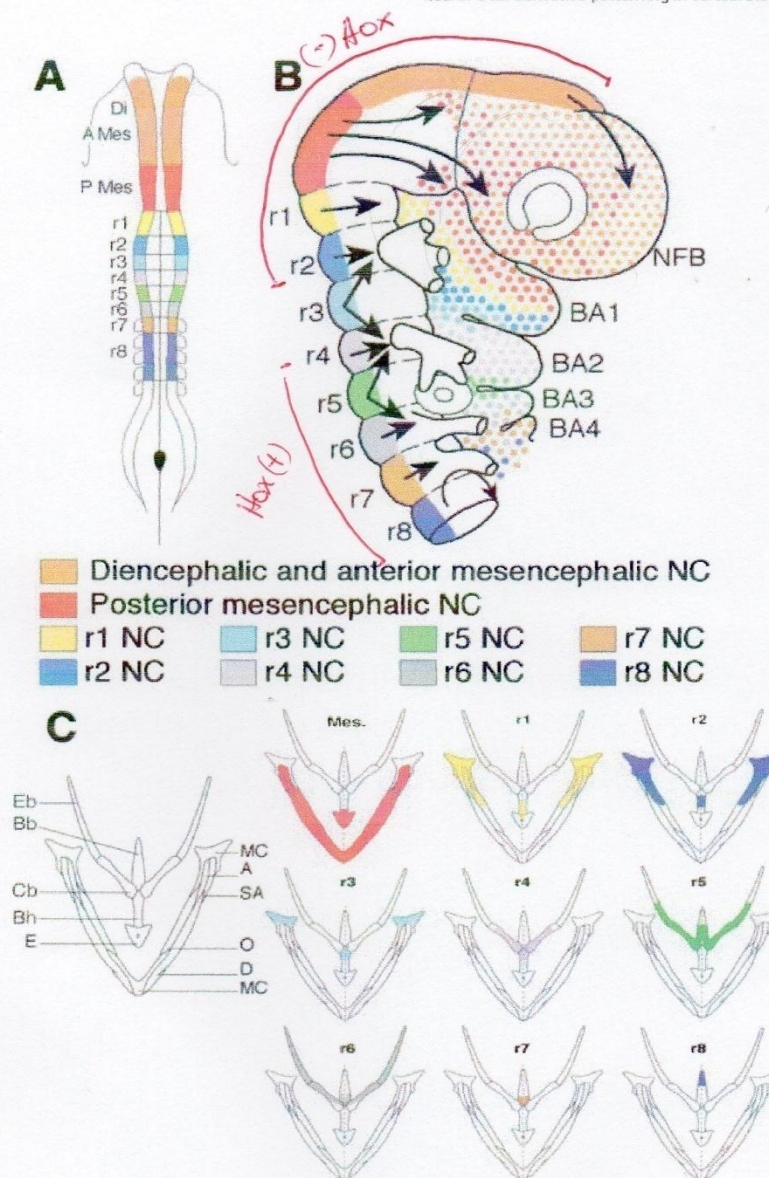


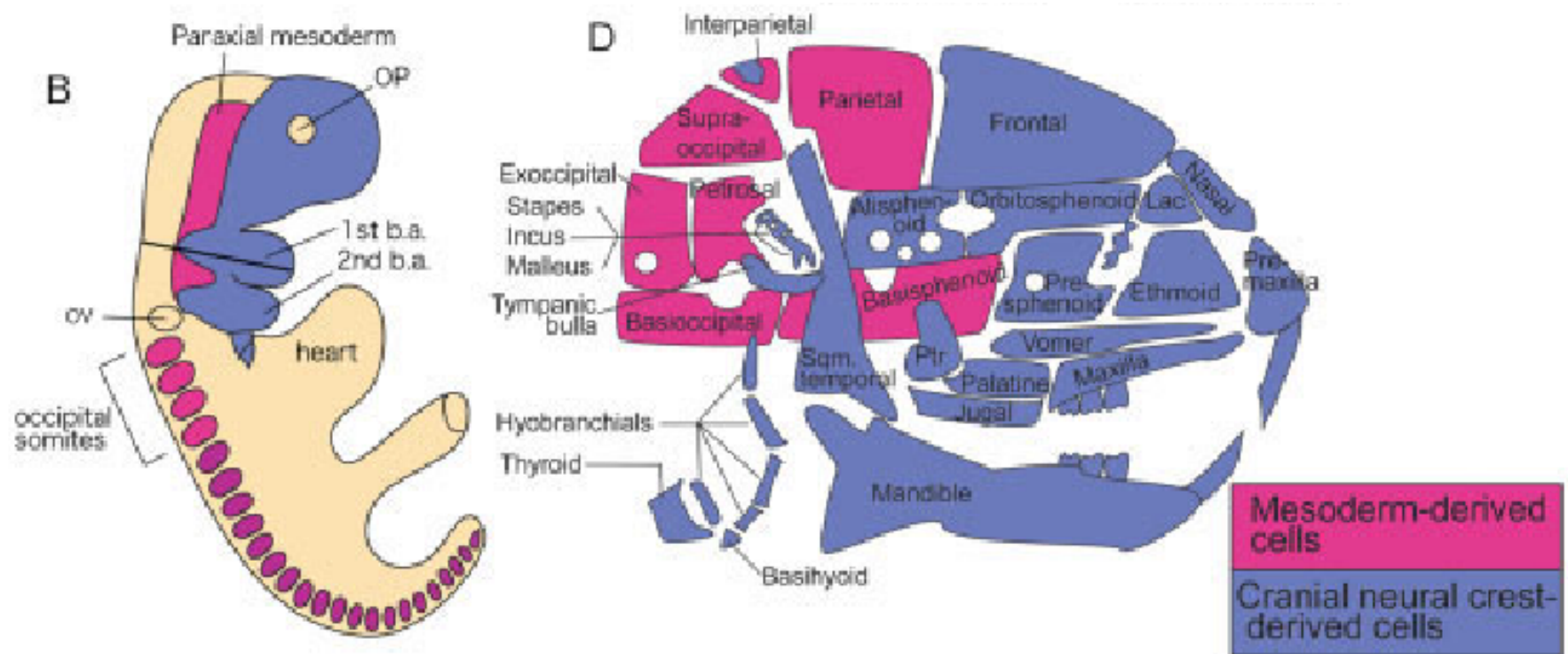
**Figure 13.2**

Regions of the neural crest. The cranial neural crest migrates into the pharyngeal arches and the face to form the bones and cartilage of the face and neck. It also produces the cranial nerves. The vagal neural crest (near somites 1–7) and the sacral neural crest (posterior to somite 28) form the parasympathetic nerves of the gut. The cardiac neural crest cells arise near somites 1–3; they are critical in making the division between the aorta and the pulmonary artery. Neural crest cells of the trunk (about somite 6 through the tail) make sympathetic neurons and pigment cells (melanocytes), and a subset of these (at the level of somites 18–24) form the medulla portion of the adrenal gland. (After Le Douarin 1982.)





**Fig. 3** The cephalic neural crest: cell migration streams and fate map in hyoid structure. (A) Presumptive diencephalic, mesencephalic and rhombencephalic territories of the NF in the avian embryo at 5ss as established by Grapin-Botton et al. (1995). (B) Migration map of cephalic NCCs in the avian embryo. The origin of NCCs found in the nasofrontal, periocular regions and in BAs is colour-coded as in A. NCCs arising from the posterior diencephalon and mesencephalon populate the nasofrontal and periocular region. Posterior mesencephalon also participates in BA1. NCCs from r1–r2 together with a small contribution of r3 complete the crest-derived mesenchyme in BA1. The major contribution to the 2nd branchial arch comes from r4. NCCs arising from r3 and r5 split to participate in the two adjacent arches: BA1 and BA2 for r3-NCCs; BA2 and BA3 for r5-NCCs, respectively. r6–r8-derived cells migrate to the more caudal BAs. (C) Skeletal components of hyoid cartilages: the participation of the crest-derived cells is colour-coded as in A. A, angular; Bb, basibranchial; Bh, basihyal; Cb, ceratobranchial; D, dentary; E, entoglossum; Eb, epibranchial; Mc, Meckel's cartilage.



