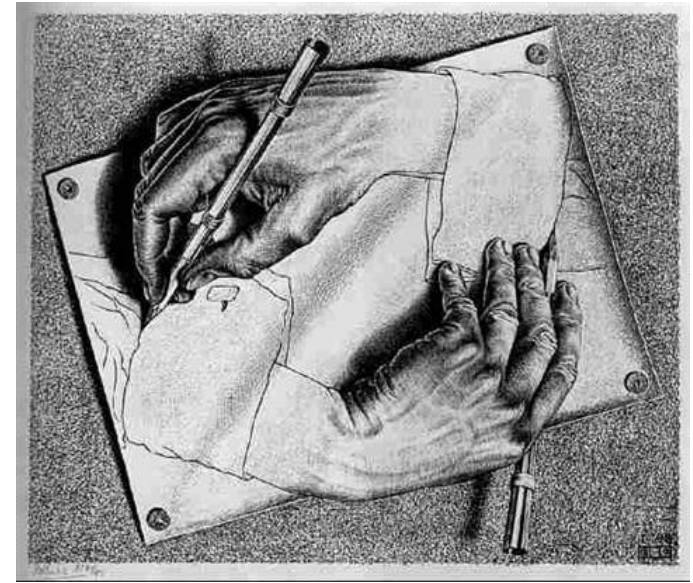


INTRODUCTION

TO ANATOMY, HISTOLOGY AND EMBRYOLOGY

TERMINOLOGY



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Budapest

Acknowledgements to Dr Sz Mezey

Dr G Gerber

HOW WE GET TO KNOW THE HUMAN BODY

"Mortui vivos docent"

"The Dead Teach The Living"



ANATOMY IN GENERAL

Anatomy (*Greek*) = dissectio (*Latin*) = to cut into pieces

Anatomy is the science of the structure of the body.

The study of anatomy introduces the student to the greater part of medical terminology

Anatomy "is to physiology as geography is to history" (Femel)

descriptive

functional

topographical

clinical/surgical

radiological

pathological

comparative

etc. ...

ANATOMICAL APPROACH

Relative to size - anatomy is usually divided into

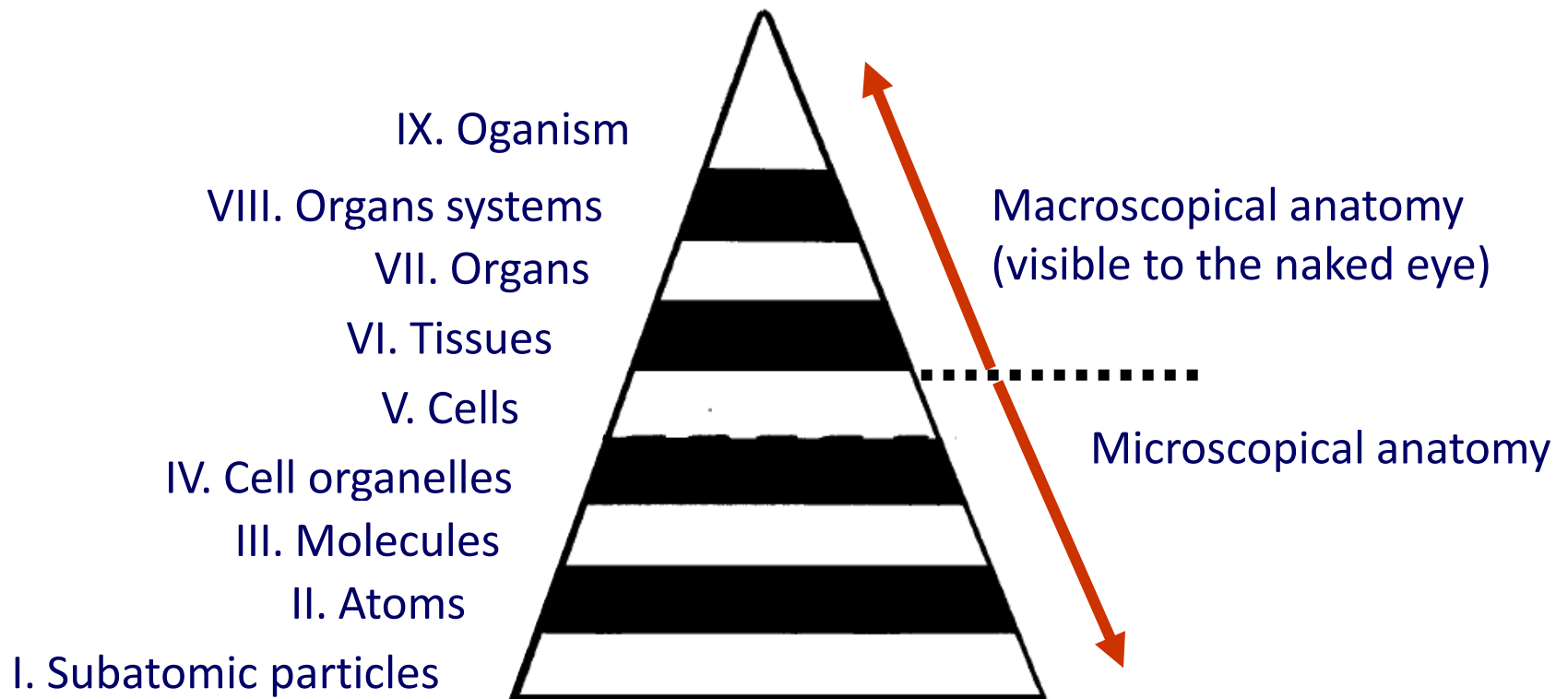
- **macroscopic** or **gross anatomy**
- **microscopic** anatomy or **histology**
- **embryology** is the study of prenatal development

In general, works dealing with human anatomy are arranged either


- **systemically** - according to various body systems
(skeletal, muscular, digestive, etc.)
- **regionally** - according to the natural, main subdivisions of the
body (head and neck, upper limb, thorax, etc.)

LEVELS OF ORGANIZATION

Description of an organism

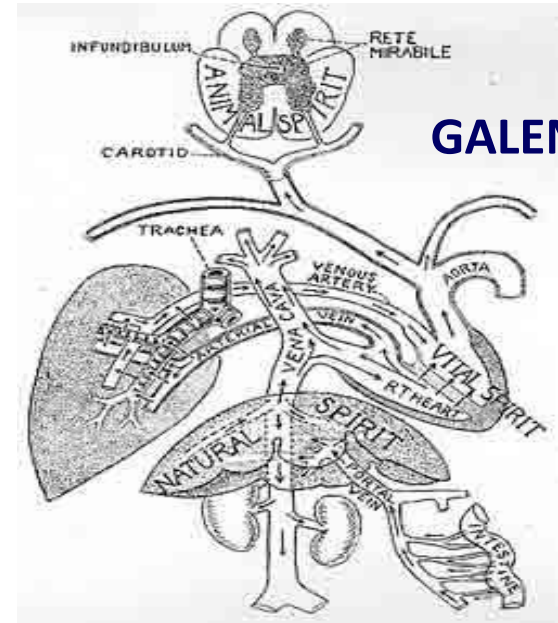


THE HISTORY OF ANATOMY



Alkmaeon	500 BC	first anatomical record
Aristoteles	4th cent. BC	systemic description of the living world; embryology: egg (!)
Herophilos		human dissections: brain, nerves, sensory organs, vessels
Erasistratos		separation of sensory and motor nerves, cardiac valves
Galenus	2nd cent. BC	dissection of a monkey; nervous system; action of the heart and arteries (incorrect though, because it was based on the fluid theory of Hippocrates)
— — — — —		
		Disintegration of the antique world -> lot of knowledge has been forgotten Arabic /Persian cultural world has saved the antique knowledge (Avicenna 11th cent.)
Andreas Vesalius	16th. Cent.	Excellent illustrations
Leonardo da Vinci		Functional description of real anatomical entities
William Harvey	17th. cent.	Correct description of circulation
Marcello Malpighi		microscopical anatomy
Giovanni Battista Morgagni		description of ill organs during autopsy - PATHOLOGY
Francois Xavier Bichat	18th cent.	Definition of a unit smaller than an organ - THE CONCEPT OF TISSUES
Schwann	19th cent.	Verifying the CELL as a general unit in the animal tissues/organism
Virchow		cellular pathology
Grant, Sobotta		modern anatomical atlas, uniform terminology

Assyrian and Babylonian astrologers practised hepatoscopia, where sacrificed animals were investigated by temple priests, searching the liver and mapping the findings

