

Embryologie et croissance du rachis

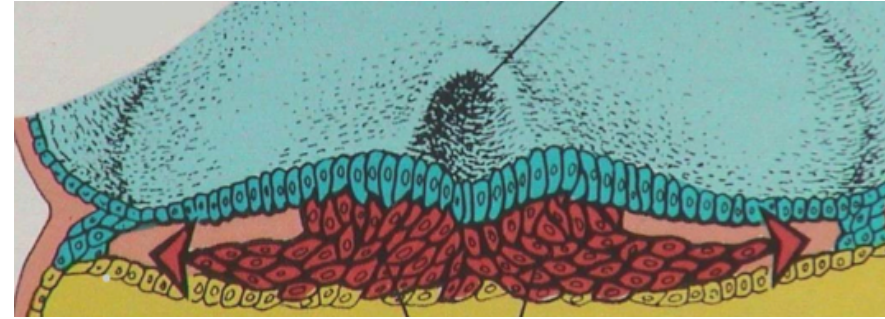
J Sales de Gauzy

Hôpital des Enfants, CHU Toulouse

NEURULATION

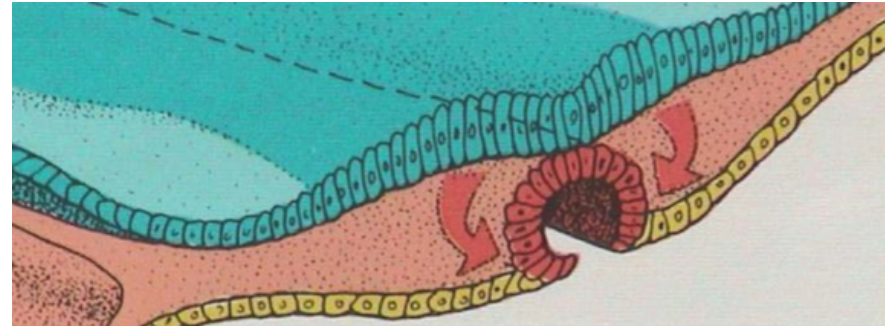
J 16- 17: Processus notochordal

Chorde= structure axiale de l'embryon



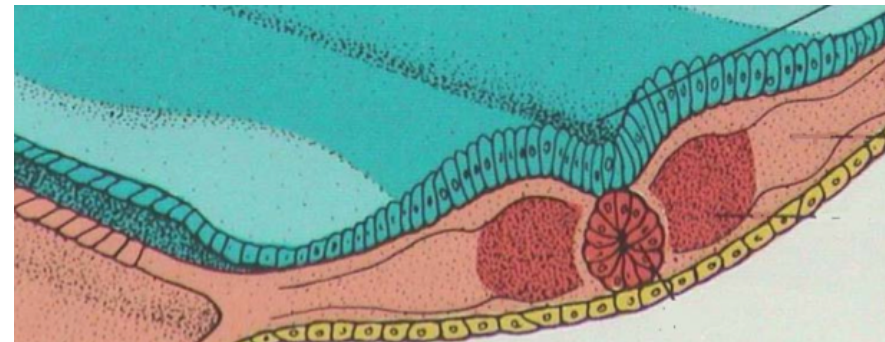
Apparition du mésoblaste

J20 : segmentation du mésoderme para axial en somites



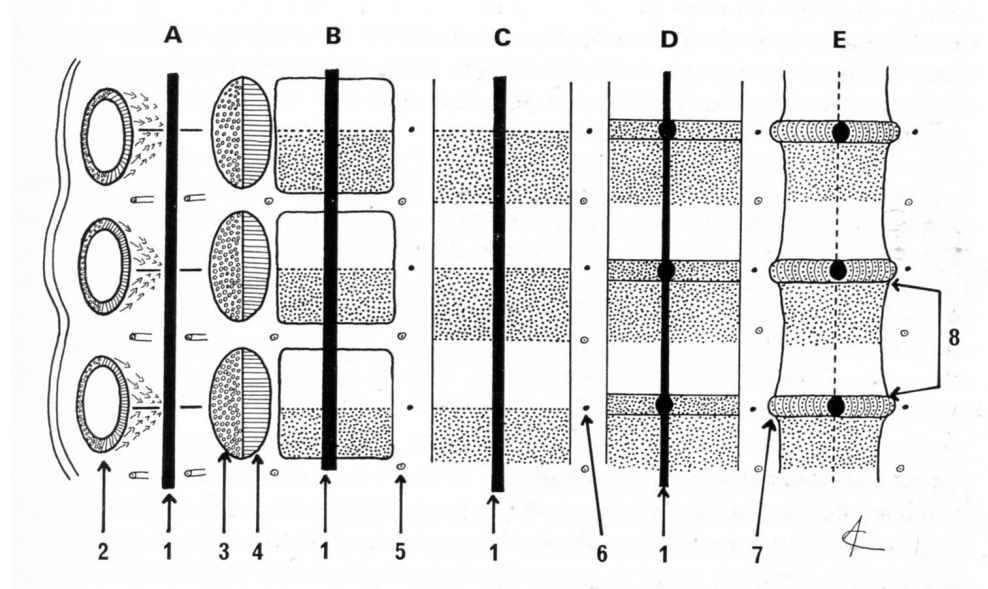
Différenciation des somites en sclérotome (dedans) et myotome (dehors)

