PIPADOR REVISION

MRCOG Part 1 Revision Notes

The First Week and Implantation

EMBRYOLOGY • LECTURE 44

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 44: The First Week and Implantation

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

TROPHOBLAST	INNER CELL MASS	SYNCYTIO / hCG	ENDOMETRIUM / ZONA	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Give the day-by-day timeline from zygote to implantation.
- ☐ Describe compaction, cavitation and the blastocyst.
- ☐ Explain the window of implantation and endometrial receptivity.
- ☐ Describe apposition, adhesion and invasion, and trophoblast differentiation.
- ☐ Explain the role of hCG in early pregnancy.
- ☐ Apply to ectopic pregnancy, moles, twinning and IVF (transfer, PGT, implantation failure).

1 Cleavage: Day by Day

IN ONE LINE: *The zygote divides while it travels down the tube, reaching the uterus as a morula on Day 4 — without getting any bigger.*

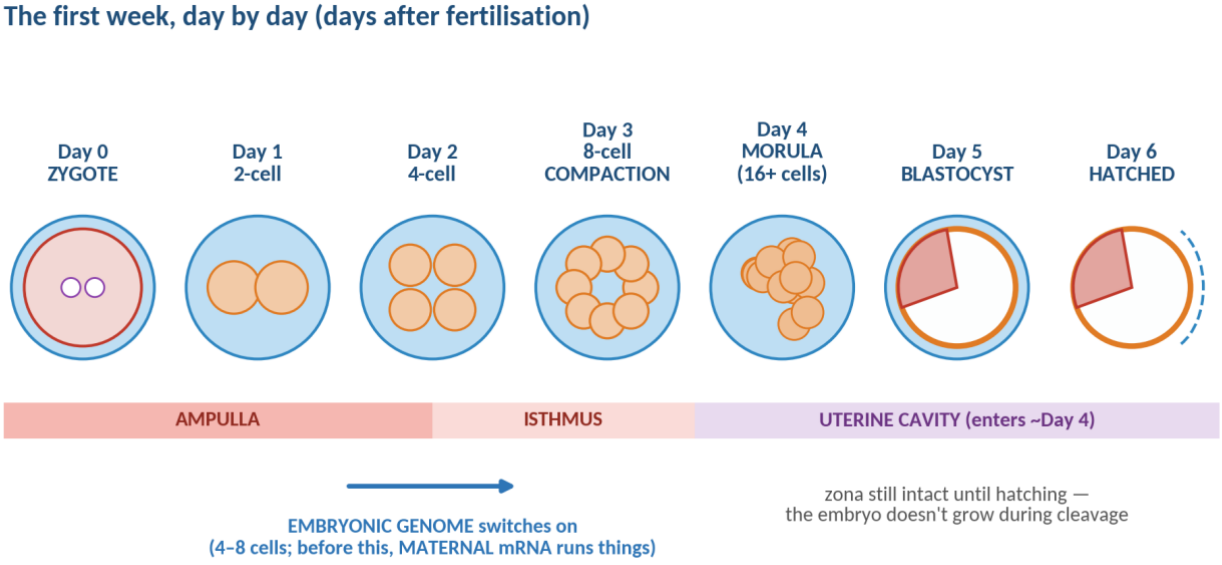


Figure 1. The first week.

Day	Stage	Where
0	Zygote	Ampulla
1	2-cell (~24–30 h)	Ampulla
2	4-cell	Ampulla / isthmus
3	8-cell — compaction	Isthmus

Day	Stage	Where
4	Morula (16+ cells)	Entering the uterus
5	Blastocyst	Uterine cavity
6	Hatched blastocyst — apposition	Endometrium
7	Implantation begins	Endometrium

- Blastomeres get smaller with each division — the **zona** holds total size constant. Early divisions run on **maternal mRNA**; the **embryonic genome switches on at the 4–8-cell stage**.
- Tubal transport: cilia (oestrogen ↑), peristalsis and fluid flow; progesterone relaxes the isthmus. Tubal damage (PID, surgery, smoking) → **ectopic**.

2 Compaction and the Blastocyst

- **Compaction** (8 cells): **E-cadherin** junctions pull cells together; outer cells become epithelial → **first lineage decision**: outer → **trophectoderm**, inner → **inner cell mass**.
- **Cavitation** (~Day 5): Na^+/K^+-ATPase pumps Na^+ inwards, water follows → blastocyst cavity.