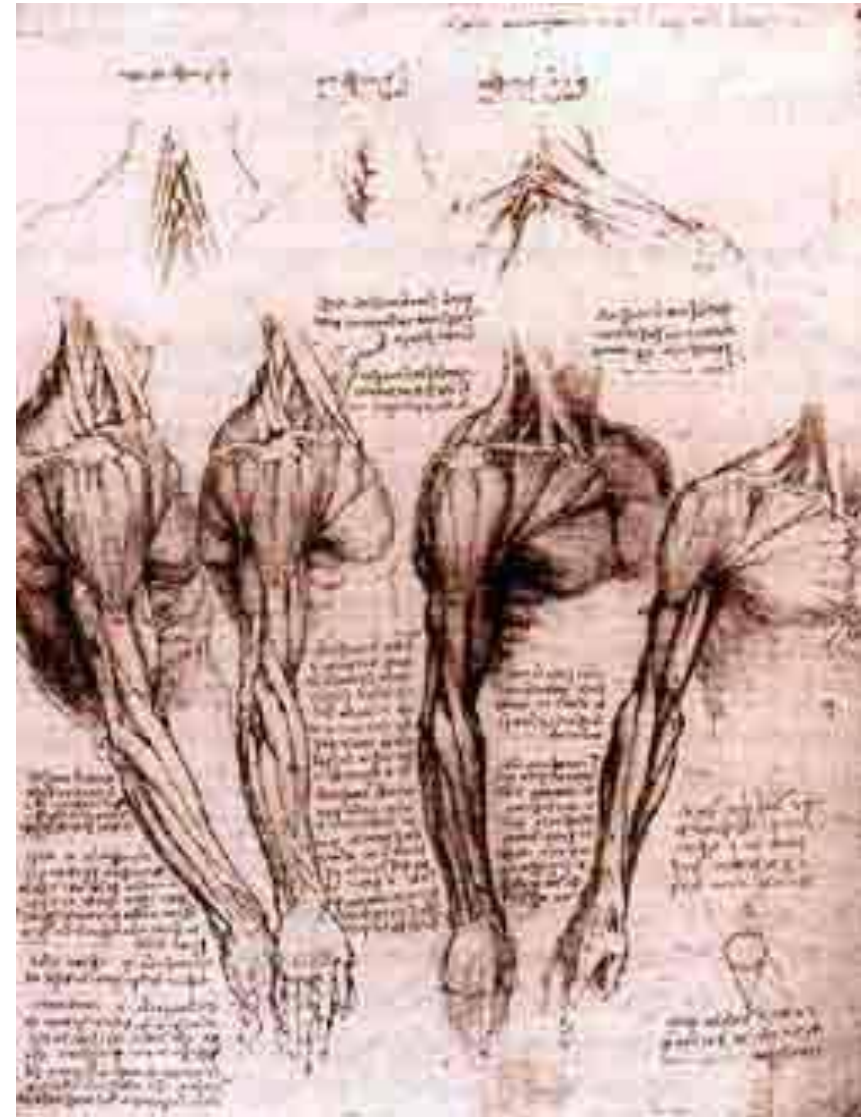


GALENUS



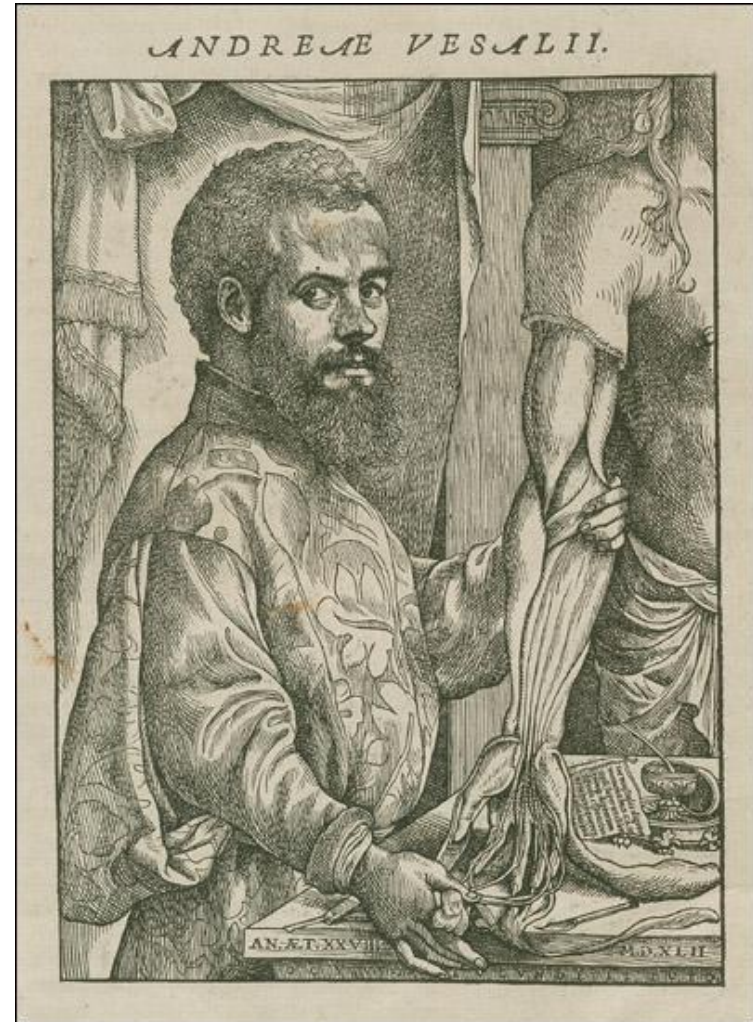
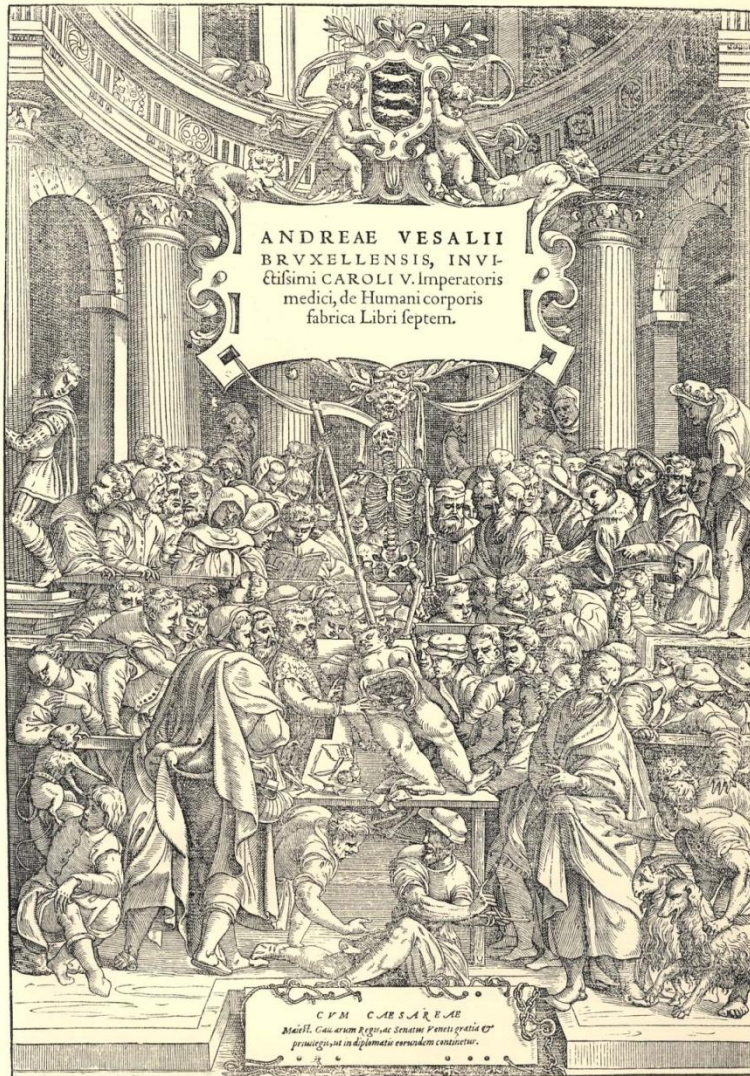
Liver of a sheep. Babylonian model of terracotta with inscriptions from 18th to 19th century B.C.

