PIPADOR REVISION

MRCOG Part 1 Revision Notes

The Musculoskeletal System

EMBRYOLOGY • LECTURE 74

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 74: The Musculoskeletal System

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

PARAXIAL / SOMITES	LATERAL PLATE / LIMBS	NEURAL CREST	CARTILAGE / SIGNALS	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Name the embryological sources of bone, cartilage and muscle.
- ☐ Compare intramembranous and endochondral ossification.
- ☐ Explain vertebral resegmentation, the skull, sutures and craniosynostosis.
- ☐ Describe limb development, signalling centres, rotation and limb defects.
- ☐ Apply to skeletal dysplasias on scan, DDH, brachial plexus injury and NTD prevention.

1 Where It Comes From

IN ONE LINE: *Axial skeleton + all skeletal muscle = paraxial mesoderm (somites). Limb skeleton = lateral plate. Face = neural crest.*

Source	Derivatives
Somites (paraxial)	Vertebrae, ribs (sclerotome); trunk + limb muscles (myotome); back dermis (dermatome)
Somitomeres (head paraxial)	Extraocular and pharyngeal-arch muscles
Lateral plate (somatic)	Limb bones, cartilage, tendons; sternum; pelvis
Neural crest	Face and most of the skull vault front; arch cartilages
Ectoderm (AER, dorsal ectoderm)	Signals that pattern the limb

2 Making Bone

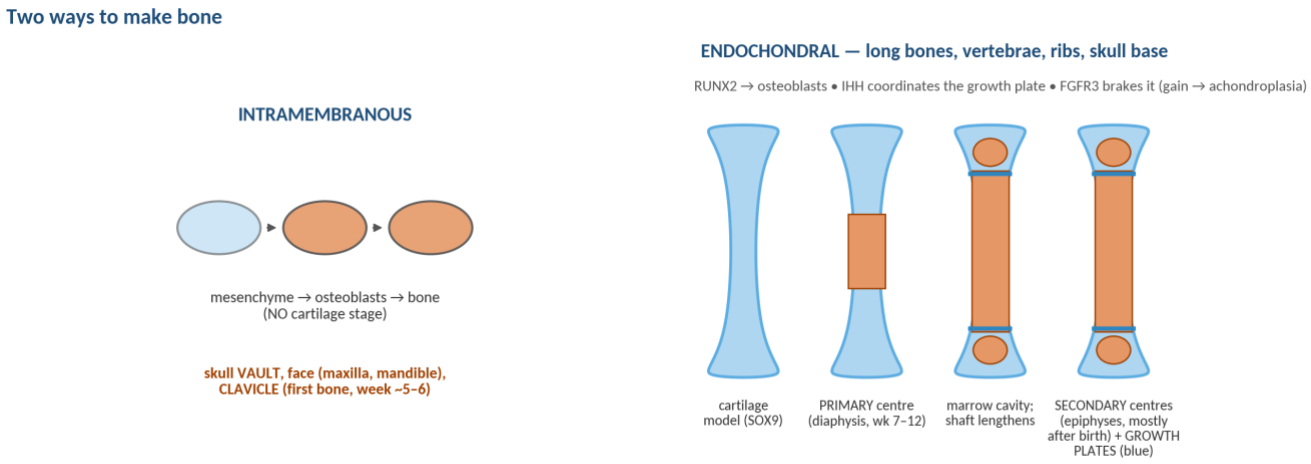


Figure 1. Intramembranous vs endochondral.

- Primary centres from **weeks 7–12** (clavicle first, ~week 5–6); secondary centres mostly after birth; fusion completes by ~25 years.