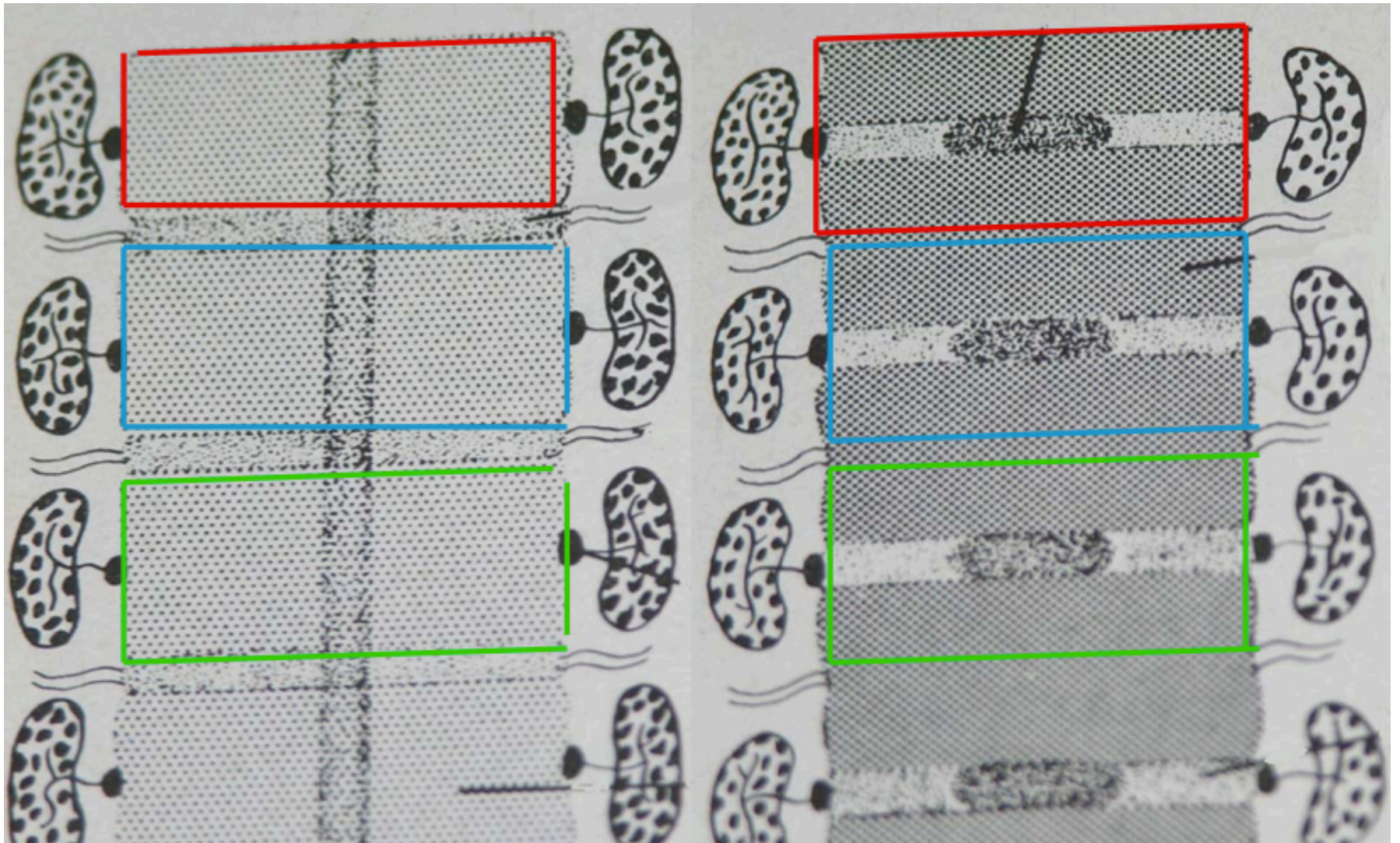
Migration des cellules des sclérotomes autour de la chorde et du tube neural :
Formation du Corps vertébral et de l'arc postérieur



Somite

- Partie caudale
 - Disque intervertébral
- Partie craniale
 - Fusion avec partie caudale adjacente : vertèbre
- Chorde
 - Dégénérescence mucoïde : nucléus pulposus
- Annulus
 - Formation à partir du sclérotome du somite





Le disque IV provient de la partie craniale du sclérotome

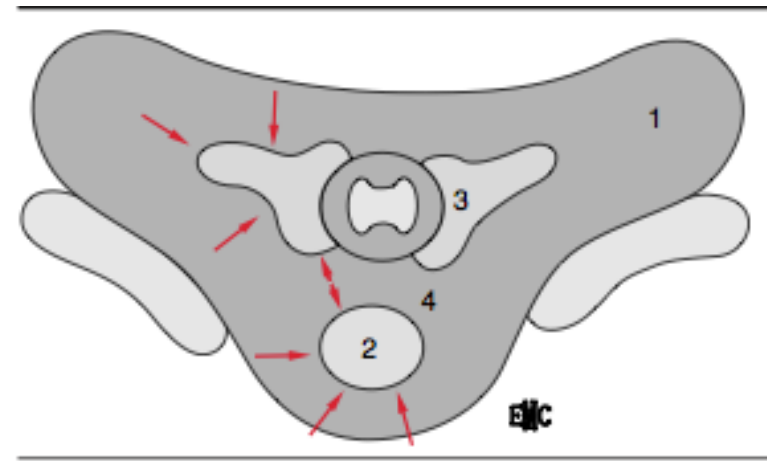
L'involution de la chorde donne le Nucleus pulposus

CHONDRIFICATION

Début : 6^{ème} semaine

1 centre pour le CV

1 centre/ héli-arc postérieur
et pédicule



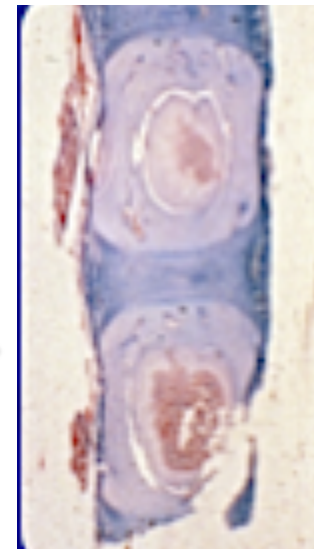
1. Mésenchyme 2. Chondrification du CV 3. Chondrification des pédicules et arcs postérieurs 4. Mésenchyme corporel



Cellules
mésenchymateuses

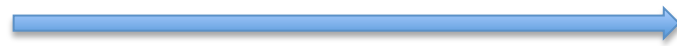


Substitution par cellules
cartilagineuses

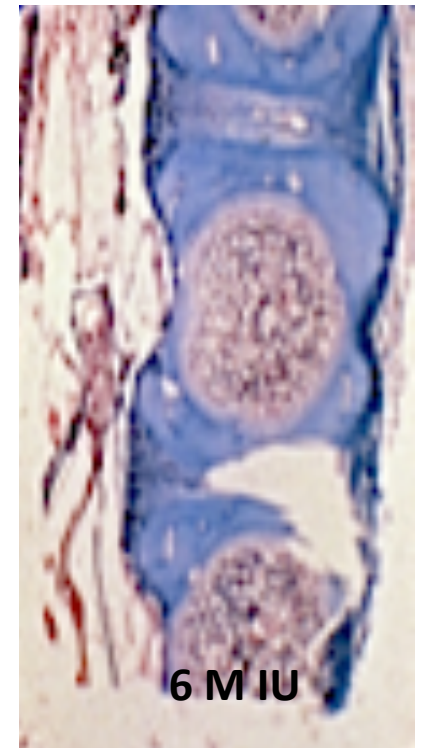
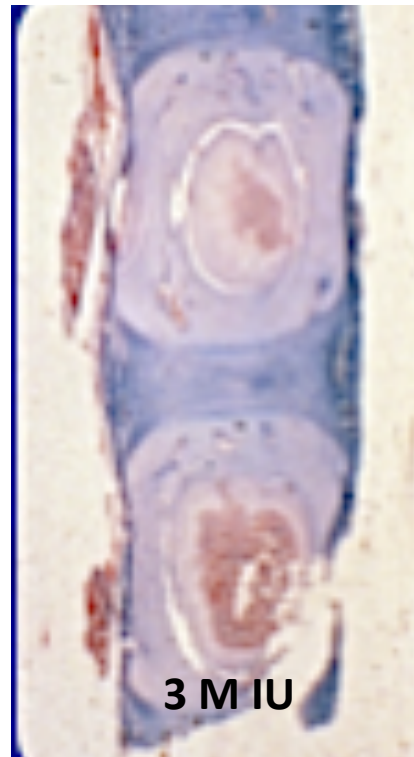