LEONARDO DA VINCI



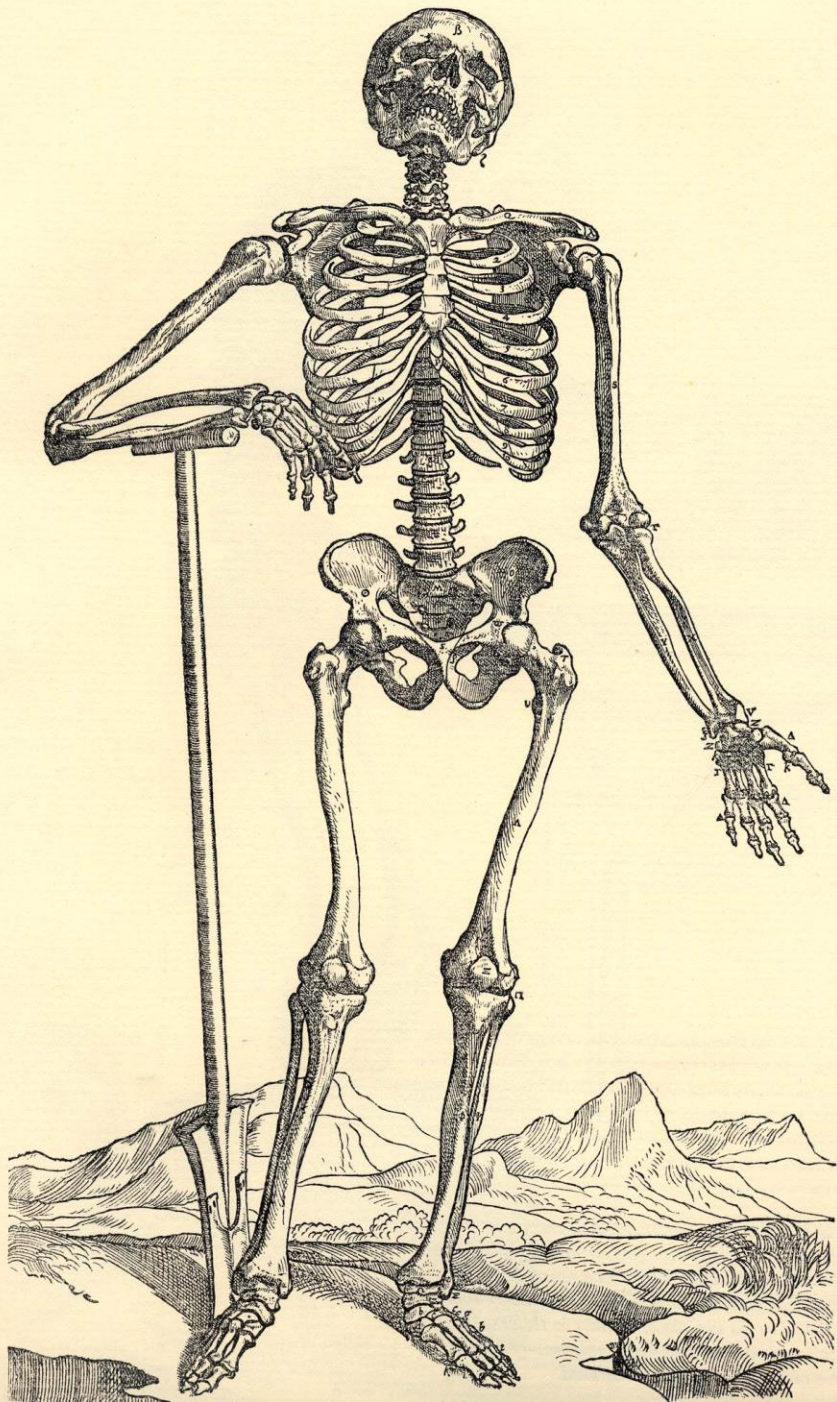
ANDREAS VESALIUS

DE HUMANI CORPORIS FABRICA, 1543



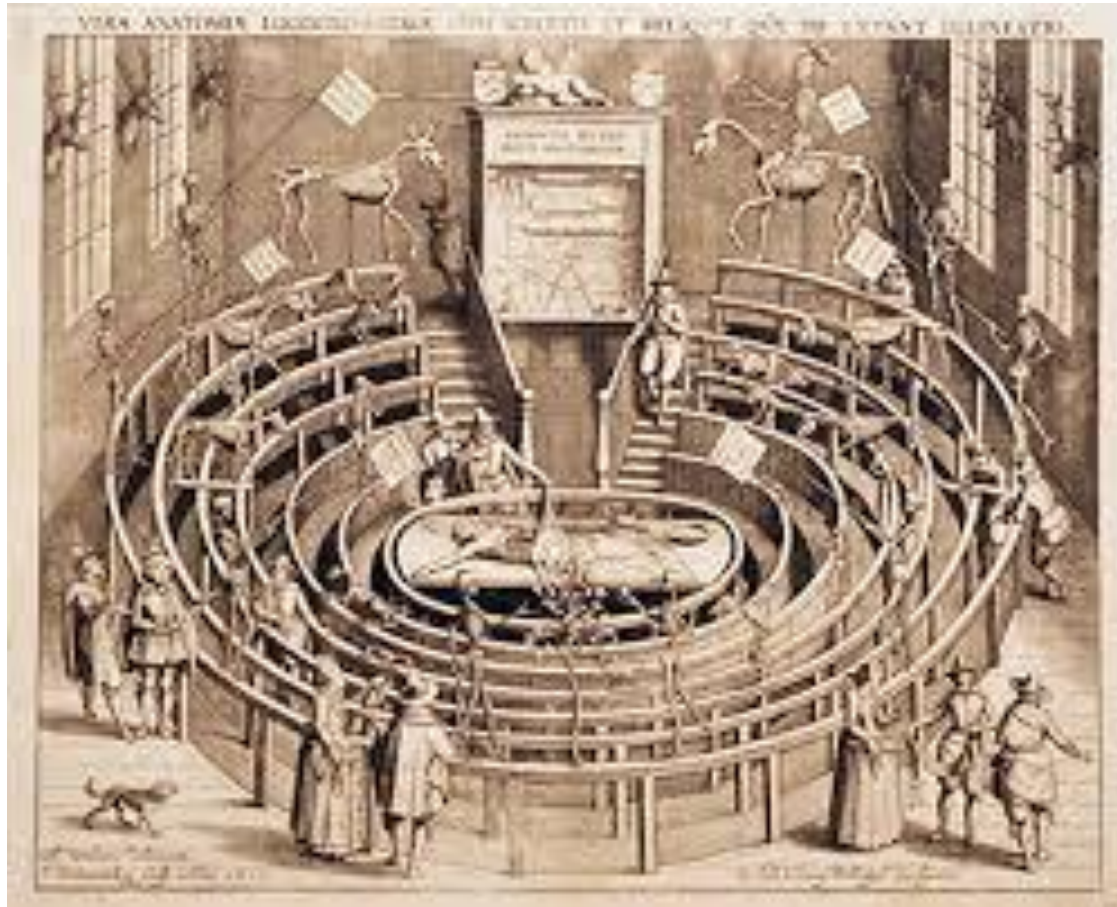


NiceArtGallery.com



THEATRUM ANATOMICUM

It was a place to view open dissections for fun in exchange for a certain admission fee



THE GENERAL DESIGN OF THE HUMAN BODY

1. Bilateral symmetry - or rather - ANAMETRY

-> right– left body halves are more or less identical („mirror image”)

-> paired organs/body parts will keep their anatomical proportions

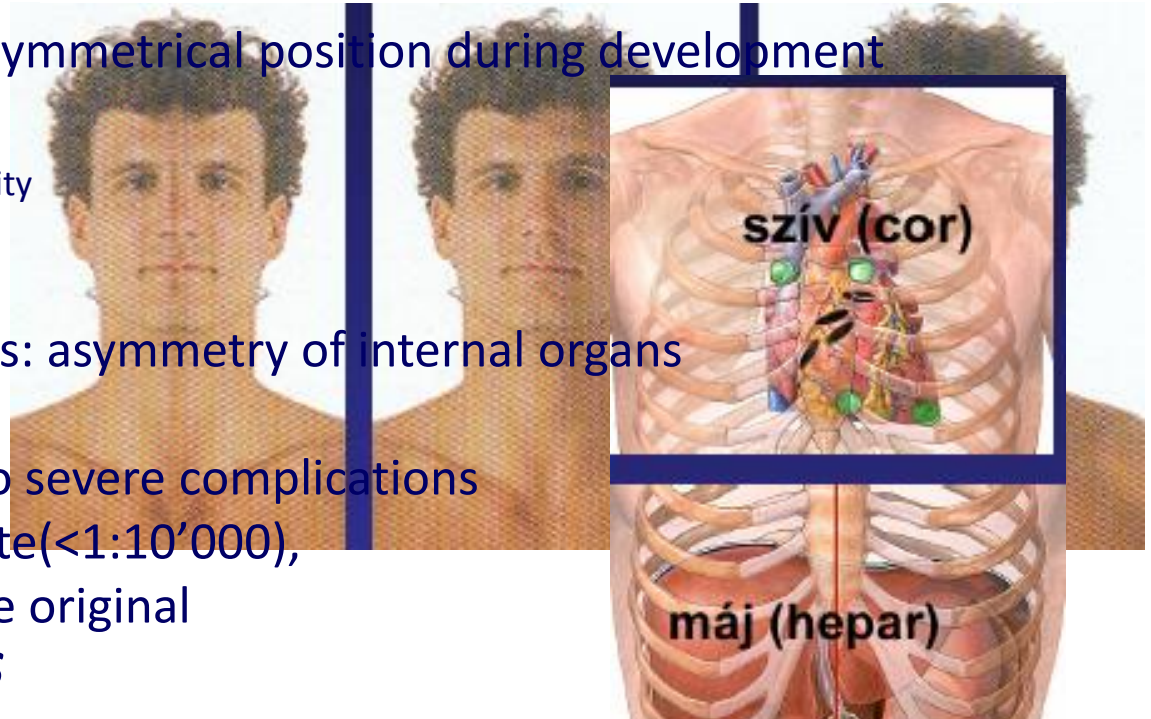
-> unpaired organs lose their symmetrical position during development
e.g. guts, or heart

