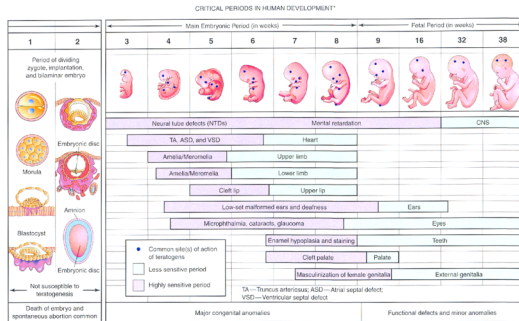


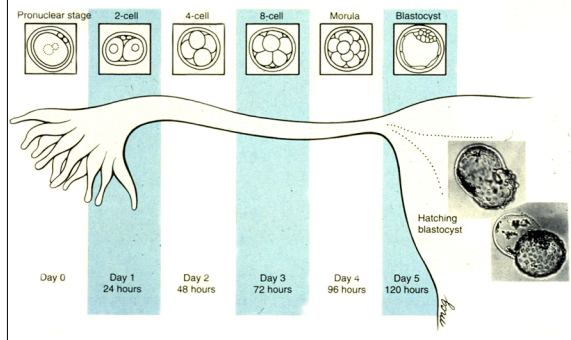
Introduction to Embryology I

A. From Cleavage to Gastrulation

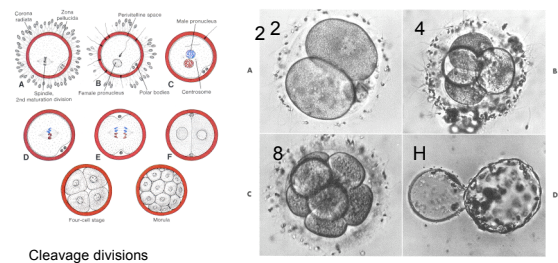


How do we begin? The first week following conception cell division takes place along the oviduct. At the end of that week the embryo "touches" down onto the uterine surface.

Cleavage divisions take place within the oviduct.
Embryo hatches out of the zona pellucida in uterus



FROM ZYGOTE TO MORULA



Cleavage divisions

Compaction: establishment of inner and outer lineages

I. PATTERNS OF DEVELOPMENT

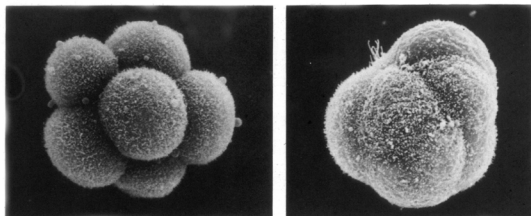
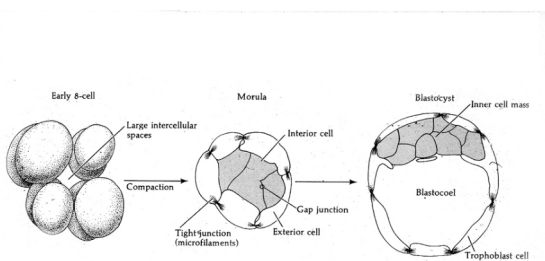


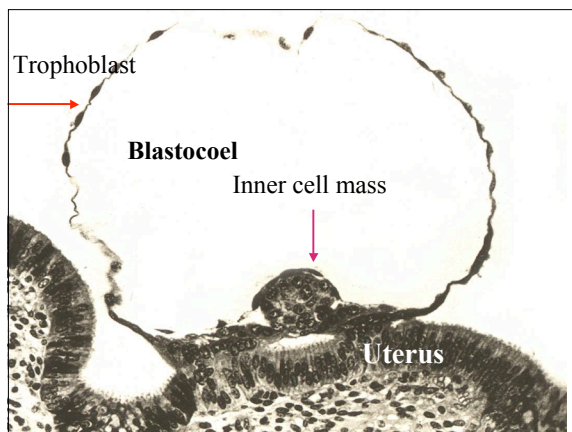
FIGURE 21
Scanning electron micrograph of uncompact (left) and compact (right) 8-cell mouse embryo. (Photographs courtesy of C. Ziomek.)

their behavior. They suddenly huddle together, maximizing their contact with the other blastomeres and forming a compact ball of cells (Figure 21). This tightly packed arrangement is stabilized by tight junctions that form between the outside cells of the ball, sealing off the

