"Week 3 of Development – Gastrulation"

Overview

- At week 3, the embryo is initially a bilaminar germ disc:
    1. Epiblast (columnar cells, dorsal)
    2. Hypoblast (cuboidal cells, ventral)
- Gastrulation occurs → formation of the three primary germ layers:
    1. Ectoderm
    2. Mesoderm
    3. Endoderm
- All three germ layers are derived from epiblast cells

Step 1: Initiation of Gastrulation – Primitive Streak

- Appears at day 15–16
- Structure: Narrow groove on dorsal epiblast with bulging sides

Key Regions

Structure	Feature
Primitive streak	Midline thickened epiblast band
Cephalic end of streak	Called primitive node
Primitive pit	Small depression at center of node

Flowchart

Epiblast → Midline thickening → Primitive streak formation → Primitive node + pit

---

Step 2: Invagination of Epiblast Cells

- Definition: Epiblastic cells migrate toward the primitive streak, become flask-shaped, and slip beneath the epiblast layer
- Mechanism: Invagination
- Molecular Regulation:
    - Fibroblast Growth Factor 8 (FGF8) synthesized by streak cells
    - FGF8 functions:
        1. Down-regulates E-cadherin → allows epiblast cells to detach

2. Controls mesoderm specification via BRACHYURY (T gene)

Cell Movements

1. Downward, lateral, cranial migration
2. Cell fate determination:
    - Cells displacing hypoblast → Endoderm
    - Cells between epiblast & endoderm → Mesoderm
    - Remaining epiblast cells → Ectoderm

Flowchart of Germ Layer Formation

Epiblast cells → Primitive streak → Invagination

- Displace hypoblast → Endoderm
- Intermediate layer → Mesoderm

- Remaining epiblast → Ectoderm

Spatial Extent of Invagination

- Cranial: Up to prechordal plate
- Lateral: Up to extraembryonic splanchnic mesoderm
- Caudal: Continues toward primitive streak end

Takeaways

- All germ layers originate from epiblast
- Primitive streak = hallmark of gastrulation
- Primitive node = organizer region; later forms notochordal process
- FGF8 is key molecular regulator:
    - Detachment (E-cadherin downregulation)

    - Mesoderm specification via BRACHYURY (T)
- Prechordal plate = cranial signaling center
- Gastrulation establishes body axes:
    - Cranial–caudal
    - Dorsal–ventral
    - Left–right symmetry

-> The End <-