their position themselves in a body cavity

right/right

right/left

left/left



Developmental malformations: asymmetry of internal organs
or, mirror images

If it is only partial may lead to severe complications

But if the mirroring is complete (<1:10'000),

It is just as harmonious, as the original

SITUS INVERSUS COMPLETUS

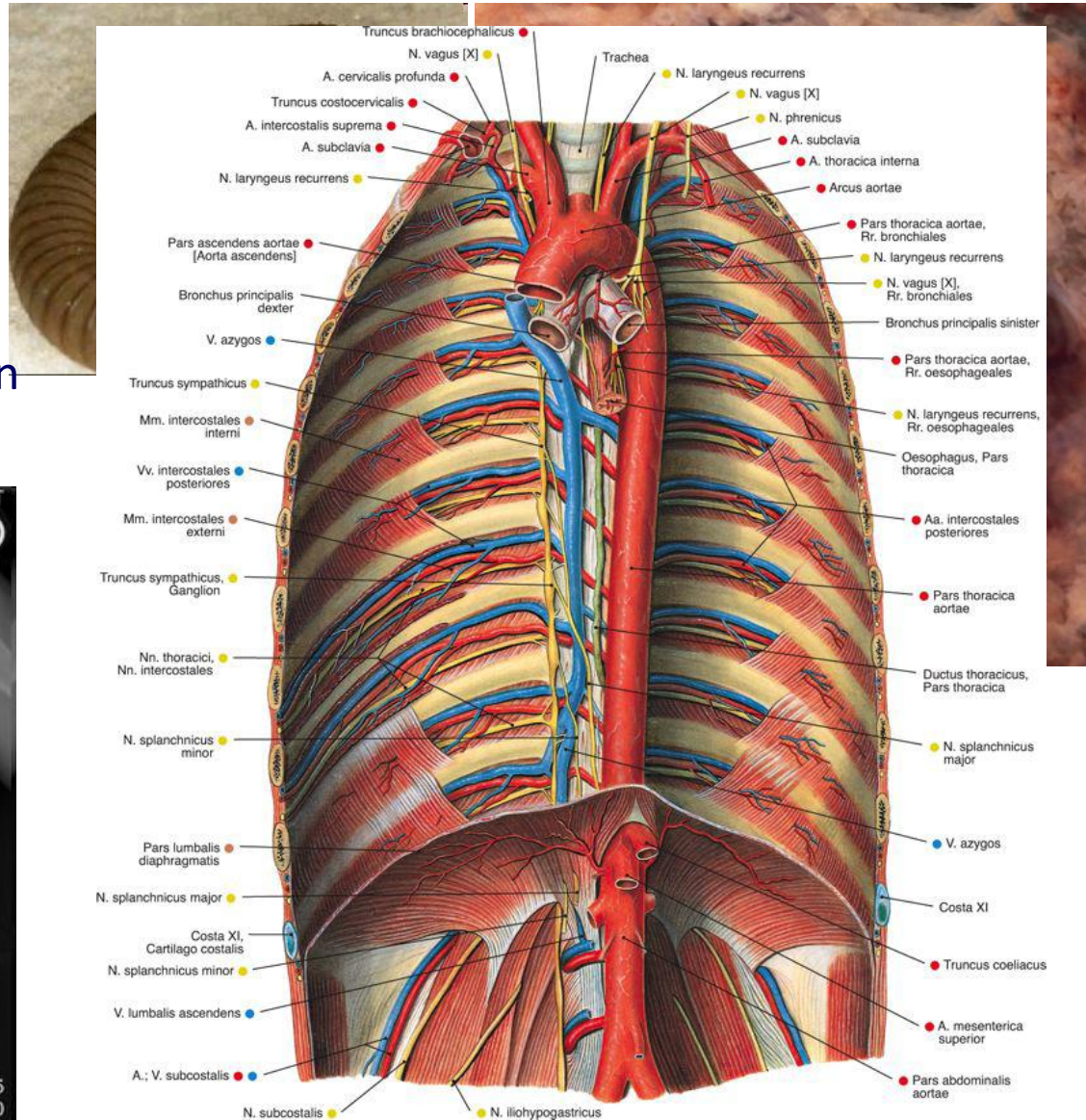
The symmetrical „BAUPLAN” of paired organs does not imply functional identity
e.g. right/left dominance of hemispheres in the brain -> left or right handedness
OR functions as a reserve (lungs, kidneys)

THE GENERAL DESIGN OF THE HUMAN BODY

2. Segmentation

Special skeletal element with muscles - Supplied by paired vessels and nerves

IN HUMANS – mostly overwritten during development



THE GENERAL DESIGN OF THE HUMAN BODY

3. Flattened body (ANTERIOR = VENTRAL, POSTERIOR = DORSAL)

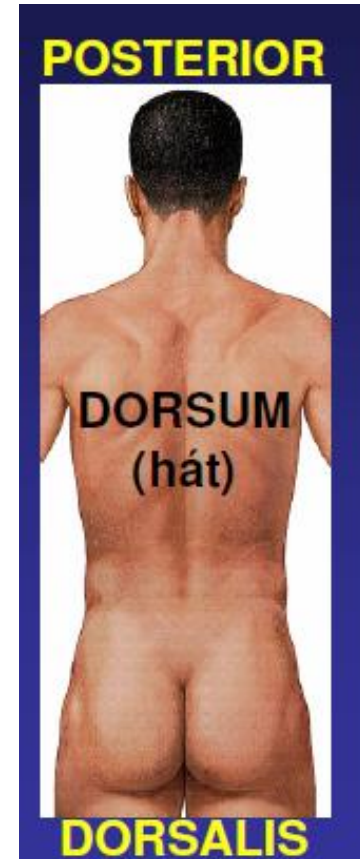
Different antero-posterior and medio-lateral diameters define the lateralization and polarity of the human body



VENTRAL
ORGANS
Face
Sensory organs
eyes
nose
ears
Respiratory
Digestive
Heart

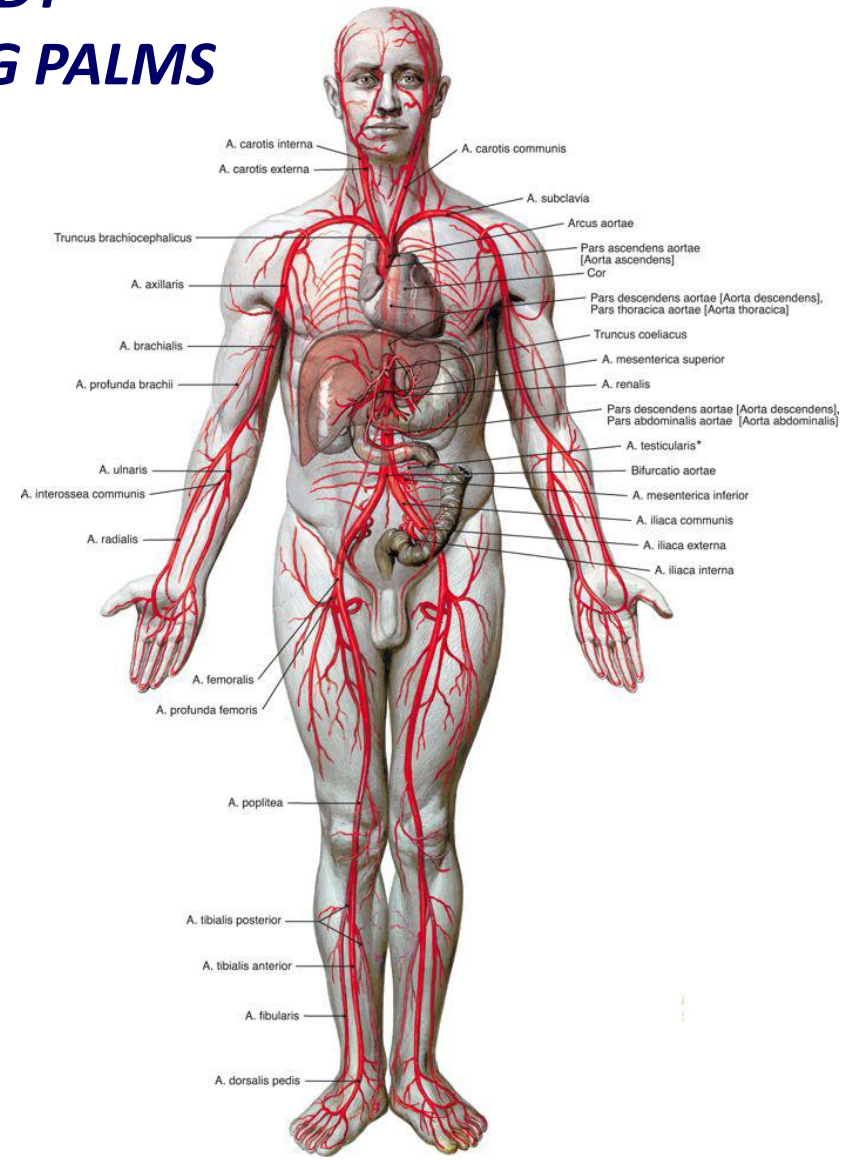
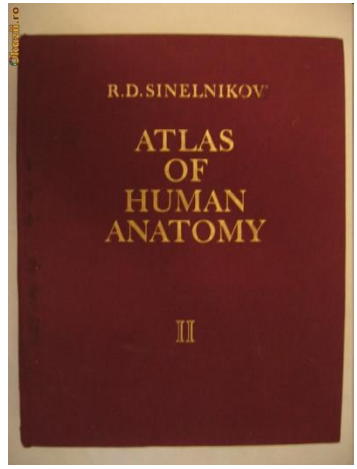
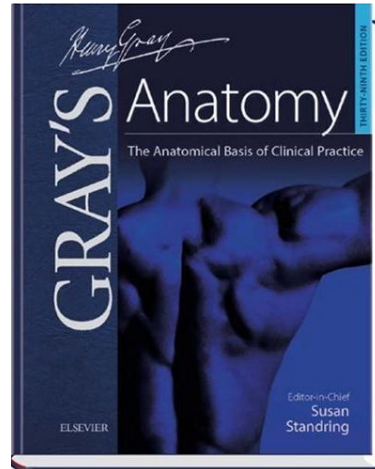
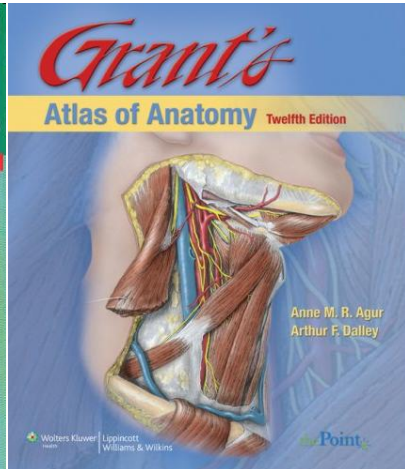
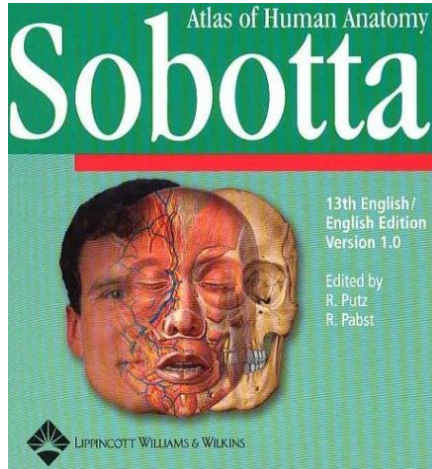