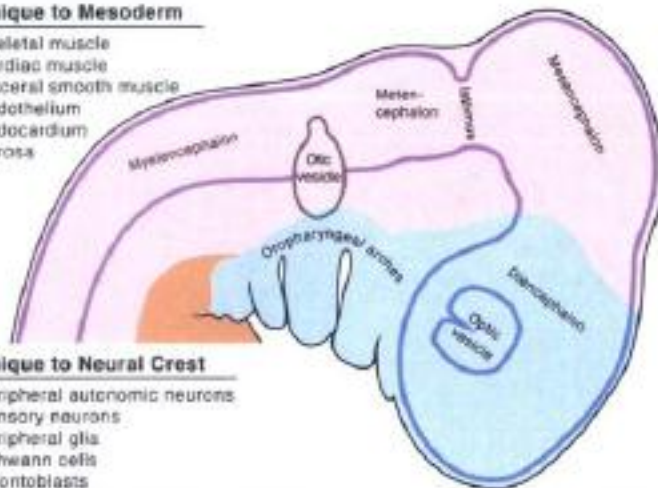
**Fig. 3.** Contribution of ectoderm, mesoderm, and endoderm during craniofacial development. **A:** Neural crest cells are formed at the junction of neural and surface ectoderm. These cells undergo epithelial-mesenchymal transformation, become ectomesenchyme, and travel into multiple destinations. **B:** Side view of an E9.5 mouse embryo shows unsegmented paraxial mesoderm in the head and mesoderm-derived somites in the trunk. OP, optic vesicle; OV, otic vesicle. **C:** Transverse section of the developing first branchial arch that is covered by surface ectoderm. The core of the first arch contains cranial neural crest (CNC)-derived (blue) and paraxial mesoderm-derived (pink) cells. The pharyngeal endoderm (yellow) lines the inner aspect of the branchial arch. **D:** Schematic drawing of an adult mouse skull shows both the CNC- and paraxial mesoderm-derived elements (modified from Noden and Trainor, 2005). Mesoderm-derived cells are in pink, and CNC-derived cells are in blue.



## A

Unique to Mesoderm

Skeletal muscle  
Cardiac muscle  
Visceral smooth muscle  
Endothelium  
Endocardium  
Serosa



Derived from Mesoderm  
and Neural Crest

- Cartilage
- Endochondral bone
- Intramembranous bone
- Perivascular smooth muscle
- Glandular stroma
- Meninges
- Dermis

### Unique to Neural Crest

- Peripheral autonomic neurons
- Sensory neurons
- Peripheral glia
- Schwann cells
- Odontoblasts

