PIPADOR REVISION

# MRCOG Part 1 Revision Notes

## *The Third Week — Trilaminar Disc*

EMBRYOLOGY • LECTURE 46

VISUAL EXAMINATION REVISION NOTES

*2026 Edition*

MRCOG Part 1 Revision Notes

# Lecture 46: The Third Week — Trilaminar Disc

*Embryology • Visual revision edition*

COLOUR CODE USED THROUGHOUT THESE NOTES

| ECTODERM | MESODERM | ENDODERM | NOTOCHORD | NEURAL TUBE |
|---|---|---|---|---|

**LEARNING OBJECTIVES — tick off as you go**

- ☐ Describe the primitive streak and how all three germ layers arise from the epiblast.
- ☐ Describe the notochord and its signalling roles.
- ☐ Outline neurulation and neural tube closure times.
- ☐ Name the mesoderm subdivisions, their derivatives, and somite differentiation.
- ☐ Explain how the body axes (including left–right) are set up.
- ☐ Know the week-3 cardiovascular and villus milestones, and the clinical correlates.

## 1 Overview

**IN ONE LINE:** *Week 3 = GASTRULATION: the two-layered disc becomes three layers — ectoderm, mesoderm, endoderm — all from the epiblast. Organ-building starts, so teratogens now cause malformations.*

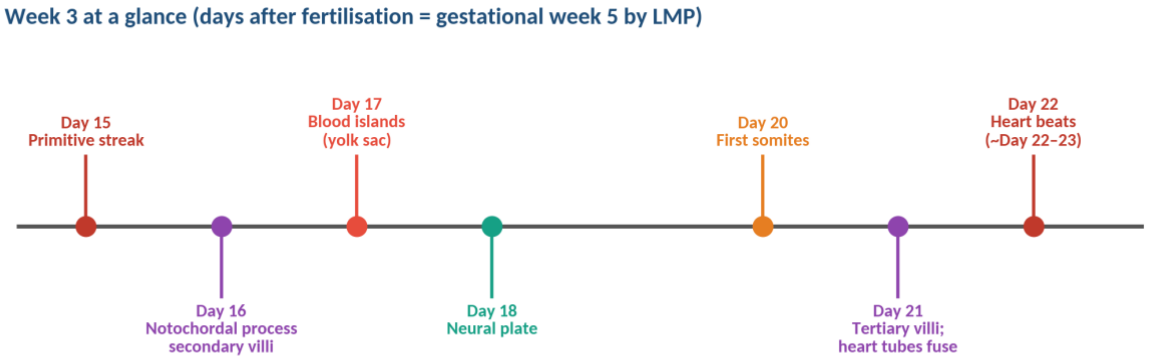



*Figure 1. Week 3 at a glance.*

- Week 3 after conception = **gestational week 5** — around the **first missed period**, often before pregnancy is known.

