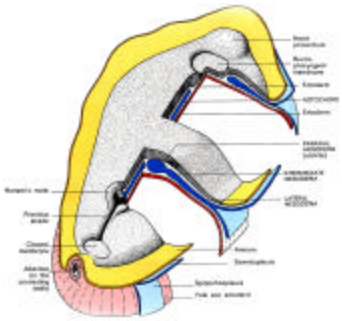
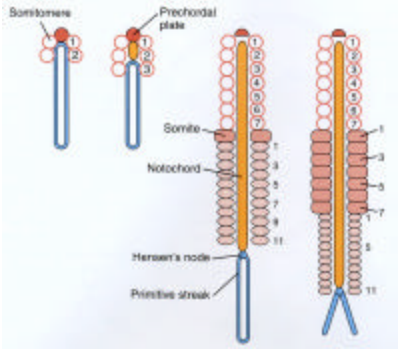
Mesoderm formation & Segmentation

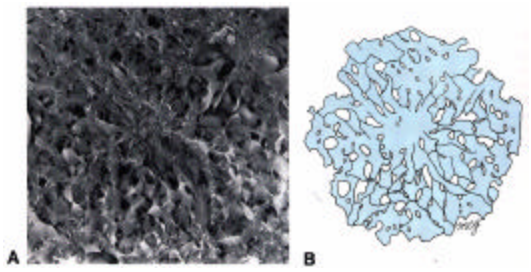
Organization of the mesoderm toward the end of gastrulation.



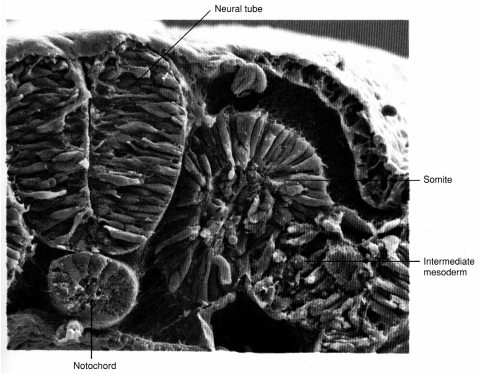
Sequential appearance of somitomeres and somites



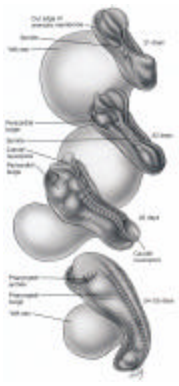
Scanning EM and diagram of somitomere.



Scanning EM of the epithelial somite.



Sequential addition of somites from day 21-day 25 post-conception



Steps in the addition of somites.

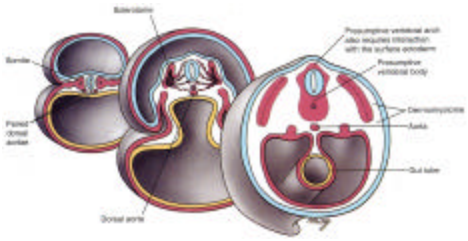
1. Paraxial mesoderm is laid down sequentially by the retreating primitive streak.

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

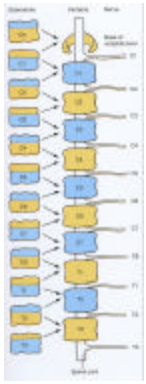
3. This pulsatile pattern is initiated in the somite precursors/presomitic mesoderm.

Subdivisions of the Epithelial Somite		
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		

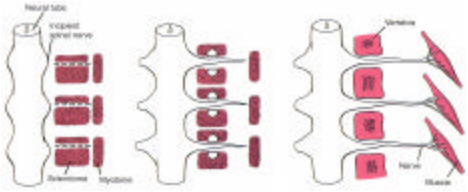
Fate of medial ventral somite : sclerotome.

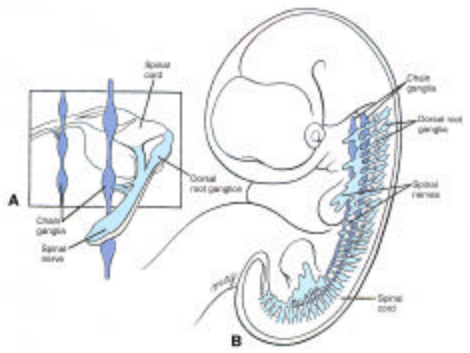


Each vertebrate is formed from the caudal portion of one somite and the cranial portion of the next.

