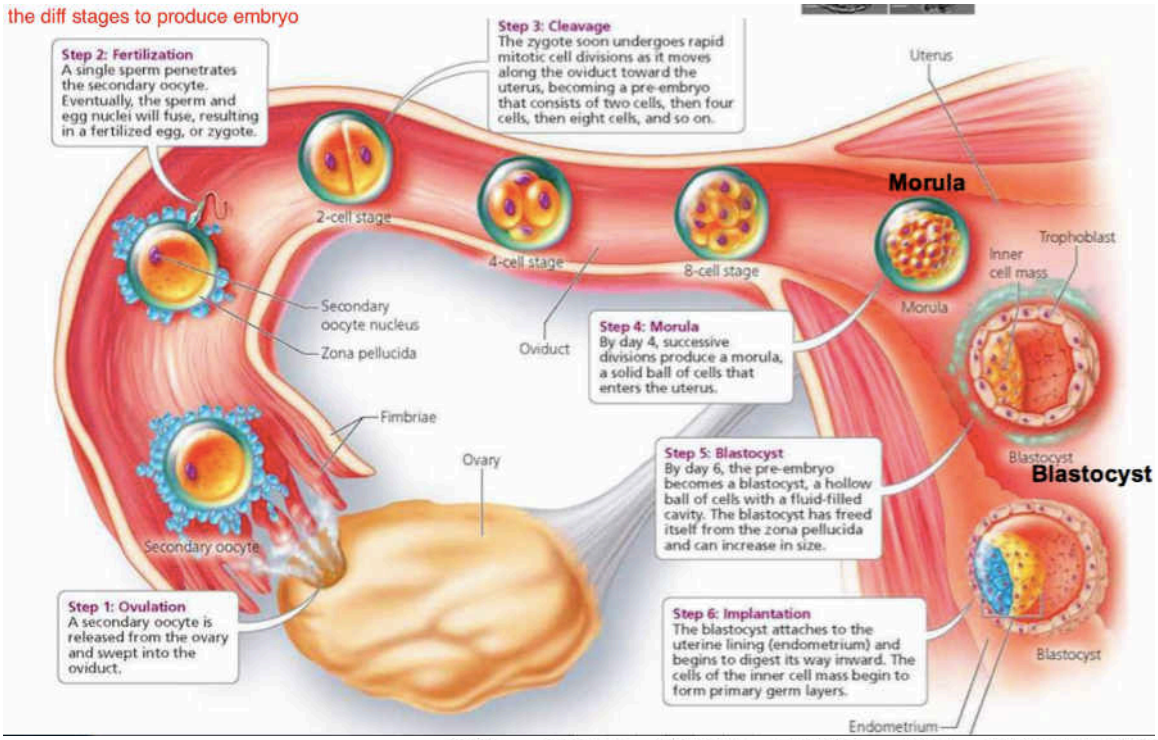


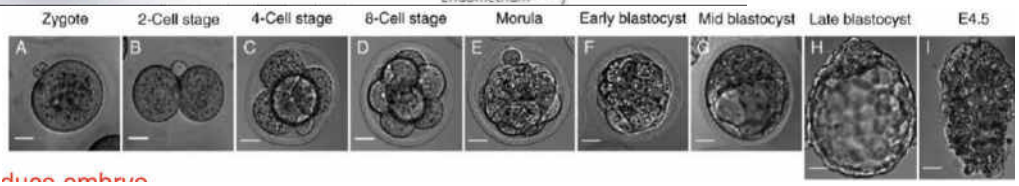
Examples: *don't know details*

- Orofacial clefts (lip, palate) – 1:1000
- Trisomy 21 – 1:700-900 (1:380 if early termination/death counted)
- Heart defect – 1:110
- Neural tube defects-- 1:2400
- Polydactyly-- 1:1100

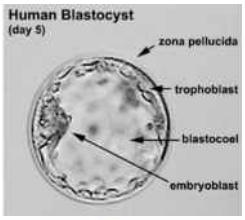
Human embryology can be split into 3 different periods:

1. Egg (conceptus) – fertilisation- end of 3rd week
2. Embryo -- start of 4th week (1st month) – end of 8th week (2nd month)
3. Fetus -- start of 3rd month - birth





duce embryo

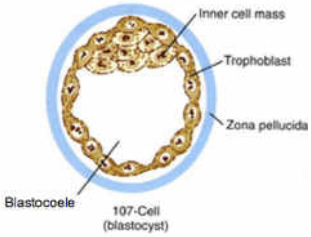


Breaking down the above diagram:

Morula: all the little cells inside are very similar

Blastocyst:

Begin to have some cell migration happening

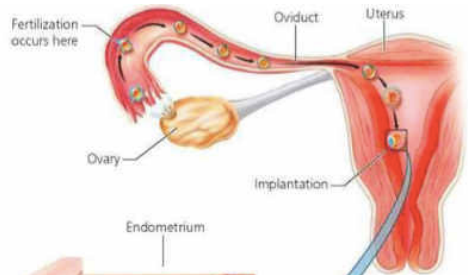


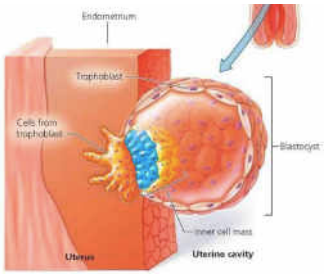
The whole blastocyst structure contains 2 different types of cells:

- **Inner cell mass** – give rise to the embryo (also called embryonic stem cells)
- **Trophoblast**-- outer epithelial layer
    - Forms some extraembryonic structures (extraembryonic membrane that surrounds the embryo) - which later forms part of the placenta
- Blastocyst implants into uterine wall after 5-10 days

Implantation:

- Causes the cell in ICM to differentiate into different cells
- Diff genes are beginning to be expressed





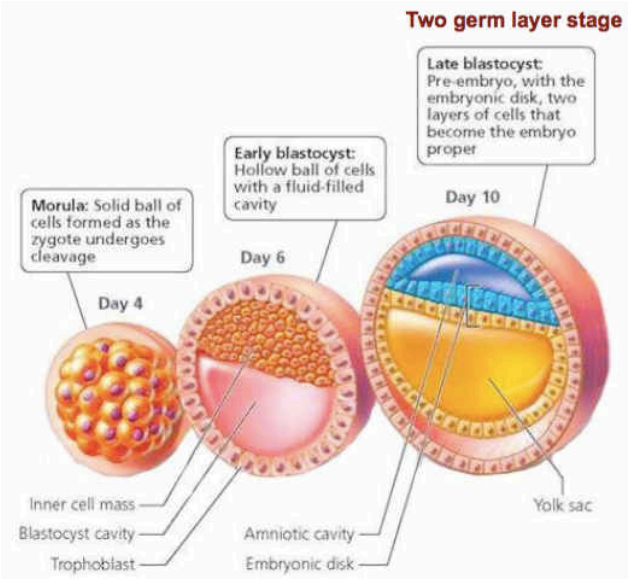
Gastrulation:

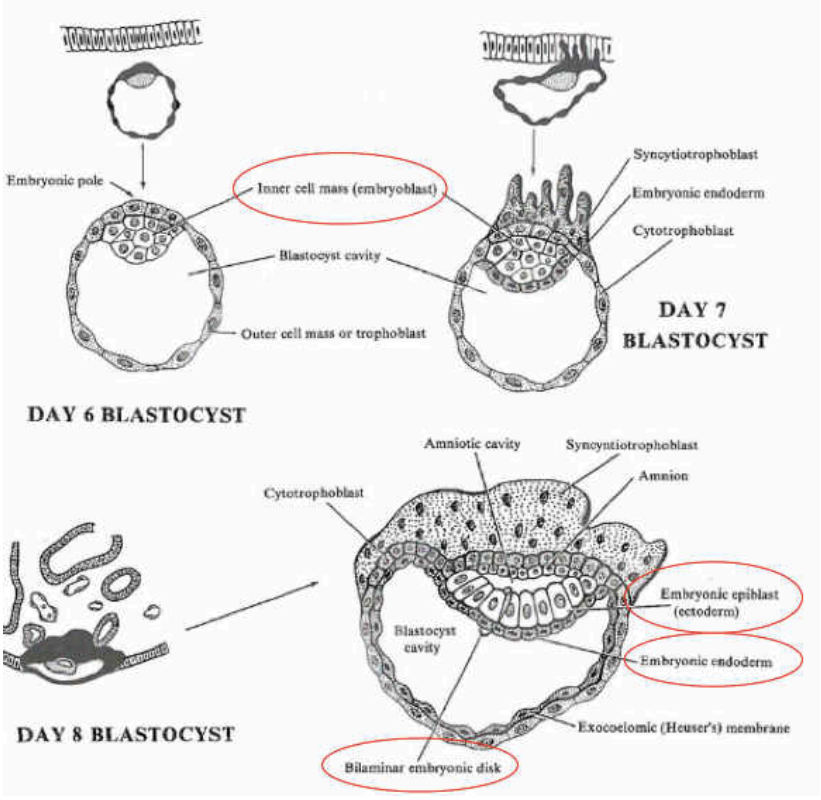
- Formation of the **primitive streak**:
    - which defines all the major body axes- ie. Dorsal, ventral, left, right is set up by this streak
- Forms the **3 germ layers**:
    - Which form the diff tissues and organs in adults
    - The 3 layers: ectoderm, mesoderm, endoderm

The Two Germ Layer Stage:

- Inner cell mass splits
- Cavitation – formation of empty space
- Embryonic disc forms

The implantation of blastocyst before would have caused cells to begin to differentiate. It will split to 2 layers of cell, which is called the **embryonic disk**. These two layers will later give rise to the embryo itself.