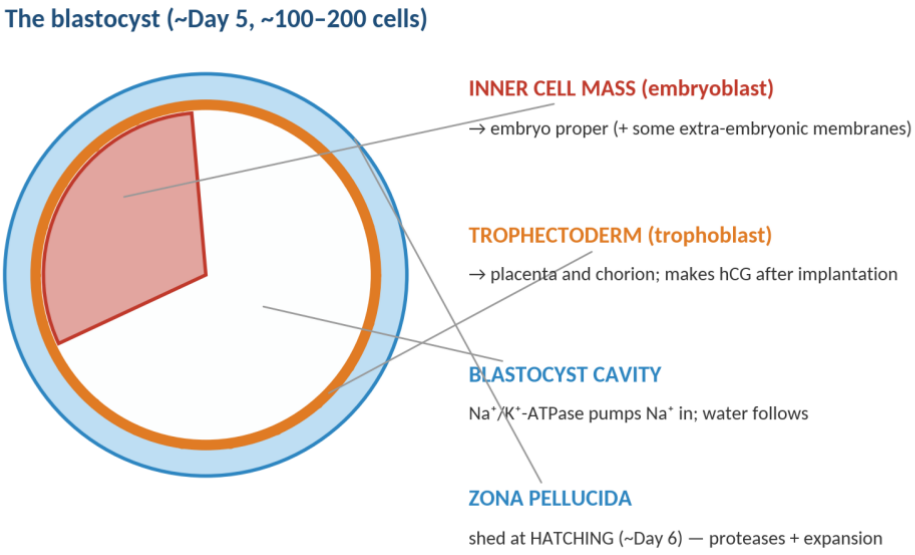
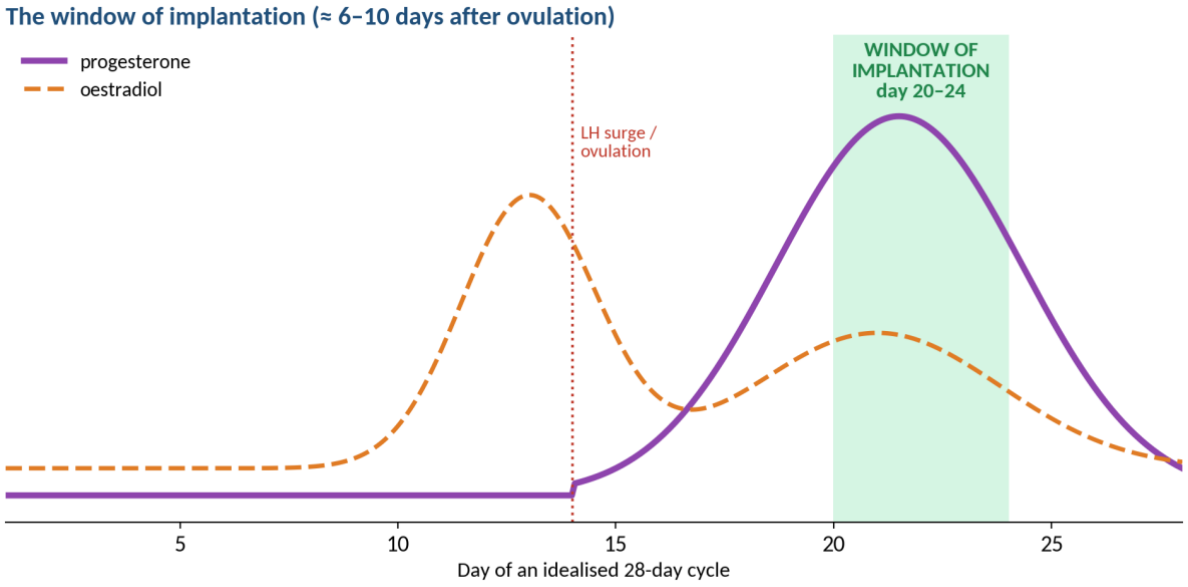


Figure 2. The blastocyst.

- **Hatching** (~Day 6) from the zona is essential for implantation. **Laser-assisted hatching** is used in some IVF units, but the HFEA rates the evidence of benefit as weak.

