PIPADOR REVISION

MRCOG Part 1 Revision Notes

Development of the Testes

EMBRYOLOGY • LECTURE 60

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 60: Development of the Testes

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

TESTIS / SRY	SERTOLI / AMH	LEYDIG / ANDROGENS	MÜLLERIAN	WOLFFIAN / CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Explain how SRY switches the indifferent gonad to a testis.
- ☐ Describe Sertoli and Leydig cells and their hormones (AMH, testosterone, INSL3).
- ☐ Explain the germ-cell meiotic block and the fate of the genital ducts.
- ☐ Describe the two phases of testicular descent and the processus vaginalis.
- ☐ Recognise cryptorchidism, AIS, 5α-reductase deficiency, PMDS and testicular tumours.

1 Switching On the Testis

IN ONE LINE: *SRY (Yp11.2), switched on briefly at weeks 6–7, turns on SOX9 in pre-Sertoli cells; SOX9 + FGF9 lock in the testis and shut down the ovarian pathway.*

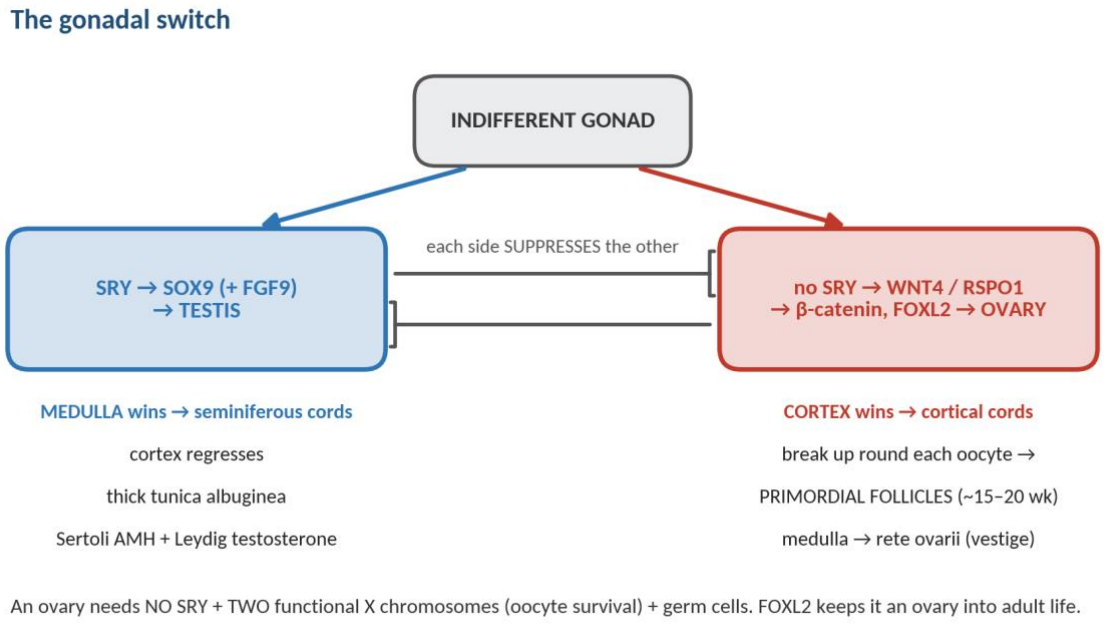


Figure 1. The gonadal switch (from Lecture 59).

- **Medulla wins**: medullary cords → testis cords (future seminiferous tubules); cortex regresses; a **thick tunica albuginea** forms.