DORSAL
ORGANS
Spinal cord



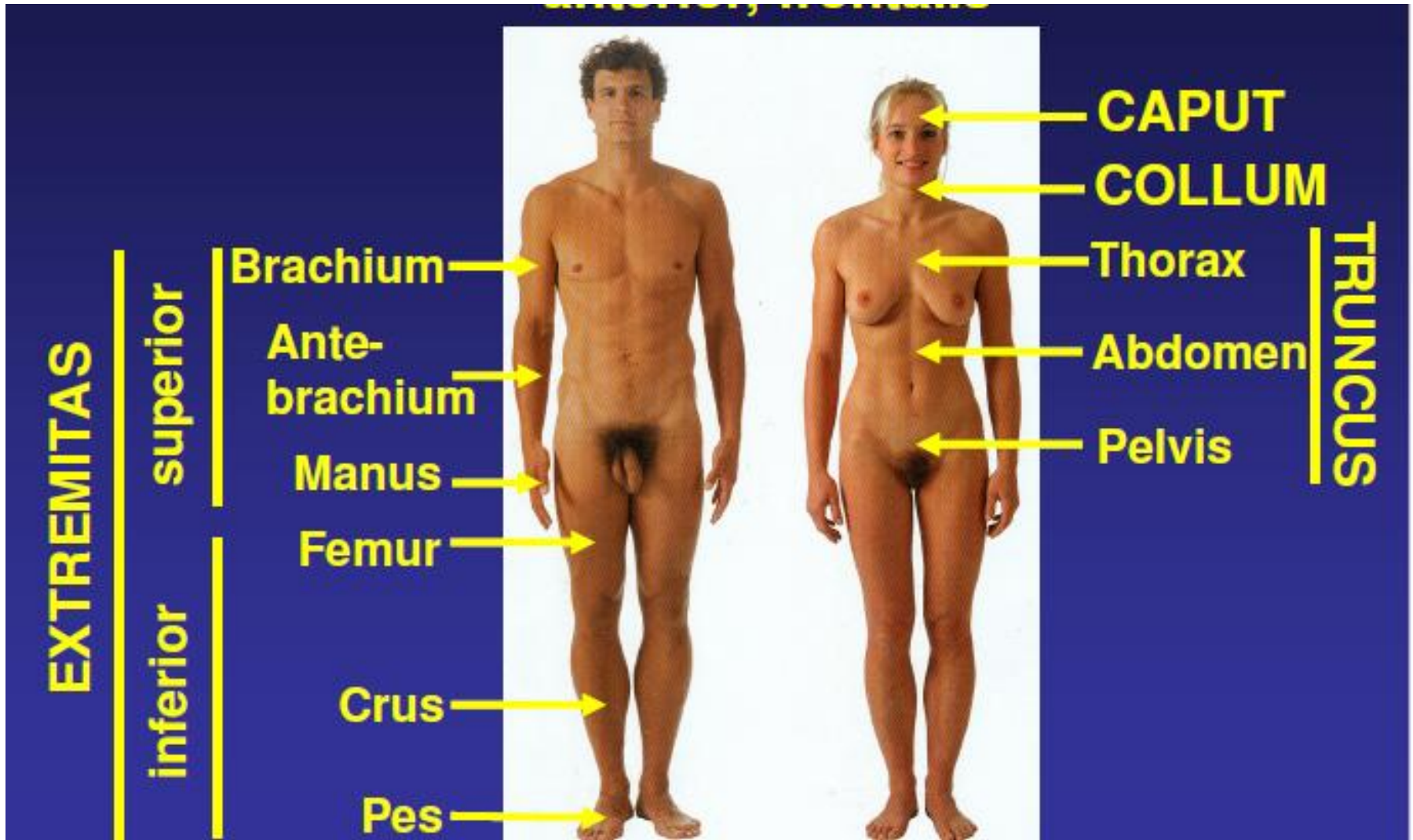
ANATOMICAL POSITION OF THE HUMAN BODY

STANDING BODY VENTRALLY LOOKING PALMS

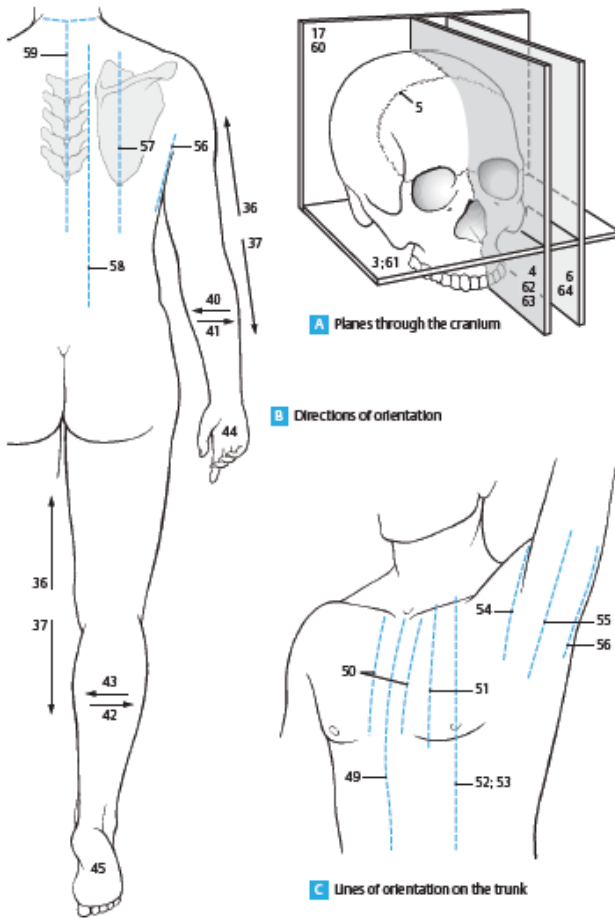


THE GENERAL DESIGN OF THE HUMAN BODY

4. Major parts



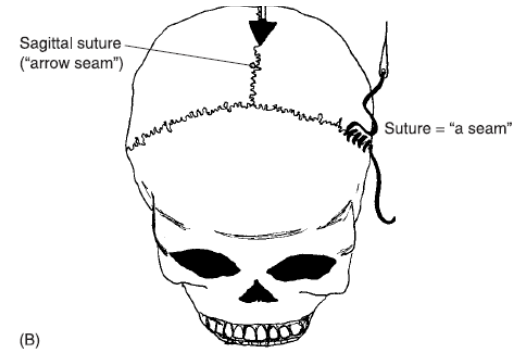
DESCRIPTION OF THE HUMAN BODY - PLANES



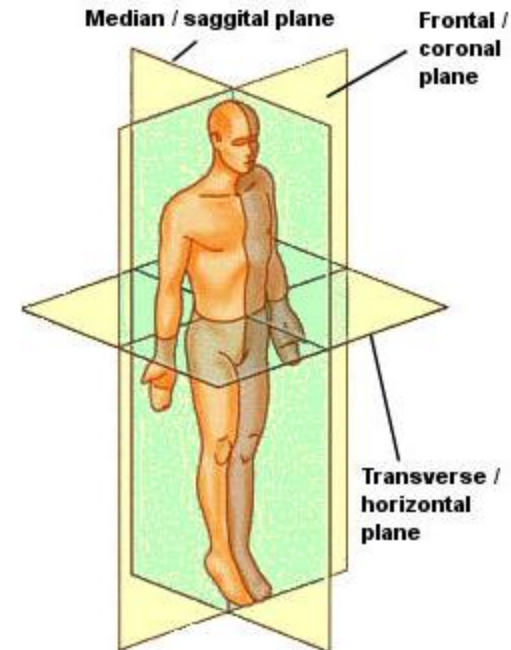
standardized fix points/planes of relations

- **median sagittal** („arrow” direction midline)
- **paramedian sagittal**
lateral to the med. sag. Plane
OR what is traversed by it
(e.g. next to the vertebrae = paravertebral)
- **frontal / coronal**
(along the forehead)
NOT symmetrical ->
what does it traverse?
e.g. centre of the femoral head

▲▲ Sagittal = "Pertains to an arrow"



(B)



- **transversal** (axial, cross sectional)
in standing man = **horizontal**
What does it cross?

DESCRIPTION OF THE HUMAN BODY - DIRECTIONS

Longitudinal axis penetrating the vertebral column

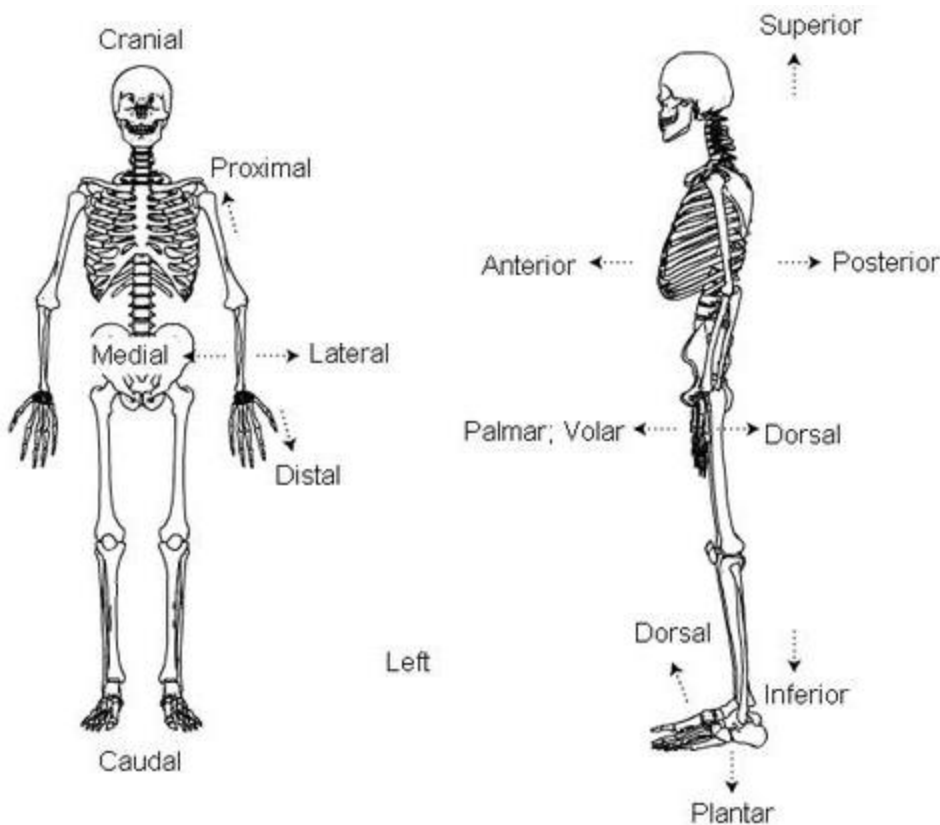
Animals: **cranial** (head end) – **caudal** (tail end)

