PIPADOR REVISION

# MRCOG Part 1 Revision Notes

## *Male Reproductive System*

PHYSIOLOGY • LECTURE 150

VISUAL EXAMINATION REVISION NOTES

*2026 Edition*

150

MRCOG PART 1 REVISION NOTES | PHYSIOLOGY

# Male Reproductive System

*Testicular anatomy and endocrinology, spermatogenesis, sexual differentiation, erection and ejaculation, semen analysis*

| ≈ 64–74 days | 2–3 °C | 16 million/mL | 4% |
|---|---|---|---|
| Spermatogenesis (+ epididymal transit) | Testis below core temperature | Sperm concentration lower ref. (WHO 2021) | Normal forms lower ref. |

■ **KEY FACTS: Learning objectives**

- Describe the anatomy and functions of the testis and accessory glands.
- Describe the hypothalamic–pituitary–testicular axis and androgen action.
- Describe spermatogenesis and compare it with oogenesis.
- Describe male sexual differentiation, testicular descent, erection and ejaculation.
- Interpret semen analysis and outline causes of male infertility.

## 150.1 Functional anatomy

| Structure | Function |
|---|---|
| **Seminiferous tubules — Sertoli cells** | 'Nurse' cells: support germ cells, blood–testis barrier (tight junctions), androgen-binding protein, inhibin B, AMH (fetal), phagocytose residual bodies; FSH and testosterone receptors |
| **Interstitium — Leydig cells** | Testosterone (LH-driven); INSL3 (testicular descent) |
| **Epididymis** | Maturation: sperm acquire progressive motility and fertilising ability (≈ 10–14 days); storage in tail |
| **Vas deferens → ejaculatory duct** | Transport; vasectomy site |
| **Seminal vesicles** | ≈ 60–70% of semen volume: fructose (energy), prostaglandins, semenogelin (coagulum) |
| **Prostate** | ≈ 20–30%: PSA (liquefies coagulum in 15–30 min), zinc, citrate, acid phosphatase |
| **Bulbourethral glands** | Pre-ejaculate mucus (lubrication) |
| **Thermoregulation** | Pampiniform plexus (countercurrent cooling), cremaster and dartos muscles; scrotal position — ↑ temperature impairs spermatogenesis (varicocele, cryptorchidism) |