Fate:
Potency:
Commitment:
Differentiation:



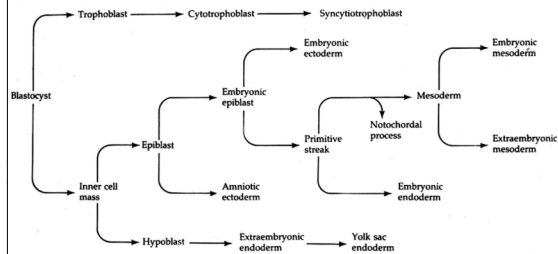
All cells contact the outside Outer cell Trophoblasts (O)
Inner Cells Inner cell mass (I)



Lineages from the cells of the blastocyst

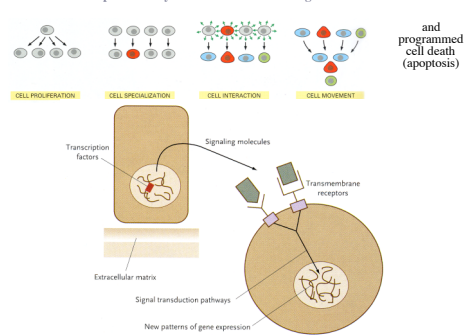
FIGURE 31

Scheme illustrating the derivation of tissues in human and rhesus monkey embryos. (After Luckett, 1978.)

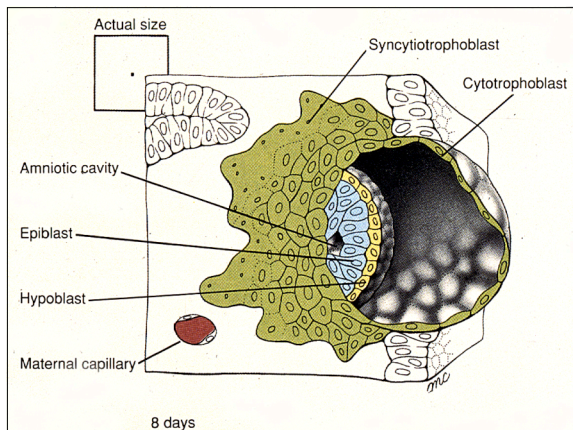


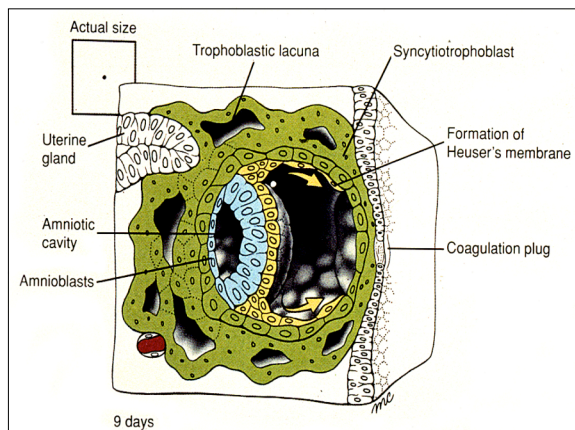
UNIVERSAL MECHANISMS OF ANIMAL DEVELOPMENT

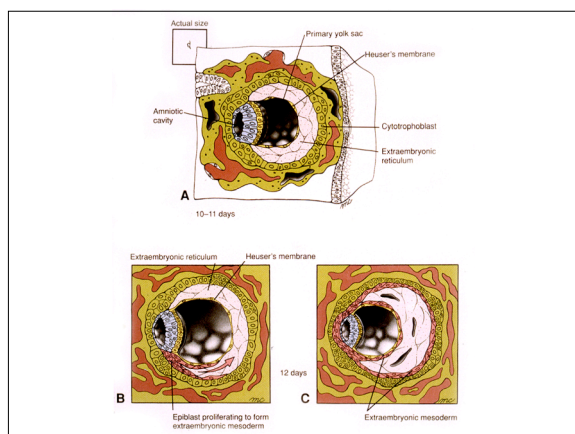
The five essential processes by which a multicellular organism is made

