PIPADOR REVISION

MRCOG Part 1 Revision Notes

Ectoderm Derivatives

EMBRYOLOGY • LECTURE 47

VISUAL EXAMINATION REVISION NOTES

2026 Edition

MRCOG Part 1 Revision Notes

Lecture 47: Ectoderm Derivatives

Embryology • Visual revision edition

COLOUR CODE USED THROUGHOUT THESE NOTES

SURFACE ECTODERM	NEUROECTODERM	NEURAL CREST	SIGNALLING	CLINICAL

LEARNING OBJECTIVES — tick off as you go

- ☐ Name the three ectodermal subdivisions and how each is specified.
- ☐ List surface ectoderm derivatives, including the placodes and mammary glands.
- ☐ Describe the brain vesicles, spinal cord plates and neuroectodermal cell types.
- ☐ Know the dual origins of the pituitary, eye and teeth.
- ☐ List the main neural crest derivatives (detail in Lecture 50).
- ☐ Apply to NTDs, holoprosencephaly, microcephaly, craniopharyngioma, ectodermal dysplasia and pigment disorders.

1 One Layer, Three Fates

IN ONE LINE: *Ectoderm 'keeps us in touch with the outside world': skin, the nervous system and the sense organs.*

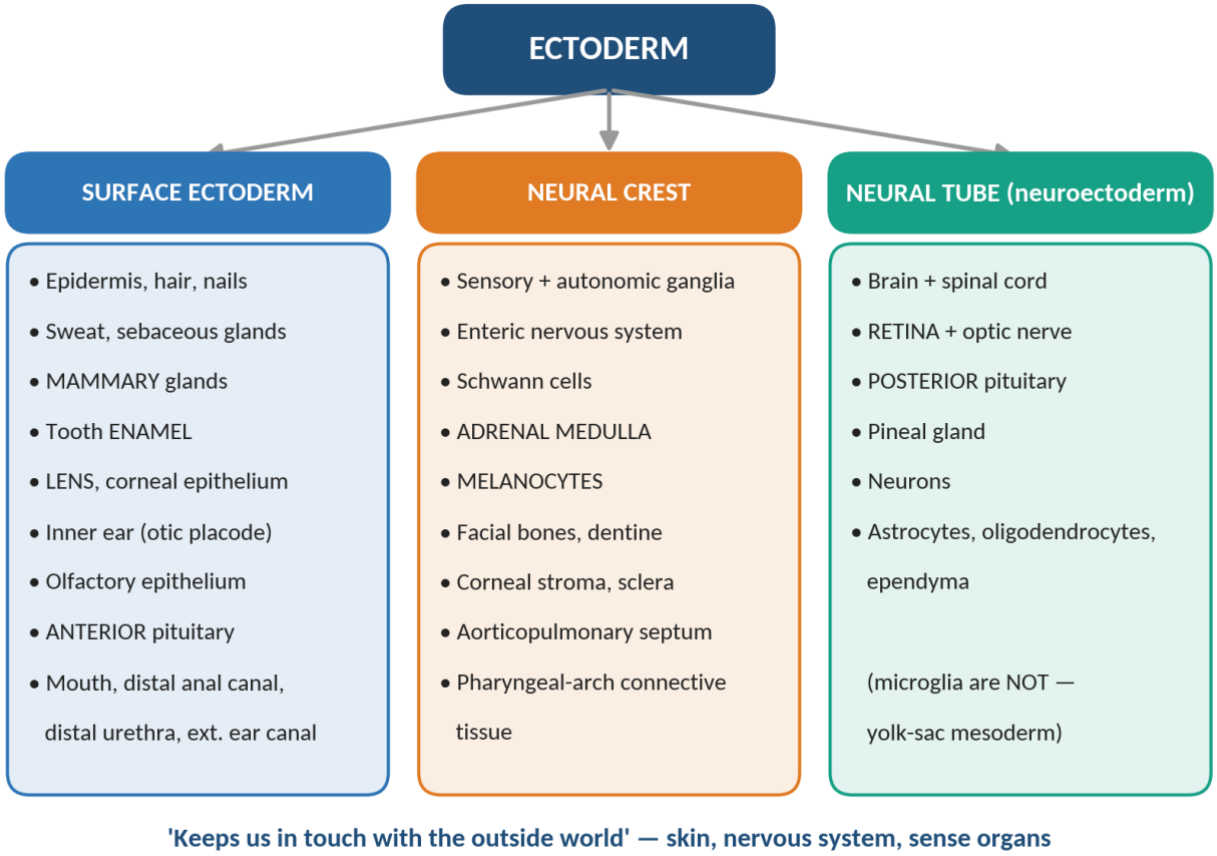


Figure 1. The ectoderm family tree.

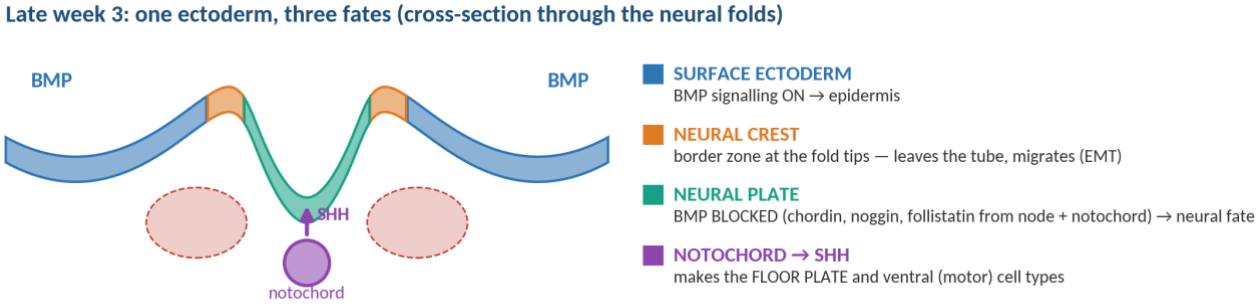


Figure 2. How the three zones are specified.