Humans: erected position : **superior** (upper) – **inferior** (lower)

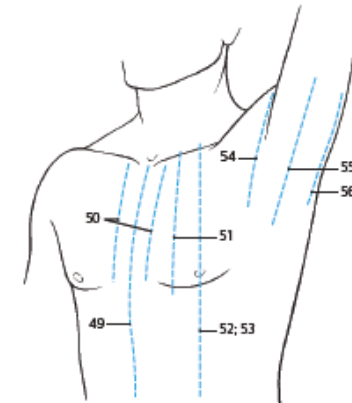
dexter (right) – **sinister** (left)

Within the sagittal plane:

anterior (front) / **ventralis** (stomach side) – **posterior** (back) / **dorsalis** (back side)



In the frontal plane:
medial (to the midline/centre) –
lateral (to the side)
median (IN the midline)
medius / intermedius (middle)



DESCRIPTION OF THE HUMAN BODY - DIRECTIONS

On the head cranialis/caudalis does not make sense -> rostral/caudal

On limbs – due to the positional changes– special directions:
proximal (closer to the trunk) / **distal** (away from the trunk)

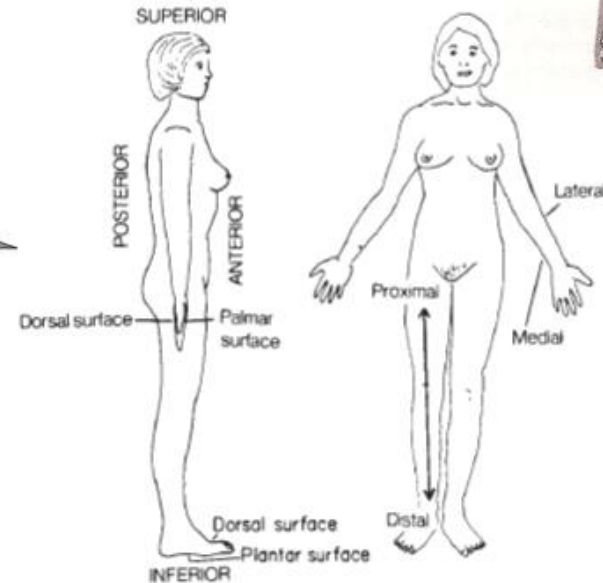
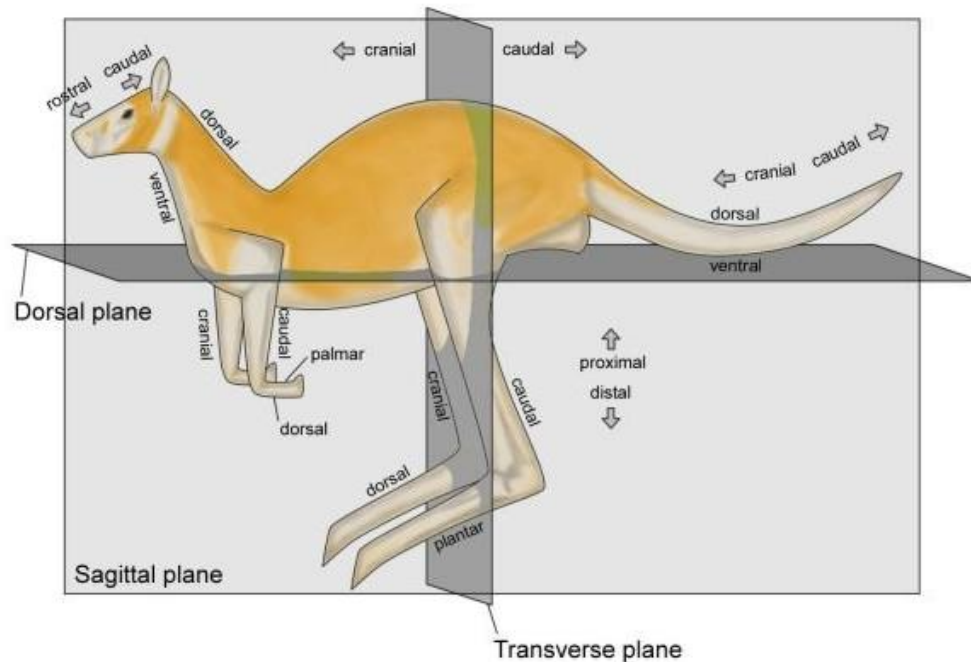
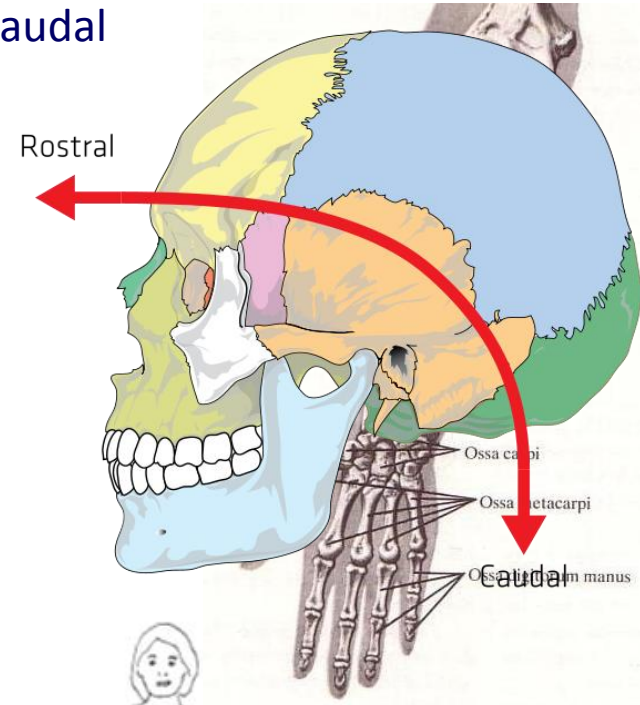
- on the foot **plantar** (foot sole) / **dorsal** (back of the foot)

- on the arms to the elbow as before

Below the elbow: **volar** (palm) / **dorsal** (back of the hand)

radial (thumb side – radius) /

ulnar (little finger side – ulna)



ANATOMICAL EXAMINATION AND PRESERVATION TECHNIQUES



The Bassett Collection



Body Worlds



IMAGING TECHNIQUES

Living organs/body , different position or volume
NON-invasive techniques are needed.

Röntgen (Wilhelm Conrad Röntgen) / X-ray

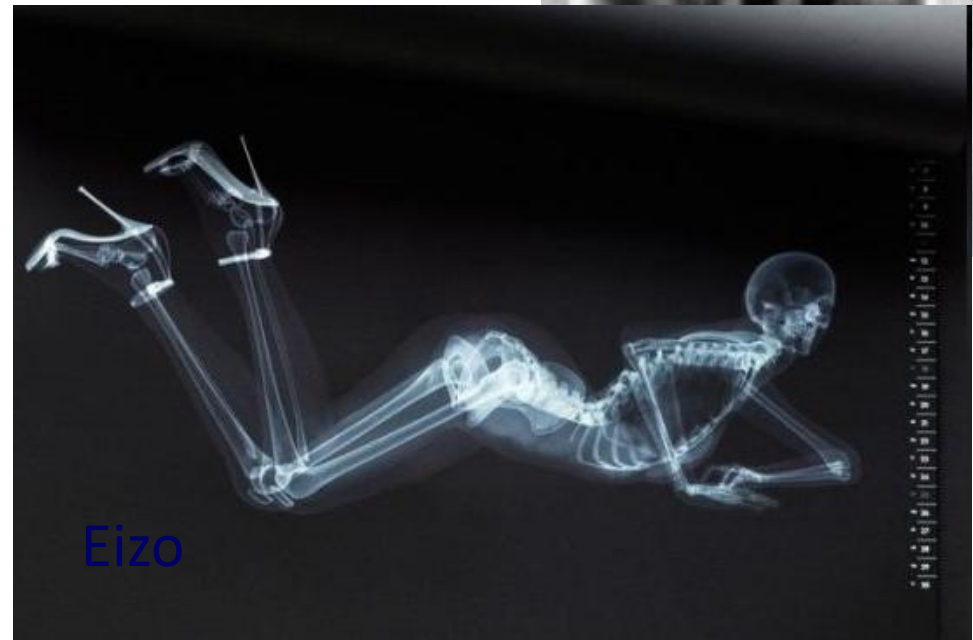
- electromagnetic radiation

- ionizing radiation ->
dissociates water in the cell to H⁺
és OH⁻ radicals and these may
harm other molecules (DNA) ->
the cell: 1. may repair it/
2. dies/ 3. incorrectly repairs it
(-> growth : malignant tumors)

- 2D image

- soft tissues are not readily visualized;

