PIPADOR REVISION

MRCOG Part 1 Revision Notes

Mesoderm Derivatives

EMBRYOLOGY • LECTURE 48

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 48: Mesoderm Derivatives

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

PARAXIAL	INTERMEDIATE	SOMATIC	SPLANCHNIC	EXTRA-EMBRYONIC

LEARNING OBJECTIVES — tick off as you go

- ☐ Name the mesodermal subdivisions and their main derivatives.
- ☐ Describe somite differentiation, epaxial/hypaxial muscle and head mesoderm.
- ☐ Outline the three kidney systems and the fates of the Wolffian and Müllerian ducts.
- ☐ Describe somatic vs splanchnic lateral plate derivatives, the coelom and the limb bud.
- ☐ Trace the sites of fetal haematopoiesis.
- ☐ Know the 'surprise' origins and the mesodermal clinical correlates.

1 The Plan

IN ONE LINE: *Mesoderm is the middle layer — connective tissue, all muscle types, blood and vessels, the urogenital tract and the linings of the body cavities.*

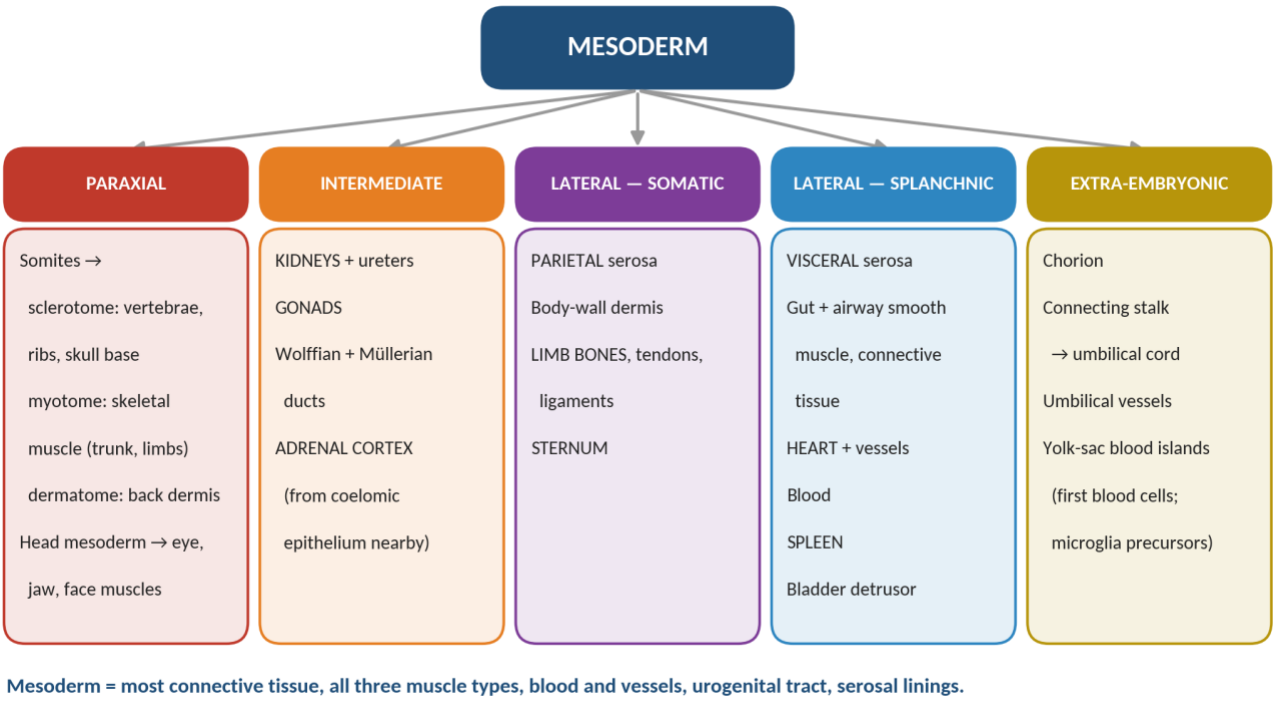


Figure 1. Mesoderm and what it makes.