Subdivision	Specified by	Examples
Surface ectoderm	BMP signalling	Epidermis, appendages, lens, anterior pituitary
Neural plate	BMP inhibited (chordin, noggin, follistatin) + FGF — 'neural by default'	CNS, retina, posterior pituitary, pineal
Neural crest	Border between neural and surface ectoderm (intermediate BMP, Wnt)	PNS, melanocytes, facial skeleton

- **SHH** from the notochord and floor plate **patterns the ventral neural tube** (motor neurons); dorsal **BMP** from the roof plate gives sensory neurons and neural crest.

2 Surface Ectoderm

Group	Derivatives
Skin	Epidermis (all layers), hair, nails, sebaceous and sweat (eccrine + apocrine) glands
Mammary glands	Mammary ridges ('milk lines', axilla → groin); the pectoral part persists → 15–20 lactiferous ducts (Lecture 31)
Placodes	Lens; otic → membranous labyrinth (cochlea, vestibule, semicircular canals); nasal → olfactory epithelium; contribute to cranial sensory ganglia
Other	Anterior pituitary (Rathke's pouch); tooth enamel; corneal epithelium; parotid epithelium
Linings	Mouth (in front of the oropharyngeal membrane), anal canal below the pectinate line (proctodeum), distal (glandular) male urethra, external auditory meatus