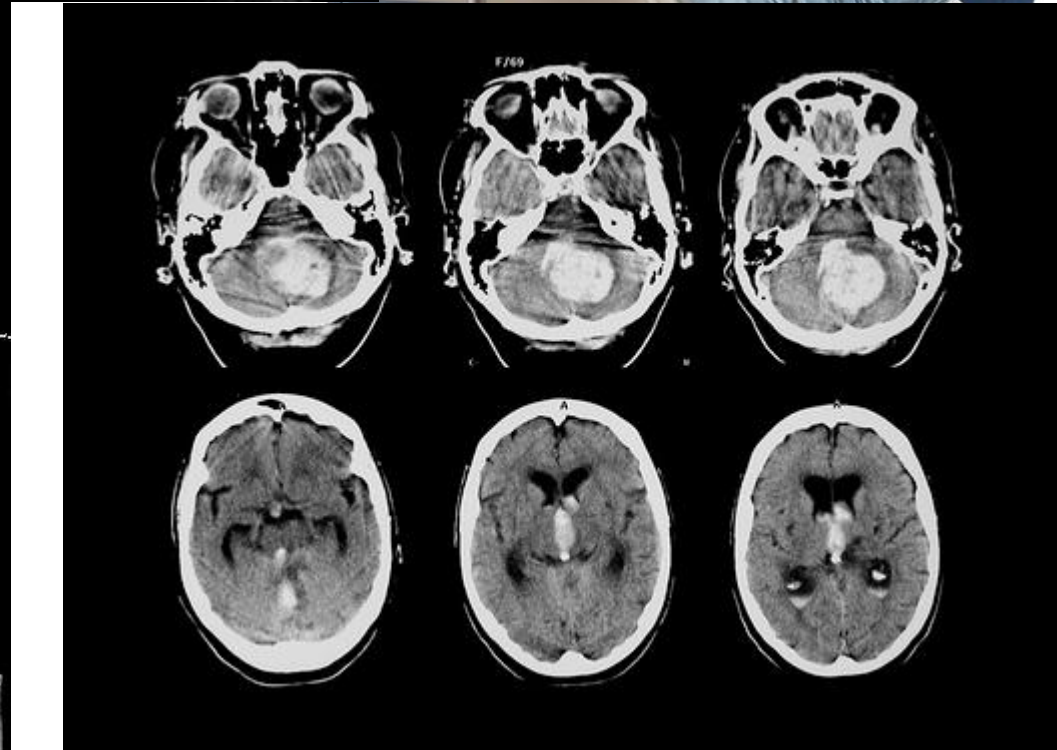
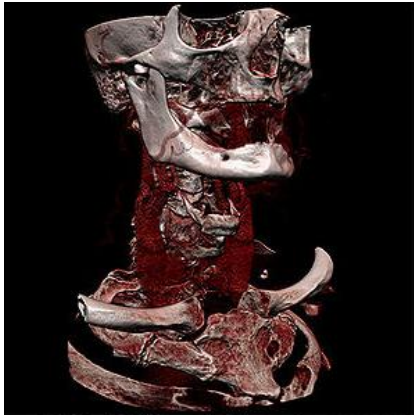
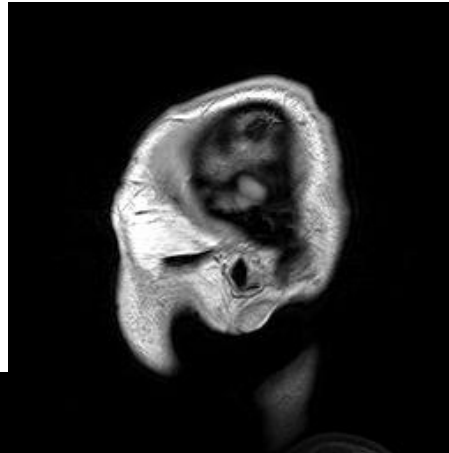
bones absorb the X rays because they contain highly electrondense materials (Ca, Mg, P)



IMAGING TECHNIQUES

CT X ray – computerized tomography

- along one or more axes
- Several consecutive 2D images
- can be turned into a 3D image
- substantial irradiation

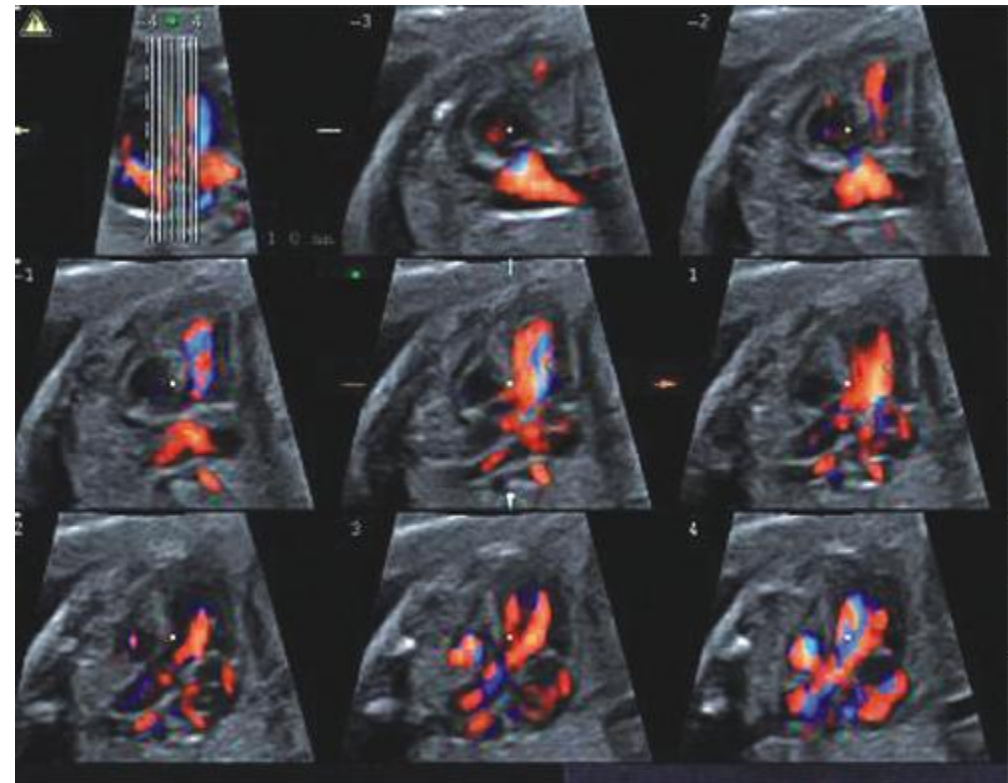


IMAGING TECHNIQUES

Ultrasonography above 20 kHz
(audible) frequency (*ULTRASOUND*)

- suitable for soft tissue examination
- NON-ionizing radiation
- 2D / 3D / 4D

Doppler US: changes in frequency (colour)



IMAGING TECHNIQUES

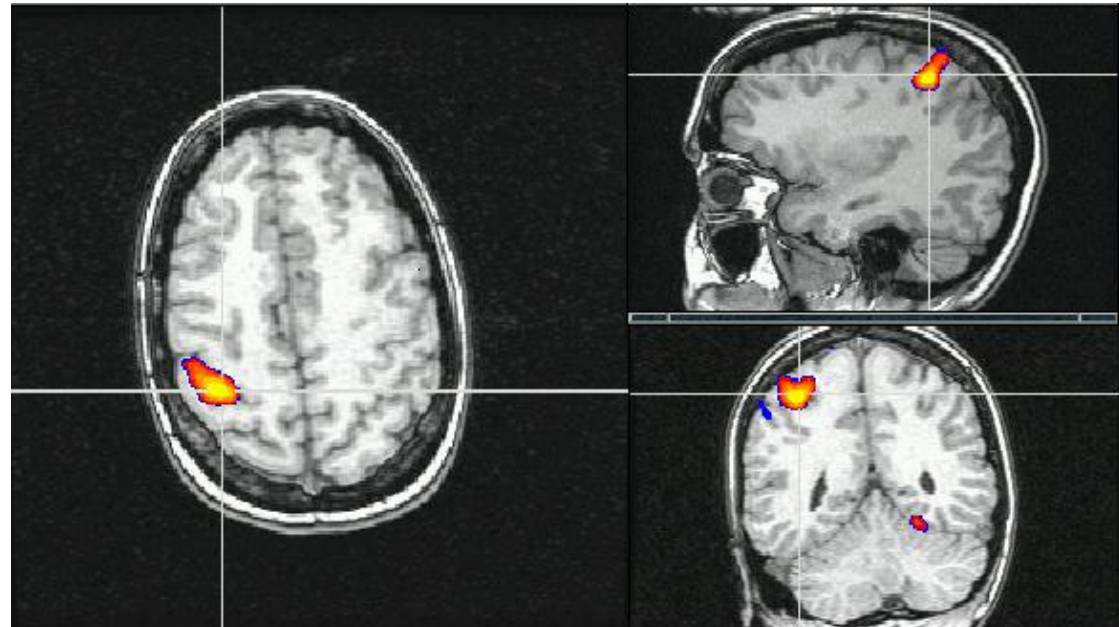
MRI (magnetic resonance imaging)

- strong(1-7 Tesla) magnetic space - the axis of protons in water is changed – when they return to the original position energy is liberated (PHOTONS!!)
- Better contrast than with CT for soft tissues
- different settings:
 - T1: „fat”(brain) is enhanced (white), CSF black
 - T2: CSF is enhanced, fat is black
- NON _onizing radiation



fMRI (functional MRI)

- active spots – energy uptake increases
 - > needs more O_2 kell -> oxyhaemoglobin is diamagnetic
 - > the signal is stronger, deoxyhaemoglobin is paramagnetic -> the signal decreases