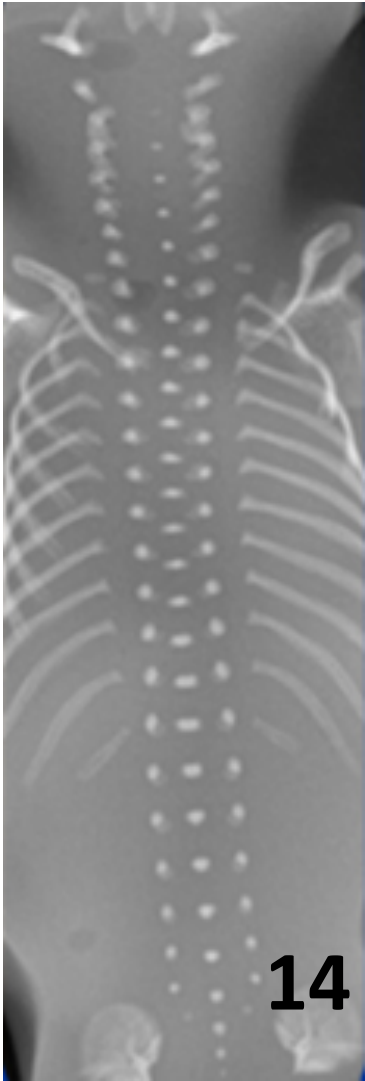
Ossification enchondrale

3° mois in utéro

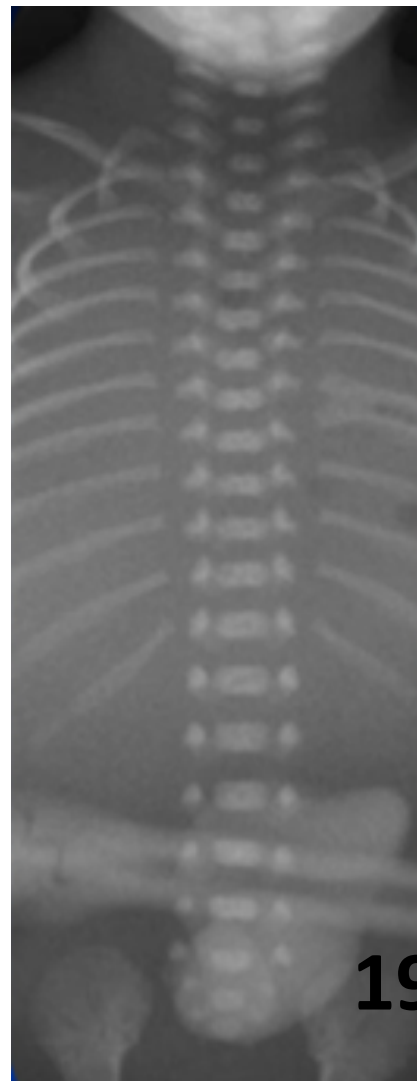
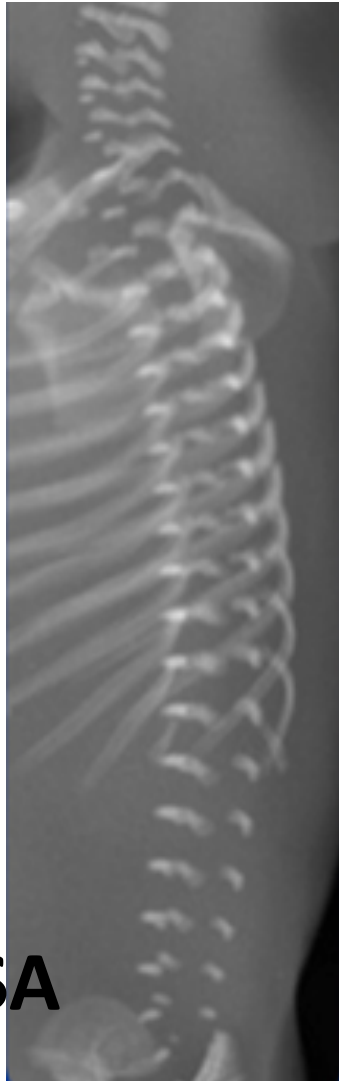


Fin de croissance

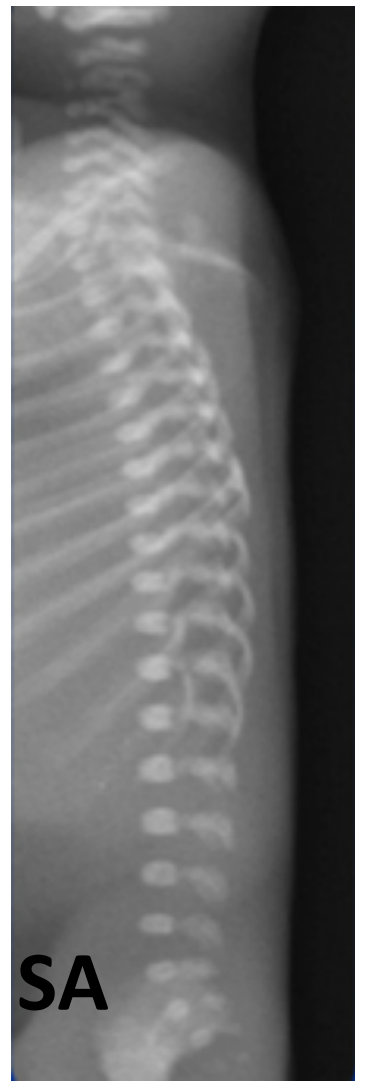


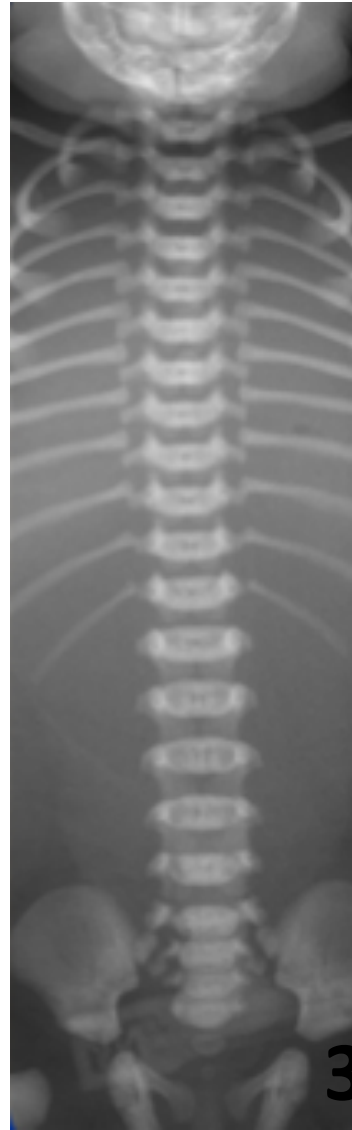
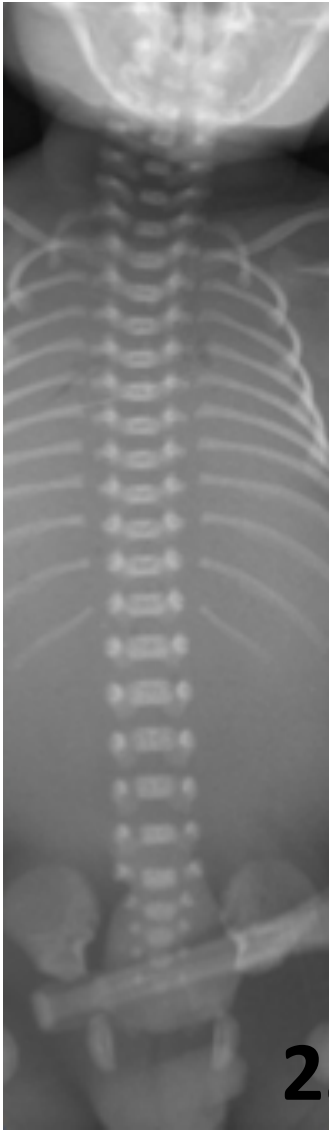