## 150.2 The hypothalamic–pituitary–testicular axis

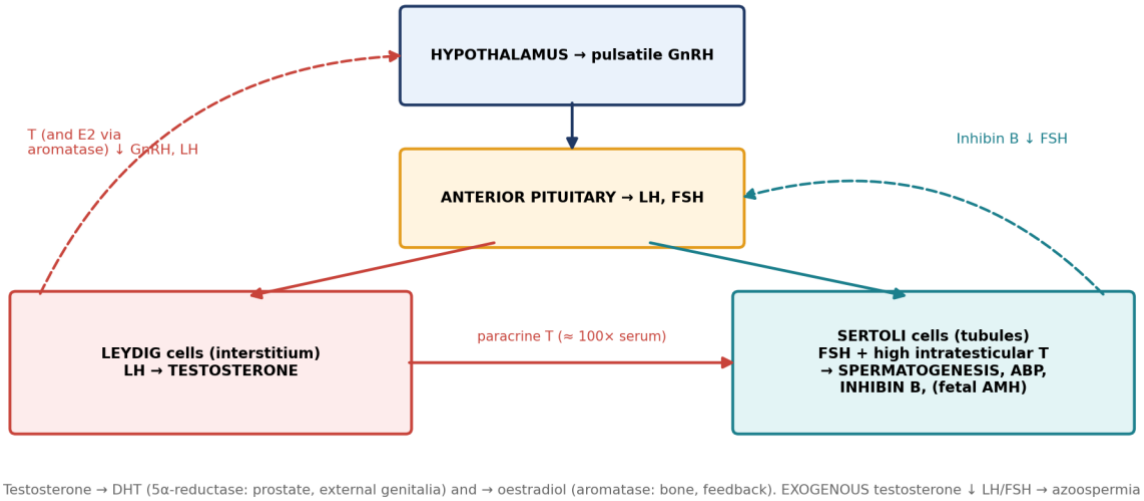



*Figure 150.1 — Hormonal control of the testis*

| Androgen | Formed by | Actions |
|---|---|---|
| **Testosterone** | Leydig cells | Wolffian duct development (fetal), spermatogenesis (high local levels), muscle, libido, voice, ↑ Hb, epiphyseal growth |
| **DHT** | 5α-reductase (type 2: prostate, genital skin) | External genitalia, prostate (fetal & BPH), male-pattern hair and baldness (finasteride blocks) |
| **Oestradiol** | Aromatase (adipose, bone, brain) | Epiphyseal closure, bone density, negative feedback; ↑ in obesity → hypogonadism, gynaecomastia |

■ **RED FLAGS**

- **Exogenous testosterone/anabolic steroids suppress LH and FSH** → low intratesticular testosterone → **oligo/azoospermia** (contraceptive effect). Never give testosterone to a man trying to conceive.

## 150.3 Spermatogenesis

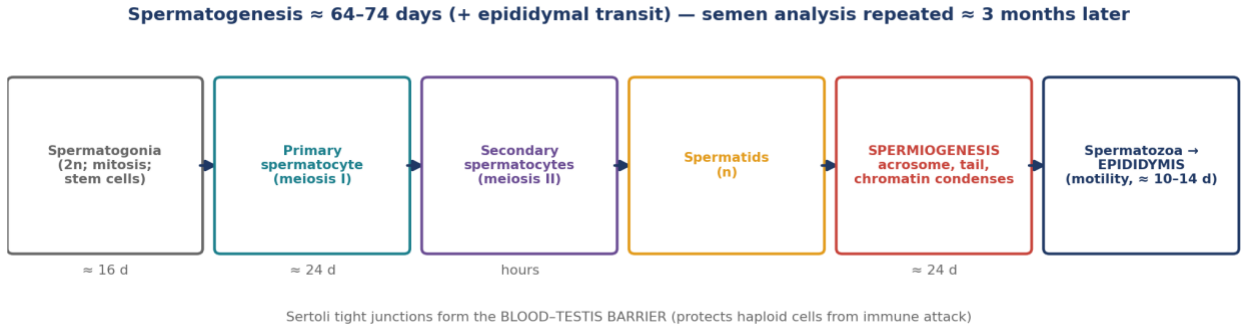



*Figure 150.2 — Stages of spermatogenesis*

| Feature | Spermatogenesis | Oogenesis |
|---|---|---|
| **Onset** | Puberty — continuous throughout life | Fetal life — finite pool |
| **Mitotic stem cells** | Persist (spermatogonia renew) | None after birth |
| **Meiosis** | Continuous, ≈ 24 days, no arrests | Two arrests (prophase I; metaphase II) |
| **Products per meiosis** | 4 spermatozoa | 1 ovum + polar bodies |
| **Output** | ≈ 100–200 million/day | ≈ 1 per month |

| Feature | Spermatogenesis | Oogenesis |
|---|---|---|
| **Age effect** | ↑ de novo point mutations (achondroplasia, Apert, autism, schizophrenia) | ↑ aneuploidy (nondisjunction) |

**Spermiogenesis** (no division): Golgi → **acrosome**; centriole → **flagellum** (axoneme 9+2 microtubules; mitochondria in midpiece); nucleus condenses (**protamines** replace histones); excess cytoplasm shed as residual body. Primary ciliary dyskinesia/Kartagener → immotile sperm.

