

SEMINARI 4: LES CIÈNCIES FORENSES

Professor: Xavier Jordana Comín



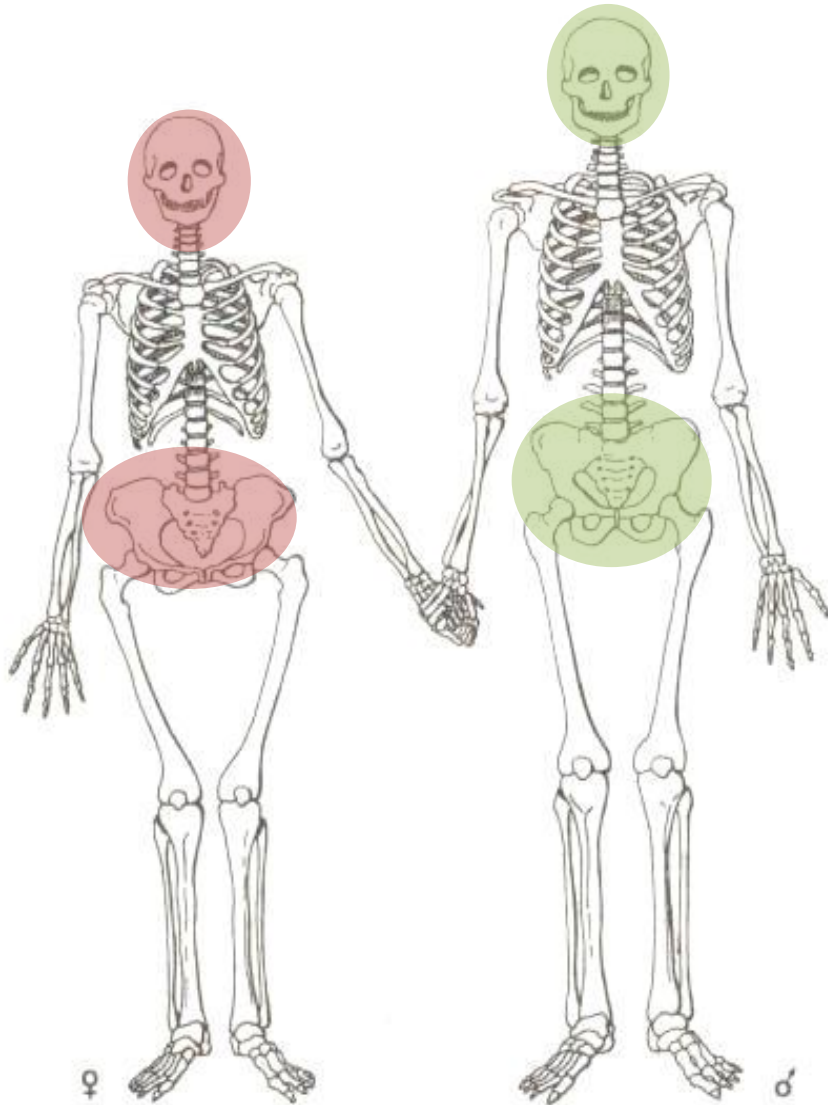
Casos pràctics

1. Determinació del perfil biològic (sexe, edat, etc.) en restes esquelètiques
2. Determinació de les causes i les circumstàncies de la mort
3. Identificació genètica
4. Identificació dactiloscòpica

Casos pràctics

1. Determinació del sexe en restes esquelètiques

- *Quina regió o regions de l'esquelet és més informativa sobre el diagnòstic de sexe en restes esquelètiques?*
- *A partir de quina edat es manifesten les diferències sexuals en l'esquelet?*



Which are the elements that show differences between men and women?

They include all the features related to reproductive role and physical effects due to their particular hormonal systems. For this reason, the sex is evident in adult skeletons but not in children (less reliable).

Males have a larger, heavier and more robust skeleton.
Overlapping = large females and small males.
The dimorphism in old adults is less marked.

Casos pràctics

1. Determinació del sexe en restes esquelètiques

- *Quines característiques morfològiques de l'esquelet són diferents entre dones i homes?*

Differences consequence of their reproductive role: birth canal

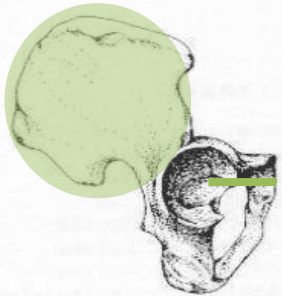
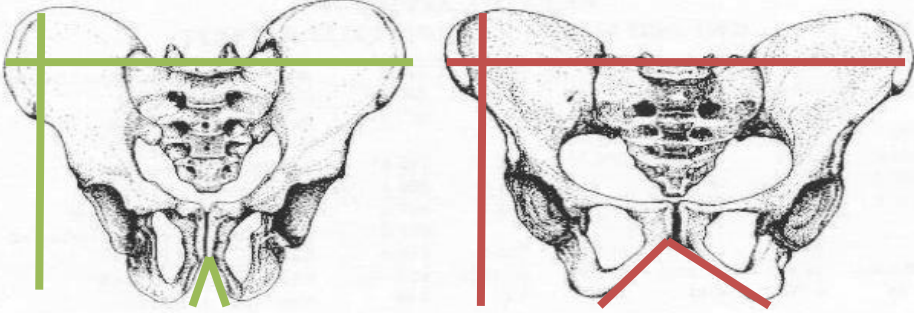


Figure 1. Male Pelvic Girdle

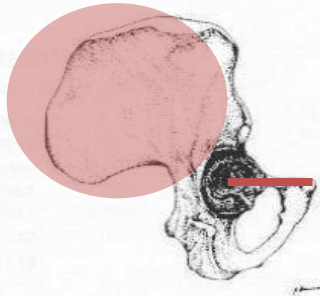


Figure 2. Female Pelvic Girdle

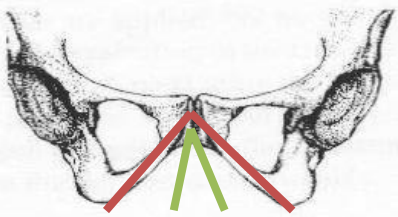
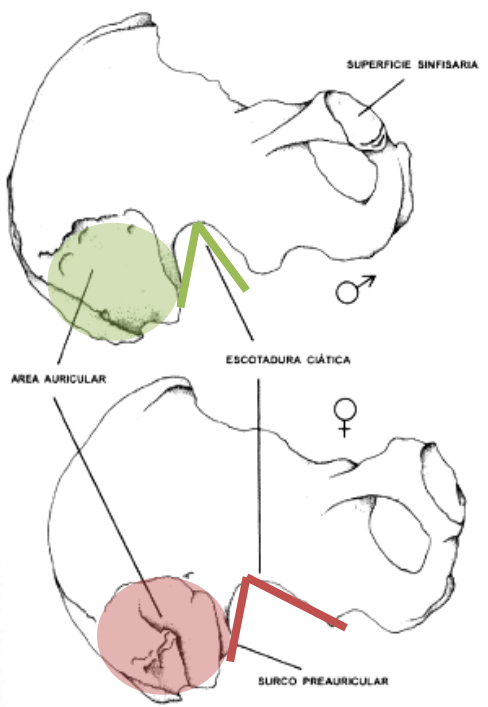
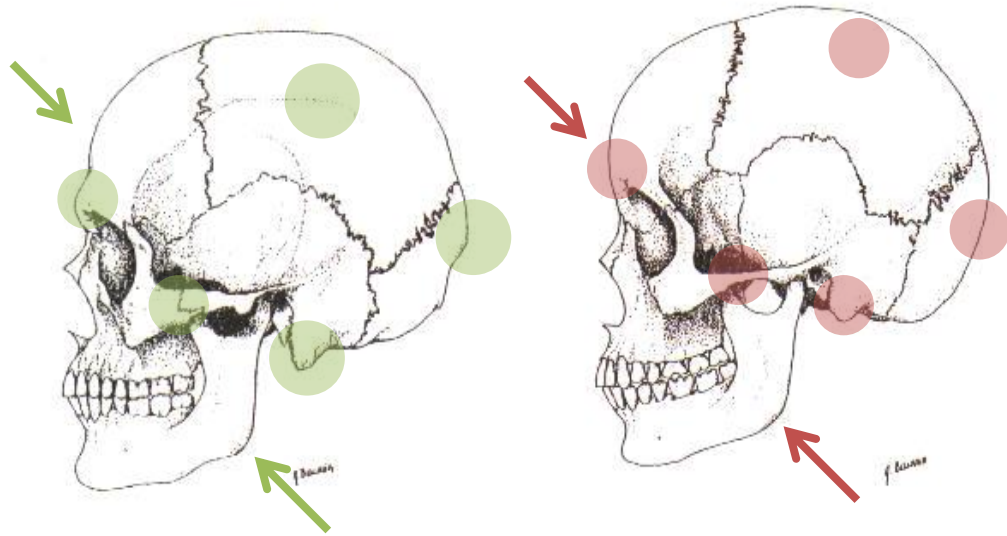