3 Vertebrae, Ribs, Sternum, Skull

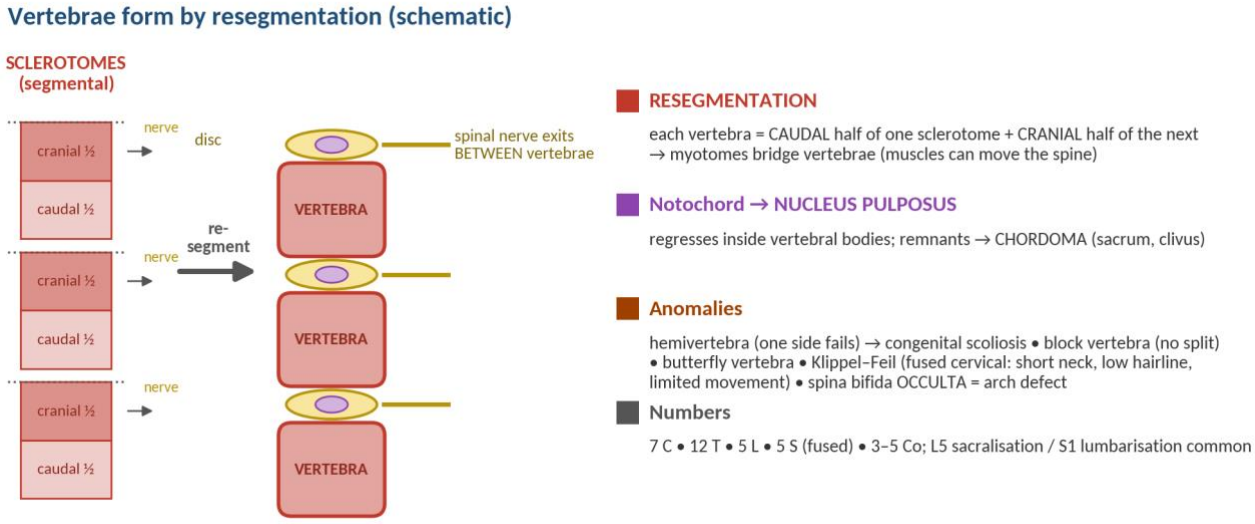


Figure 2. Resegmentation.

- **Ribs** from costal processes of thoracic vertebrae; **sternum** from two lateral-plate bars fusing in the midline (pectus excavatum/carinatum; sternal cleft in Cantrell).
- **Spina bifida occulta** is a vertebral-arch (sclerotome) defect; **open spina bifida** is a failure of **neural tube closure** (Lecture 46).

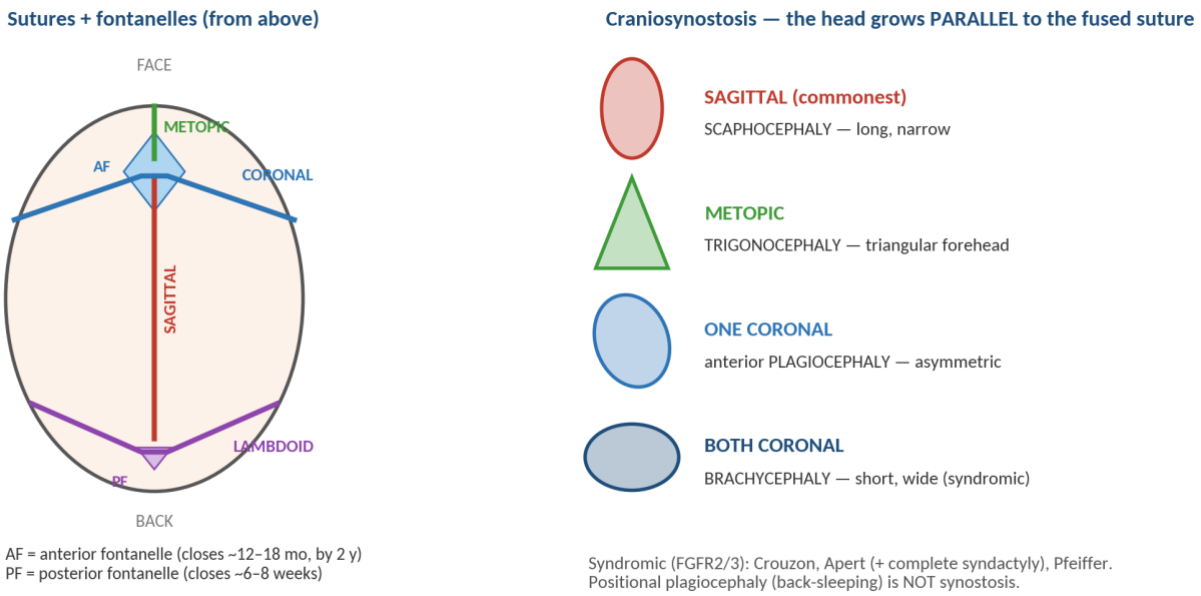


Figure 3. Sutures, fontanelles, craniosynostosis.