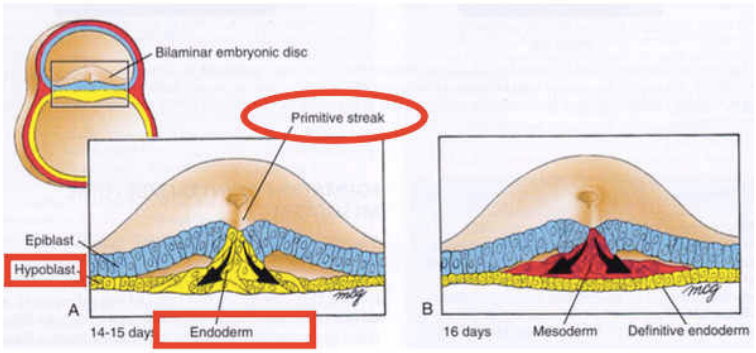


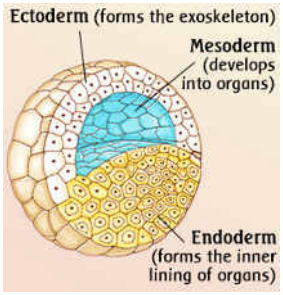


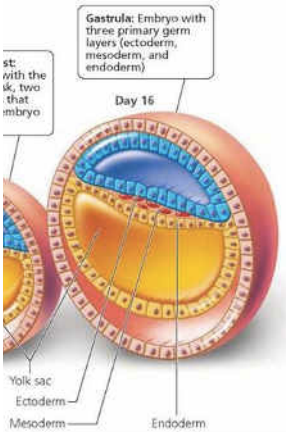
To get to the Third Layer Stage:

When the ICM split into 2 different layers—it formed the **embryonic disc /bilaminar disc**

- The bilaminar disc is composed of epiblast and endoderm/hypoblast
- The top surface of the bilaminar disc is the **epiblast**
- The epiblast has a line of thickened cells—**primitive streak**
- The primitive streak invaginates to form **primitive groove**
- The bottom surface of the disc is the **hypoblast/endoderm**
  (the cells of epiblast will move into the hypoblast to form the endoderm)
  (hypoblast also called the primitive endoderm)



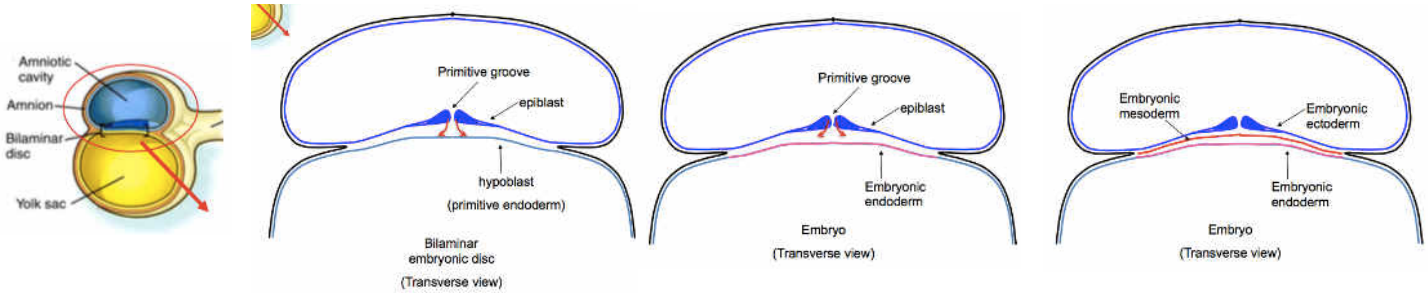




Gastrulation:

- Cells of the **epiblast** migrate towards the middle and into the **primitive groove**
- Firstly—cell move into **hypoblast** – forms embryonic endoderm
- Then – cells move into space **between epiblast and endoderm** – forms embryonic mesoderm
- Last—cells **left in epiblast** becomes embryonic ectoderm

Three layers stage now!



Embryonic Body Axes:

- Where primitive streak starts:
  Caudal (posterior)
  Towards the tail
- Opposite end of streak
  Cranial (anterior)
  Towards the head
- "Top" side where primitive streak is:
  Dorsal
- "Bottom side" without primitive streak is:
  Ventral
- Also gives **Left right asymmetry**