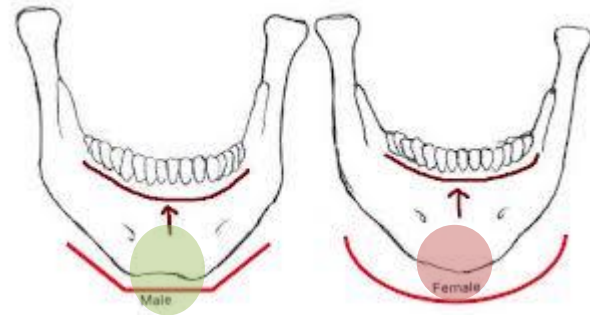
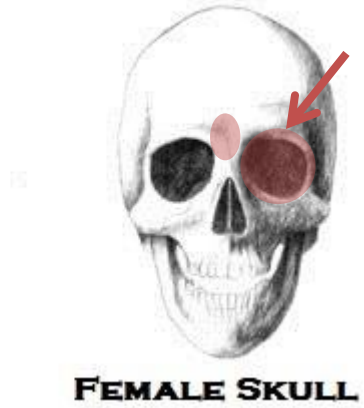
Figure 3. Ventral Arc



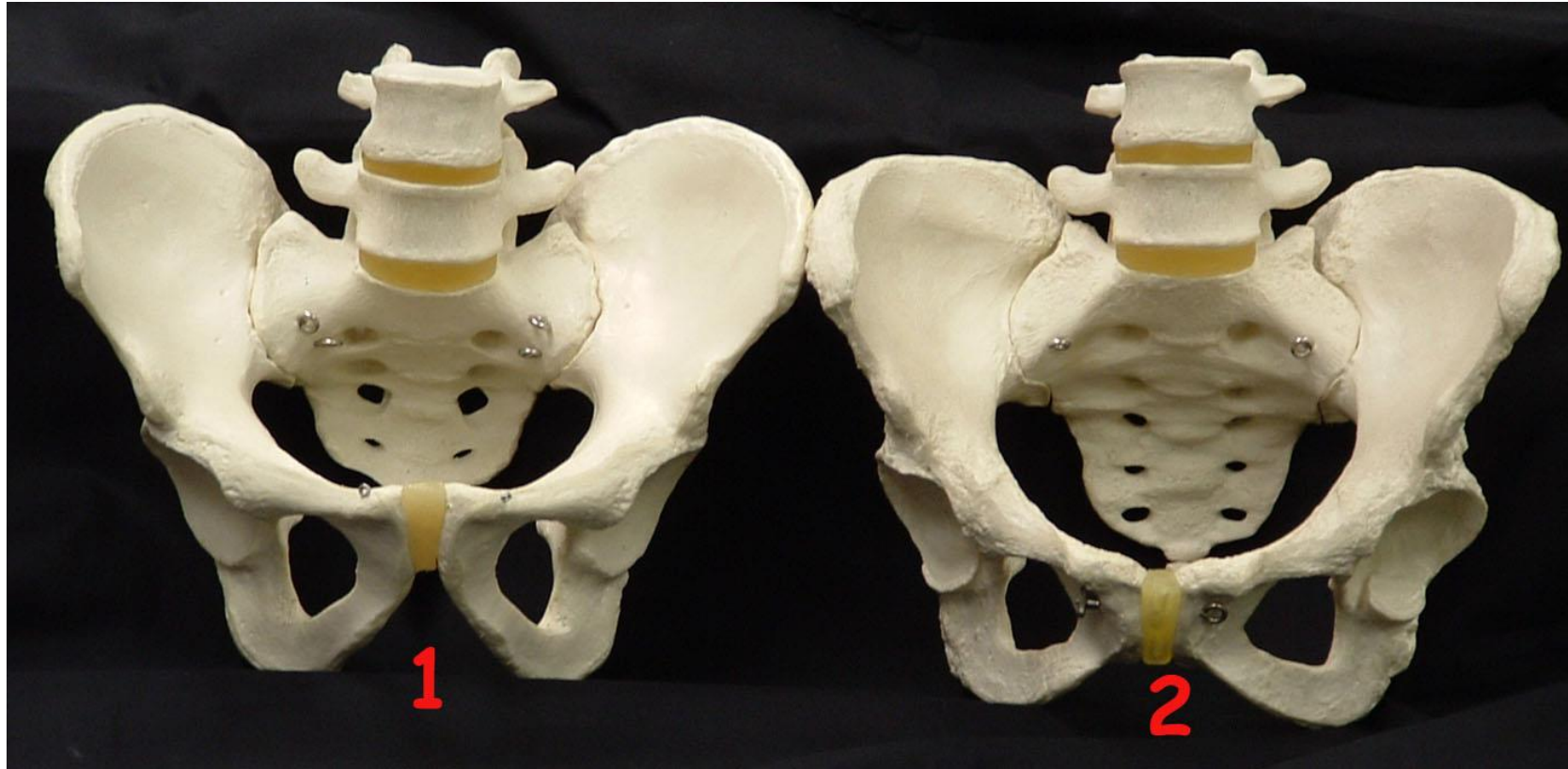
SEX DETERMINATION : SKULL



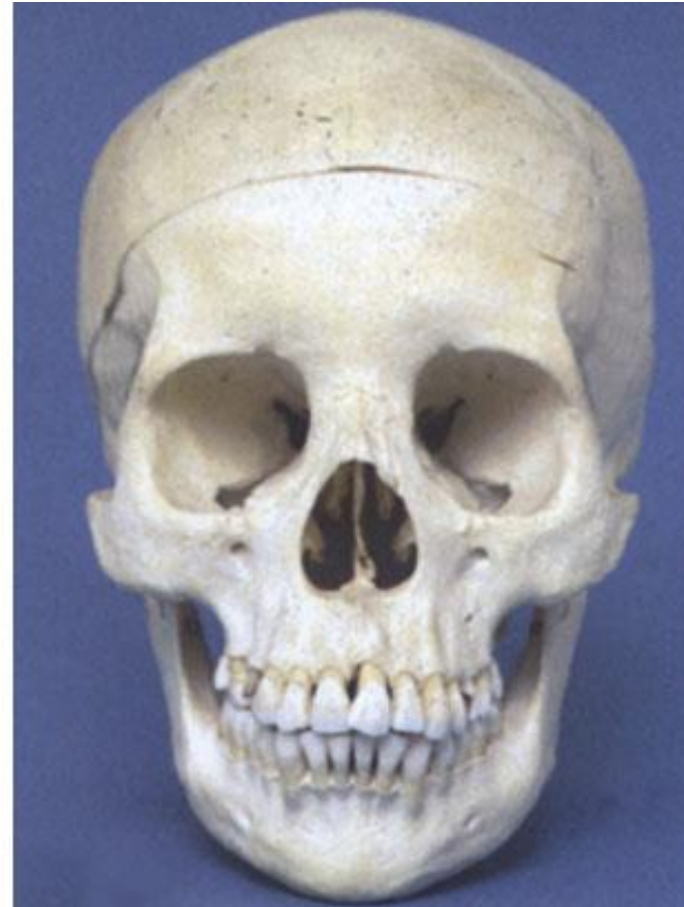
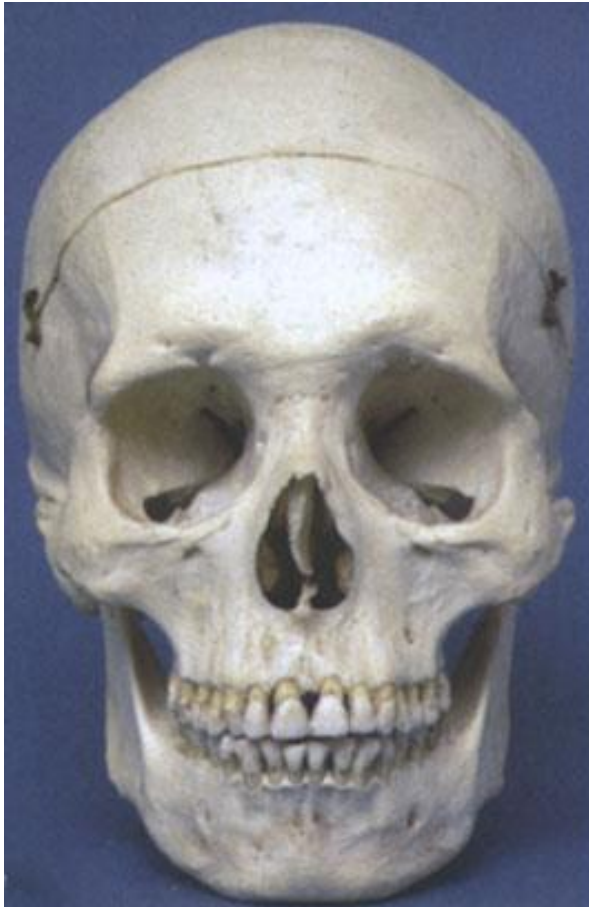
Males modify the skull substantively during the adolescence, and females retain a more juvenile aspect. Estimating