

R. M. LA JEUNESSE, Ph.D. Professor of Anthropology Department of Anthropology California State University, Fresno Fresno, CR. 93740-0016

## Terms of Direction and Location

- 1. Distal—farthest end from the trunk or head.
- 2. Proximal-closest part nearest the trunk or head.
- 3. Medial—toward the midline.
- 4. Lateral-away from the midline.
- 5. Anterior-front side of the body.
- 6. Posterior—back side of the body.
- 7. Superior-above or near the head.
- 8. Inferior-below or near the feet.
- 9. Supra-prefix meaning above or over.
- 10. Infra-prefix meaning below or under.

Parts of the Human Skull

- 1. Skull—includes both the cranium and mandible.
- 2. Cranium-includes the face and the calvarium.
- 3. Calvarium—includes the brain case.

Terms Pertaining to Bone Morphology

- 1. Line—a narrow raised ridge.
- 2. Crest—a narrow prominent ridge.
- 3. Condyle—a smooth rounded projection for articulation with another bone.
- 4. Trochanter—a large rounded projection for muscle attachment.
- 5. Sulcus-a groove.
- 6. Foramen—a true hole in the bone.
- 7. Meatus—a small tubular opening.

Should your laboratory be equipped with photographic equipment and you decide to try photographing human skulls, the proper way to do so is to have the skull in the Frankfort horizontal plane. To find the Frankfort horizontal plane, draw a line which passes from porion through orbitale (see below for an explanation of these two terms). This line is then placed in parallel to the surface upon which the skull is resting.





Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.

Figure 9.4 Clavicle



THE LEFT CLAVICLE

Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.

## Figure 9.6 Scapula



Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society. Figure 9.8 Radius



Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.

# Figure 9.10 Bones of the Hand and Wrist



Reproduced with the permission of Carolina Biological Supply Company.

Figure 9.11 Pelvis—Sacrum



Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.

# Figure 9.13 Patella (Knee Cap)



## PATELLA (KNEE CAP)



ANTERIOR VIEW



LEFT PATELLA

Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.



LEFT TIBIA

Reproduced from "Human Osteology: A Laboratory and Field Manual of the Human Skeleton" by William M. Bass with the permission of David R. Evans of the Missouri Archaeological Society.



Figure 9.19 Major Bones and Features of the Human Cranium, Base View.

Key:

- A. Basilar Suture
- B. Occipital Condyles
- C. Foramen Magnum



SUTURE

1

----

EPIPHYSIS

DIAPHYSIS

**DECIDUOUS TEETH** 

.

•

### Permanent Teeth

First Molars Central Incisors Lateral Incisors First Premolar Second Premolars Lower Canines Upper Canines Second Molars Third Molars

6th year 7th year 8th year 9th year 10th year 9th to 14th year 11th to 14th year 12th to 15th year

In order to use this information, examine the skull to be aged and note which teeth have erupted and whether they are deciduous or permanent teeth. Following the examination of the skull, compare that data with the above information on age of tooth eruption. If, for example, the first molars and central incisors have erupted but not the lateral incisors or first premolars, then the individual was most probably between 7 and 8 years old when she died.

### **Epiphyses** Closure

Most of the bones of the postcranium are composed of two separate parts — the diaphysis and the epiphysis. The diaphyses are the shafts or main parts of the bones and the epiphyses the ends of the bones. At birth, the epiphyses are composed of cartilage and are attached to the diaphyses by another layer of cartilage called the epiphyseal plate. From birth until puberty, the bones grow by ossification in an area called the metaphysis which is located toward the ends of the diaphyses. Between birth and puberty, ossification of the epiphyses begins. The bony epiphyses then fuse to the diaphyses and growth comes to an end between puberty and the end of adolescence. Fusion between the epiphyses and diaphyses does not, however, take place at the same time in all bones. The various ages at which the bones fuse is well documented and can be used to age skeletal material provided that the individual died before all of the epiphyses fused. In general the epiphyses fuse earlier in girls than in boys. Moreover, there is interindividual variation in the age of fusion. Therefore, when aging skeletal material it is wise not to rely on only one technique of aging but instead to use as many aging techniques as possible given the preservation state of the material you are working with.