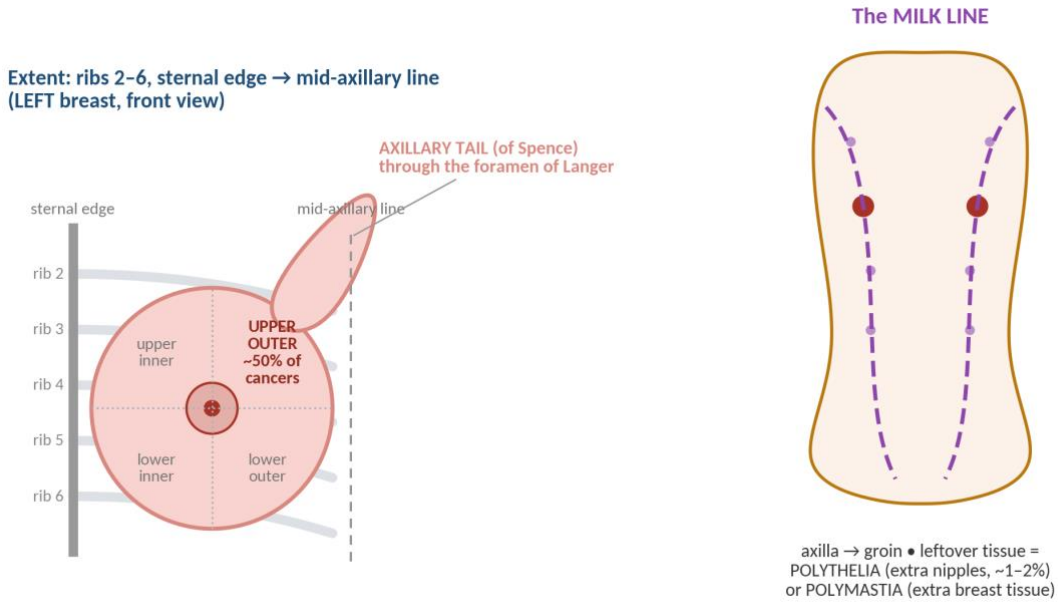


Figure 3. The milk line (from Lecture 31).

3 Neuroectoderm

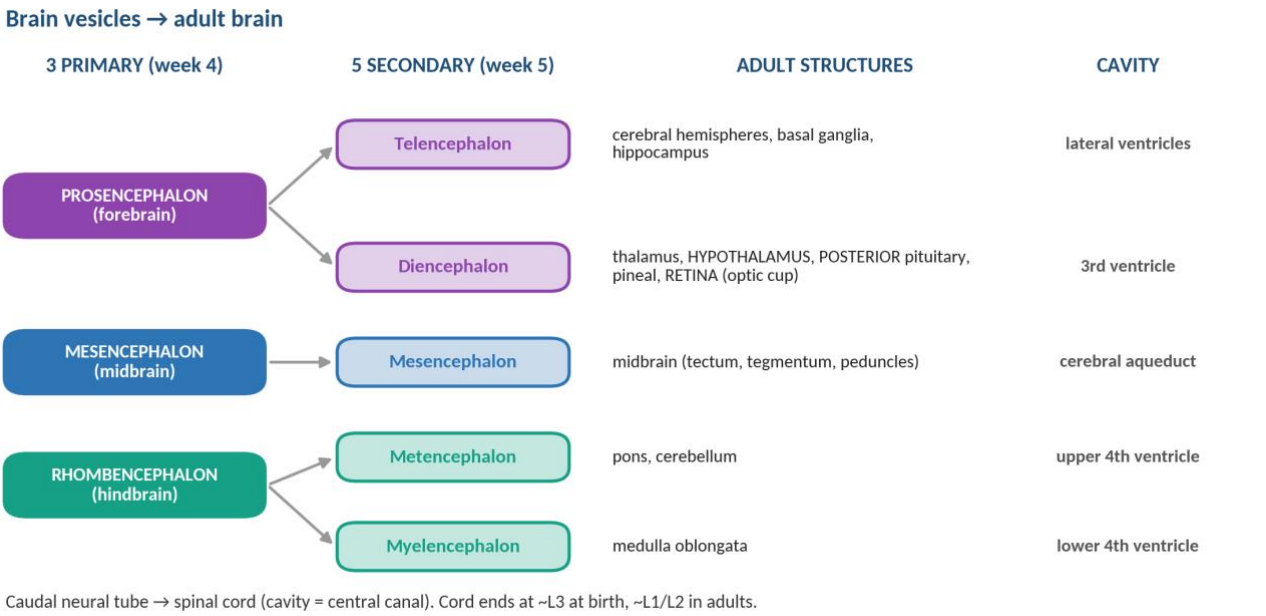


Figure 4. Three vesicles become five.