sex based on cranial features is less reliable and can be a challenging process.



Male or female?



Male or female?



Casos pràctics

1. Determinació del sexe en restes esquelètiques

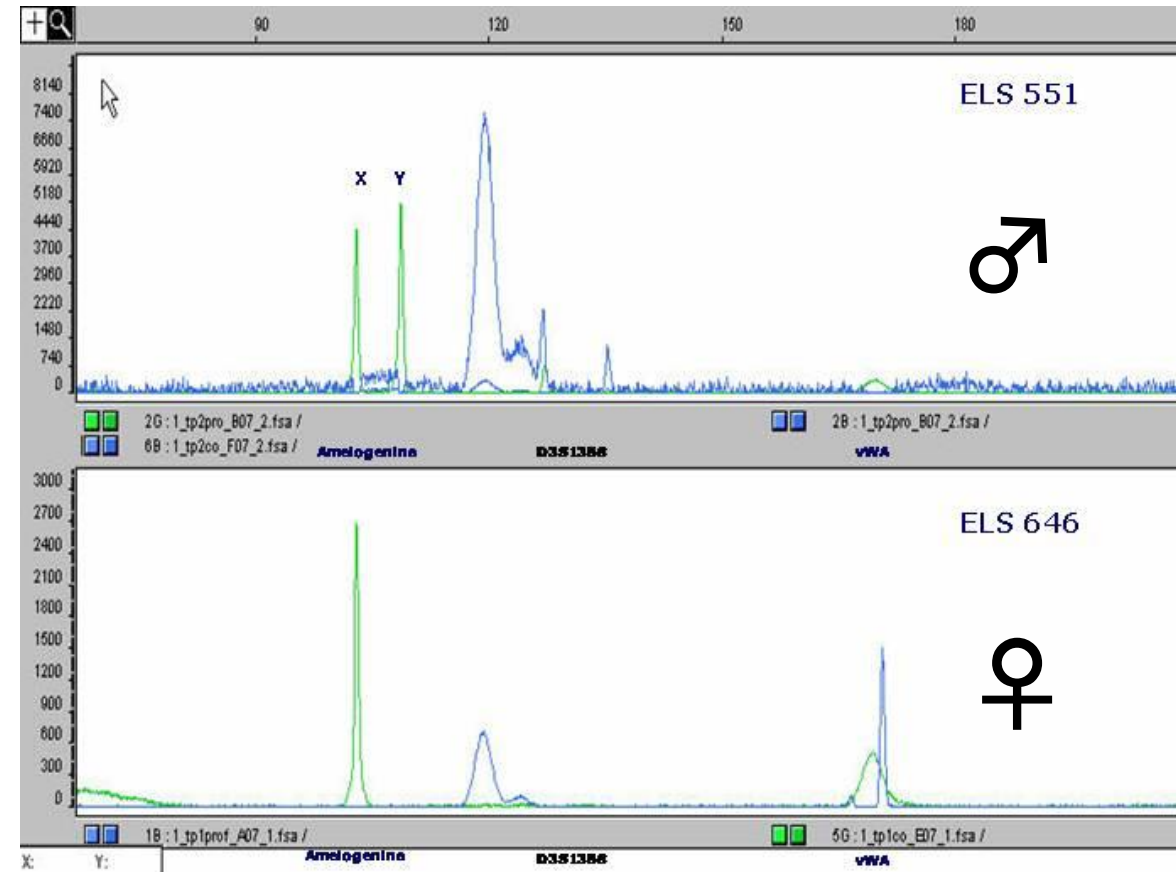
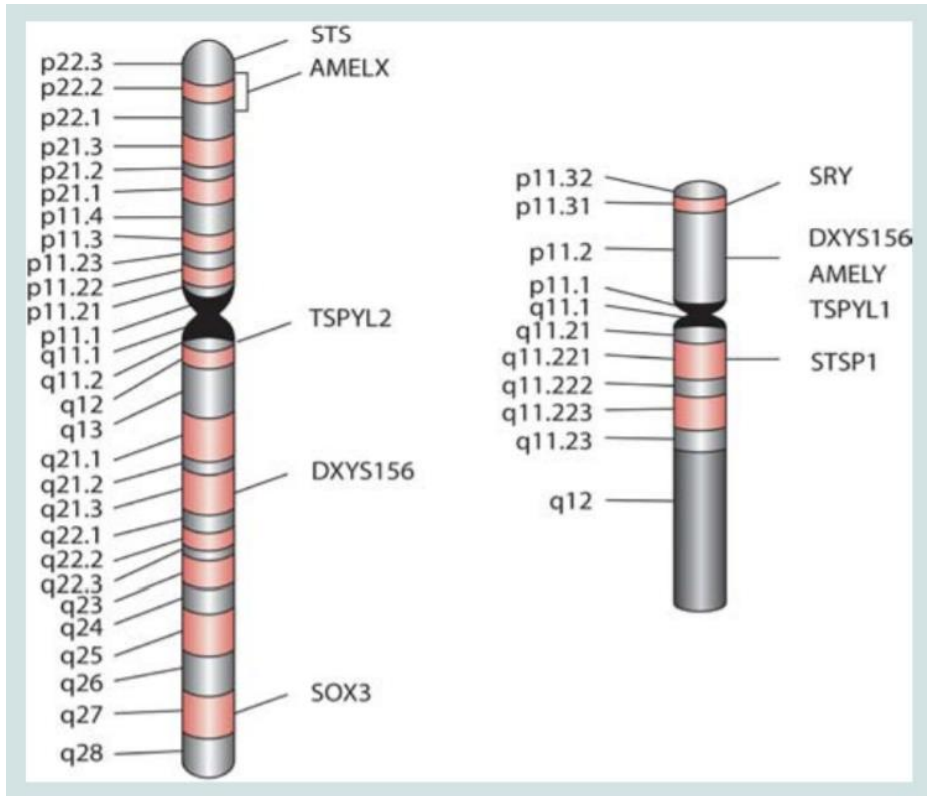
- *Podem determinar el sexe d'unes restes esquelètiques a partir de l'anàlisi genètica?*