## 2 Gastrulation and the Primitive Streak

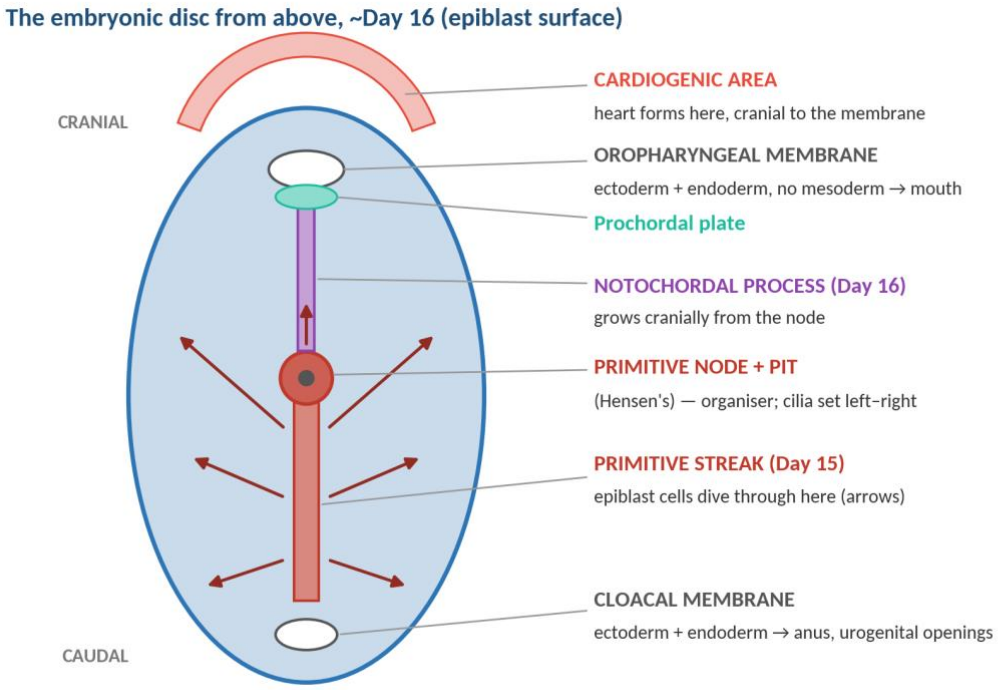



*Figure 2. The disc from above.*

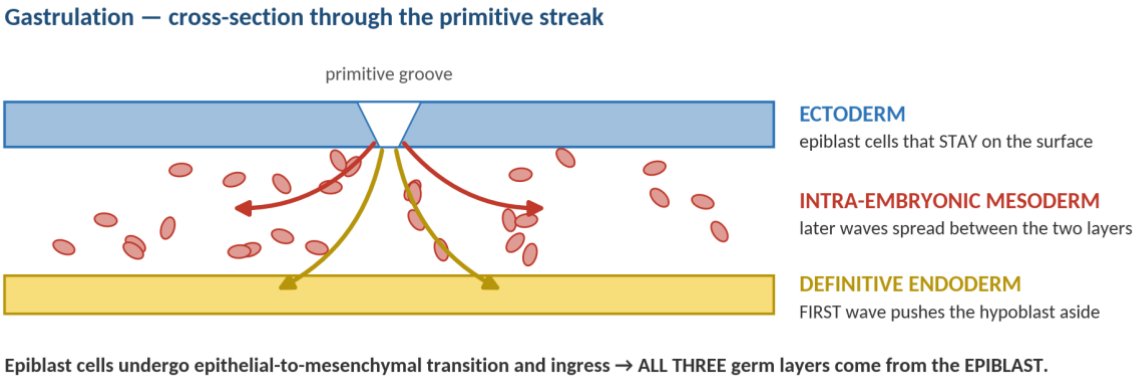



*Figure 3. How the three layers form.*

- **Day 15**: epiblast cells heap up in the caudal midline → **primitive streak**; its cranial end is the **primitive node** (Hensen's) with a **pit**. The streak later regresses.
- The streak fixes the **axes**: cranial–caudal (node vs streak), dorsal–ventral (epiblast vs endoderm), left–right (node cilia).
- **Oropharyngeal** (cranial) and **cloacal** (caudal) membranes: ectoderm fused to endoderm with no mesoderm between → future mouth and anus/urogenital openings.

## 3 Notochord and Neurulation

- **Day 16**: notochordal process grows cranially from the node → fuses with endoderm (notochordal plate) → folds off as the solid **notochord**.
- **Notochord** = midline axis + signalling centre (**SHH**): induces the neural plate, patterns the ventral neural tube (motor neurons) and the **sclerotome**. Survives only as the **nucleus pulposus**.