- Skull vault = intramembranous; skull base (chondrocranium) = endochondral; face from arch neural crest. Sutures and fontanelles let the head **mould** in labour.

4 Limbs

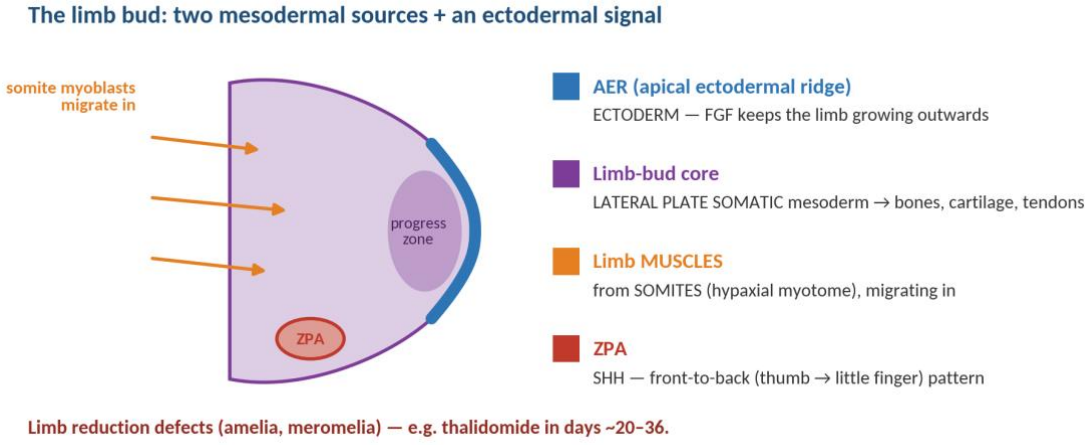


Figure 4. The limb bud (from Lecture 48).

Centre	Signal	Axis
AER (ectoderm)	FGF8 / FGF4	Proximal → distal outgrowth
ZPA (posterior mesoderm)	SHH	Anterior → posterior (thumb → little finger)
Dorsal ectoderm	WNT7A	Dorsal → ventral (back of hand vs palm)

- Upper buds end of **week 4** (C5–T1), lower ~1–2 days later (L2–S2); TBX5 arm, TBX4 leg; HOX genes pattern segments (HOXA13 → hand–foot–genital). Digits separate by **apoptosis** by ~week 8.
- **Rotation**: upper limb ~90° **laterally** (thumb outward, extensors behind); lower limb ~90° **medially** (big toe inward, extensors in front) — why leg dermatomes spiral.

> **MNEMONIC / MEMORY HOOK**
>
> **'Arms out, legs in'** — upper limb rotates laterally, lower limb medially.

Defect	Key points
Amelia / meromelia / phocomelia	Absent / partial / hands or feet on the trunk — thalidomide (days ~20–36)
Polydactyly	Postaxial commonest; isolated or syndromic (T13, Meckel–Gruber, Bardet–Biedl)
Syndactyly	Failed interdigital apoptosis; Apert = complete syndactyly + coronal synostosis
Talipes equinovarus	Positional (corrects passively) vs structural; Ponseti casting; check hips and spine
Amniotic band sequence	Constriction rings, amputations, clefts — not genetic

5 Muscle

- **Epaxial** myotome → deep back muscles (dorsal rami); **hypaxial** → body wall, limbs, diaphragm (ventral rami). **Arch muscles**: 1 mastication (V3), 2 facial expression (VII), 3 stylopharyngeus (IX), 4 constrictors + cricothyroid (X superior laryngeal), 6 intrinsic laryngeal (X recurrent laryngeal).