MNEMONIC / MEMORY HOOK

'Pro-Mes-Rhomb' → 'Tel-Di-Mes-Met-Myel'. Pros splits in two, Mes stays, Rhomb splits in two: **3 → 5**.

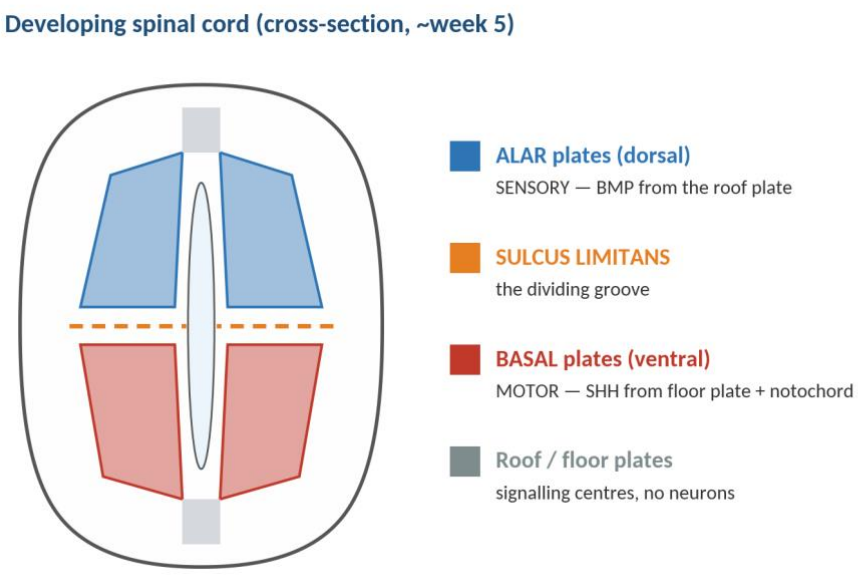


Figure 5. Alar (sensory) and basal (motor) plates.

- **Cell types**: neurons, astrocytes, **oligodendrocytes** (CNS myelin), ependyma. **Microglia are the exception** — yolk-sac (mesodermal) macrophages.

4 Organs with More Than One Source

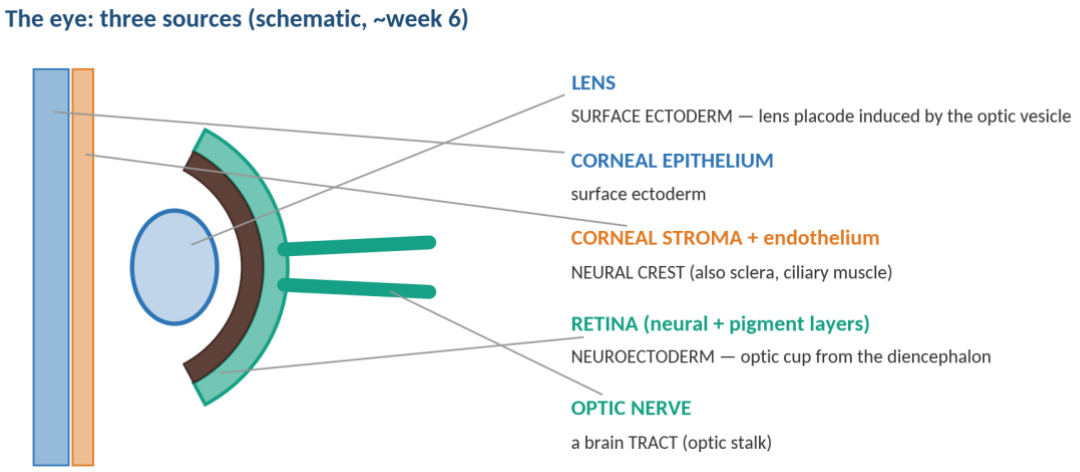


Figure 6. The eye.