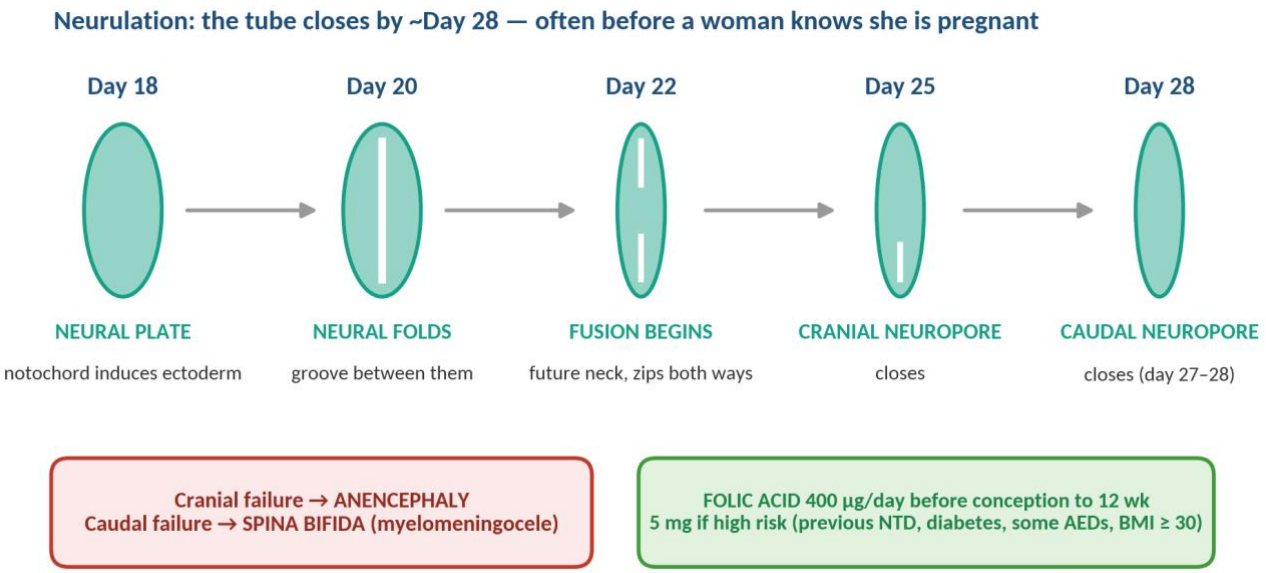



*Figure 4. Neural tube closure.*

**EXAM HOOK**

Cranial neuropore closes **~Day 25**, caudal **~Day 27–28** — so **folic acid must be started before conception** (400 µg/day to 12 weeks; **5 mg** if previous NTD, diabetes, some antiepileptics, BMI ≥ 30).

## 4 Mesoderm and Somites

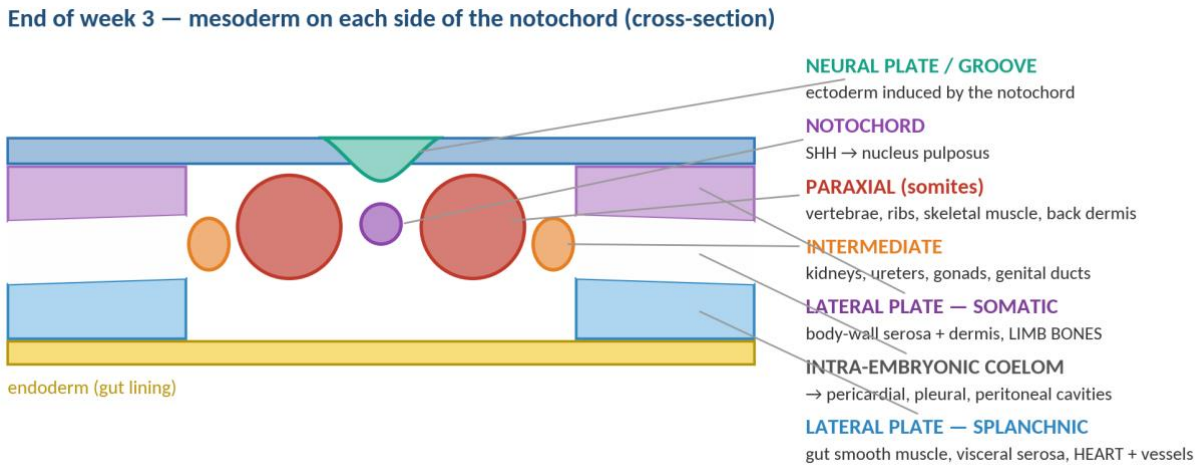



*Figure 5. Mesoderm on each side of the notochord.*

| Mesoderm | Position | Derivatives |
|---|---|---|
| **Paraxial** | Beside the neural tube → somites | Vertebrae, ribs, skeletal muscle (trunk + limbs), dermis of the back |
| **Intermediate** | Lateral to paraxial | Kidneys, ureters, gonads, genital ducts |
| **Lateral plate — somatic** | Body wall | Parietal serosa, body-wall dermis, limb bones and connective tissue |
| **Lateral plate — splanchnic** | Around the gut | Visceral serosa, gut smooth muscle, heart and blood vessels |

- The **intra-embryonic coelom** between somatic and splanchnic layers → pericardial, pleural and peritoneal cavities.