14 SA



19 SA





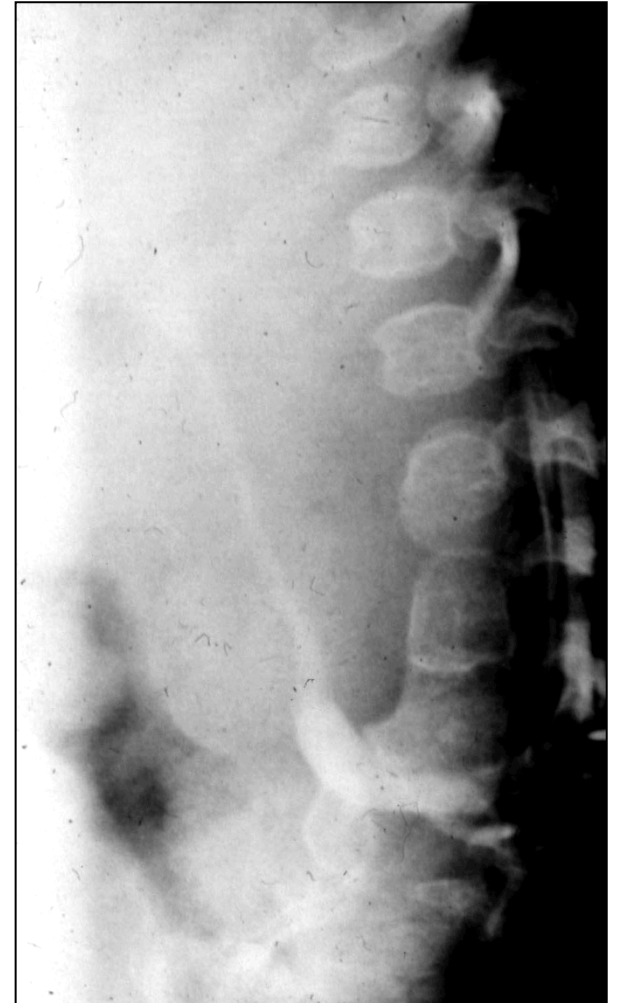
A la naissance 30% du rachis est ossifié

Notochordodysraphies

- 3^e semaine de gestation
- Division de la corde
- Malformations
vertébrales associées

Notochordodysraphies

- Persistance du canal
 - Fistule ou kyste neurentérique
 - Somatoschisis antérieur



Notochordodysraphies

- Troubles de l'induction de la chorde
 - Diastématomyélie



Notochordodysraphies

- Défauts de fermeture du tube neural
 - Méningocèle
 - myéloméningocèle





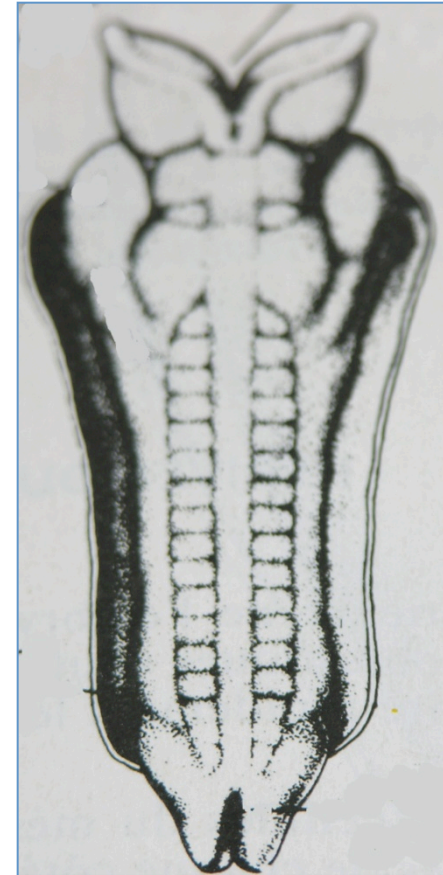
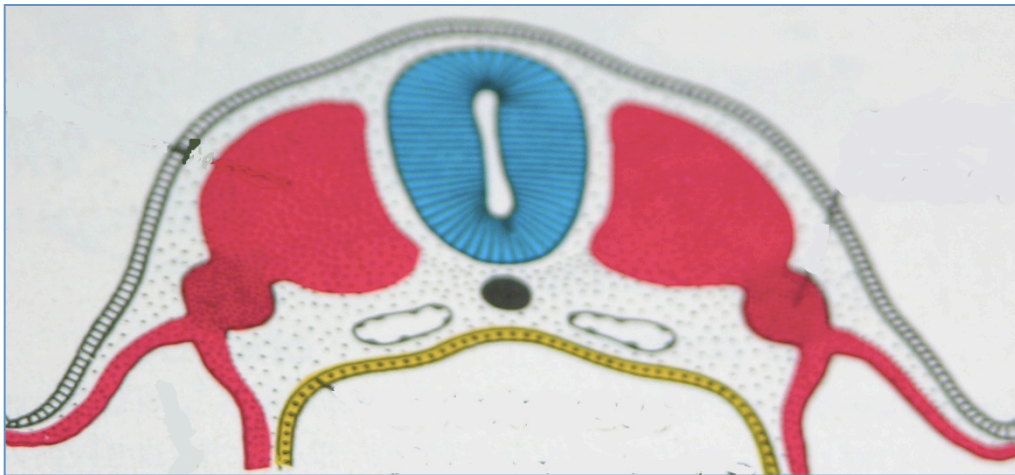
Notochordodysraphies