3 The Window of Implantation

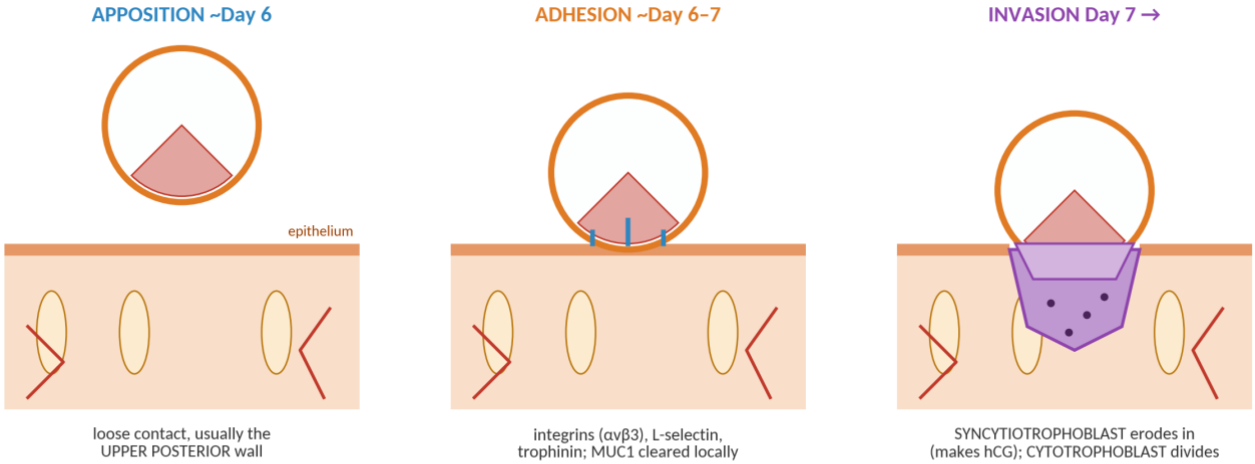


Progesterone-primed endometrium: tortuous glands, stromal oedema, pinopodes, LIF and IL-11, HOXA10/11, αvβ3 integrin; decidualisation begins.

Figure 3. A short, progesterone-dependent window.

Feature	Detail
Timing	Roughly days 20–24 of a 28-day cycle (~6–10 days after ovulation)
Endometrium	Secretory change under progesterone: tortuous glands, stromal oedema, spiral arteries, pinopodes; decidualisation starts in the late luteal phase
Molecules	LIF, IL-11, HOXA10/11; αvβ3 integrin, L-selectin ligands; anti-adhesive MUC1 cleared at the implantation site

4 Implantation



Fully embedded by ~Day 10–12; the defect in the epithelium is sealed over (schematic).

Figure 4. Apposition, adhesion, invasion.

TROPHOBLAST SPLITS INTO TWO

- **Cytotrophoblast** (inner) — single cells, dividing: the stem pool
- **Syncytiotrophoblast** (outer) — multinucleated, no division; **invades** and makes **hCG**

DECIDUA

- Stromal cells swell with glycogen and lipid — the **decidual reaction**
- **Basalis** (under the embryo → maternal placenta), **capsularis** (over it), **parietalis** (the rest)

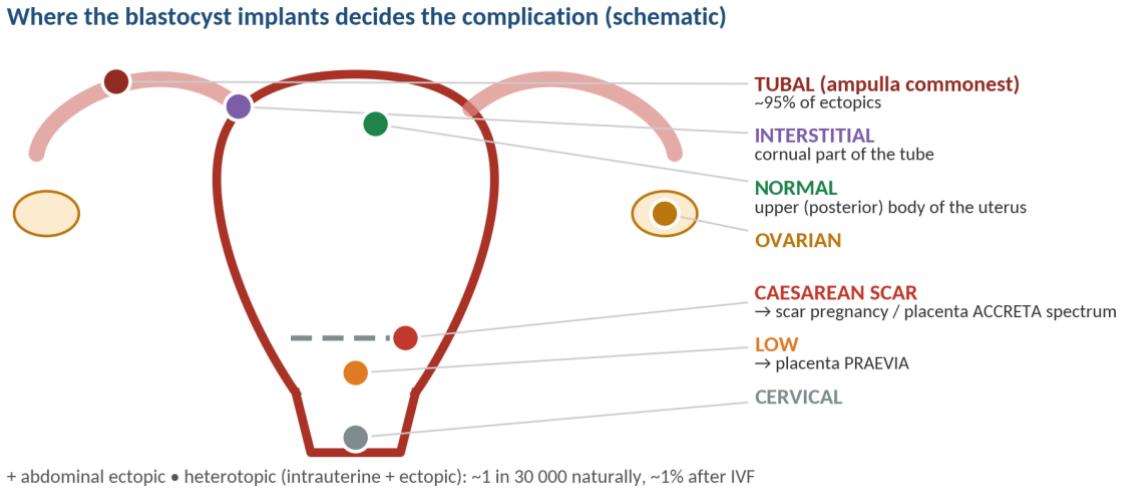


Figure 5. The implantation site matters.