Disorder	Key points
Duchenne	X-linked recessive, dystrophin; weakness from ~3–5 y, Gowers', cardiomyopathy; carrier females — prenatal testing
Myotonic dystrophy	DMPK CTG expansion, autosomal dominant, anticipation; congenital form via an affected MOTHER (polyhydramnios, hypotonia)
SMA	SMN1 deletion; nusinersen, gene therapy, risdiplam; carrier screening

6 Clinical Correlates

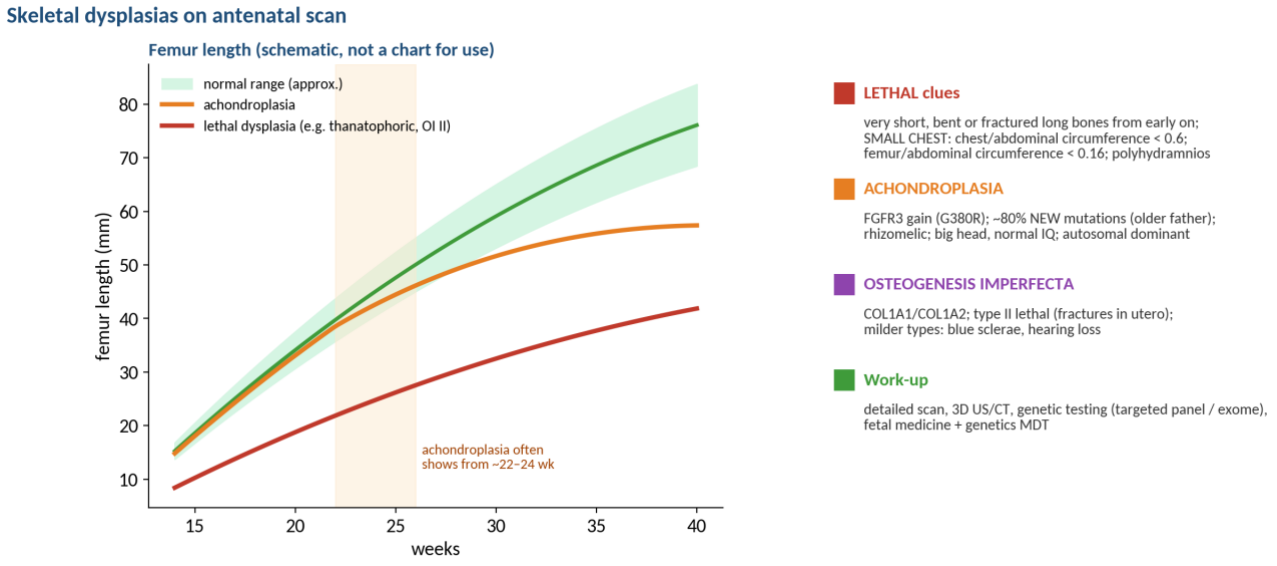


Figure 5. Skeletal dysplasias on scan.