- Excès de régression caudale
 - Agénésie sacrée



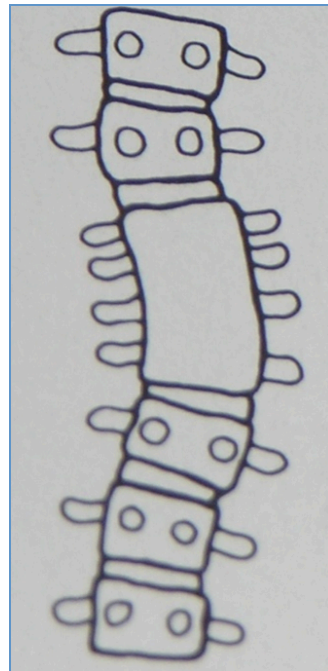
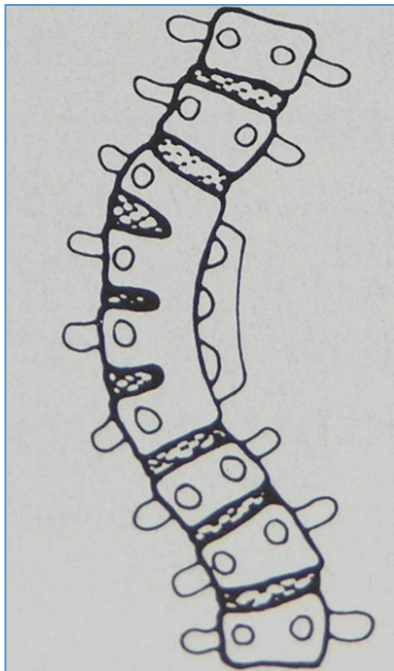
Troubles segmentation

