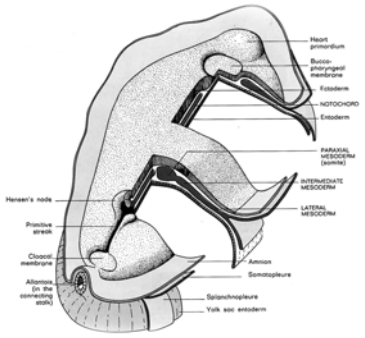
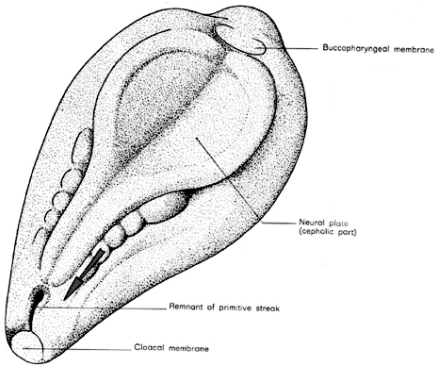
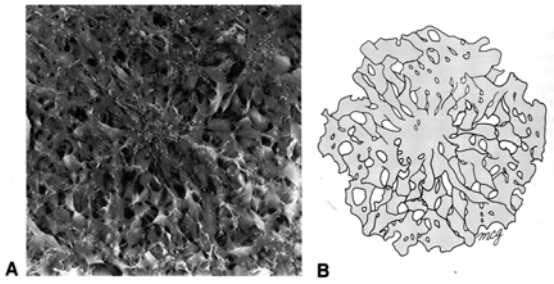
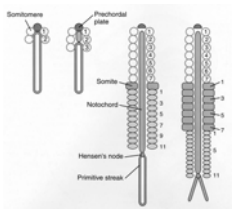
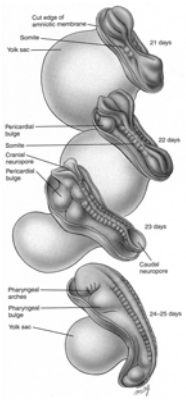
Mesoderm formation: Segmentation

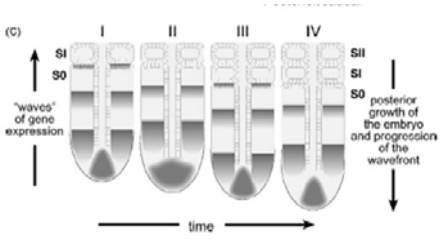










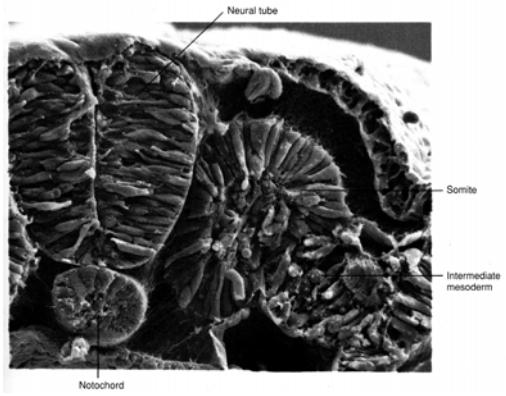


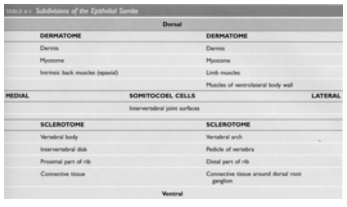
1. Paraxial mesoderm is laid down sequentially by the retreating primitive streak.

2. An oscillation of gene transcription generates each somite pair in sequence

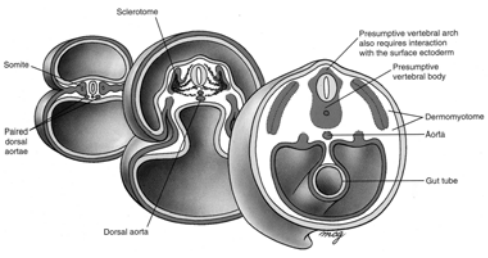
3. This pulsatile pattern is initiated in the somite precursors/presomitic mesoderm.

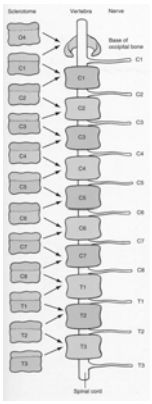
4. Coordination of the segmentation mechanism (clock cycling) is dependent on Notch-1 signaling. Notch is a transmembrane receptor that recognizes two transmembrane ligands - Serrate and Delta. KO of Notch, its ligand or elements of its down-stream cascade result in loss of segmentation.