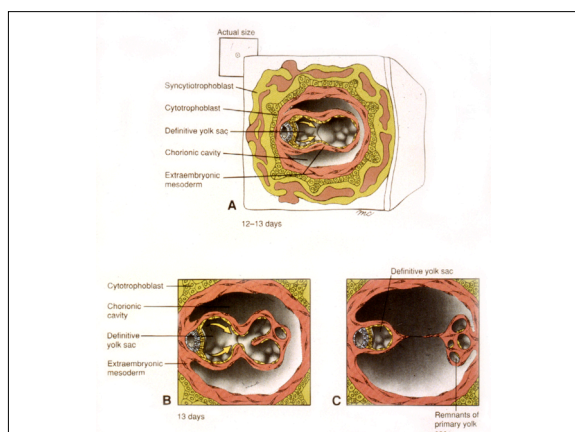


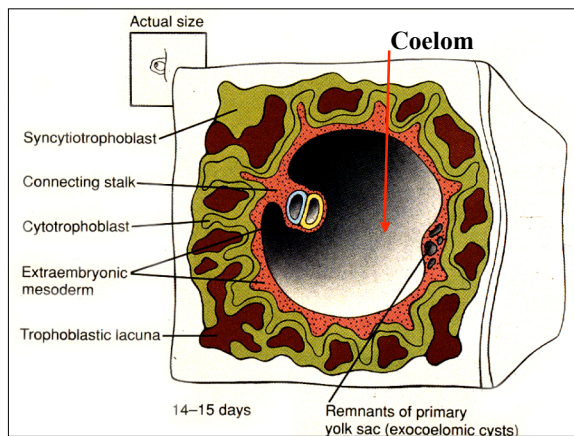
Schematic representation of types of developmentally important molecules and their sites of action











Gastrulation

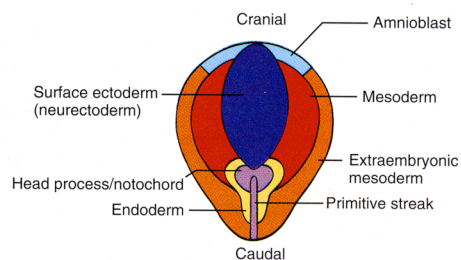
Formation of the 3 germ layers

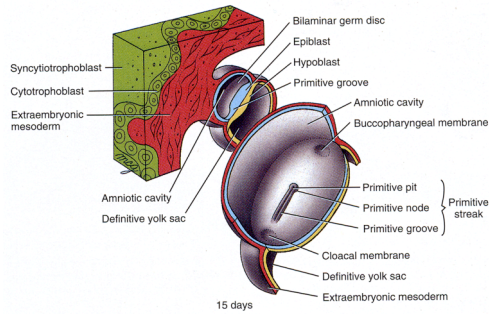
Ectoderm: Epidermis, neural tissue, neural crest

Mesoderm: axial, paraxial, intermediate and lateral plate

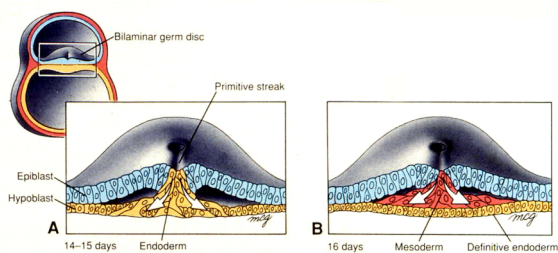
Endoderm: lining of gut and respiratory tract

Fate map of epiblast prior to gastrulation.



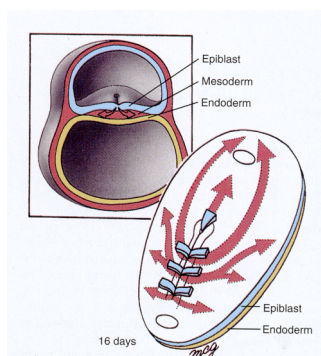


First sign of gastrulation
is the formation at midline of primitive streak.
Formation of streak defines cranial and caudal axes.

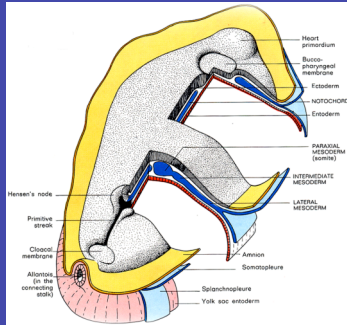


Cells of the epiblast gain access to the interior via primitive node and streak.
Hypoblast is replaced by true endoderm.