- Fin de la 3^{ème} - 5^{ème} semaine:
segmentation du mésoblaste en somites

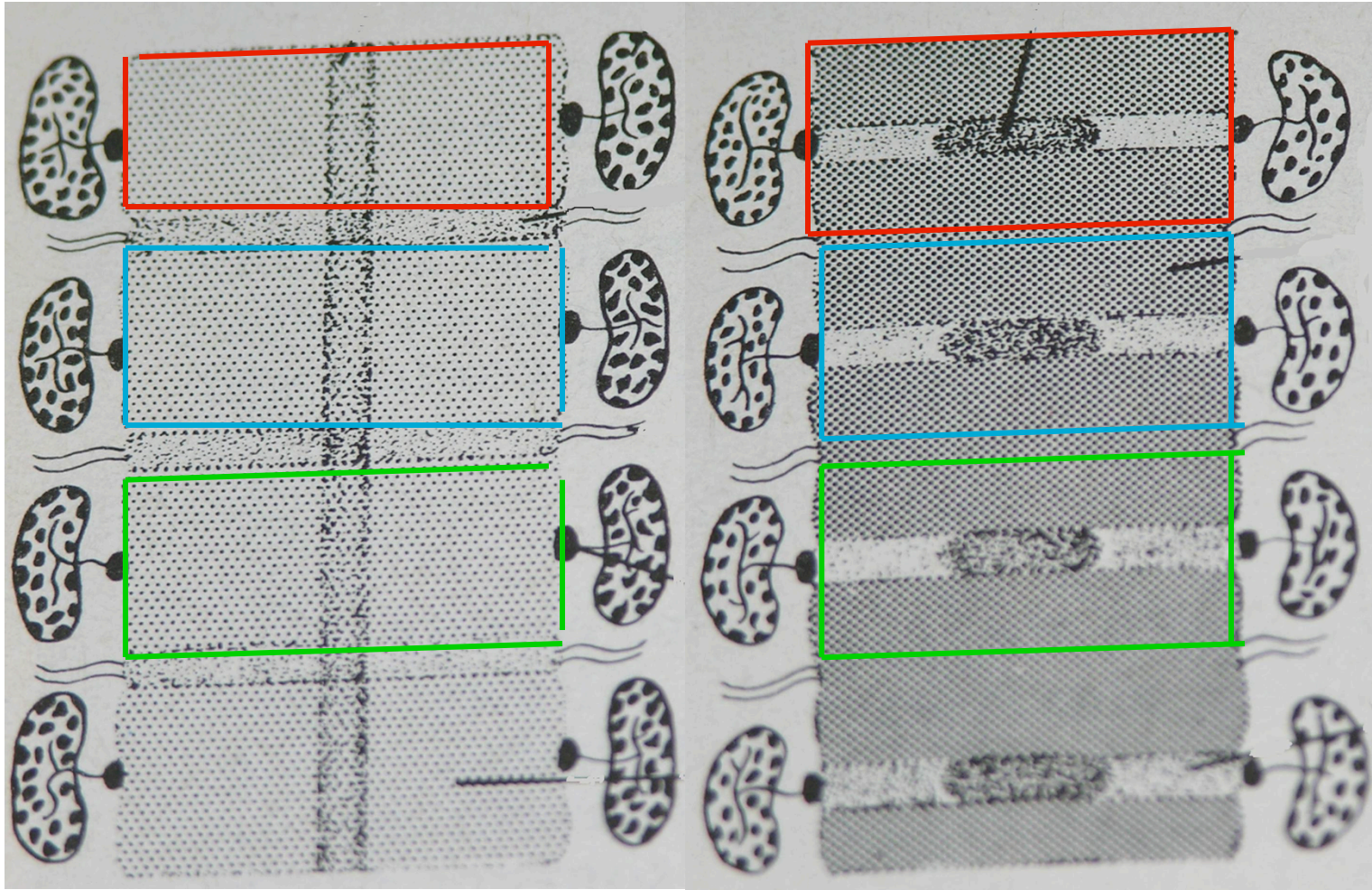


Troubles de la segmentation

- Defaut de segmentation
 - Bloc vertébral
 - Barre vertébrale



Troubles de formation



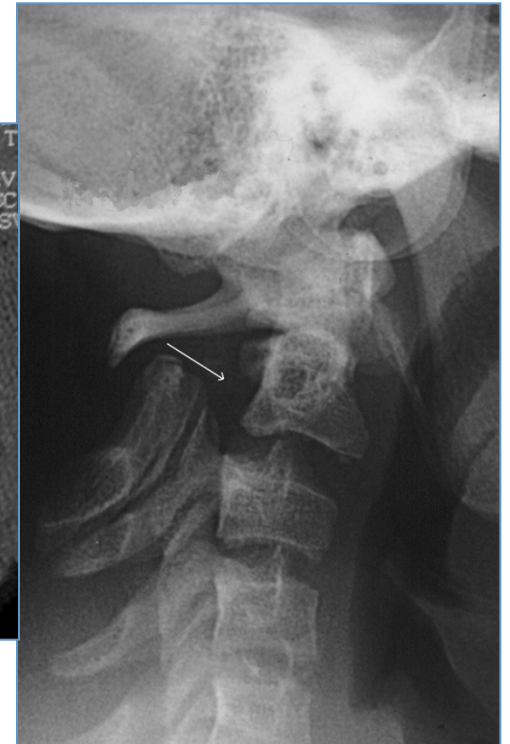
Troubles de formation

- Aplasie du corps vertébral
 - Vertèbre en aile de papillon
 - hémivertèbre



Troubles de formation

- Aplasie de l'arc postérieur
 - Lames
 - Articulaires

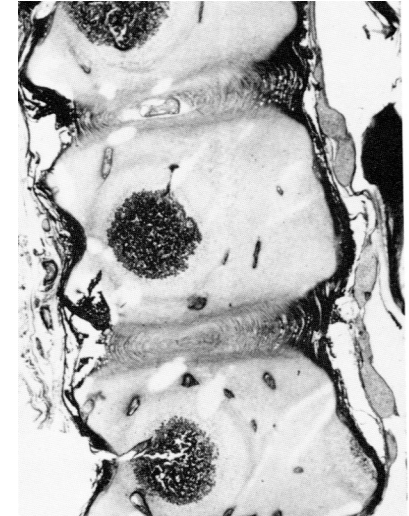


Conclusion

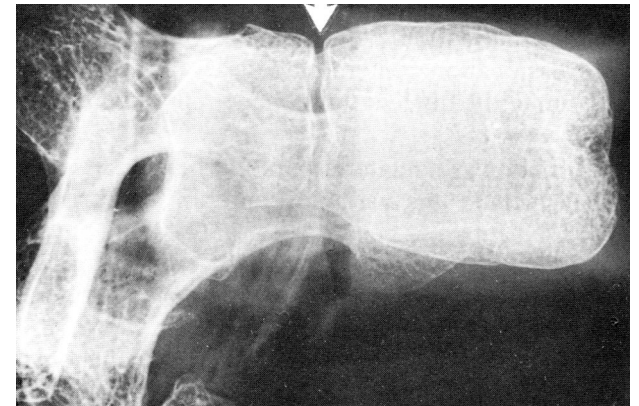
- Vertèbre est une structure inter-segmentaire
- Grande variété des malformations

Croissance du rachis

- Ossification de type enchondral
Cellules mésenchymateuses
Cellules cartilagineuses
Cellules osseuses



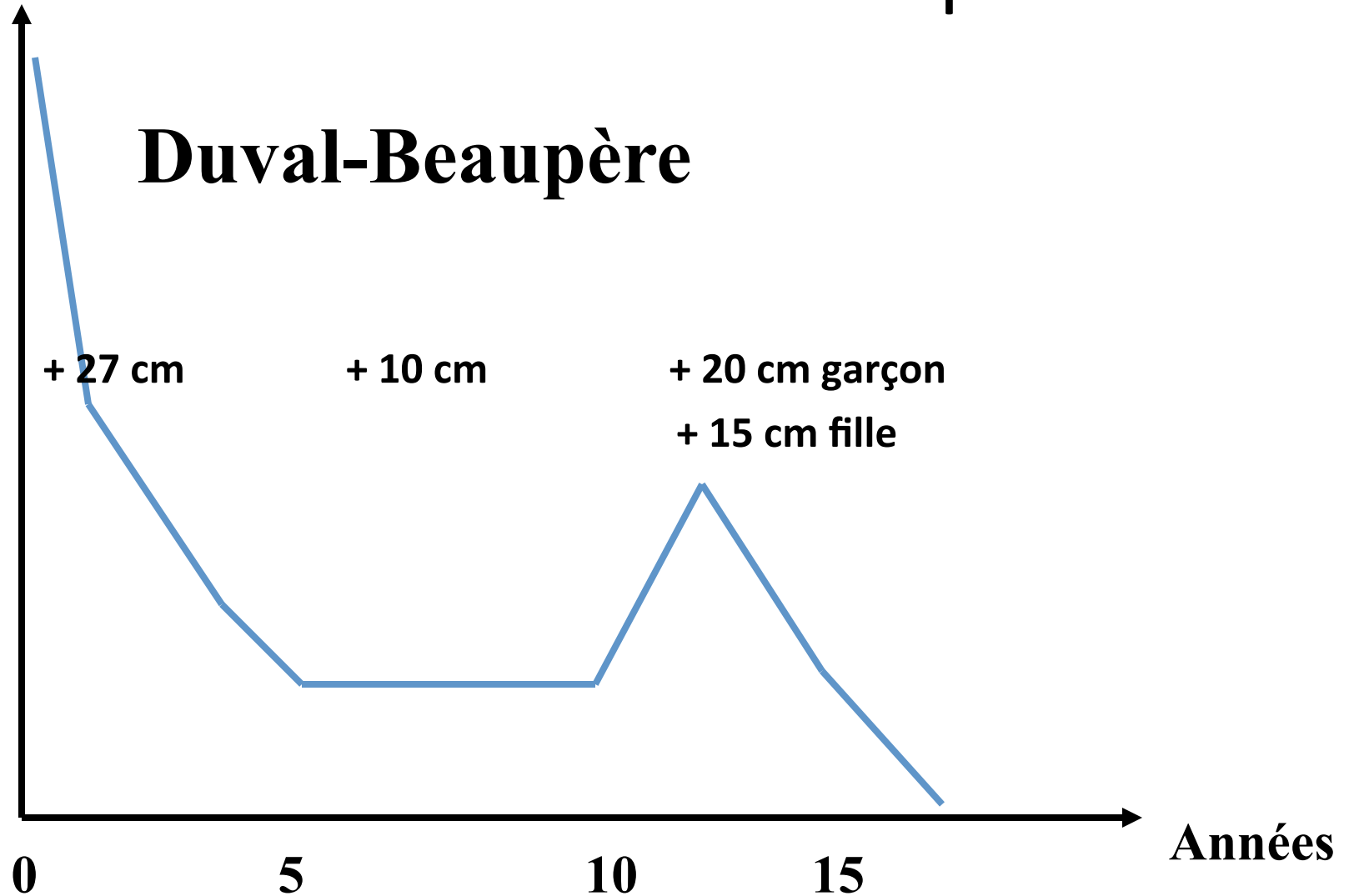
- 4 cartilages de croissances
 - 2 corps vertébral
 - Cartilage neuro-central