5 hCG and the Corpus Luteum

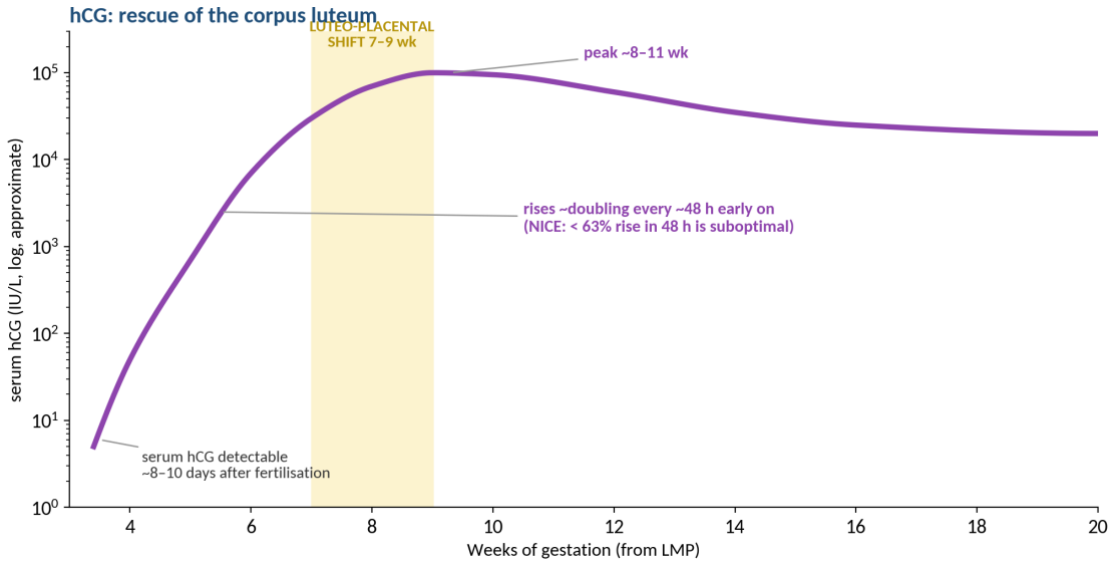


Figure 6. hCG in early pregnancy.

- Syncytiotrophoblast makes hCG from **Day 7–8** after fertilisation; serum-positive ~8–10 days after fertilisation; urine tests around the missed period.
- hCG **rescues the corpus luteum** → progesterone until the **luteo-placental shift (~7–9 weeks)**.

EXAM HOOK

Early on, hCG roughly doubles every ~48 h. **NICE (pregnancy of unknown location): a rise under 63% in 48 h** suggests a non-viable or ectopic pregnancy; a fall over 50% suggests a failing pregnancy. Very high hCG → **multiple or molar pregnancy**.

6 The First Week in IVF

TRANSFER + PGT

- **Day 3** (6–10 cells) or **Day 5 blastocyst** (better selection); Day 6 transfer or freezing for slower embryos
- **PGT-A** (aneuploidy), **PGT-M** (single-gene), **PGT-SR** (structural)
- **Trophectoderm biopsy** at blastocyst stage — spares the ICM

REPEATED IMPLANTATION FAILURE

- No universal definition; often failure after several good-quality embryo transfers (e.g. ≥3–4) (ESHRE 2023 good practice)
- Embryo: aneuploidy, poor quality
- Uterus: thin endometrium, **hydrosalpinx**, fibroids, polyps, scar
- Systemic: thyroid, APS, others

7 Clinical Correlates

Condition	Key points
Ectopic	~1–2% of pregnancies; ~95% tubal, ampulla commonest. Risks: previous ectopic, tubal damage, IVF, conception with an IUD, smoking, age. Diagnose with TVS + serial hCG
Complete mole	Androgenetic diploid (46,XX in ~80–90%); no fetus; very high hCG; theca-lutein cysts; highest GTN risk
Partial mole	Usually triploid (69,XXY / XXX); some fetal tissue; lower GTN risk
Heterotopic	Intrauterine + ectopic: ~1 in 30 000 spontaneously, ~1% after IVF
Implantation bleeding	Light bleeding as trophoblast invades, around the expected period; early-pregnancy bleeding overall is common (~1 in 5)