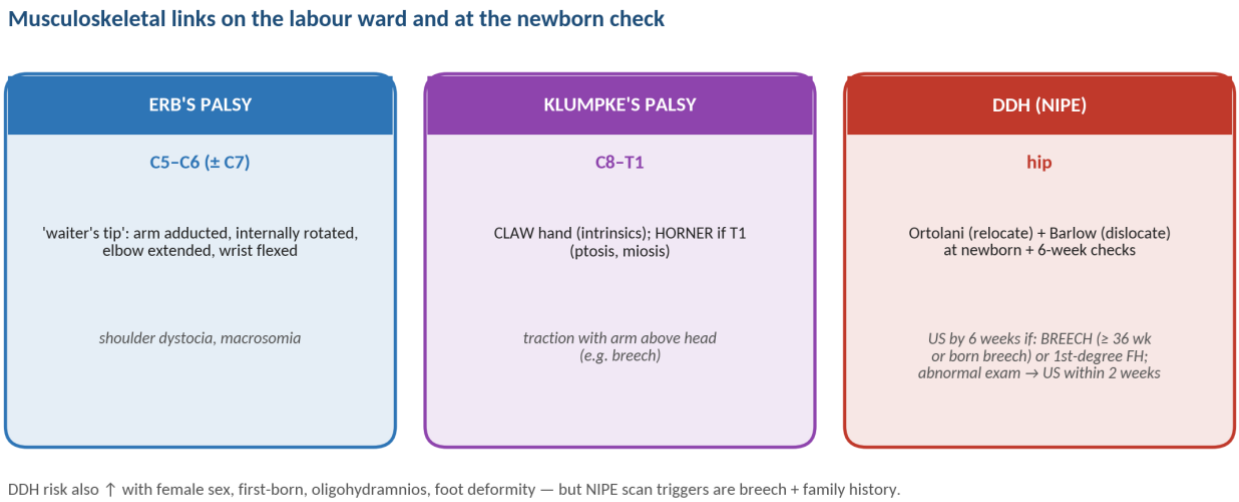


Figure 6. Brachial plexus injury and DDH.

FOLIC ACID

- **400 µg** from before conception to **12 weeks**
- **5 mg** if previous NTD or family history, **BMI ≥ 30**, **diabetes**, antiepileptics, sickle cell / thalassaemia

THE PELVIS

- Hip bone = ilium + ischium + pubis, fused at the **triradiate cartilage** (~mid-teens)
- Gynaecoid pelvis: subpubic angle ≥ ~80–90°, wide outlet
- Relaxin + progesterone loosen the **symphysis** → pelvic girdle pain

★ **PEARL**

FGFR3 gain-of-function: hypochondroplasia (mild) → achondroplasia → thanatophoric (lethal). Small chest = lethal.

Notochord → nucleus pulposus; AER → FGF (length); ZPA → SHH (thumb–little finger); dorsal ectoderm → WNT7A.

7 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

Wk 5–6 Clavicle ossifies	**Wk 7–12** Primary centres	**End wk 4** Upper limb buds	**Wk 8** Digits separate
12–18 mo Anterior fontanelle shuts	**< 0.6** Chest/abdo circ. = lethal	**~80%** Achondroplasia de novo	**400 µg / 5 mg** Folic acid

HIGH-YIELD CHECKLIST

- ☐ Somites → vertebrae, ribs, all skeletal muscle; lateral plate → limb skeleton; crest → face.
- ☐ Intramembranous: vault, face, clavicle. Endochondral: long bones, vertebrae, base.
- ☐ Resegmentation; notochord → nucleus pulposus; chordoma.
- ☐ Craniosynostosis: sagittal commonest (scaphocephaly); FGFR syndromes.
- ☐ AER/FGF, ZPA/SHH, dorsal ectoderm/WNT7A.
- ☐ Arms rotate out, legs in; apoptosis separates digits.
- ☐ Phocomelia = thalidomide; syndactyly + synostosis = Apert.
- ☐ FGFR3 spectrum; OI = COL1A1/2; lethal = small chest.
- ☐ Erb C5–6 vs Klumpke C8–T1 (Horner).
- ☐ DDH scan triggers: breech + family history; folic acid doses.

Self-assessment — cover the right-hand column

Question	Answer
Which bones form by intramembranous ossification?	Skull vault, face, clavicle
What does the notochord become?	Nucleus pulposus
Signal from the ZPA?	Sonic hedgehog
Which way does the lower limb rotate?	Medially (~90°)
Cause of syndactyly?	Failed interdigital apoptosis
Gene in achondroplasia?	FGFR3 (gain of function)
Scan sign of a lethal dysplasia?	Small chest (chest/abdominal circumference < 0.6)
Roots in Erb's palsy?	C5–C6
DDH ultrasound triggers on NIPE?	Breech presentation, first-degree family history
Who needs 5 mg folic acid?	Previous NTD/family history, BMI ≥ 30, diabetes, antiepileptics, sickle/thalassaemia

8 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Public Health England / NHS. Newborn and Infant Physical Examination (NIPE) screening programme standards.
- RCOG Green-top Guideline No. 42. Shoulder Dystocia. 2012.