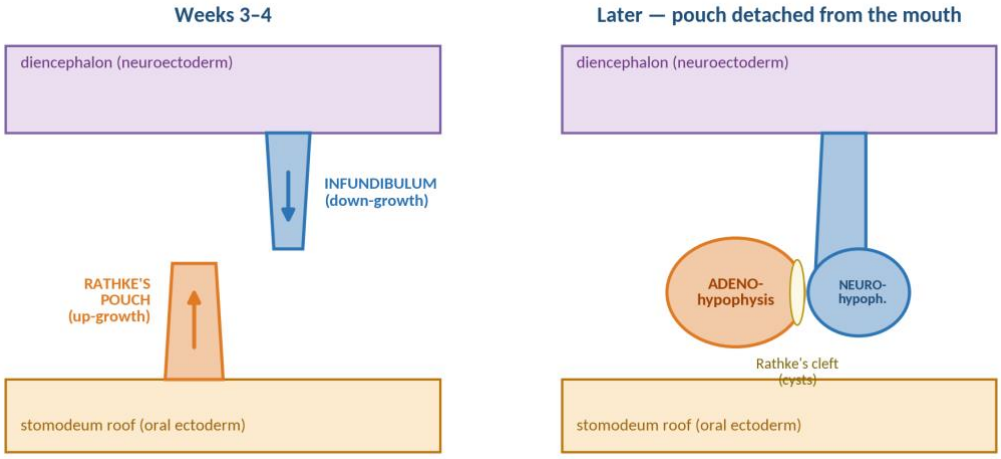


Figure 7. Pituitary: Rathke's pouch + infundibulum (from Lecture 36).

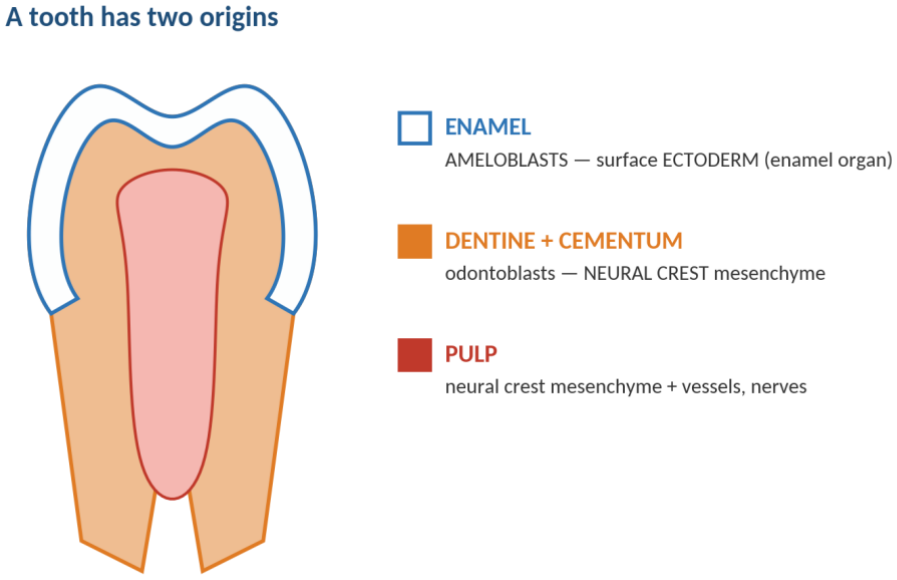


Figure 8. Enamel vs dentine.

EXAM HOOK

Anterior pituitary = surface ectoderm (Rathke's pouch). **Posterior pituitary = neuroectoderm** (diencephalon). Lens = surface ectoderm; **retina = neuroectoderm**; corneal stroma = neural crest. **Enamel = ectoderm; dentine = neural crest.**

5 Neural Crest in Brief (see Lecture 50)

- Sensory (dorsal root + cranial) and **autonomic ganglia**; **enteric nervous system**; **Schwann cells**; **adrenal medulla**; **melanocytes**; most **facial bones**, dentine, corneal stroma, sclera, ciliary muscle; **aorticopulmonary septum**; pharyngeal-arch connective tissue.