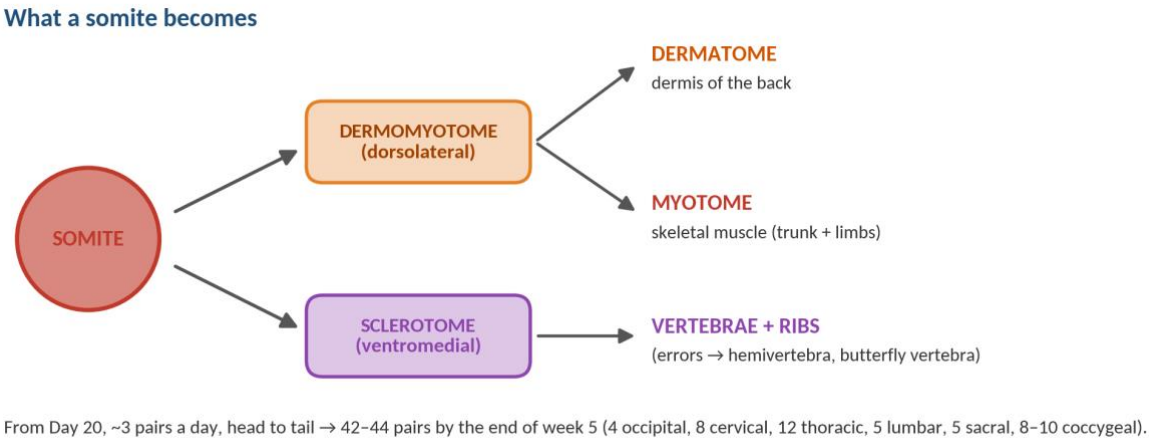



*Figure 6. Somite fates.*

> **MNEMONIC / MEMORY HOOK**
>
> **Somite = 'S-D-M'**: **S**clerotome (skeleton — vertebrae, ribs) • **D**ermatome (dermis) • **M**yotome (muscle).

- Somite counts are used to **stage embryos** (in specimens); clinical dating uses the **CRL** on ultrasound.

## 5 Body Axes

| Axis | How it's set |
|---|---|
| **Cranial–caudal** | Anterior visceral endoderm (before gastrulation); node vs streak; Hox genes in sequence |
| **Dorsal–ventral** | BMP high ventrally; node/notochord antagonists (chordin, noggin, follistatin) dorsally |
| **Left–right** | Motile node cilia → leftward fluid flow → Nodal then Pitx2 on the left |

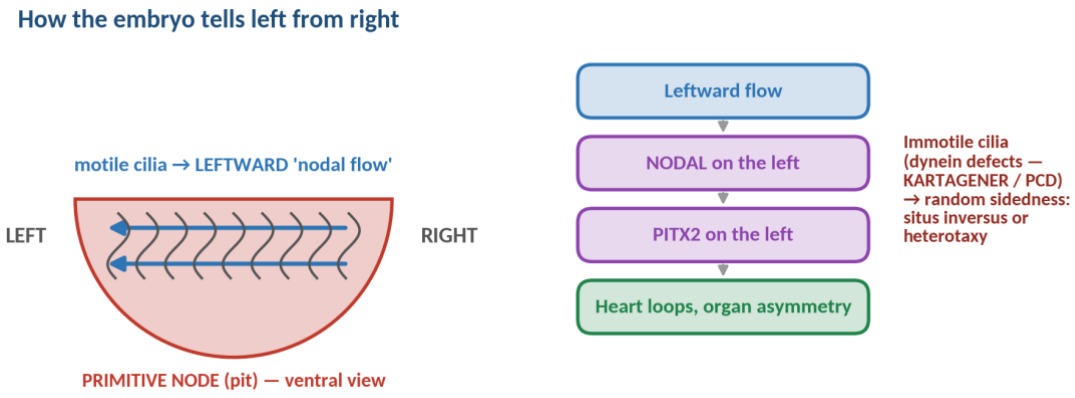



*Figure 7. Left–right asymmetry.*

## 6 Blood, Heart, Allantois and Villi

**BLOOD + HEART**

- **Day ~17**: blood islands in yolk-sac mesoderm (outer cells → endothelium, inner → primitive blood), then in the embryo
- Paired endocardial tubes form in the **cardiogenic area** (cranial to the oropharyngeal membrane)
- Folding brings them together → **single heart tube ~Day 21–22**; **beats ~Day 22–23**