Figure 9.20 diagrams the order in which the epiphyses fuse. Information on the ages at which these epiphyses fuse is used in the same manner as is the information on the ages of tooth eruption. Some ages of epiphyseal fusion are as follows:

- 1. The Elbow-fuses between 13-19 years of age.
- 2. The Hip—The head and the greater and lesser trochanter of the femur fuse between 15-20 years of age. The crest of the ilium fuses between 16 and 23 years of age, the acetabulum between 13 and 16 years and the ischium between 17 and 25 years of age.
- 3. The Ankle-fuses between 16-20 years of age.
- 4. The Knee-fuses between 16-23 years of age.
- 5. The Wrist—The distal ends of the radius and ulna fuse between 18 and 23 years of age. 6. The Shoulder—The proximal end of the humerus fuses between 19 and 25 years of age. The borders of the scapula fuse between 17 and 22 years of age. The lateral end of the clavicle fuses between 19 and 20 years of age and the sternal end fuses between 25 and 30 years of age.

### Suture Fusion

The skull is composed of 22 bones (plus the bones of the ear). Before the age of 17, these bones come together along serrated interlocking joints called sutures. These sutures (except for five—the coronal, sagittal, lambdoidal, basilar and squamosal) are named according to the names of the particular intersecting bones of the skull (see Figures 9.18 and 9.19). After the age of 17, the

# Figure 9.21 Suture Closure of the Cranium, Lateral View.

- A. Fuses by 40 years of age.
- B. Fused by 65 years of age.
- C. Fused by 72 years of age.
- D. Fused by 80 years of age.
- E. Fused by 40 years of age.
- F. Fused by 50 years of age.
- G. Fused by 80 years of age.
- H. Fused by 65 years of age.



### LABORATORY SEXING A SKELETON

## INTRODUCTION

There are differences in the human skeleton between women and men. For example, the skeletons of males are, in general, larger and more robust than the skeletons of females. There are also specific differences between women and men in their skulls and pelves which are used to sex human skeletal material. In figures 9.23 and 9.24 many of the features which are used to sex human skulls are illustrated. Look these Figures over carefully before attempting to sex the skulls available to you.

The major morphological differences between male and female pelves are illustrated in Figures 9.25 and 9.26 and outlined in Table 9.1. In addition to inspecting the pelvis for these morphological differences, there is also an index available which will assist in discriminating between the male and female pelvis. The procedure for calculating this index is as follows:

 Measure in a straight line the distance between A and B and A and C as shown in Figure 9.26. The point A is an irregularity, often a notch, which represents the place where the three bones of the innominate bone—the ilium, the ischium and the pubis—fused. Point B is the tip of the pubis and C is the bottom of ischium. With these measurements, the Ischium-Pubic Index can be calculated with the following formula:

> Ischium-Pubic Index = Pubis Length × 100 Ischium Length

The results are judged against the following:

Whites—If the Ischium-Pubic index is below 90, the pelvis is male, and female if above 95. A result of between 90 and 95 is difficult to diagnose.

Blacks—If the index is below 84, the pelvis is male, and female if above 88. Results between 84 and 88 are difficult to diagnose.

.....

# Figure 9.24 Sexing a Human Skull, Adult Female.

Key:

- A. The chin is rounded.
- B. The angle of the ascending ramus is obtuse.
- C. The root of the zygoma is not likely to extend beyond the auditory meatus.
- D. The mastoid process is small.
- E. The occipital protuberance is poorly developed.
- F. There is a smooth gracile skull.
- G. The muscle lines are not prominent.
- H. There is a vertical forehead.
- 1. The supraorbital ridges are absent or poorly developed.
- 1. The orbital margins are sharp.



# Figure 9.26 Human Innominate Bones, Adult Male and Female.

Key in Table 9.1



# Table 9.1 Sex Characteristics of the Pelvis and Key to Figures 9.25 and 9.26 (1).

Кеу	Trait	Male	Female		
A. D. F. G. H. I. (1) Fc	Acetabulum Greater Sciatic Notch Preauricular Sulcus Obturator Foramina Pelvic Inlet Iliac Blade Sacrum or explanation of B and C o	Large Narrow and deep Generally absent Large and oval Heart-shaped High and upright Long and narrow, curved in on Figure 9.26, see text.	Smaller Wide and shallow Better developed Smaller and triangular Oval-shaped Lower and flaring Shorter and broader, straight		

GENERAL:Difficult to determine because (1) intermixture and (2) variation within a race.

CALLONDER		
CAUCASOID	NEGROID	MONGOLOID
Head:		
Elongated, rough	Some elongation, smooth	Round
Narrow nasal orifice Height twice width	Wide nasal orifice Height equals width	Intermediate
Interorbital distance narrow	Wide	The malar bones project; face width is greater than bead width
Narrow nasal bone; overhanging glabella	Wide nasal bone	and need wroth
"Hatchet face"		"Elat face"
Nasal sill has sharp edge with smooth floor	Nasal sill has smooth edge with nasal gutter in floor	
		Shovel-shaped incisor teeth
Rounded contour viewed in sagittal plane	Sagittal plateau Post coronal sulcus	
	Alveolar prognathism	



Figure 5.2 Sex

 $(+) = \infty$ 

35

ini.