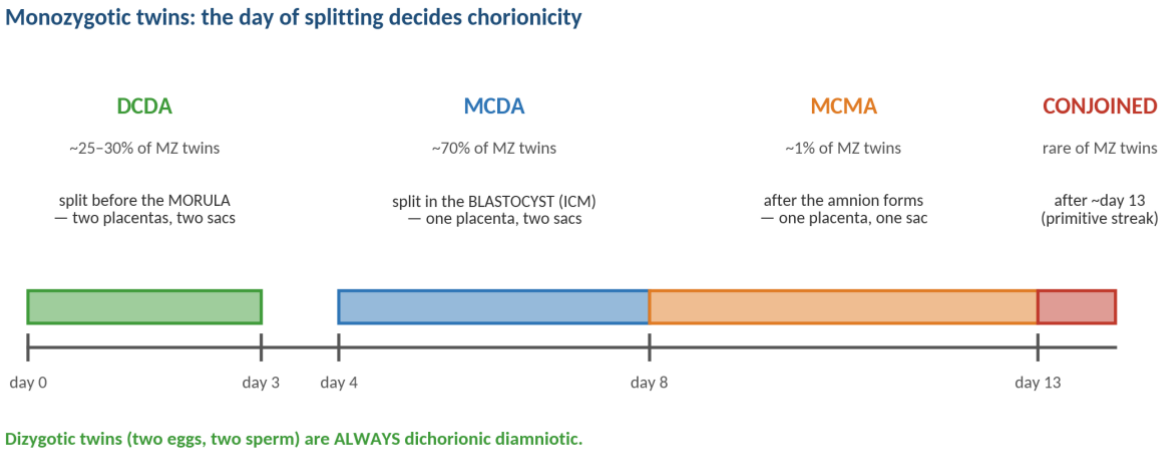


Figure 7. Monozygotic twinning.

MNEMONIC / MEMORY HOOK

MZ twins: split early = separate everything. Days 0–3 **DCDA** • 4–8 **MCDA** (commonest) • 8–13 **MCMA** • > 13 **conjoined**. Dizygotic = always DCDA.

8 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Day 3 8-cell, compaction	**Day 4** Morula into uterus	**Day 5** Blastocyst	**Day 7** Implantation starts
20–24 Window (cycle days)	**63%** Minimum 48-h hCG rise	**7–9 wk** Luteo-placental shift	**~70%** MZ twins MCDA

HIGH-YIELD CHECKLIST

- ☐ Cleavage in the tube; morula enters the uterus on Day 4.
- ☐ Maternal mRNA drives early cleavage; embryonic genome at 4–8 cells.
- ☐ Compaction (E-cadherin) at 8 cells → trophectoderm vs ICM.
- ☐ Blastocyst Day 5; hatching Day 6; implantation from Day 7, embedded by ~Day 10–12.
- ☐ Window of implantation cycle days 20–24 (progesterone).
- ☐ Apposition → adhesion (integrins, L-selectin) → invasion (syncytiotrophoblast).
- ☐ Syncytiotrophoblast makes hCG → corpus luteum rescued until 7–9 weeks.
- ☐ hCG: < 63% rise in 48 h = suboptimal (NICE).
- ☐ Site: low → praevia; scar → accreta / scar pregnancy; tube → ectopic.
- ☐ MZ twins: DCDA 0–3, MCDA 4–8, MCMA 8–13, conjoined > 13 days.

Self-assessment — cover the right-hand column

Question	Answer
When does the embryo reach the uterus, and at what stage?	Day 4, as a morula
What is compaction and when?	E-cadherin tightening of blastomeres at 8 cells
Fates of the trophoblast and inner cell mass?	Trophoblast → placenta/chorion; ICM → embryo
Three phases of implantation?	Apposition, adhesion, invasion
Window of implantation?	Cycle days ~20–24, progesterone-dependent
Which layer makes hCG, and what does hCG do?	Syncytiotrophoblast — rescues the corpus luteum
MZ twins splitting on day 5?	MCDA
MZ twins splitting after day 13?	Conjoined
Five ectopic risk factors?	Previous ectopic, tubal damage/PID, IVF, IUD in situ, smoking
Why biopsy the trophectoderm for PGT?	Spares the inner cell mass

9 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- NICE NG126. Ectopic pregnancy and miscarriage: diagnosis and initial management. 2019 (updated 2023).
- ESHRE Working Group. Good practice recommendations on recurrent implantation failure. 2023.
- HFEA. Treatment add-ons with limited evidence (online rating).