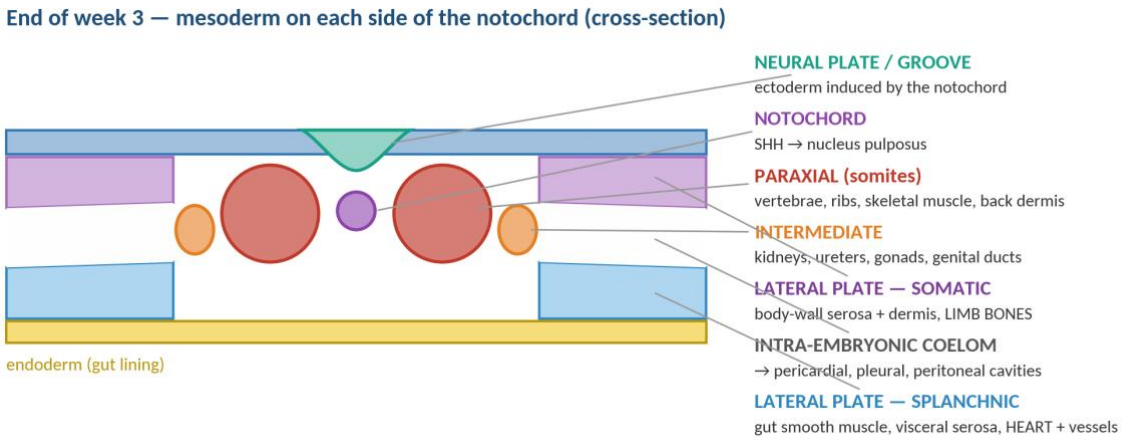


Figure 2. Position of each block (from Lecture 46).

2 Paraxial Mesoderm

- **Somites** from **Day 20**, head to tail, **~3 pairs a day → 42–44 pairs** (4 occipital, 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, 8–10 coccygeal). Their segmental order sets up vertebrae, intercostals and spinal nerves.

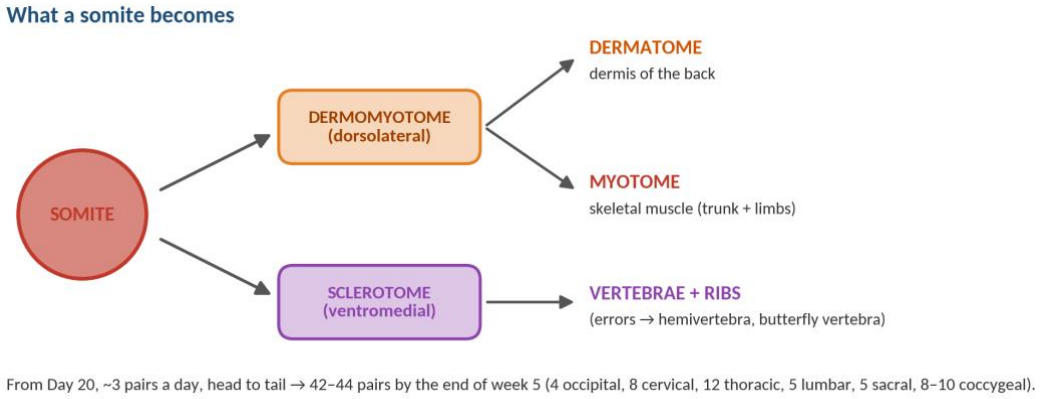


Figure 3. Somite fates (from Lecture 46).

