

# “Neural Crest Cells (NCCs)”

The neural crest is sometimes called the “4th germ layer” due to its remarkable multipotency and contribution to numerous tissues and organ systems.

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## 1. Origin of Neural Crest Cells

- Arise from lateral borders of the neuroectoderm as neural folds elevate and fuse
- Process: Cells dissociate from neighbors → epithelial-to-mesenchymal transition (EMT) → migrate into underlying mesoderm
- Clinical relevance: Involved in ~1/3 of congenital birth defects and cancers (melanomas, neuroblastomas)

Definitions:

- Mesoderm: Cells derived from epiblast and extraembryonic tissues
  - Mesenchyme: Loosely organized embryonic connective tissue (regardless of origin)
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## 2. Migration Pathways of NCCs

### A. After Neural Tube Closure

Two pathways:

1. Dorsal Pathway (through dermis)
  - Enter ectoderm via basal lamina openings
  - Form melanocytes in skin & hair
2. Ventral Pathway (through anterior half of somite)
  - Form:
    - Schwann cells
    - Sensory ganglia

- Sympathetic neurons
- Enteric neurons
- Adrenal medulla

Mnemonic: Super Salty SEA

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## B. Before Neural Tube Closure

- Form:
  - Craniofacial skeleton
  - Cranial ganglia
  - Glial cells
  - Melanocytes

Mnemonic: Cry Cry and Get Me → Craniofacial, Cranial ganglia, Glial cells, Melanocytes

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### 3. Complete Derivatives of NCCs

Category	Derivatives
4 S's	Spinal ganglia, Sympathetic ganglia, Schwann cells, Smooth muscles of face
4 C's	Cranial ganglia, Connective tissue, C-cells of thyroid, Conotruncal septum of heart
MANGO	Melanocytes, Adrenal medulla, Meninges, Glial cells, Odontoblasts

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### 4. Summary Flow of Neural Crest Cells

Neuroectoderm → Neural folds elevate & fuse → NCCs  
dissociate → EMT → Migrate

Migration pathways:

- Before tube closure → Craniofacial skeleton + Cranial ganglia + Glial cells + Melanocytes
- After tube closure →
  - Dorsal → Melanocytes
  - Ventral → Schwann cells + Sensory ganglia + Sympathetic neurons + Enteric neurons + Adrenal medulla

Key mnemonics for exams:

- Super Salty SEA → Ventral pathway derivatives
- Cry Cry and Get Me → Pre-closure derivatives
- 4S, 4C, ManGO → Complete NCC derivatives

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-> The End <-