**ALLANTOIS + VILLI**

- **Allantois** buds from the yolk sac into the connecting stalk around **Day 16**; its vessels → **umbilical vessels**; its stalk → **urachus → median umbilical ligament**
- Villi: **primary** (Day 13) → **secondary** (Day 16, mesoderm core) → **tertiary** (Day 21, fetal vessels)

## 7 Clinical Correlates

| Condition | Link to week 3 |
|---|---|
| Sacrococcygeal teratoma | Leftover primitive-streak cells; commonest newborn tumour; more in girls; malignant risk rises with age at presentation |
| Caudal regression | Caudal mesoderm defect — sacral agenesis → sirenomelia; strongly linked to maternal diabetes |
| Neural tube defects | Anencephaly (cranial neuropore); myelomeningocele/meningocele (caudal). Spina bifida occulta is a vertebral-arch defect with the cord covered |
| Situs inversus / heterotaxy | Node cilia defect — Kartagener / primary ciliary dyskinesia; heterotaxy → complex heart disease, asplenia/polysplenia |
| Vertebral anomalies | Sclerotome errors — hemivertebra, butterfly vertebra; part of VACTERL |
| Conjoined twins | Incomplete splitting around Day 13–15, as the primitive streak forms |

★ **PEARL**

**All three germ layers come from the epiblast.** The first cells through the streak make **endoderm**; later ones make **mesoderm**; those that stay are **ectoderm**.

The neural tube closes by ~**Day 28** (6 weeks by LMP) — why folic acid must start **before** conception.

## 8 MRCOG Exam Pearls — Last-Minute Page

**Numbers to know**

| | | | |
|---|---|---|---|
| **Day 15**<br>Primitive streak | **Day 16**<br>Notochordal process | **Day 18**<br>Neural plate | **Day 20**<br>First somites |
| **Day 22–23**<br>Heart beats | **Day 25 / 28**<br>Cranial / caudal neuropore | **42–44**<br>Somite pairs (week 5) | **400 µg / 5 mg**<br>Folic acid |

**HIGH-YIELD CHECKLIST**

- ☐ Gastrulation: epiblast → endoderm (first), mesoderm, ectoderm.
- ☐ Streak Day 15; node at the cranial end; membranes without mesoderm at each end.
- ☐ Notochord (SHH) induces the neural plate; remnant = nucleus pulposus.
- ☐ Neural plate Day 18; fusion Day 22; neuropores close Day 25 and 27–28.
- ☐ Paraxial → somites; intermediate → urogenital; lateral plate somatic/splanchnic.
- ☐ Somite → sclerotome, dermatome, myotome; ~3 pairs a day from Day 20.
- ☐ Left–right: node cilia → Nodal → Pitx2; PCD → situs defects.
- ☐ Blood islands Day 17; heart tube Day 21–22; beats Day 22–23.
- ☐ Villi: primary Day 13 → secondary Day 16 → tertiary Day 21.
- ☐ Sacrococcygeal teratoma; caudal regression (diabetes); NTDs (folic acid).

**Self-assessment** — cover the right-hand column

| Question | Answer |
|---|---|
| **Where do all three germ layers come from?** | The epiblast |
| **First germ layer formed by cells passing through the streak?** | Definitive endoderm |
| **Adult remnant of the notochord?** | Nucleus pulposus |
| **Main signal from the notochord?** | Sonic hedgehog (SHH) |
| **When does the caudal neuropore close?** | Day 27–28 |
| **Which mesoderm forms the kidneys and gonads?** | Intermediate |
| **Which mesoderm forms the heart?** | Splanchnic lateral plate |
| **Three parts of a differentiating somite?** | Sclerotome, dermatome, myotome |
| **What sets left–right asymmetry?** | Node cilia → leftward flow → Nodal → Pitx2 |
| **Commonest tumour of the newborn?** | Sacrococcygeal teratoma |
| **Maternal condition linked to caudal regression?** | Diabetes |

## 9 References


- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- NICE PH11. Maternal and child nutrition (folic acid). 2008 (updated 2014).
- NICE NG201. Antenatal care. 2021.