Where and when epiblast cells enter the node or streak
determines their fate.



At the end of gastrulation the 3 primary germ layers are present. The 3 axes of the embryo are established. The embryo still touches extra-embryonic tissue on all edges.



Gamete production and fertilization – re-establishment of the 2N state.

Cleavage divisions: setting aside embryonic vs. extra-embryonic lineages

Initial stages of implantation and formation of extra-embryonic spaces.

Gastrulation: place and time of migration determines fate. Formation of 3 germ layers.

Introduction to Embryology I

B. Neural induction

What is induction?

It is the interaction of two cells/tissues which leads to a change in fate of (at least) one of them. Responding tissue must show competence. Competence can change over time.

What are the mechanisms of induction:

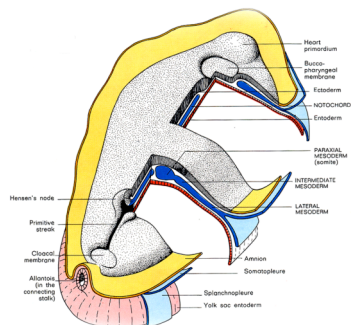
1. Diffusible signals referred to as morphogens. Cells/ tissues that "see" the morphogen take on a new fate. For many morphogens both the biochemistry and the concentration of the morphogen carry information. Gradients are stabilized by restrictions on diffusion.

2. ECM

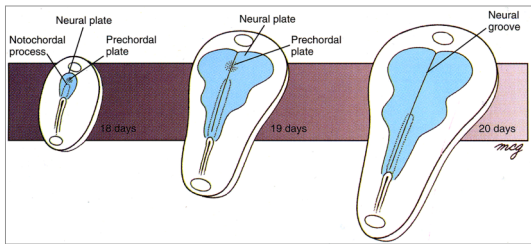
3. Cell-Cell

In all cases the tissue with altered fate had to have been competent to respond.

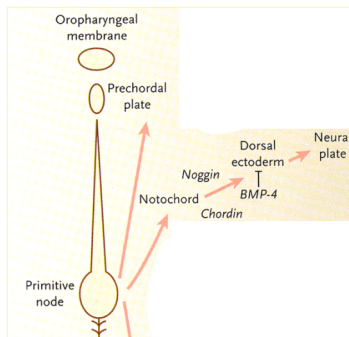
Note the midline position of the notochord vis-à-vis dorsal ectoderm.



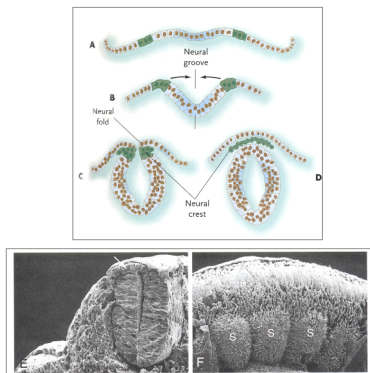
Shaping the neural plate

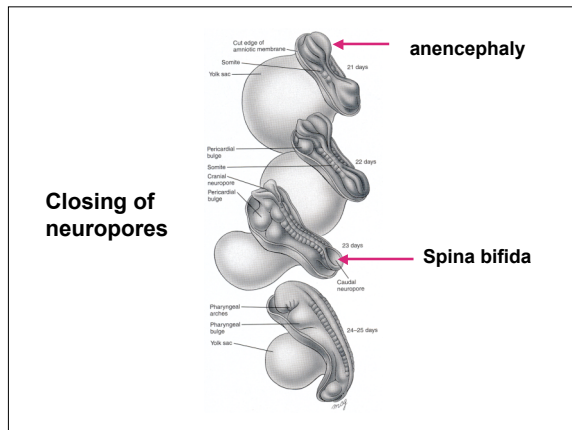


“Negative” induction of neural plate.



The neural crest





Neural tube –
 “induced” by inhibition of signals
 (morphogens) coming from dorsal ectoderm
 (block BMP-4) by secretions from notochord
 and prechordal plate (noggin).
 neural plate folds into a tube
 central canal of tube is maintained.

Introduction to Embryology II

II. FLEXION AND FOLDING

Formation of the body cylinder or how to turn a flat structure into a tube.

II. FLEXION AND FOLDING

Formation of the body cylinder or how to turn a flat structure into a tube.

A Movie