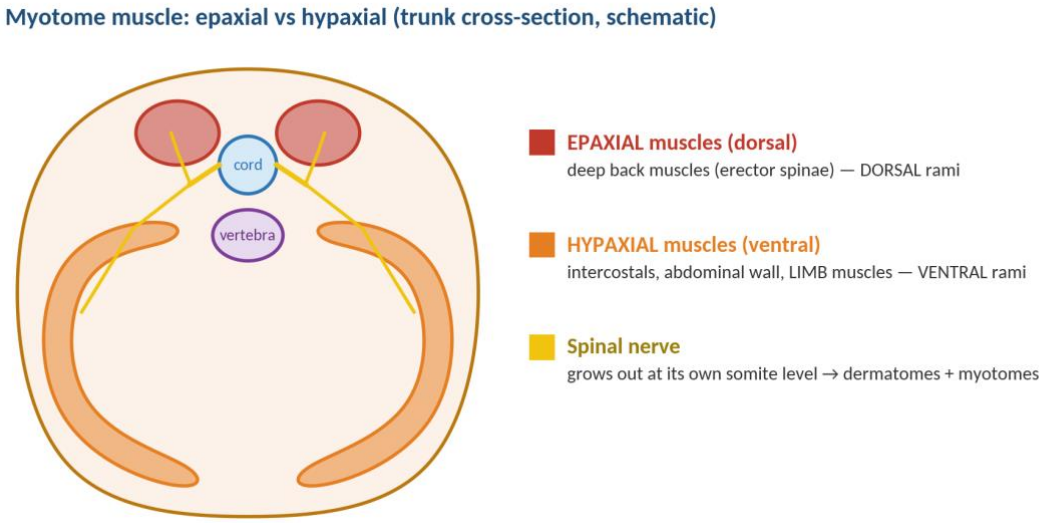


Figure 4. Epaxial vs hypaxial muscle.

- **Head (cranial paraxial) mesoderm / somitomeres** → most **extraocular muscles** and the muscles of the **pharyngeal arches** (mastication, facial expression).

3 Intermediate Mesoderm

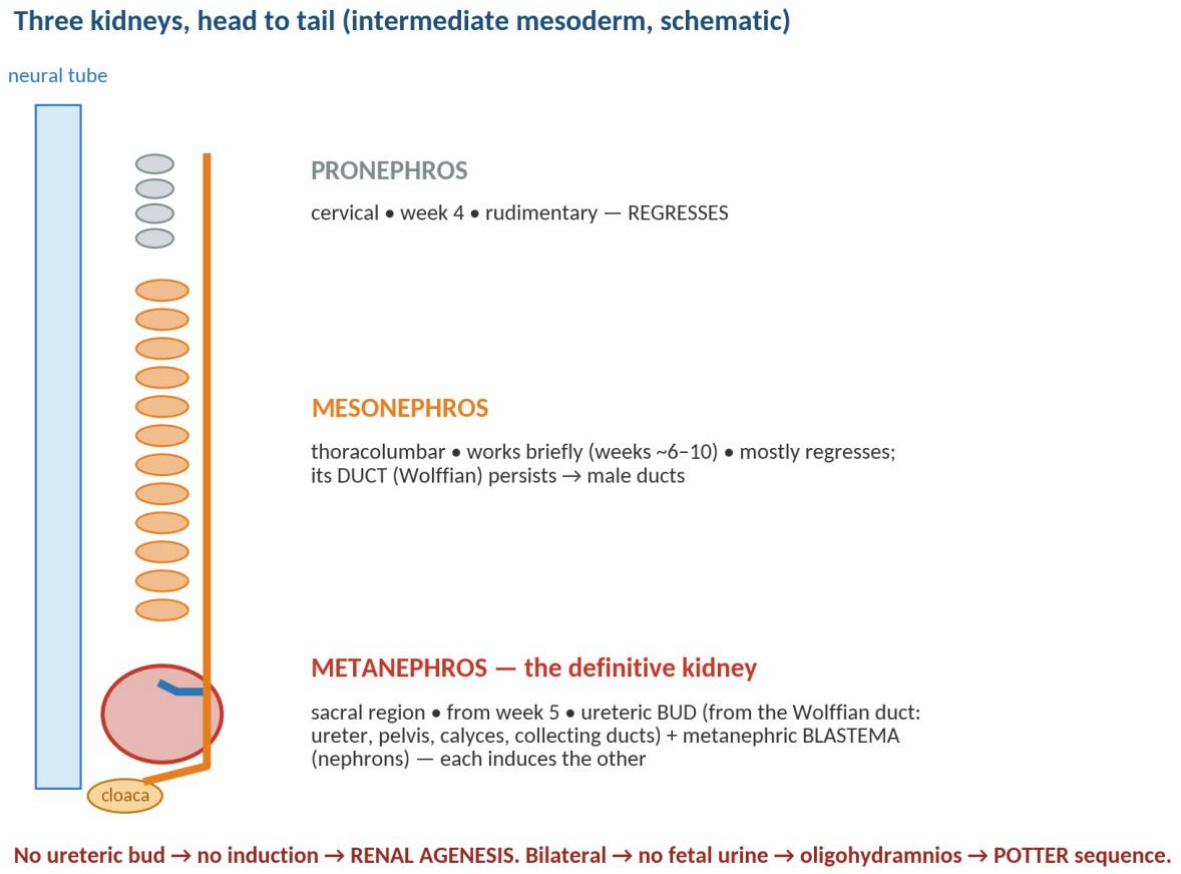


Figure 5. Pronephros, mesonephros, metanephros.