Sex estimation

Molecular techniques: Amelogenin gene

Chromosome X
112 pb

Chromosome Y
106 pb

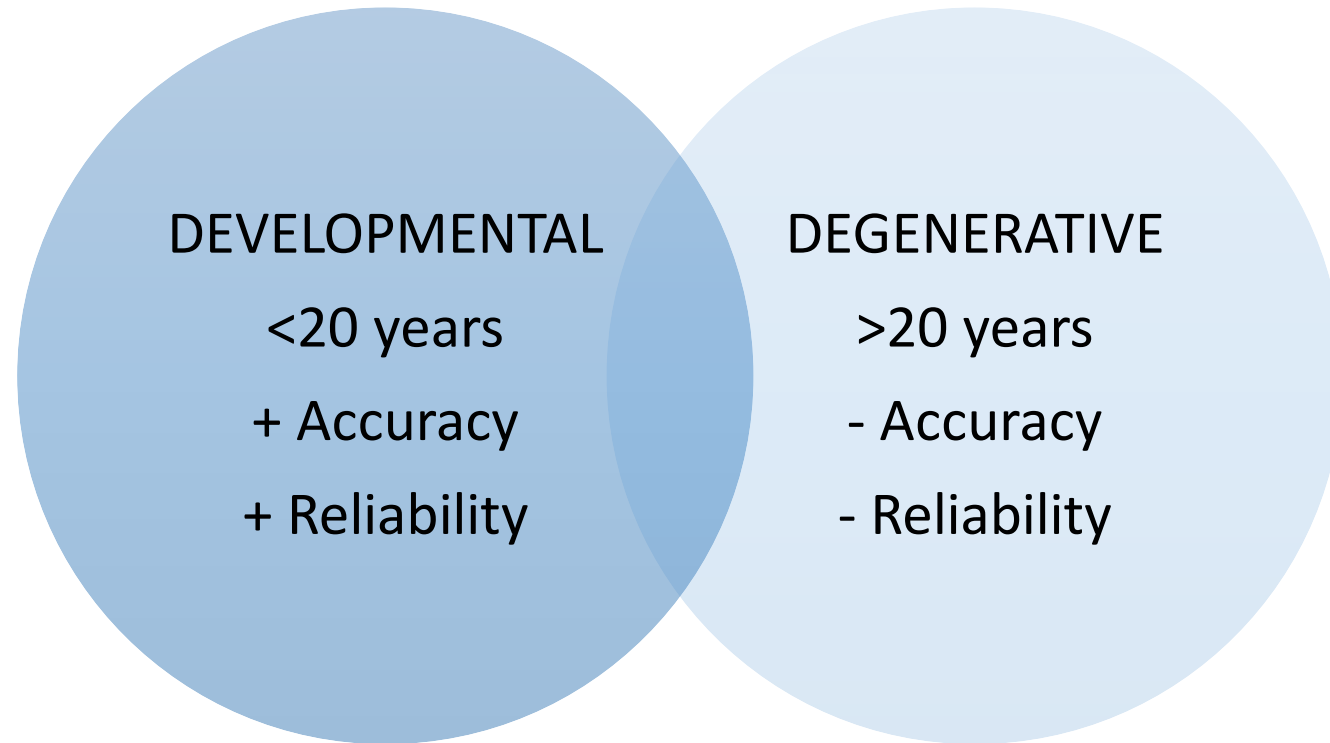


Casos pràctics

1. Determinació de l'edat a la mort en restes esquelètiques

- *Podem determinar l'edat biològica o cronològica a partir de les restes esquelètiques?*
- *Quina regió o regions de l'esquelet és més informativa sobre el diagnòstic d'edat a la mort en restes esquelètiques?*

Age-at-death estimation



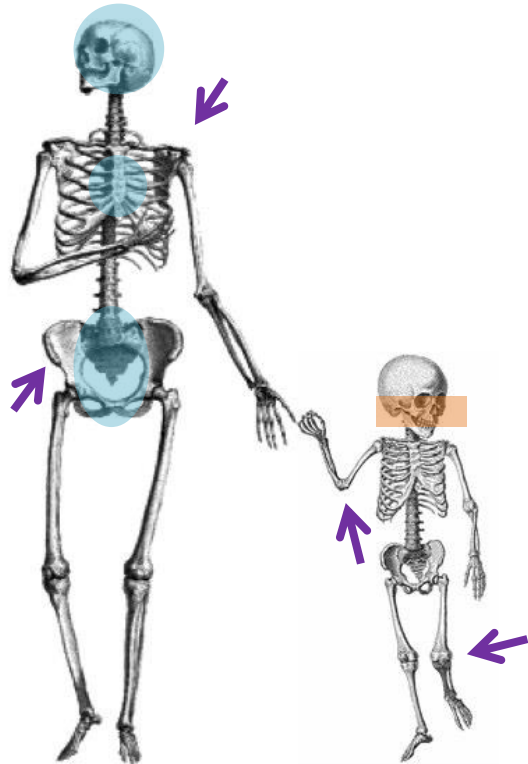
Biological age

AGE DETERMINATION

BIRTH



ADULT SIZE



Development of bones and teeth
Pattern and pace of dental eruption
Synostosis

More accurate and reliable

Young adults (20-35 years): development and remodeling.

Changes in the skeleton consequence of aging

- Metamorphosis of pubic symphysis
- Metamorphosis of auricular surface
- Metamorphosis at the sternal rib end
- Tooth wear
- Obliteration of cranial sutures

Less accurate and reliable

From 0-12 years; from 12-20 years, and > 20 years:



To evaluate these changes, it is important to select an appropriate reference population

AGE DETERMINATION : 0 – 12 years

Dental development (formation and eruption) has a high potential for estimating the age of child skeletons (from 0 to 12 years).

The eruption of the first molar coincides with the end of first childhood. The eruption of the second molar coincides with the end of the second childhood, the beginning of the puberty and the apparition of the secondary sexual traits. Finally the eruption of the third molar marks the end of the development and the beginning of the adult stage.

6 meses:	aparecen primeros dientes deciduos(incisivos centrales mandibulares)
2 años:	erupción completa de los dientes deciduos
2-6 años:	calcificación de las raíces dentales
6 años:	primer molar mandibular permanente
6,5 años:	inicio de caída de los dientes deciduos (primero los incisivos)
6,5-11 años:	sustitución por los dientes permanentes
12 años:	aparición del 2do. molar
~18 años:	aparición del 3er. molar

AGE DETERMINATION : 12 – 20 years

Synostosis is the fusion of two or more centers of ossification (epiphyses and diaphysis).



The ossification and fusion is developed first in females than in males.

The bones are developed in several centers of ossification. We are born with 450 centers of ossification while in adults there are only 206 bones.

Following Ubelaker (1999) the most important indicators are the proximal humerus, the medial epicondyle, distal radius, head of the femur, iliac crest, external clavicle, and the lateral articulations of the sacrum.