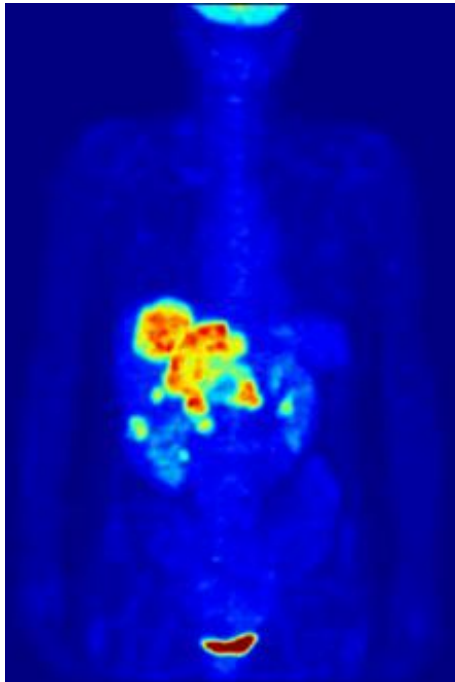
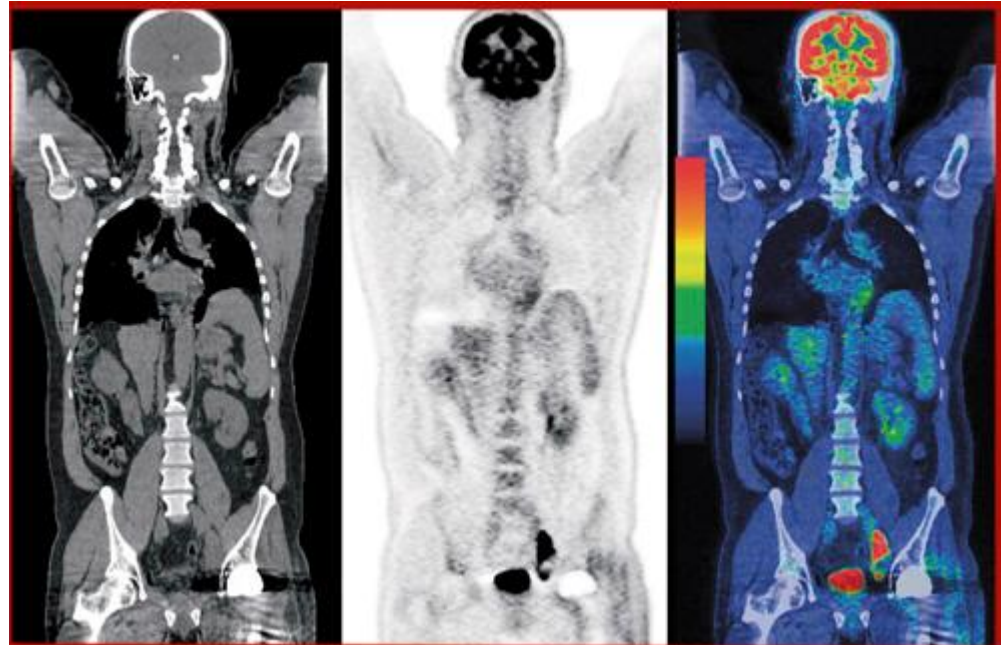
IMAGING TECHNIQUES

PET (positron emission tomography)

- functional (non anatomical) examination
- an isotope is injected in the body (emits positrons when breaks down) -> activity is calculated according to cocentration gradient;
in theory ANY organic molecule may be labelled by a radioisotope

e.g. 18-fluoro-deoxy-glucose to examine glucose metabolism

- anatomical structures are less recognizable -> combined with CT/ MRI



DISSECTION ROOM TOOLS

SCALPEL



OR



A PAIR OF ANATOMICAL FORCEPS

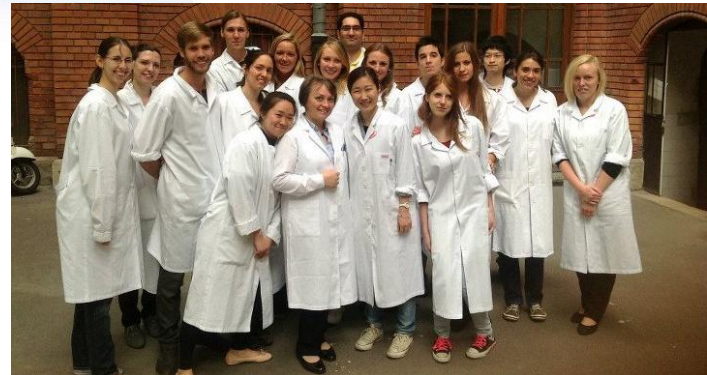


RUBBER GLOVES



**PROTECTIVE CLOTHING
(LABCOAT)**

GOGGLES



DEPARTMENTAL HOMEPAGE

semmelweis.hu/anatomia/en/



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Welcome,

Semmelweis University with more than 250 years of teaching experience is one of the most renowned universities in Europe. We are dedicated to give our students the best learning experience possible.

Sincerely,

Department of Anatomy, Histology and Embryology



MIKLÓS RÉTHELYI - JÁNOS SZENTÁGÓTHAI

FUNCTIONAL ANATOMY



Department of Anatomy, Histology and Embryology from January 2016 includes both former "anatomy" departments (Dept. of Anatomy and Dept. of Human Morphology).

CURRICULUM, MIDTERMS, RULES, ANNOUNCEMENTS, SCHEDULES, HISTOLOGY SLIDES, TOPIC LISTS

Semmelweis University
Department of Anatomy, Histology and Embryology

Faculty of Dentistry
1st year

ANATOMY HANDBOOK
September 2018



Dr. Andres D. Székely
Associate Professor
Course Director of the English Language Program

Dr. Gébor Gerber
Associate Professor
Deputy Head of Department
Dean of the Faculty of Dentistry, Semmelweis University



**The average human body
contains enough bones**



to make an entire human skeleton.

TERMINOLOGY

International agreement has been reached on an English and Latin nomenclature, the Terminologia Anatomica. A revision of this terminology is used in this book. Eponyms are avoided except where so common in clinical practice as to be considered essential for the medical student.

Terms of position and direction.

All descriptions in human anatomy are expressed in relation to the anatomical position, a convention whereby the body is erect, with the head, eyes, and toes directed forward and the upper limbs by the side and held so that the palms of the hands face forward. There is no implication that the anatomical position is one of rest. It is often necessary, however, to describe the position of the viscera also in the recumbent posture, because this is a posture in which patients are frequently examined clinically.

The median plane is an imaginary vertical plane of section that passes longitudinally through the body and divides it into right and left halves. The median plane intersects the surface of the front and back of the body at what are called the anterior and posterior median lines. It is a common error, however, to refer to the "midline" when the median plane is meant.

Any vertical plane through the body that is parallel with the median plane is called a sagittal plane. The sagittal planes are named after the sagittal suture of the skull, to which they are parallel. The term "parasagittal" is redundant: anything parallel with a sagittal plane is still sagittal.

Any vertical plane that intersects the median plane at a right angle and separates the body into anterior and posterior parts is termed a coronal, or frontal, plane.

The term horizontal plane refers to a plane at a right angle to both the median and coronal planes: it separates the body into superior and inferior parts. This is often termed an axial plane, particularly in radiology.

The term transverse means at a right angle to the longitudinal axis of a structure. Thus, a transverse section through an artery is not necessarily horizontal. A transverse section through the hand is horizontal, whereas a transverse section through the foot is coronal.

The term medial means nearer to the median plane, and lateral means farther from it. Thus, in the anatomical position, the thumb is lateral to the little finger, whereas the big toe is medial to the little toe. Intermediate means lying between two structures, one of which is medial and the other lateral. In the upper limb radial means lateral and ulnar means medial: in the lower limb fibular or peroneal means lateral and tibial means medial. The border of a limb on which either the thumb or the big toe is situated is sometimes called preaxial, and the opposite border, postaxial. These two terms are based on the arrangement of the limbs in the embryo during the sixth postovulatory week, when the thumbs and the big toes are both on the rostral border of the limbs).

Medial and lateral rotation (which should never be referred to as internal and external) means rotation (e.g., of the hip) around a vertical axis so that the anterior aspect of the part moves medially or laterally, respectively.

Anterior or ventral means nearer the front of the body. Posterior or dorsal means nearer the back. In the upper limb the term palmar (formerly volar) means anterior. In the foot, plantar means inferior, and the term dorsal is commonly used for superior in the foot.

Superior means nearer the top or upper end of the body. Inferior means nearer the lower end.

Cranial or cephalic is sometimes used in stead of superior, and caudal instead of inferior. Rostral means nearer the "front end," that is, the region of the nose and mouth. this is superior in the most of the body althoug it represents the anterior aspect of the head.

The suffix "-ad" is sometimes added to a positional term to indicate the idea of motion. Thus, cephalad means proceeding toward the head. Such terms are useful occasionally in describing growth processes, but their application is best limited.

In the limbs, proximal and distal are used to indicate, respectively, nearer to and farther from the root or attached end of the limb. (Proximal and distal have a special meaning in the case of the teeth.)

Internal and external mean, respectively, nearer to and farther from the center of an organ or a cavity. Superficial and deep mean, respectively, nearer to and farther from the surface of the body.

The term middle is used for a structure lying between two others that are anterior and posterior, or superior and inferior, or internal and external.

In addition to the technical terms of position and direction, certain common expressions may be cautiously used in anatomical descriptions: front, back, in front of, behind, forward, backward, upper, lower, above, below, upward, downward, ascending, descending. These terms are free of ambiguity only if they are used in reference to the anatomical position. A number of other common terms, such as "under," however, are generally best avoided. In this work we will use technical terms of position and direction.