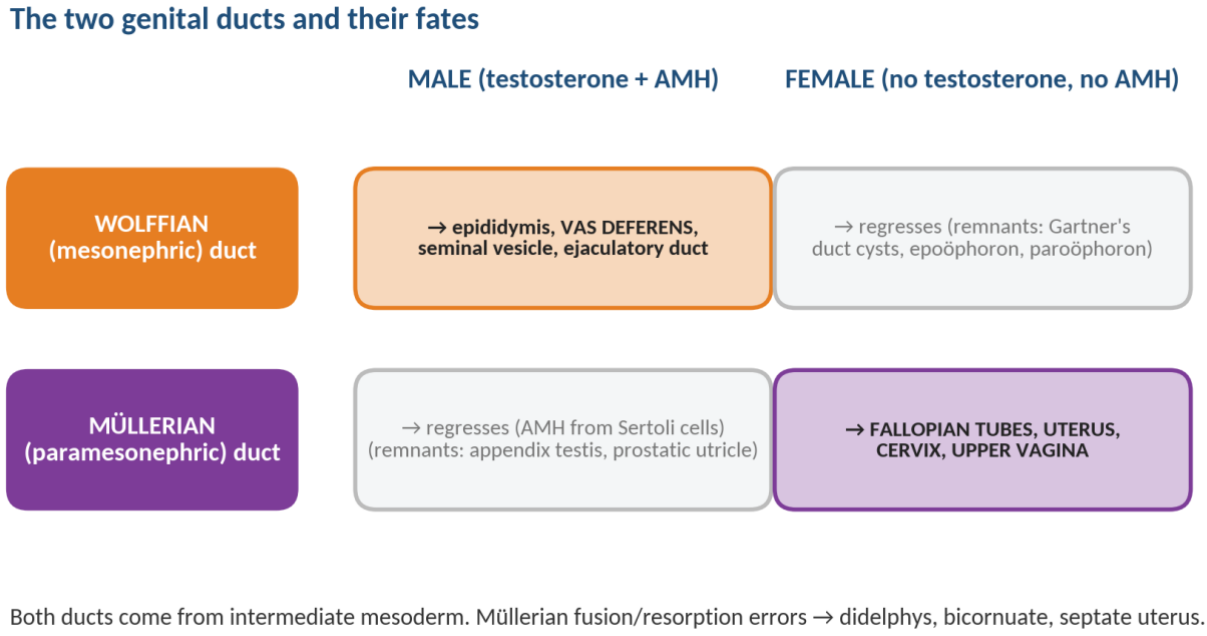


Figure 6. Wolffian and Müllerian ducts.

- **Gonads**: somatic cells from the **genital ridge** (coelomic epithelium + underlying mesenchyme); **germ cells** arise in the **epiblast** and reach the ridge via the yolk-sac wall (Lecture 41).
- **Adrenal cortex**: mesoderm — the coelomic epithelium next to the gonadal ridge (often grouped with intermediate mesoderm). **Adrenal medulla**: neural crest.

4 Lateral Plate Mesoderm

SOMATIC (parietal) — next to ectoderm

- **Parietal** peritoneum, pleura, pericardium
- Dermis of the ventrolateral body wall and limbs
- **Limb bones**, cartilage, ligaments, tendons
- **Sternum**

SPLANCHNIC (visceral) — next to endoderm

- **Visceral** peritoneum, pleura, pericardium
- Smooth muscle + connective tissue of gut and airways
- **Heart** (cardiogenic mesoderm) and **blood vessels**
- **Spleen** (dorsal mesogastrium); bladder **detrusor**

- The **intra-embryonic coelom** between them is divided by the **septum transversum** and the pleuropericardial and pleuroperitoneal membranes → pericardial, pleural and peritoneal cavities.