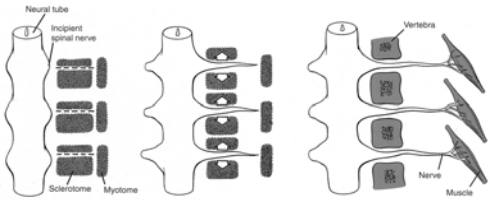


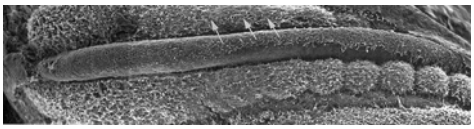


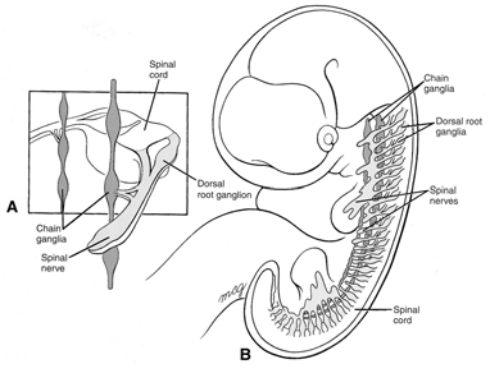
Dorsal	
DERMATOME	DERMATOME
Dermis	Dermis
Myotome	Myotome
Intrinsic back muscles (epaxial)	Limb muscles
	Muscles of ventrolateral body wall
MEDIAL — SOMITOCOEL CELLS — LATERAL	
Intervertebral joint surfaces	
SCLEROTOME	SCLEROTOME
Vertebral body	Vertebral arch
Intervertebral disk	Pedicle of vertebra
Proximal part of rib	Distal part of rib
Connective tissue	Connective tissue around dorsal root ganglion
Ventral	

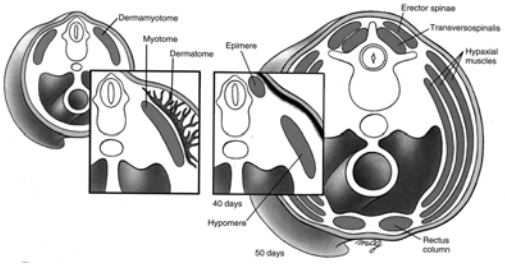


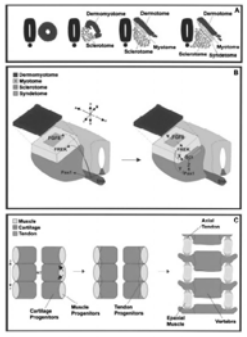

Sclerotome
Vertebra
Nerve
O1
C1
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
Base of occipital bone
Spinal cord


Neural tube
Incipient spinal nerve
Sclerotome
Myotome
Vertebra
Nerve
Muscle

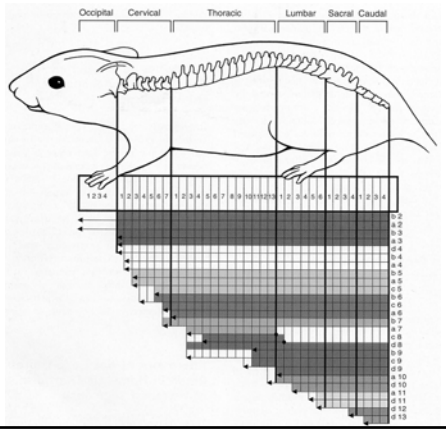


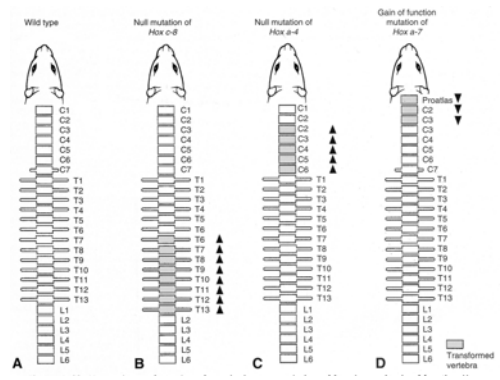

Spinal cord
Chain ganglia
Dorsal root ganglia
Dorsal root ganglion
Spinal nerves
A
Chain ganglia
Spinal nerve
Spinal cord
B

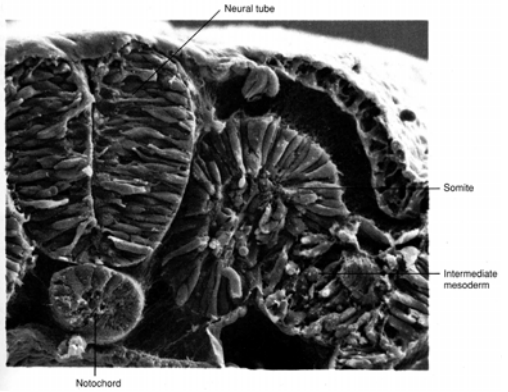

Dermamyotome
Myotome
Dermatome
Epimere
Erector spinae
Transversospinalis
Hypaxial muscles
40 days
Hypomere
50 days
Rectus column

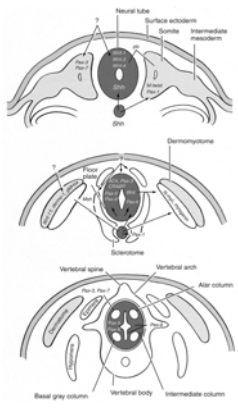


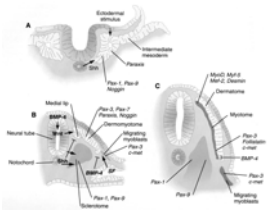
Generation of form and diversity: homeotic transformations











Positional information:

Transplantation of somites

Summary:

1. somites establish body segmentation.
2. somite has 3 separate compartments.
3. differential A/P properties of the somite result in segmentation of vertebral column and peripheral nervous system.
4. overlapping patterns of HOX gene expression result in somites with individual characteristics.
5. positional information is present in somites prior to epithelial-mesenchymal transformation