2 Sertoli, Leydig and Their Hormones

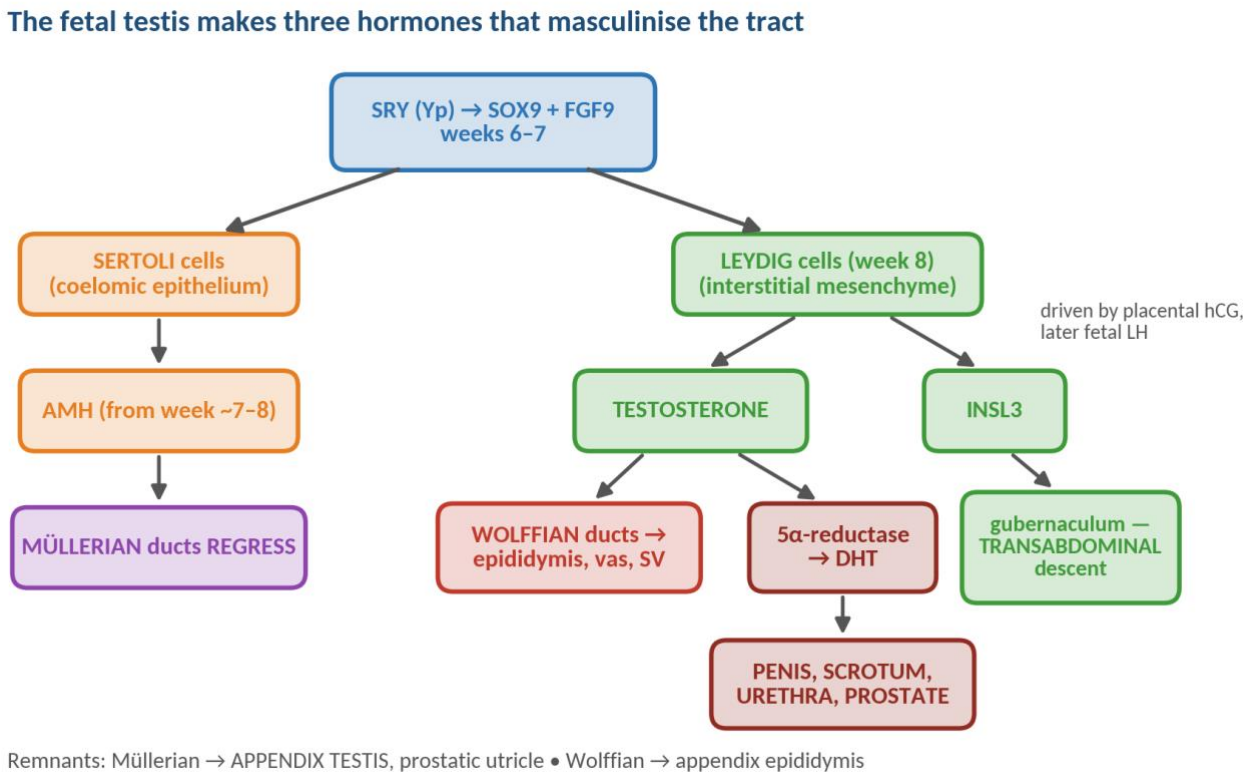


Figure 2. Three hormones masculinise the tract.

SERTOLI CELLS

- From **coelomic epithelium**; line the testis cords round the germ cells
- **AMH** from ~week 7–8 → Müllerian ducts regress
- Blood–testis barrier forms only at **puberty**

LEYDIG CELLS

- From **interstitial mesenchyme**; appear ~week 8
- **Testosterone** — driven first by placental **hCG** (acts on LH receptors), later by fetal LH
- **INSL3** → gubernaculum → first phase of descent

MNEMONIC / MEMORY HOOK

'Sertoli Stops the uterus, Leydig Lets the male tract grow' — Sertoli AMH removes Müllerian ducts; Leydig testosterone keeps Wolffian ducts (DHT for the outside).

- **Germ cells** stay in the cords without entering meiosis — **CYP26B1** breaks down retinoic acid (the signal that starts meiosis in the ovary). Cords canalise into **seminiferous tubules at puberty**.