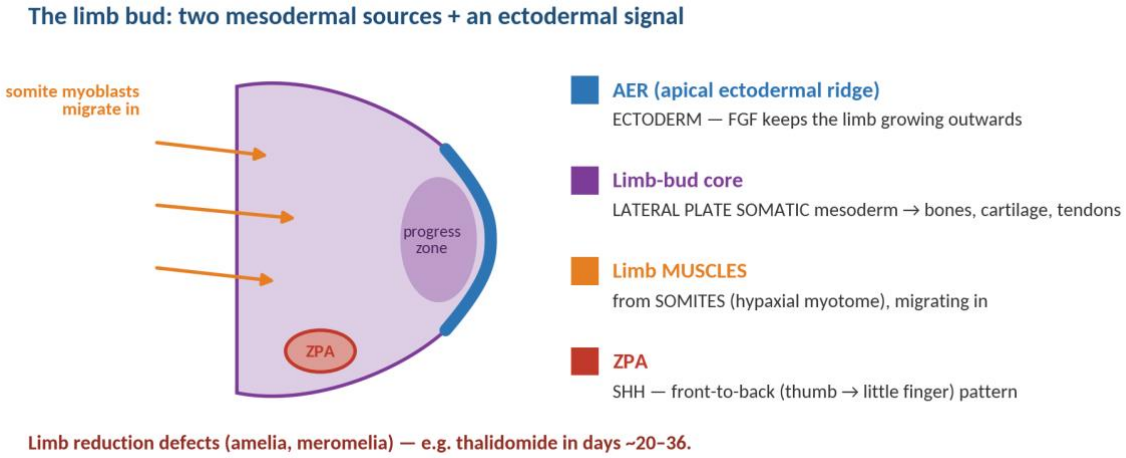


Figure 7. The limb bud.

MNEMONIC / MEMORY HOOK

Limb: 'bones from the side, muscles from the back' — lateral plate makes the skeleton; somites send in the muscle; ectoderm (AER) keeps it growing.

5 Blood and the Heart

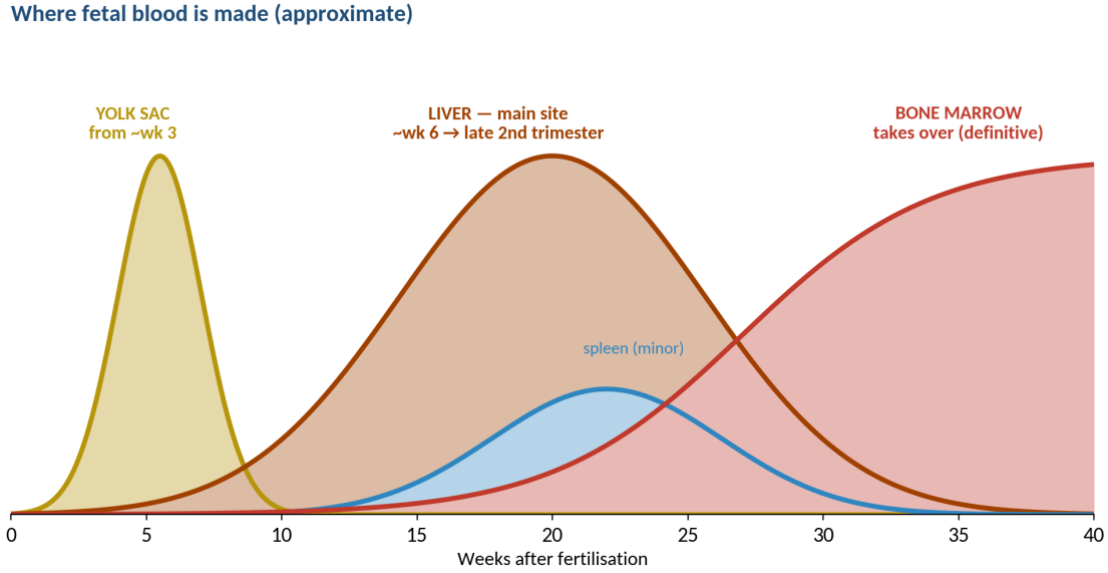


Figure 8. Sites of fetal haematopoiesis.

- **Blood islands** in yolk-sac mesoderm (~Day 17), then in the embryo: outer cells → endothelium, inner → blood. Heart tube from paired endocardial tubes in **splanchnic cardiogenic mesoderm**, brought into the chest by folding.
- Haematopoiesis: **yolk sac** (week 3) → **liver** (from ~week 6, main site through mid-pregnancy) → spleen (minor) → **bone marrow** (starts ~weeks 10–12, dominant in the third trimester).