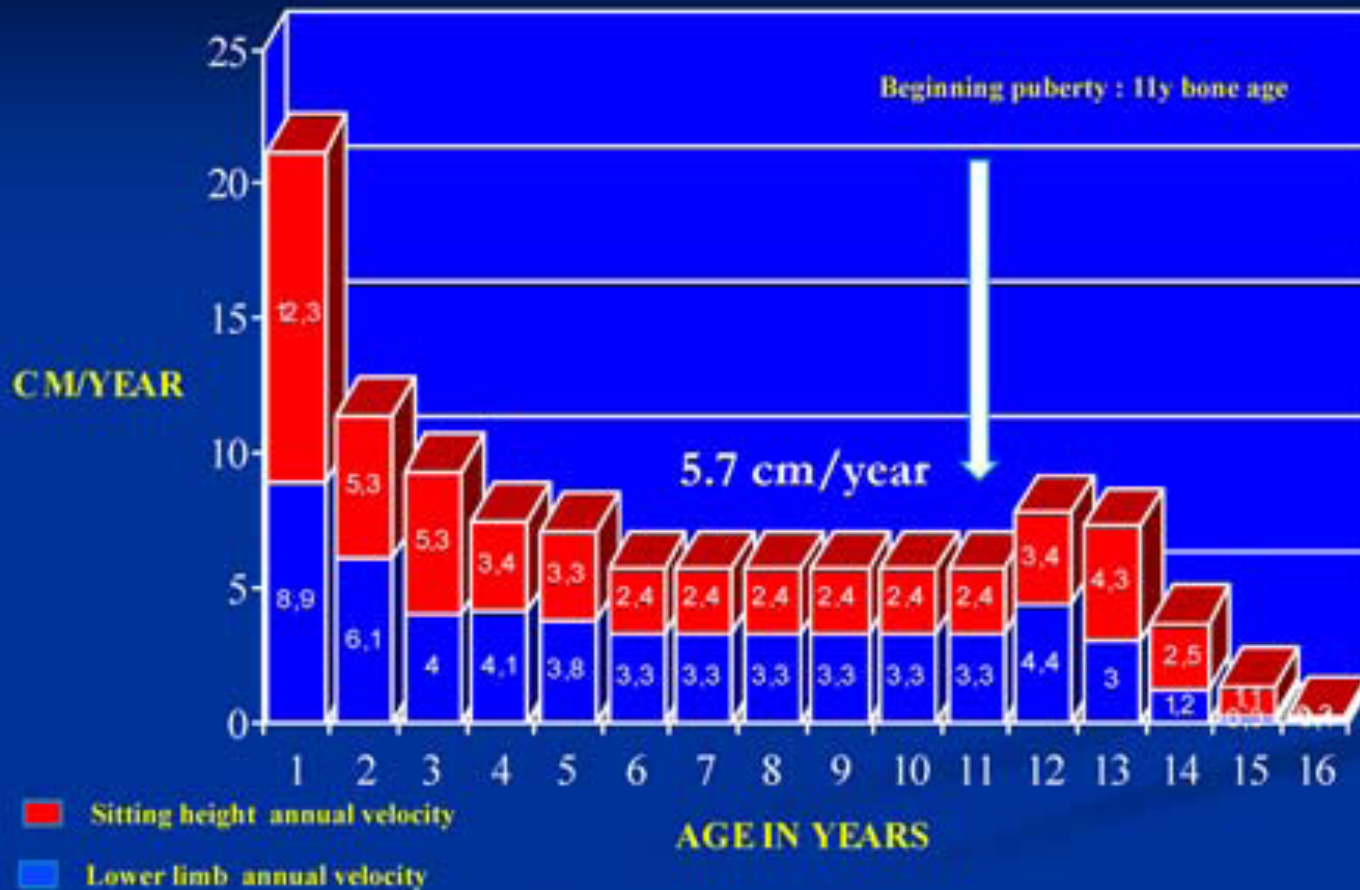
Hauteur du rachis triple de la naissance à l'âge adulte

- 24 cm à la naissance
- 70 cm garçon, 60 cm fille à l'âge adulte
- Canal médullaire
 - Croissance terminée à 5 ans
 - Taille
 - Cervical : pouce
 - Thoracique : auriculaire
 - Lombaire : index
- Disque intervertébral
- 4,4 mm en C4 22% rachis cervical
- 2,5 mm en T5 18% rachis thoracique
- 17 mm en L5 35% rachis lombaire

La croissance du rachis n'est pas linéaire dans le temps

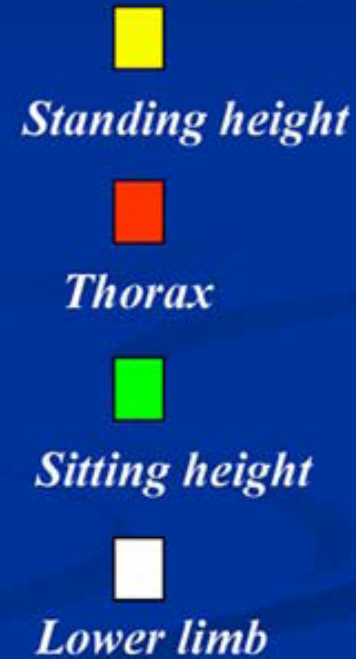
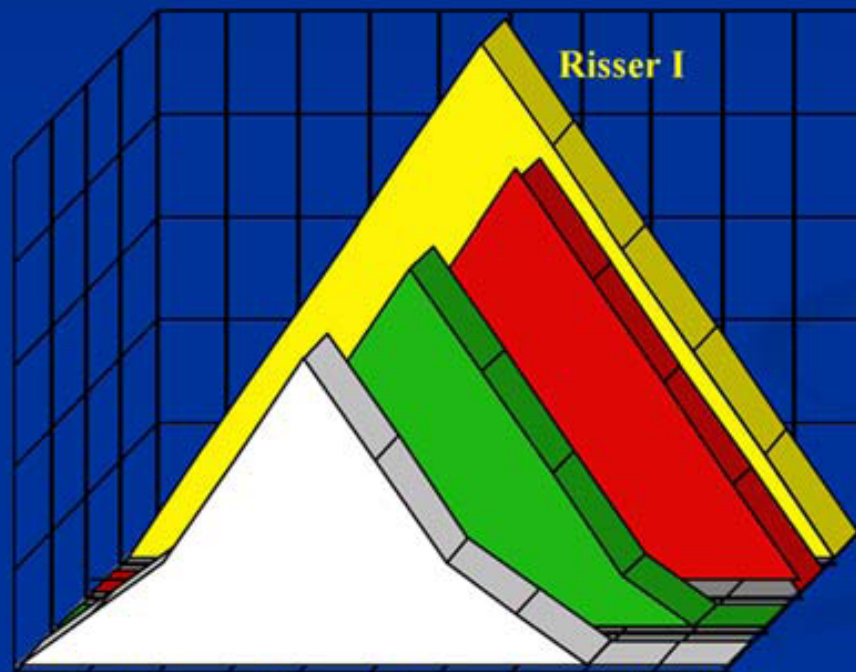


GROWTH VELOCITY IN GIRLS



Growth and Adolescent Idiopathic Scoliosis: When and How Much?
 Alain Dimeglio, MD, Federico Canavese, and Philippe Charles JPO A 2010

3 Periods in growth Standing height



Puberty is a juxtaposition of three micro-peaks: the first peak occurs in the lower limb, the second peak occurs in the trunk and the third peak occurs in the thorax just after Risser I.