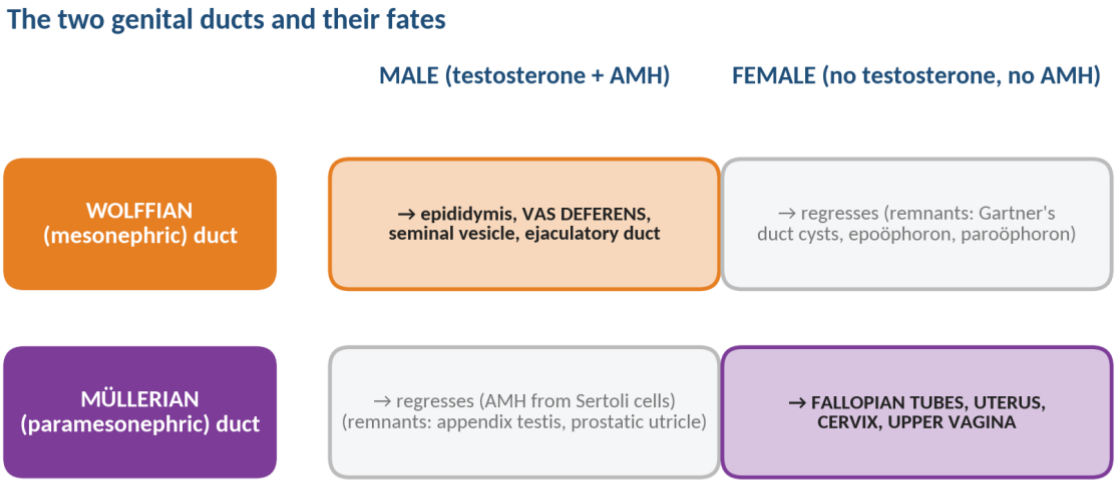


Figure 3. Wolffian vs Müllerian fates (from Lecture 48).

3 Descent of the Testis

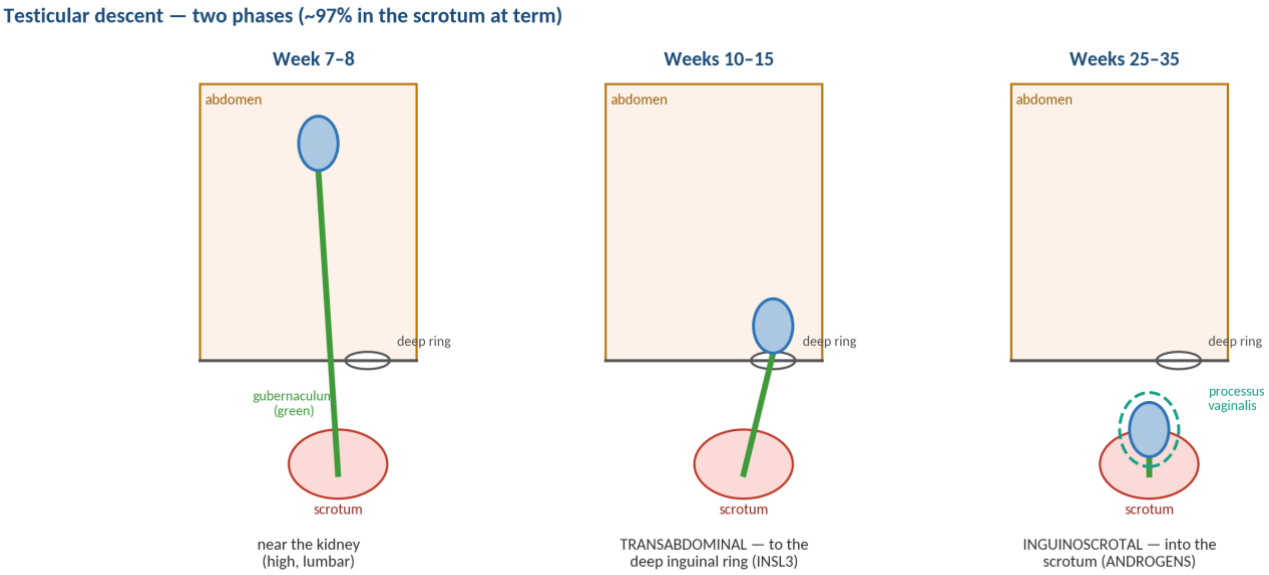


Figure 4. Two phases of descent.