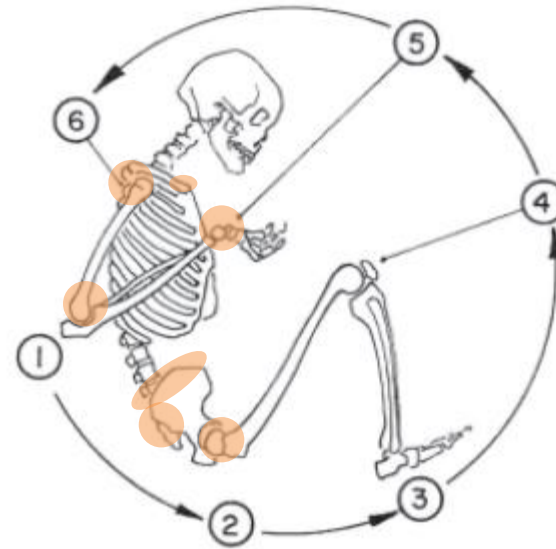


Fig. 47 Secuencia de la osificación (por Shipman et al. 1985)

AGE DETERMINATION : 12 – 20 years

EDADES DE FUSION DE LAS PARTES DE LOS HUESOS

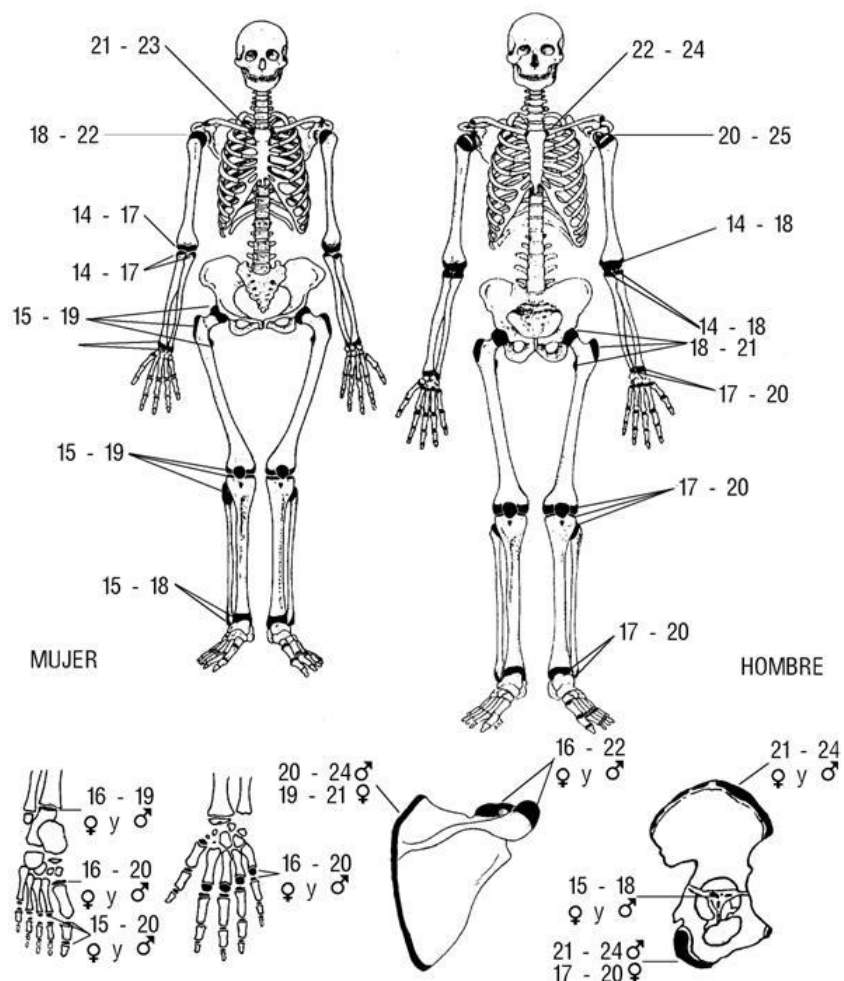
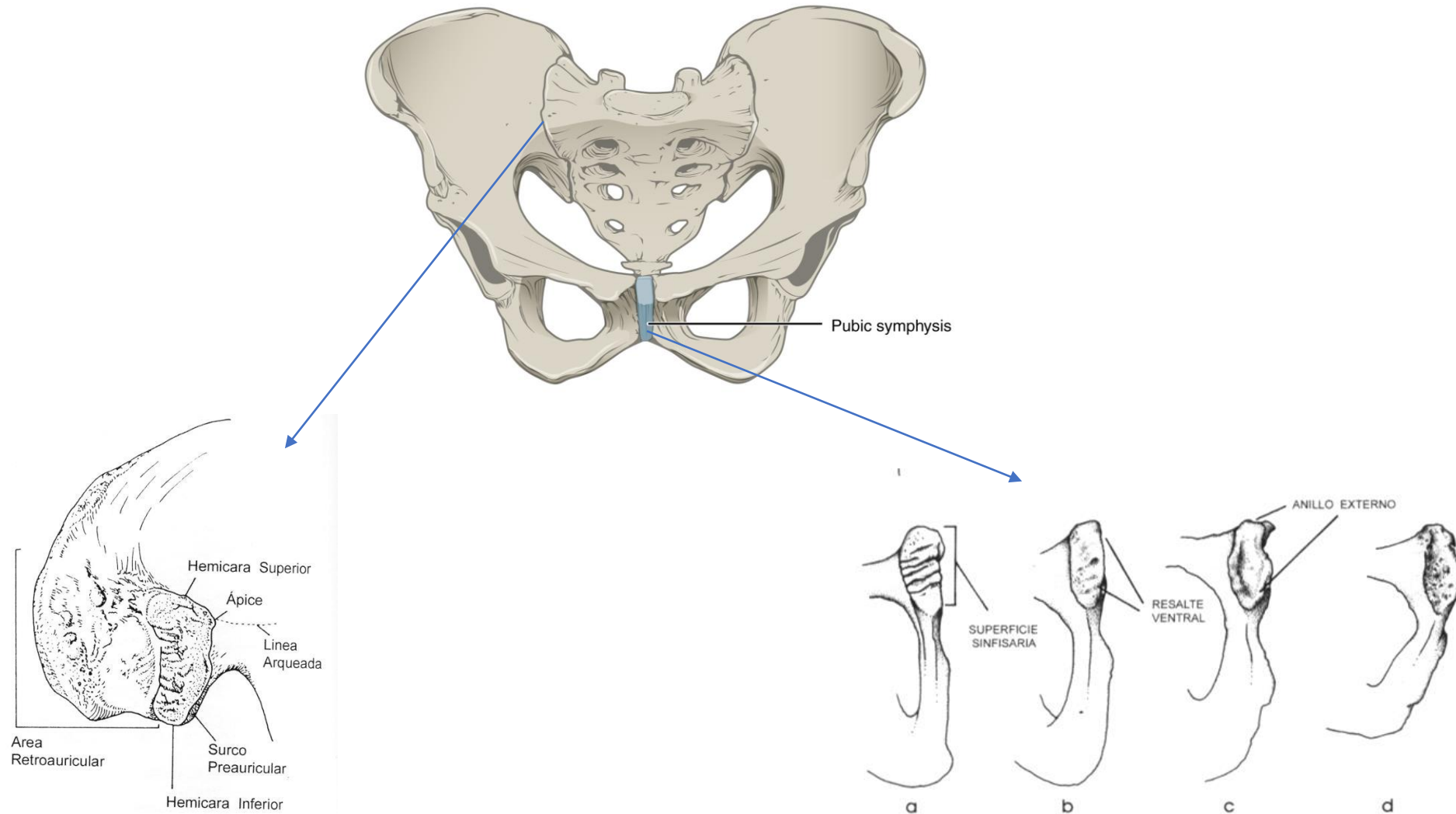


Tabla 60 Obliteración de los centros secundarios de osificación (según Knussmann 1988, Owings Webb & Suchey 1985, Krogman & Iscan 1965)

hueso	centro de osificación	Krogman & Iscan	Knussmann	
		rango de edad	varones	mujeres
omóplato	acromion	18,0-19,0	16-22	16-22
	margen vertebral	20,0-21,0	20-24	19-21
	ángulo inferior	20,0-21,0	20-24	19-21
clavícula	terminación esternal	25,0-28,0	22-24	21-23
	terminación acromial	19,0-20,0	-	-
húmero	cabeza	19,5-20,5	20-25	18-22
	epífisis distal	14,0-15,0	14-18	14-17
	epicóndilo medial	15,0-16,0	-	-
radio	epífisis proximal	14,5-15,5	14-18	14-17
	epífisis distal	18,0-19,0	17-20	16-19
cúbito	epífisis proximal	14,5-15,5	14-18	14-17
	epífisis distal	18,0-19,0	17-20	16-19
mano	metacarpos	15,5-16,5	17-22	16-21
	falange I	15,0-16,0	-	-
	falange II	15,0-16,0	-	-
	falange III	14,5-15,5	-	-
pelvis	elementos primarios	13,0-15,0	15-18	15-18
	cresta iliaca	18,0-19,0	21-24	21-24
	tuberosidad isquion	19,0-20,0	21-24	17-20
fémur	cabeza	17,0-18,0	18-21	15-19
	trocánter mayor	17,0-18,0	18-21	15-19
	trocánter menor	17,0-18,0	-	-
	epífisis distal	17,5-18,5	17-20	15-19
	tibia	epífisis proximal	17,5-18,5	17-20
peroné	epífisis proximal	17,5-18,5	17-20	15-19
	epífisis distal	15,5-16,5	17-19	15-18
calcáneo		14,5-15,5	16-22	13-20
pie	metatarsianos	15,0-16,0	16-22	13-20
	falange I	14,5-15,5	-	-
	falange II	14,0-15,0	-	-
	falange III	14,0-15,0	-	-