## 150.4 Male sexual differentiation

**SRY** (Yp11) → bipotential gonad becomes **testis** (≈ 6–7 wk) ▶ **Sertoli → AMH** → Müllerian duct regression ▶ **Leydig → testosterone** (placental hCG, then fetal LH) → Wolffian ducts (epididymis, vas, seminal vesicles) ▶ **DHT** → penis, scrotum, prostate (≈ 9–12 wk) ▶ **Testicular descent**: transabdominal (INSL3, gubernaculum) then inguinoscrotal (androgens; ≈ 28–35 wk)

| Disorder | Karyotype | Features |
|---|---|---|
| **Androgen insensitivity (complete)** | 46,XY | Androgen receptor defect: female phenotype, testes (AMH present → no uterus, short blind vagina), primary amenorrhoea, sparse pubic hair; gonadectomy after puberty |
| **5α-reductase deficiency** | 46,XY | Ambiguous/female external genitalia at birth; virilisation at puberty |
| **Klinefelter syndrome** | 47,XXY | Commonest chromosomal cause of male infertility: small firm testes, azoospermia, ↑ FSH/LH, ↓ T (hypergonadotrophic hypogonadism); micro-TESE |
| **Kallmann syndrome** | 46,XY | GnRH neuron migration failure + anosmia → hypogonadotrophic hypogonadism (treat with gonadotrophins/pulsatile GnRH) |
| **Y-chromosome microdeletions (AZFa, b, c)** | 46,XY | Severe oligo/azoospermia; transmitted to sons with ICSI |
| **CFTR mutations** | 46,XY | Congenital bilateral absence of the vas → obstructive azoospermia; screen partner for CF |
| **Cryptorchidism** | — | ↑ Infertility and testicular cancer; orchidopexy at 6–18 months |

## 150.5 Erection and ejaculation

**Point**
ERECTION — Parasympathetic (pelvic splanchnic S2–4) → NO → cGMP → smooth-muscle relaxation

**Squeeze**
EMISSION — Sympathetic (T10–L2, hypogastric): vas, vesicles, prostate; bladder neck closes

**Shoot**
EJACULATION — Somatic (pudendal S2–4): bulbospongiosus, ischiocavernosus

**PDE5 inhibitors** (sildenafil) prevent cGMP breakdown. Retrograde ejaculation (bladder-neck failure — diabetes, α-blockers, prostate surgery): sperm in post-ejaculatory urine.

## 150.6 Semen analysis

| Parameter (WHO 6th edition, 2021) | Lower reference limit (5th centile) |
|---|---|
| **Volume** | 1.4 mL |
| **Sperm concentration** | 16 million/mL |
| **Total sperm number** | 39 million per ejaculate |
| **Total motility (progressive + non-progressive)** | 42% |

| Parameter (WHO 6th edition, 2021) | Lower reference limit (5th centile) |
|---|---|
| **Progressive motility** | 30% |
| **Vitality** | 54% live |
| **Normal morphology (strict criteria)** | 4% |
| **pH** | ≥ 7.2 |

- Collect after **2–7 days' abstinence**, deliver within 1 hour at body temperature. If abnormal, **repeat after ≈ 3 months** (one spermatogenic cycle) or sooner if azoospermic/severe (NICE CG156).
- Terminology: **oligozoospermia** (↓ count), **asthenozoospermia** (↓ motility), **teratozoospermia** (↓ normal forms), **azoospermia** (none — obstructive vs non-obstructive; check FSH, karyotype, Y microdeletions, CFTR).
- Lifestyle and other factors: smoking, alcohol, **obesity**, heat, anabolic steroids, cannabis, chemotherapy/radiotherapy (offer sperm banking), varicocele, infection, mumps orchitis, sulfasalazine.

## 150.7 Must-know summary

■ **EXAM TIP**

- **Leydig = LH = testosterone; Sertoli = FSH = spermatogenesis + inhibin B** (blood–testis barrier).
- Spermatogenesis ≈ **64–74 days** → repeat semen analysis after ≈ 3 months.
- SRY → testis; AMH → Müllerian regression; testosterone → Wolffian ducts; **DHT → external genitalia/prostate**.
- Seminal vesicles ≈ 60–70% of volume (**fructose**); prostate ≈ 20–30% (**PSA**).
- WHO 2021 lower limits: **1.4 mL, 16 million/mL, 42% total motility, 30% progressive, 4% normal forms**.

■ **MNEMONIC / MEMORY AID**

**'Point and Shoot'**: Parasympathetic = erection (Point); Sympathetic = emission; Somatic = ejaculation (Shoot). **'Leydig Loves LH; Sertoli Sees FSH'**.