Phase	When	Control
Transabdominal	Weeks ~8–15	INSL3 (Leydig) on RXFP2 in the gubernaculum; AMH may help
Inguinoscrotal	Weeks ~25–35	Androgens (+ genitofemoral nerve / CGRP)

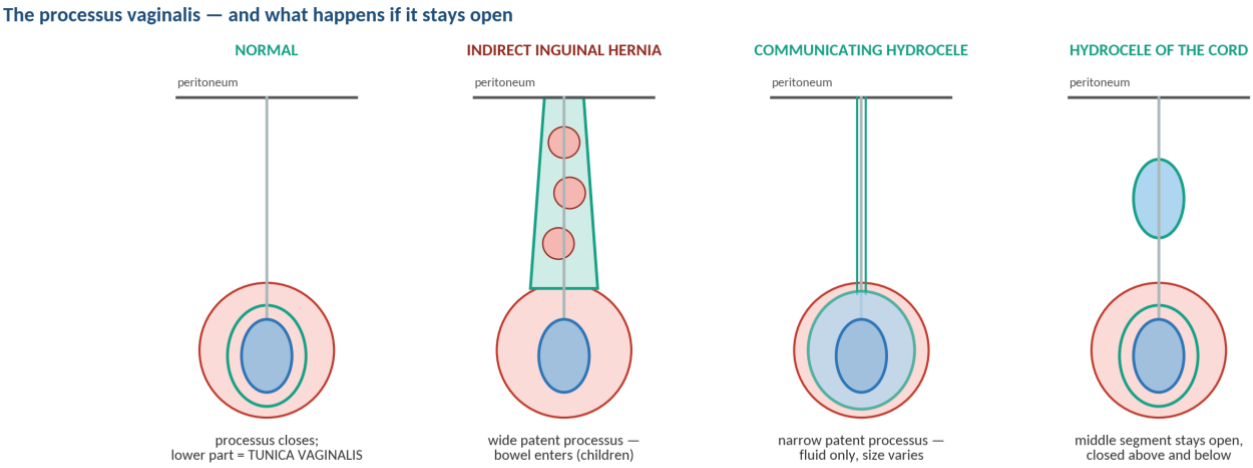


Figure 5. Processus vaginalis — normal and patent.

- **Supply** reflects the lumbar start: testicular artery from the aorta at **L2**; pampiniform plexus → testicular vein (right → IVC, **left → left renal vein**, hence left varicocele); lymph → **para-aortic** nodes; pain referred to the **umbilicus** (T10–T11).

4 Anomalies and DSD

Condition	Key points
Cryptorchidism	~3% of term boys (much higher in preterm), ~1% at 1 year; most often in the inguinal canal. Risks: subfertility, testicular cancer (several-fold, highest if abdominal), torsion, hernia. Orchidopexy at 6–12 months (by 18 months at the latest); bilateral impalpable testes → urgent DSD / CAH work-up
Anorchia / vanishing testis	46,XY, no testis — presumed antenatal torsion or vascular accident
Polyorchidism	Rare extra testis

46,XY differences of sex development — side by side

	Karyotype	Gonads	Müllerian (uterus/tubes)	Wolffian (vas, epididymis)	External genitalia	Key point
Complete AIS	46,XY	testes	ABSENT	absent	FEMALE	AR (X-linked); breasts, scant hair; gonadectomy often after puberty
5α-reductase deficiency	46,XY	testes	absent	PRESENT	AMBIGUOUS	SRD5A2; virilises at puberty; variable gender identity
PMDS	46,XY	testes (often undescended)	PRESENT	present	MALE	AMH / AMHR2; uterus found at hernia repair or orchidopexy
Swyer (46,XY CGD)	46,XY	STREAKS	PRESENT	absent	FEMALE	no AMH, no testosterone; gonadoblastoma → gonadectomy

Logic: Müllerian ducts vanish only with AMH (Sertoli); Wolffian ducts survive only with testosterone; external male genitalia need DHT.