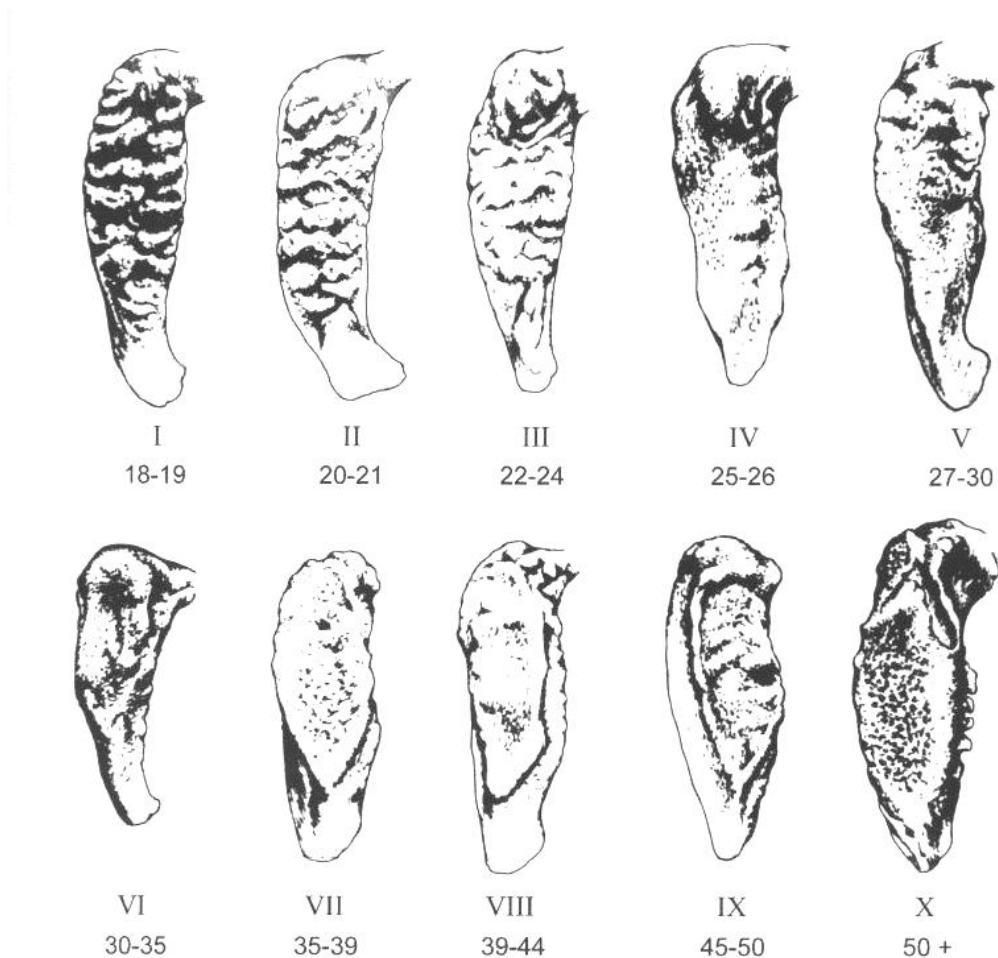
Age-at-death estimation: Adults





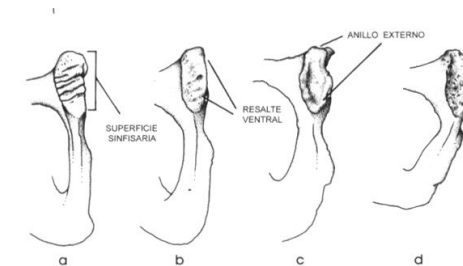
AGE DETERMINATION : > 20 years

Metamorphosis of pubic symphysis



Ten stages: 18-50 years

- The surface loses its reliefs and it is initiated the construction of edges.
- Arthrosis signs.
- Development of ventral ramp.
- Development of a ring around the symphysis.
- Destruction of the medial surface.



AGE DETERMINATION : > 20 years

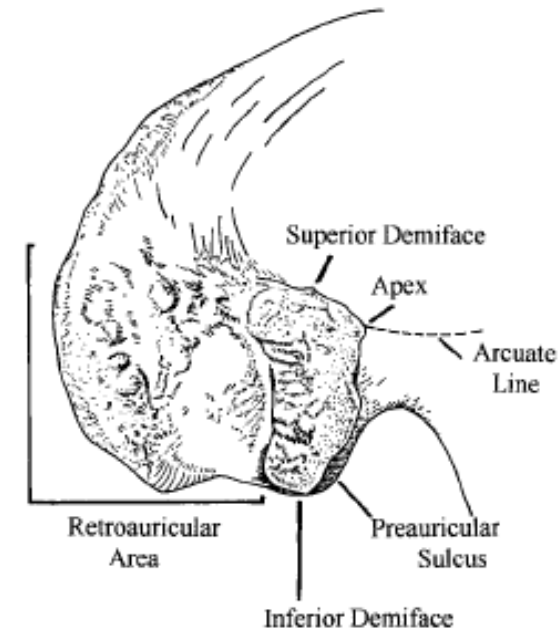
Metamorphosis of auricular surface

Lovejoy and collaborators (1985) described a close correlation between the age and the metamorphosis of the auricular surface of the ilium.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY 68:15-28 (1985)

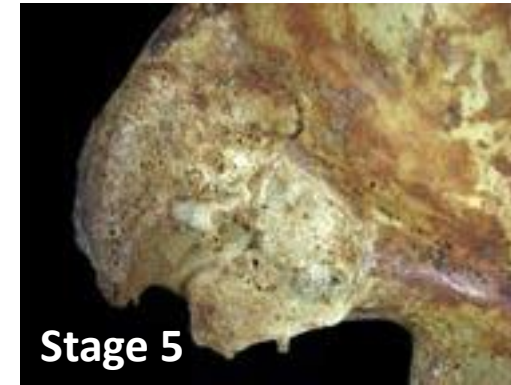
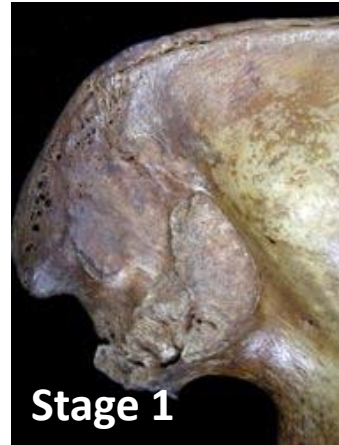
Chronological Metamorphosis of the Auricular Surface of the Ilium: A New Method for the Determination of Adult Skeletal Age at Death

C. OWEN LOVEJOY, RICHARD S. MEINDL, THOMAS R. PRYZBECK,
AND ROBERT P. MENSFORTH
Departments of Anthropology and Biology, Kent State University, Kent, Ohio 44242 (C.O.L., R.S.M., R.P.M.); Department of Orthopaedic Surgery, Case Western Reserve University, Cleveland, Ohio 44106 (C.O.L.); Cleveland Museum of Natural History, Cleveland, Ohio 44106 (C.O.L.); Department of Human Anatomy, Northeast Ohio Universities College of Medicine, Rootstown, Ohio 44272 (C.O.L.); Cuyahoga County Coroner's Office, Cleveland, Ohio 44106 (C.O.L.); Department of Anthropology, Washington University, St. Louis, Missouri 63130 (T.R.P.)