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GROWTH OF THE THORAX IS THE FOURTH DIMENSION OF THE SPINE



**New
born**



5 years



10 years

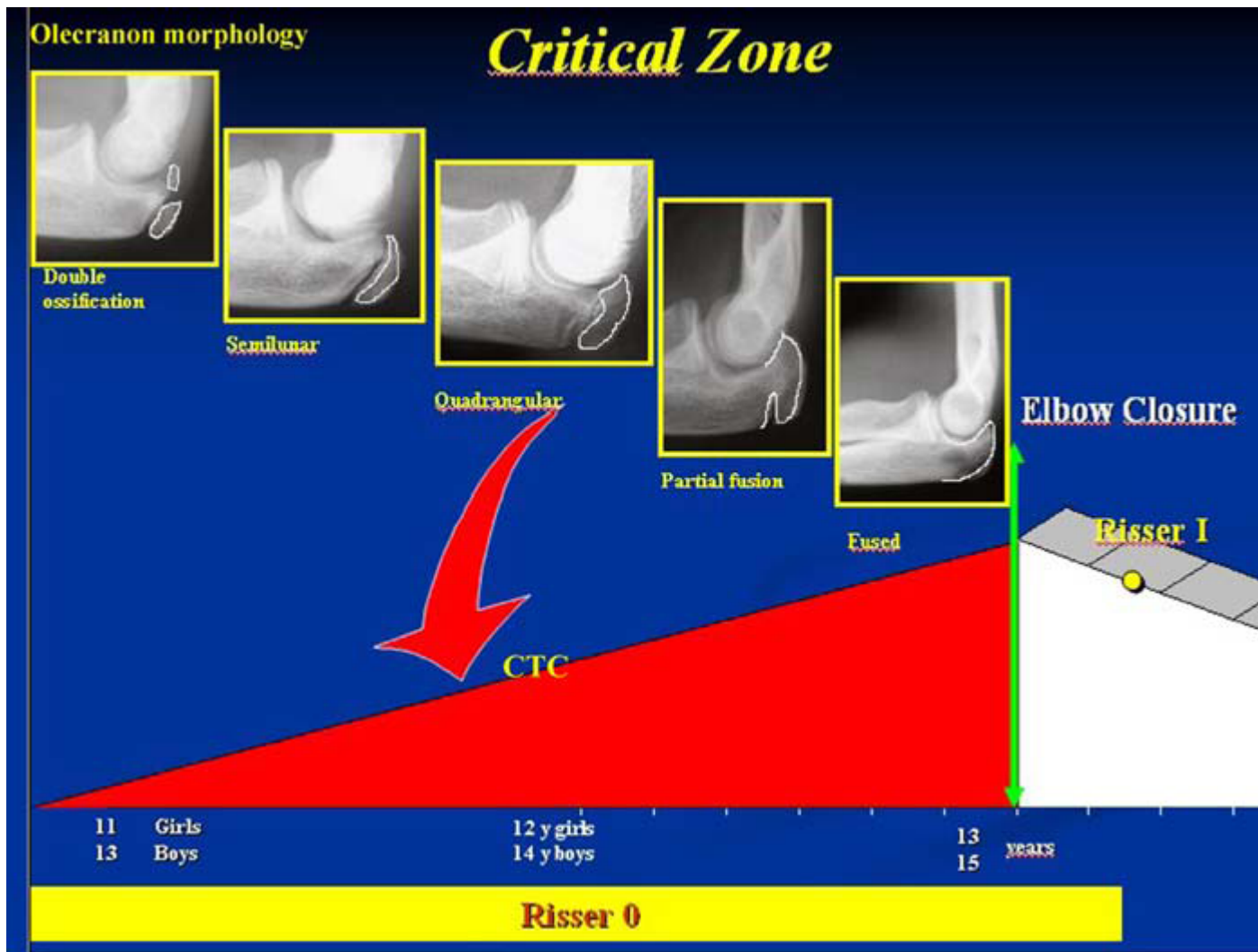


15 years

The growing spine, springer Velarg 1990

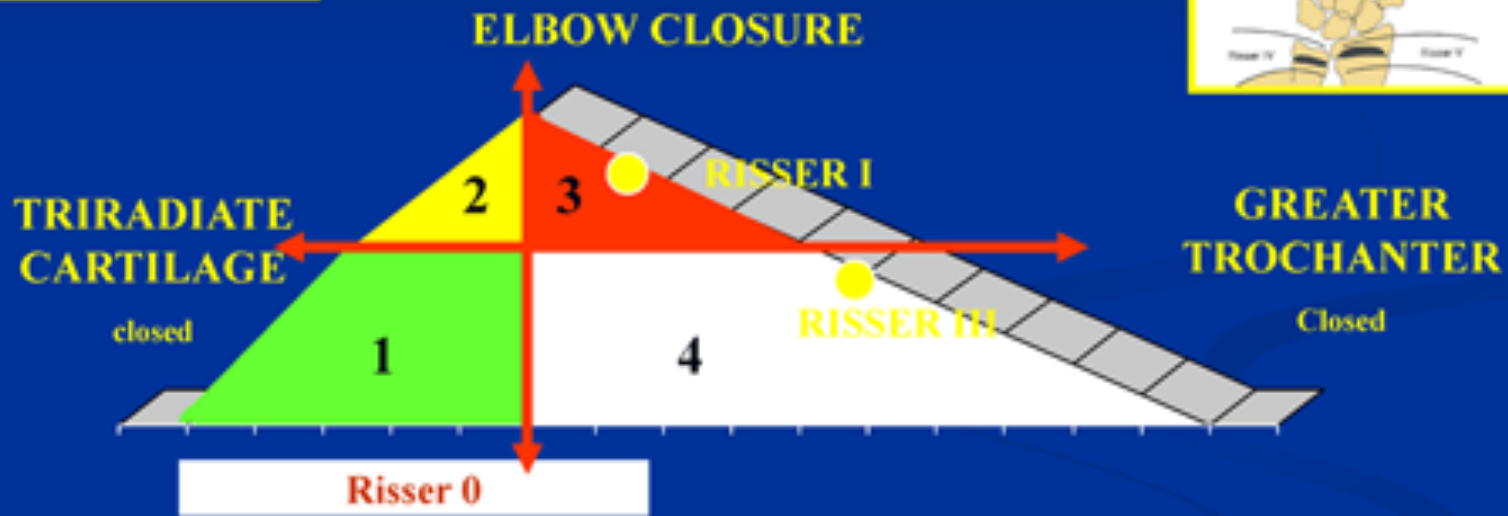
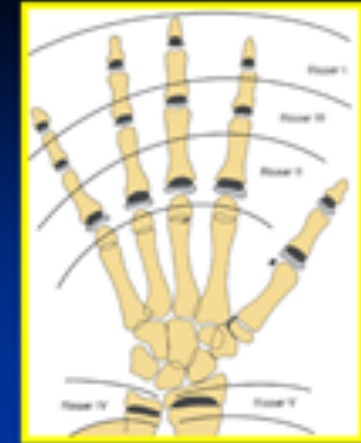
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PUBERTAL DIAGRAM



- Zone 1: Risser 0, triradiate open
- Zone 2: Risser 0, triradiate closed
- Zone 3: Risser I-II, Greater trochanter open
- Zone 4: Risser III-IV, Greater trochanter closed

Conclusion

- Analyse multifactorielle
- Taille (debout – assise)
- Tanner
- Maturation squelettique
- Croissance thoracique