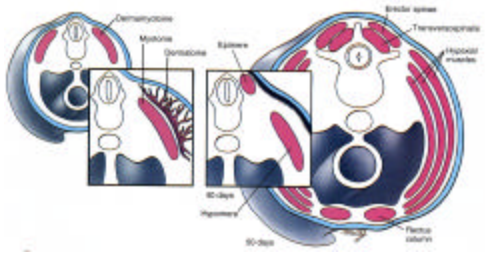


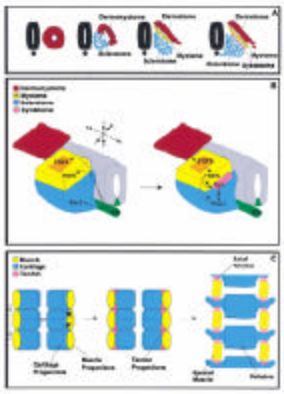
Each spinal nerve traverses the cranial aspect of the sclerotome as it grows to innervate the myotome. The segmental nature of the PNS is due to segmentation of somites.



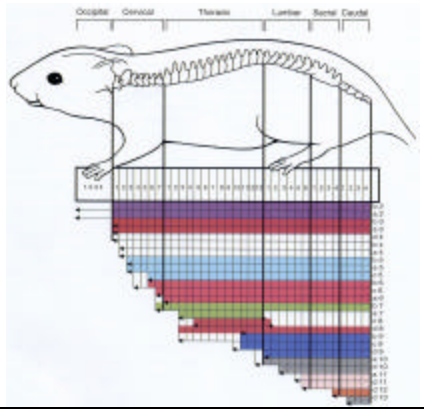


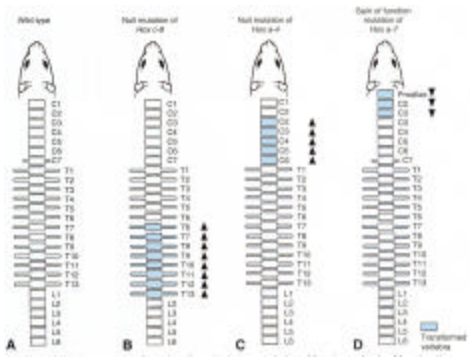
Migration of dermamytomone cells. All skeletal muscle arises from the myotome.





Generation of form and diversity: homeotic transformations

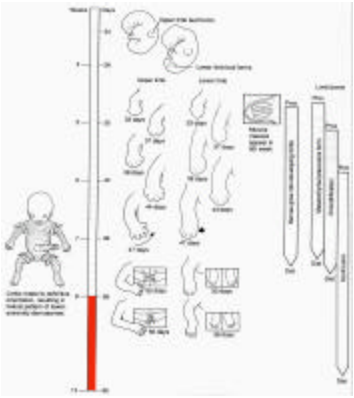




Positional information: Transplantation of somites

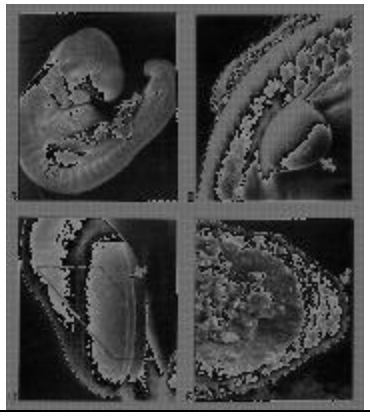
Summary:

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.