Į,

Figure 5-5 See sketches from George Neumann "Laboratory Manual Bioanthropology"

Fontanelle (Figure 5.8)	
Occipital	2 years
Sphenoid	l year
Mastoid	shortly after birth shortly after birth
Epiphysial Union (Figure 5.9)	13 to 25 years
Face of the Pubic Symphysis	17 to 50 mar
(See Todd's Chart on Age, Figure 5.10)	17 to JU years

At one time, the Todd system of examining the face of the pubic symphysis was thought to be very accurate, but Todd's method applied only to males and also confusion may result if the pubic symphysis of the victim's skeleton is atypical. McKern and Stewart (1957), working with the Korean war dead, devised a method of estimating age which appeared more reliable, especially between the ages of seventeen to thirty. Later, Gilbert and McKern (1973) proposed a similar procedure applicable to females. Recently, Judy Suchey (1979 and 1979) working with the Medical Examiner, Los Angeles, has analyzed hundreds of pubic symphyses obtained forensically, where the ages at time of death are documented. Hopefully, Dr. Suchey will be able to clarify some of the problems encountered in attempts to estimate age.

#### Others:

Unreliable). (See Figure 5.11, Neumann, 1961)	2 years to 80+
Vertebral osteophytosis (variable)	After 40 years
Tooth wear (good for single population if all are on same diet)	?
Atrophy of bone around teeth	?
Osteoporosis (interference by disease and inactivity)	Above 50 years
Microscopic appearance (counting osteones in a thin section of bone) Kerley, 1965 and 1969; Ubelaker, 1974, 1978; and Thompson, 1979)	All ages

39

---



# ERUPTION CHRONOLOGY OF THE HUMAN DENTITION (APPROXIMATE)

lst, 2nd and 3rd Molars

S 0.0

## PERMANENT DENTITION

Central incisors6-7 yearsLateral incisors7-8 yearsCanines10-11 yearsFirst premolars9-10 yearsSecond premolars10-12 yearsFirst molars6-7 yearsSecond molars10-12 yearsThird molars17-25 years

## DECIDUOUS DENTITION

Central incisors	7-9 months
Lateral incicon-"	7 J MONTENS
C	9~11 months
Lanines	16-17 months
First molars	12-14 months
Second malana	12-14 months
second motars	20-24 months

4

Figure 5.6





Sphenoidal fontanelle

Mastoid fontanelle

FONTANELLES AT BIRTH

Figure 5.8



.

.

Figure 5-10 CHANGES IN THE APPEARANCE OF THE FACE OF THE SYMPHYSIS PUBIS WITH AGE (FROM T. WINGATE TODD--(applicable for males)

. Š

)

45

e,

### STATURE

The height can be estimated by using Tables 5.3 and 5.4, which were formulated by Mildred Trotter and Goldine Gleser in 1952. The femur and tibia give the most accurate estimate. If these bones are not present, other long limb bones may be used (see Stewart, 1979). These tables are reproduced through the courtesy of Dr. Mildred Trotter. Figure 5.12 illustrates how to measure the tibia and femur when using Tables 5.3 and 5.4.





#### WEIGHT

There is no proportionate relationship between the weight of a skeleton and the total body weight except there would be a difference of a few pounds plus or minus in a skeleton that could be classified as "medium frame" as opposed to one classifed as "heavy" or "light." A heavy frame would have larger bony projections for muscle attachements and thus a larger muscle bulk which would contribute to total weight.

The weight of the bones can be markedly reduced in a condition called osteoporosis (softening) which is usually caused by inactivity. Other causes are endocrine disturbances and prolonged illness. There is no reason to assume that there would always be a corresponding weight reduction in other tissues.

A rough estimation of weight during life can sometimes be determined by the examination of wearing apparel recovered at the death scene.

#### MALE

The label, if still present, may reveal the manufacturer. Someone familiar with men's clothing should be contacted for help. The following table 5.5 is an abbreviated form of Updated Measurement Chart. The original had thirteen measurements for each height. We have chosen to list four of these as being the most helpful: chest, pant's waist, pant's seat\* and weight. The purpose of the charts was to assist the tailor in checking customers' measurements and proportions and were compiled from thousands of actual orders from all parts of the country, for which an average has been estimated for all sizes, weights and heights. This chart appears in each semi-annual issue of <u>Made to Measure</u> magazine published by the Halper Publishng Company in Chicago.