AGE DETERMINATION : > 20 years

Metamorphosis of auricular surface



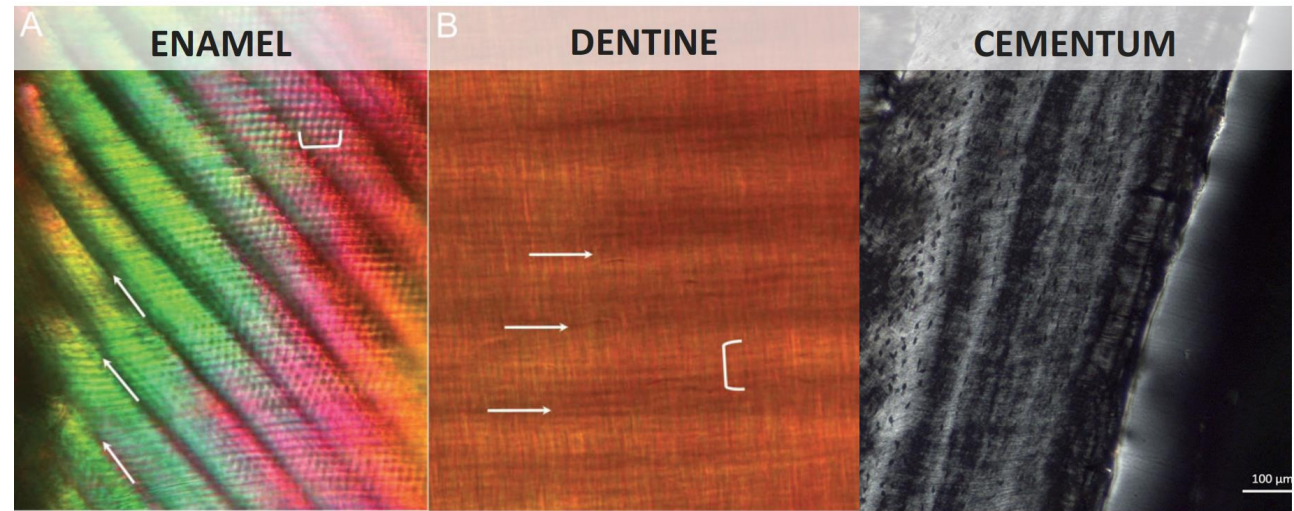
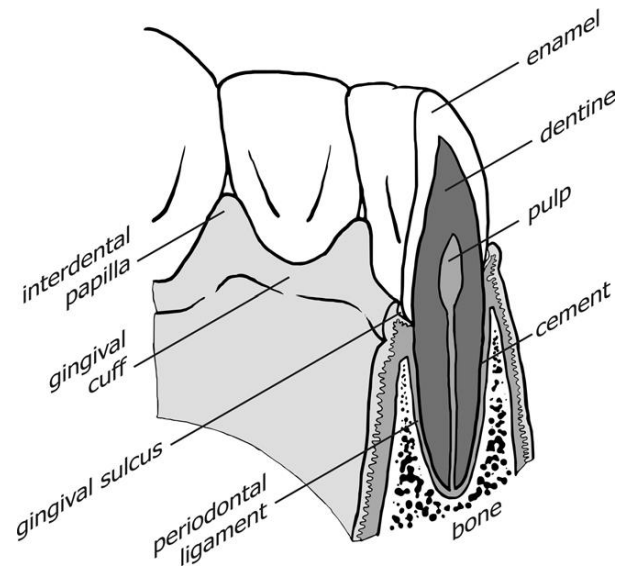
Artrosis



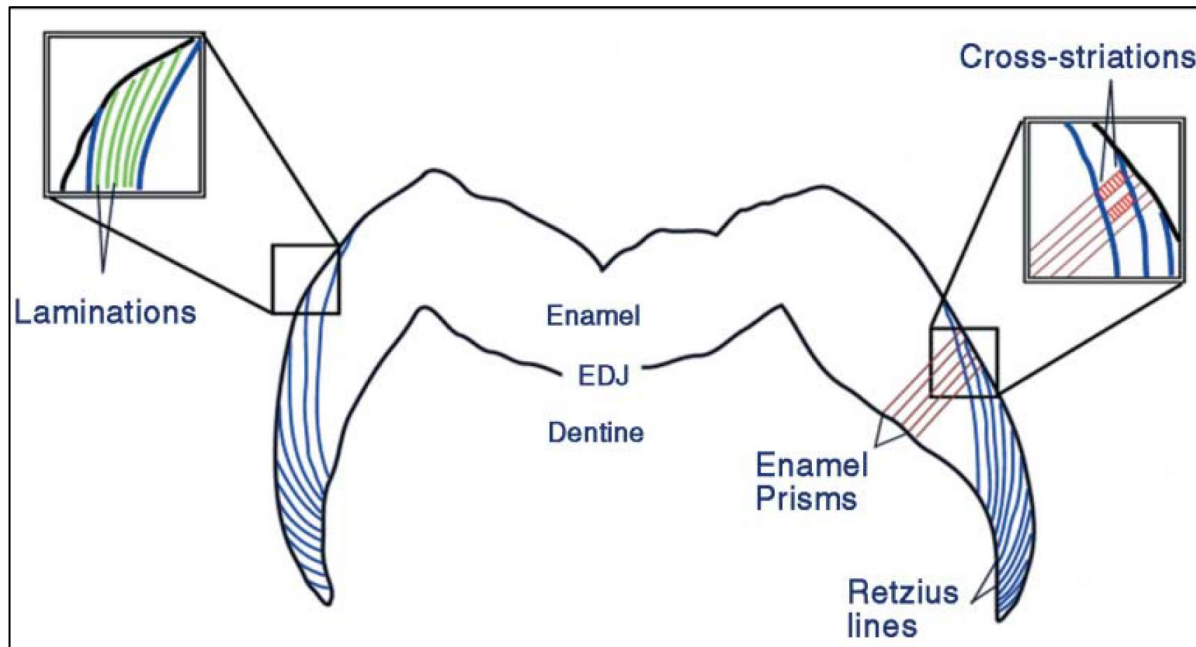
Casos pràctics

1. Determinació de l'edat a la mort en restes esquelètiques

- *Podem determinar l'edat cronològica?*
- *Podem determinar l'edat a la mort d'unes restes esquelètiques a partir de l'anàlisi genètica?*



Enamel and Dentine from Smith & Tafforeau (2008)