Figure 6. 46,XY DSDs compared.

- **Testicular germ-cell tumours** arise from **germ cell neoplasia in situ** (fetal gonocytes that didn't mature): seminoma, embryonal, yolk sac, choriocarcinoma, teratoma, mixed. **Cryptorchidism is the strongest risk factor.** Sex cord–stromal (Leydig, Sertoli) tumours are rarer.

5 Clinical Correlates

ANTENATAL SEX

- Genitalia on scan from ~14–16 weeks, reliable later
- **Cell-free DNA** for Y sequences from ~9–10 weeks — used in X-linked conditions (haemophilia, DMD) and **CAH** families

DSD CARE

- Specialist **MDT** (endocrinology, urology, genetics, psychology)
- Avoid assigning sex before assessment; irreversible surgery increasingly **deferred**
- CAIS: gonadectomy usually after puberty (low early tumour risk)

★ PEARL

Complete AIS: 46,XY, testes, **no uterus** (AMH works), **no Wolffian ducts** (no androgen receptor), female body with breasts — presents with **primary amenorrhoea**.

Patent processus vaginalis explains most childhood **indirect hernias** and **communicating hydroceles**.

6 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Wk 6–7 SRY switched on	**Wk 7–8** AMH from Sertoli	**Wk 8** Leydig testosterone	**Wk 8–15** Transabdominal descent
Wk 25–35 Inguinoscrotal descent	**~3% → 1%** Undescended: term → 1 yr	**6–12 mo** Orchidopexy	**L2** Testicular artery

HIGH-YIELD CHECKLIST

- ☐ SRY → SOX9/FGF9 loop (weeks 6–7); medulla wins; thick tunica albuginea.
- ☐ Sertoli (coelomic) → AMH; Leydig (interstitial) → testosterone + INSL3.
- ☐ Early testosterone is driven by placental hCG.
- ☐ CYP26B1 keeps male germ cells out of meiosis until puberty.
- ☐ Wolffian → epididymis, vas, seminal vesicle, ejaculatory duct; Müllerian remnant = appendix testis.
- ☐ Descent: INSL3 (weeks 8–15), androgens (25–35).
- ☐ Patent processus vaginalis → indirect hernia, communicating hydrocele.
- ☐ Cryptorchidism 3% → 1%; orchidopexy 6–12 months; cancer + subfertility risk.
- ☐ CAIS vs 5ARD vs PMDS vs Swyer — use the AMH / testosterone / DHT logic.
- ☐ Testicular artery L2; left vein → renal vein; lymph para-aortic.

Self-assessment — cover the right-hand column

Question	Answer
What does SRY switch on?	SOX9 in pre-Sertoli cells (with FGF9 feedback)
Which cell makes AMH, and what does it do?	Sertoli — Müllerian regression
What drives fetal testosterone early on?	Placental hCG acting on LH receptors
How are male germ cells kept out of meiosis?	CYP26B1 degrades retinoic acid

Question	Answer
Hormone for transabdominal descent?	INSL3 (on RXFP2 in the gubernaculum)
What does a patent processus vaginalis cause?	Indirect inguinal hernia, communicating hydrocele
UK timing of orchidopexy?	6–12 months (by 18 months)
CAIS: uterus present?	No — AMH still works
PMDS: genotype and findings?	46,XY male with testes + uterus/tubes
Lymph drainage of the testis?	Para-aortic nodes

7 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Radmayr C et al. EAU/ESPU guidelines on undescended testes (timing of orchidopexy). 2016 (and updates).
- Ahmed SF et al. Society for Endocrinology UK guidance on the initial evaluation of a suspected DSD. 2021.