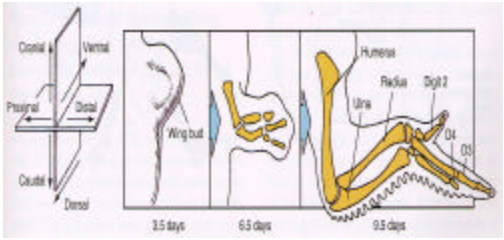


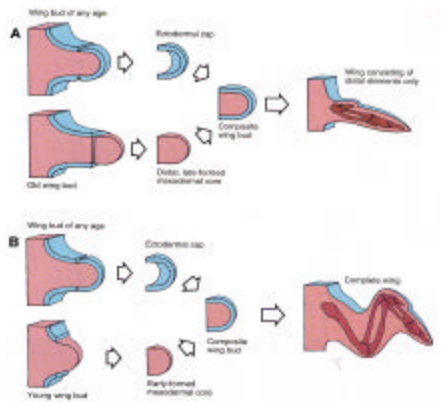
White arrow
To limb bud

White arrow to apical ecto-dermal ridge. M=mesoderm of progress zone

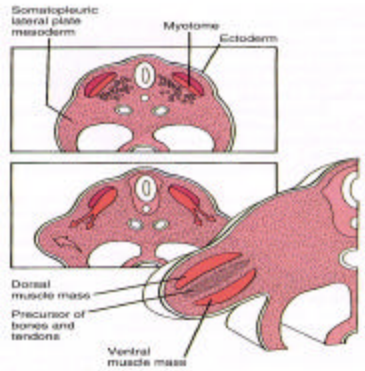


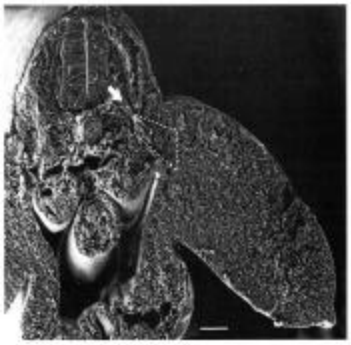
Limb segments are laid down proximal to distal

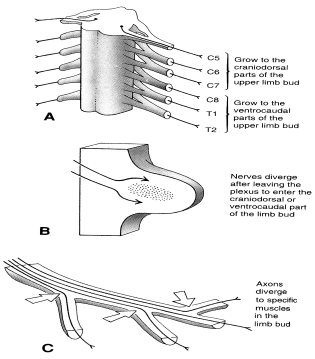




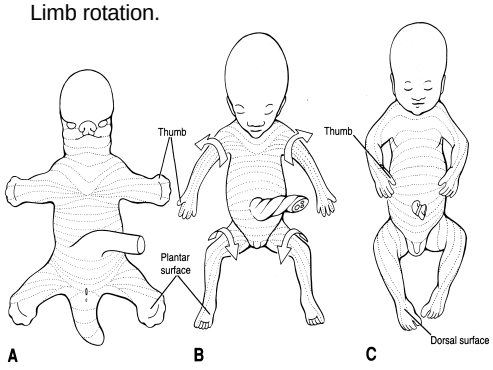
Hox gene expression is also important in patterning limb as with vertebral column


Somatopleuric lateral plate mesoderm
Myotome
Ectoderm
Dorsal muscle mass
Precursor of bones and tendons
Ventral muscle mass

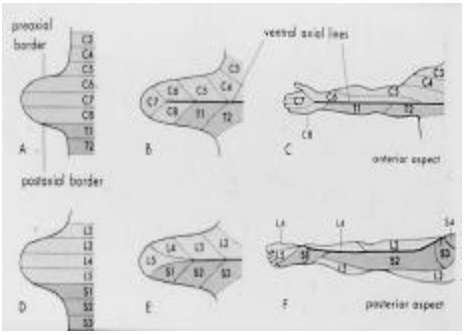



C5
C6
C7
Grow to the craniodorsal parts of the upper limb bud
C8
T1
T2
Grow to the ventrocaudal parts of the upper limb bud
A
Nerves diverge after leaving the plexus to enter the craniodorsal or ventrocaudal part of the limb bud
B
Axons diverge to specific muscles in the limb bud
C

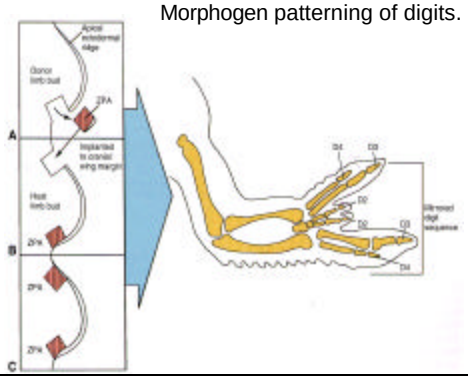
Limb rotation.



Consequences of limb rotation on innervation



Morphogen patterning of digits.



Limb summary

1. Two sources of mesoderm limb: lateral plate forming cartilage and bone; somite derived cells forming muscle.
2. The trunk level of the lateral plate mesoderm determines whether it becomes forelimb or hind limb.
3. The ectoderm is a signaling center regulating growth and it participates in patterning this outgrowth.
4. Because innervation of the limb arrives just as the muscle masses are forming, the segmental pattern of this innervation will be altered as limb rotate.