Smith, 2006

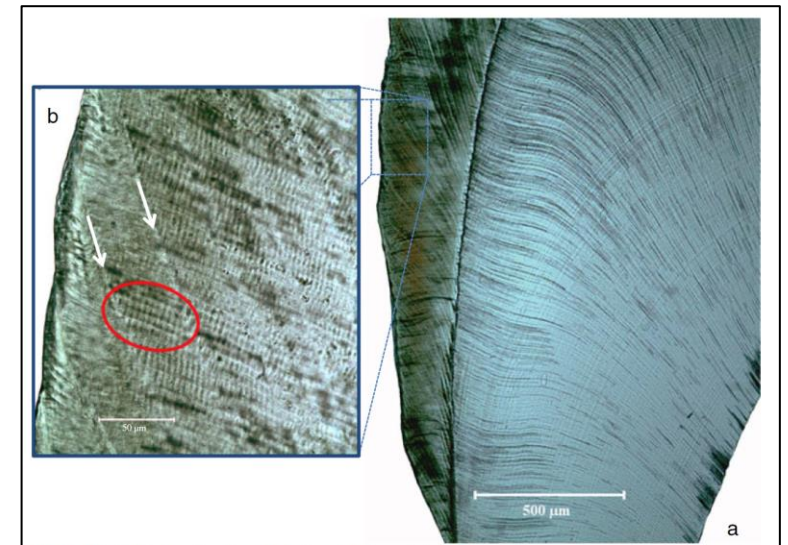
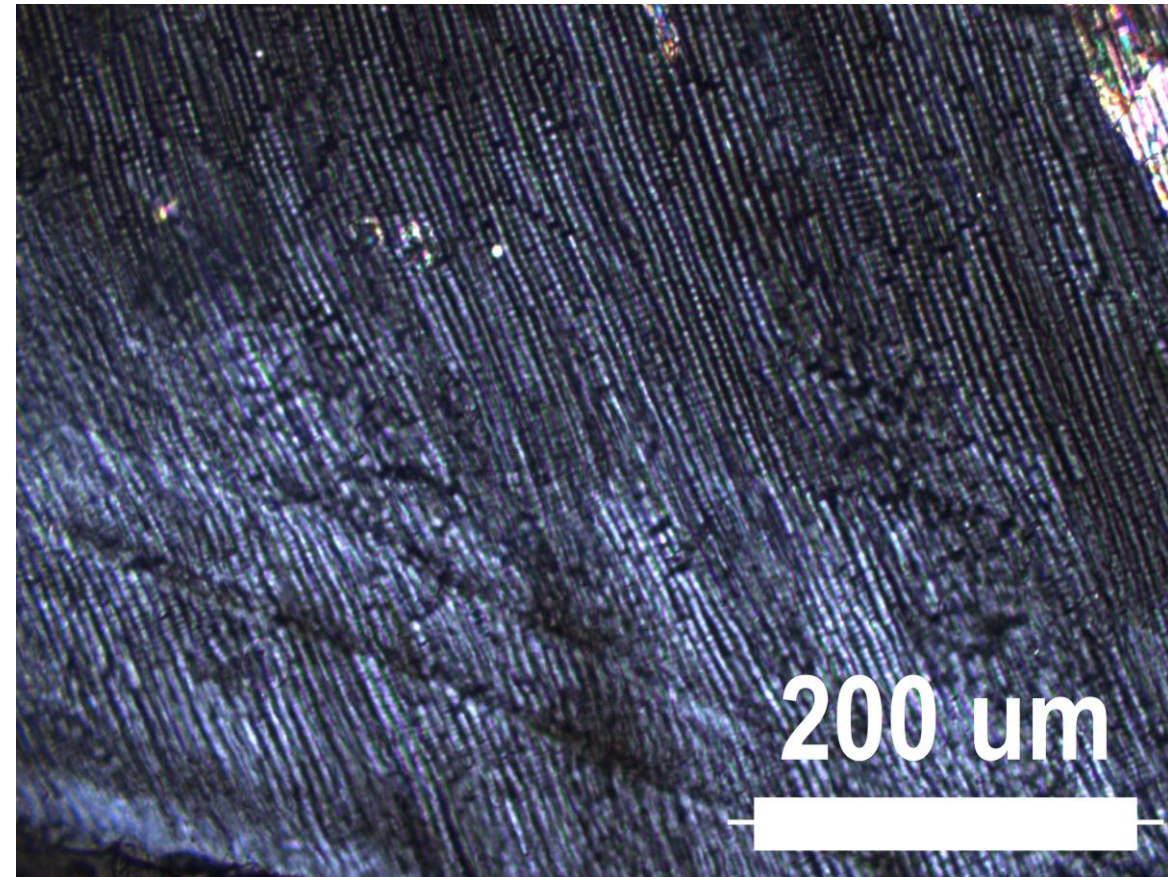


Fig. 1 Histological section through the lateral and cervical portion of an M¹ crown of *Pongo pygmaeus*. (a) Long-period incremental growth lines in enamel (to the left) and dentine (to the right), termed, respectively, Retzius and Andresen lines. (b, inset): Close-up of a sector of lateral enamel highlighting two Retzius lines (arrows) and a series of daily cross striations between them (circle); the number of cross striations between adjacent Retzius lines represents the long-period line periodicity. These incremental growth lines allow calculation of tooth formation times and, for individuals that died during the period of dental development and eruption, age at death.

Kelley and Schwartz, 2012



Casos pràctics

1. Determinació de característiques *antemortem per a la identificació*

- *Quina altra informació del perfil biològic de les restes esquelètiques ens pot ajudar a la identificació?*

Degenerativa i Traumàtica



Espondiloartrosi

Espondilolisi



Nòduls Schmorl

Degenerativa i Traumàtica

Artrosi perifèrica



Osteocondritis dissecans



Entesopaties



Fractures



Erosions cranials



Infeciosa

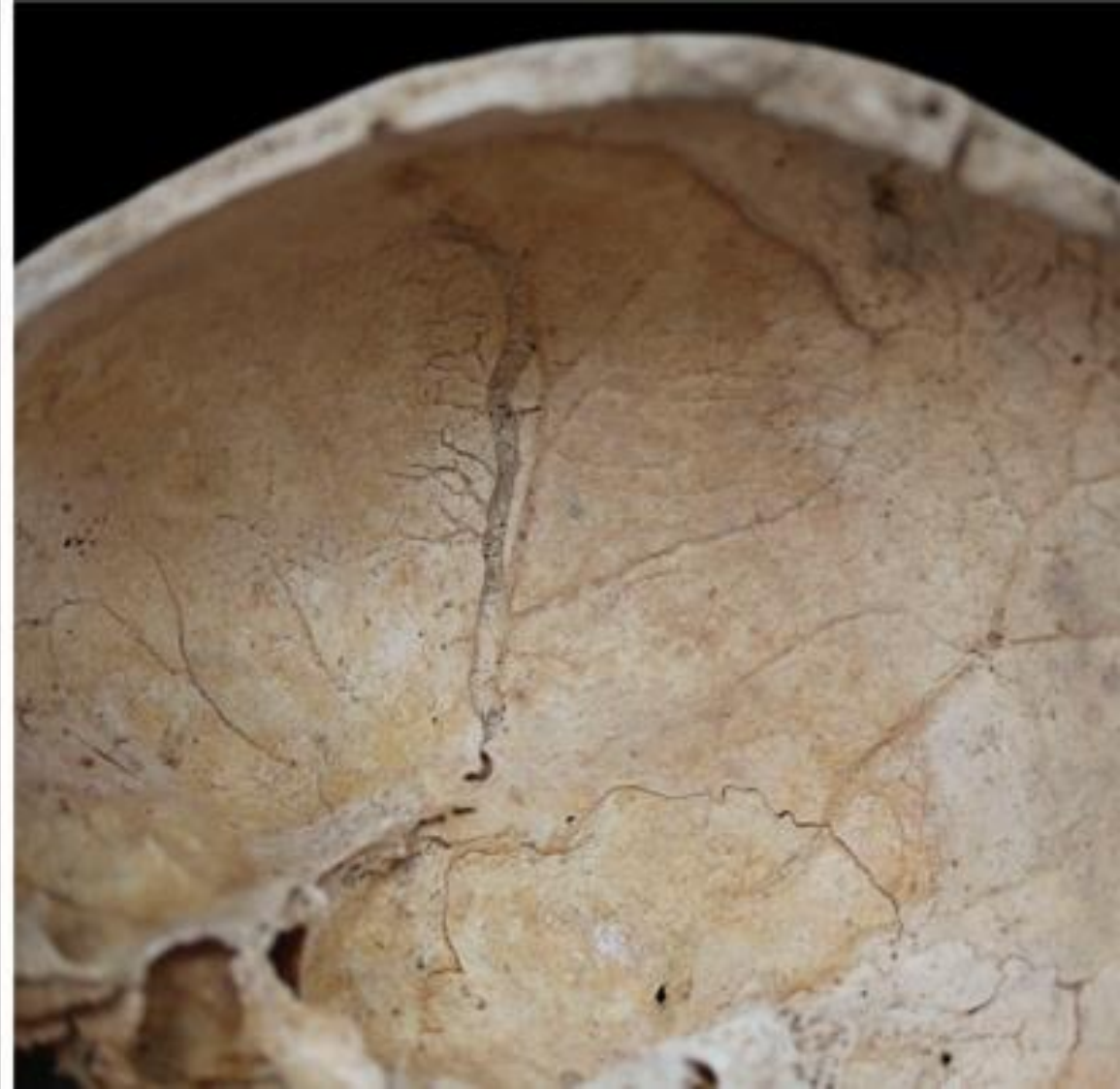
Espondilodiscitis



Arthritis



Tumors - meningioma



Tumors – metástasi òssia