- 49

<sup>\*</sup>The largest measurement of the pants at the seat.

FEMALE

To assist in the analysis of womens' clothing found at the scene, it is advisable to consult an expert who has knowledge of women's styles and apparel. If the label is still attached and readable, the manufacturer could be contacted and the possible weight range obtained for that particular garment.

The adult female figure can be divided into the following classifications:

MISSES

Misses Petite Misses Misses Tall

WOMEN (mature women)

HALF SIZES (shorter women)

JUNIORS

Junior Petite Juniors

## YOUNG TEEN or YOUNG JUNIORS

The young teens or young juniors are from thirteen to sixteen years of age. Chronological age is not, however, a criterion for style classification. The following definitions are quotes from a recent book <u>Figure Types and Size Ranges</u> by Debbie Ann Giollo and Beverly Berke (1979).

MISSES:

for women... whose form is characterized by a figure that is fully developed and well proportioned in all areas of the body. Considered statistically average with a normal waist, the hips are approximately 2 inches larger than the bust. 12.55

is to locate the entry on the tables that matches or most nearly matches the measurements of your skeleton. If an exact match cannot be found, and this usually happens, then a great deal of interpolating is necessary to compensate for variations in waist size, hip size and stature.

As a rough test of the value of the tables, a graduate student in the Department of Anthropology, Florida State University, Dinah Walker, gathered statistics from 186 patrons of several spas specializing in body building and weight reduction. These statistics included: stature, waist size, hip size, bust size, age and weight. Using the tables, the WEIGHT was estimated with the following results:

Estimate was within:	0 to 5 pounds	6 to 10 pounds	11 to 15 pounds
NUMBER	102	49	21
PERCENT	54 1/2	26	11

Fourteen or 7 1/2 percent were more than 15 pounds over or under the actual weight. This varied from plus 27 pounds to minus 31 pounds.

This means that 54 1/2 percent were within five pounds; 81 percent were within 10 pounds, and 92 percent within 15 pounds. These estimates were made by one of the authors (Morse). The results would vary with the individual making the estimates. The greatest spread between the actual weight and the estimated weight occurred in women with the larger measurements.

	TAE	ILE 5.6 (WOHL	EN)	HISSES PET	ITE (HEIGHT	59111				
Inches					one one ronni	294" to 62")				
BUST WAIST HIP STATUR WEIGHT (pound	321 231 341 E 591 100 s)	331 241 351 60 108	35 26 37 601 118	36 <u>1</u> 27 <u>1</u> 38 <u>1</u> 61 130	38 29 40 61 <del>1</del> 141	40 31 42 62 155				
RUCT				HISSES	(HEIGHT 624	to 661)				
WAIST HIP STATURE WEIGHT (pounds	314 224 334 624 98	324 234 344 63 106	33 <del>1</del> 24 <u>1</u> 35 <u>1</u> 63 <u>1</u> 113	35 26 37 64 125	36 <u>1</u> 27: <u>1</u> 38 <u>1</u> 64 <u>1</u> 136	38 29 40 65 147	40 31 42 65 <del>1</del> 161	42 33 44 66	44 35 46 66	
DUCT	( <b>x</b> ))			HISSES TAL	L (HEIGHT 6;	74 to 701)		176	190	
BUST WAIST HIP STATURE WEIGHT (pounds)	331 241 351 671 120	35 26 37 68 131	364 274 384 684 142	38 29 40 69 153	40 31 42 691 168	42 33 44 70 182	44 35 46 70j 197			
			HALE ST	ZES - NONEW						
BUST	36	38		WUMEN	S SHORT (HEI	GHT 60¦'' to	64'')			
WAIST HIP STATURE WEIGHT (pounds)	28 37 60 <del>1</del> 123	30 39 61 138	40 32 41 61 <u>+</u> 153	42 34 43 62 167	44 36 <u>4</u> 45 62 <u>4</u> 183	46 39 47 63 198	48 41 <del>1</del> 49 631 214	50 44 51 64 229		
DUCT	WOMENS (HEIGHT 644 to 664)									
WAIST HIP STATURE WEIGHT (rounds)	38 30 39 64 <u>1</u> 144	40 32 41 65 159	42 34 43 65 <u>1</u> 173	44 363 45 66 189	46 39 47 66 <u>4</u> 204	48 413 49 663 219	50 44 51 664 233	52 461 53 661 248	54 49 55 66} 262	56 513 57 663 277
		C 585								

1

٦,

152

\_\_\_\_

TABLE 5.6

55

ж ж