Neural  
Crest

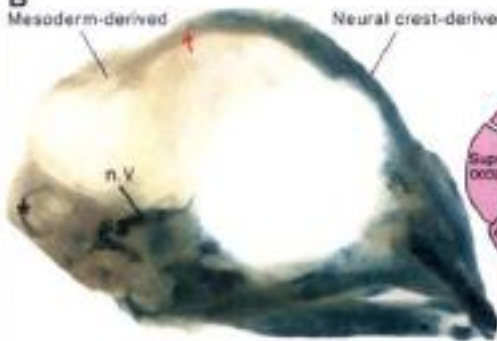
### Paraxial Mesoderm

**Lateral Mesoderm**

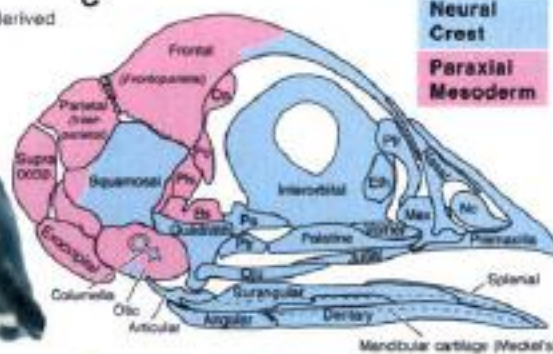
## 8

**Mesoderm-derived**

Neural crest-derived



## C



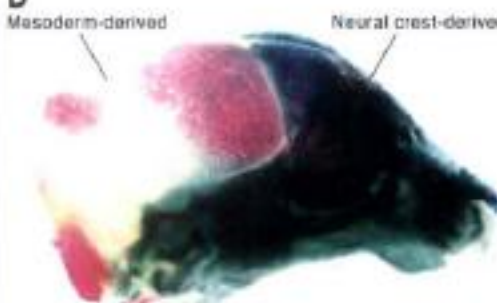
Neural  
Crest

### Paraxial Mesoderm

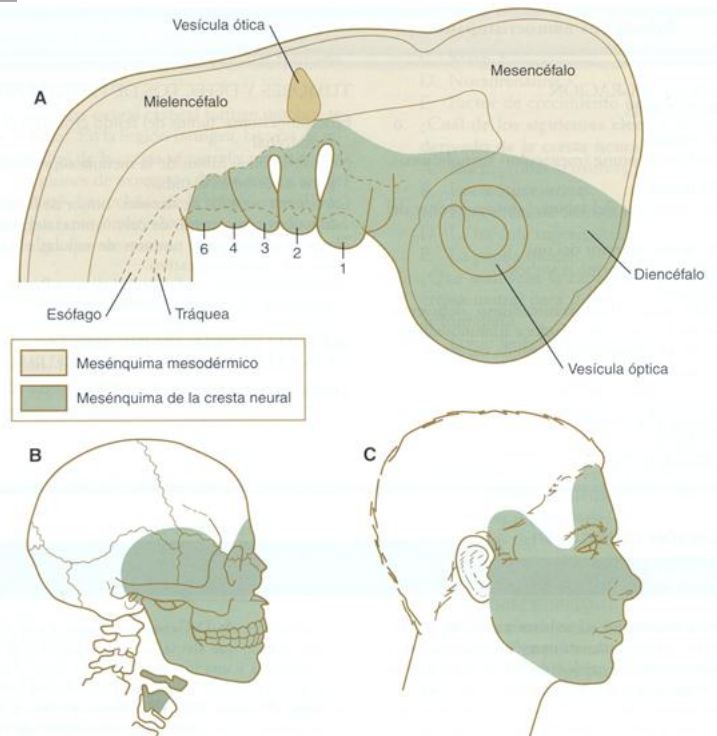
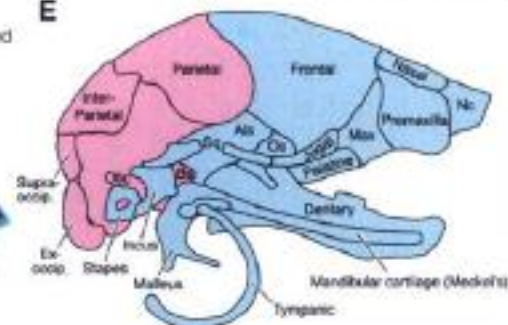
## D

Mesoderm-derived

Neural crest-derived



## E



**FIGURA 12-10** Distribución de la cresta neural en la cara y el cuello del ser humano. **A**, En el embrión precoz **B y C**, En el esqueleto y la dermis de un adulto.

Figure 4. Neural crest-mesoderm boundary in the head. A) The location of the neural crest-mesoderm interface is shown at a stage following the initial translocation of neural crest cells but before the secondary movements associated with muscle morphogenesis. Listed are tissue types derived in anjoints from either neural crest or mesoderm exclusively, or from both of these mesenchymal populations. B) The extent and boundaries of neural crest contributions to the avian skull are shown in a bisected head from a 14-day chick embryo whose neural plate, including neural crest precursors, and surface ectoderm were washed with a replication-incompetent retrovirus containing the *LacZ* ( $\beta$  galactosidase) reporter gene. Note the complete labeling (blue stain) of frontonasal, maxillary, mandibular, and other pharyngeal arch skeletal structures in addition to sensory ganglia such as the trigeminal (n.V). The red arrow points to the site of the neural crest-mesoderm boundary between rostral and calvarial parts of the frontal bone. Asterisk (\*) denotes labeled cells within a semicircular duct, which is derived from the otic placode. Figure legend continued on next page.