6 Clinical Correlates

NEURAL TUBE DEFECTS

- Anencephaly, encephalocele, spina bifida (occulta, meningocele, myelomeningocele)
- Folic acid **400 µg** pre-conception to 12 weeks; **5 mg** if previous NTD, diabetes, antiepileptics, BMI ≥ 30, sickle cell / thalassaemia
- **Anencephaly → polyhydramnios** (impaired fetal swallowing)

FOREBRAIN + HEAD SIZE

- **Holoprosencephaly**: forebrain fails to divide — single ventricle, midline facial defects up to cyclopia. Causes: **SHH** mutations, **trisomy 13**, **maternal diabetes**, alcohol
- **Microcephaly**: poor neuronal proliferation — congenital **CMV, Zika**, other TORCH, genetic, alcohol

PITUITARY

- **Craniopharyngioma** from Rathke's pouch remnants — bitemporal hemianopia, hypopituitarism
- **Septo-optic dysplasia**: optic nerve hypoplasia + absent septum pellucidum ± pituitary deficiency

SKIN, PIGMENT, BREAST

- **Ectodermal dysplasias**: hair, nails, teeth, sweat glands — commonest X-linked hypohidrotic (**EDA**)
- **Albinism**: melanin synthesis defect (e.g. tyrosinase). **Piebaldism** (KIT) and **Waardenburg** (PAX3, MITF, SOX10): melanocyte migration defects
- **Polythelia** usually below the breast; accessory tissue in the axilla

★ PEARL

Dual-origin favourites: **pituitary** (surface ecto + neuroecto), **eye** (surface ecto + neuroecto + neural crest), **tooth** (ecto + neural crest), **anal canal** (ectoderm below the pectinate line, endoderm above).

Microglia are the odd one out in the CNS — not ectodermal.

7 MRCOG Exam Pearls — Last-Minute Page

Numbers to know

3 Ectoderm subdivisions	**3 → 5** Brain vesicles (wk 4 → 5)	**15–20** Lactiferous ducts	**L3 / L1–2** Cord end: birth / adult
400 µg Folic acid (standard)	**5 mg** Folic acid (high risk)	**12 wk** Continue folic acid to	**1** CNS cell NOT ectodermal (microglia)

HIGH-YIELD CHECKLIST

- ☐ Surface ectoderm (BMP on) • neural plate (BMP blocked) • neural crest (border).
- ☐ Surface: skin + appendages, mammary glands, enamel, lens, inner ear, olfactory epithelium, anterior pituitary.
- ☐ Linings: mouth, anal canal below the pectinate line, distal male urethra, ear canal.
- ☐ Neuroectoderm: CNS, retina, optic nerve, posterior pituitary, pineal.
- ☐ 3 primary → 5 secondary vesicles; know the cavities.
- ☐ Alar = sensory (BMP), basal = motor (SHH); sulcus limitans between.
- ☐ Microglia = mesoderm (yolk sac).
- ☐ Enamel ectoderm; dentine neural crest. Corneal stroma neural crest.
- ☐ NTDs + folic acid; holoprosencephaly (SHH, T13, diabetes); craniopharyngioma.

Self-assessment — cover the right-hand column

Question	Answer
Three subdivisions of ectoderm?	Surface ectoderm, neural tube (neuroectoderm), neural crest
Origin of the lens?	Surface ectoderm (lens placode), induced by the optic vesicle
Origin of the retina?	Neuroectoderm — optic cup from the diencephalon
Origins of anterior and posterior pituitary?	Rathke's pouch (surface ecto) / diencephalon (neuroecto)
Secondary vesicles of the prosencephalon?	Telencephalon + diencephalon
Cavity of the mesencephalon?	Cerebral aqueduct
Which CNS glial cell is not ectodermal?	Microglia
Origin of dentine vs enamel?	Dentine — neural crest; enamel — ectoderm
Main causes of holoprosencephaly?	SHH pathway defects, trisomy 13, maternal diabetes
Tumour from Rathke's pouch remnants?	Craniopharyngioma

8 References

- Sadler TW. Langman's Medical Embryology. 14th ed. 2019.
- Moore KL, Persaud TVN, Torchia MG. The Developing Human. 11th ed. 2020.
- NICE NG201. Antenatal care. 2021.