6 'Surprise' Origins

Structure	Origin
Spleen	Splanchnic mesoderm (dorsal mesogastrium) — not gut endoderm
Adrenal	Cortex mesoderm; medulla neural crest
Microglia	Yolk-sac mesoderm — the only non-ectodermal CNS glia
Bladder / urethra	Epithelium endoderm (cloaca); detrusor splanchnic mesoderm
Cornea	Epithelium ectoderm; stroma + endothelium neural crest
Tooth	Enamel ectoderm; dentine, pulp, cementum, PDL neural crest
Aorticopulmonary septum	Cardiac neural crest, not mesoderm

7 Clinical Correlates

Condition	Mesodermal link
Vertebral anomalies	Sclerotome errors — hemivertebra (→ scoliosis), Klippel–Feil (fused cervical vertebrae); spina bifida occulta is a vertebral-arch defect (open spina bifida is primarily neural tube failure)
Renal agenesis	No ureteric bud–blastema induction; bilateral → Potter sequence (oligohydramnios, pulmonary hypoplasia, limb contractures, Potter facies)
Müllerian anomalies	Failed fusion (didelphys, bicornuate) or resorption (septate)
Wolffian anomalies	Absent vas deferens, seminal vesicle cysts; unilateral renal agenesis often coexists
Cryptorchidism	Failed testicular descent (gubernaculum)
Limb reduction	Limb-bud / AER failure — amelia, meromelia; thalidomide (days ~20–36)
Achondroplasia	FGFR3 gain-of-function → impaired endochondral bone growth
VACTERL	Vertebral, Anal, Cardiac, Tracheo-oesophageal, Renal, Limb — a midline mesoderm/endoderm field defect

★ PEARL

Kidney = ureteric bud (collecting system) + metanephric blastema (nephrons), each inducing the other. No bud → no kidney → (if bilateral) no liquor → **Potter sequence**.

Spleen is mesodermal, and the **aorticopulmonary septum is neural crest** — two favourite traps.

8 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Day 20 First somites	**~3/day** Somite pairs formed	**42–44** Somite pairs	**3** Kidney systems
Week 5 Metanephros begins	**Week 6** Liver haematopoiesis	**Wk 10–12** Marrow starts	**Days 20–36** Thalidomide limb window

HIGH-YIELD CHECKLIST

- ☐ Paraxial → somites → sclerotome, myotome, dermatome; head mesoderm → eye and arch muscles.
- ☐ Epaxial (dorsal rami) vs hypaxial (ventral rami, incl. limb muscles).
- ☐ Intermediate → pro-, meso-, metanephros; gonads; Wolffian + Müllerian ducts; adrenal cortex.
- ☐ Metanephros = ureteric bud + blastema, reciprocal induction.
- ☐ Wolffian → male ducts; Müllerian → tubes, uterus, cervix, upper vagina.
- ☐ Somatic → parietal serosa, limb bones, sternum. Splanchnic → visceral serosa, gut muscle, heart, spleen.
- ☐ Limb: lateral plate skeleton + somite muscle + AER (FGF) + ZPA (SHH).
- ☐ Haematopoiesis: yolk sac → liver → (spleen) → marrow.
- ☐ Surprises: spleen mesoderm; microglia mesoderm; AP septum neural crest.
- ☐ Potter sequence; Klippel–Feil; VACTERL; achondroplasia (FGFR3).

Self-assessment — cover the right-hand column

Question	Answer
Four subdivisions of intra-embryonic mesoderm?	Paraxial, intermediate, lateral plate somatic, lateral plate splanchnic
What does the sclerotome form?	Vertebrae, ribs (and part of the skull base)
Origin of kidneys, gonads and genital ducts?	Intermediate mesoderm
Origin of parietal vs visceral serosa?	Somatic vs splanchnic lateral plate
Why is the spleen mesodermal?	It forms in the dorsal mesogastrium (splanchnic mesoderm)
Limb bones vs limb muscles?	Bones — lateral plate somatic; muscles — somites
Origin of the adrenal cortex and medulla?	Cortex mesoderm; medulla neural crest
What causes Potter sequence?	Bilateral renal agenesis → oligohydramnios
Which duct forms the uterus?	Müllerian (paramesonephric)
Main haematopoietic organ at 12–20 weeks?	Liver

9 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Moore KL, Persaud TVN, Torchia MG. The Developing Human. 11th ed. 2020.