Human Anatomy

Pengantar Anatomi

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- Anatomi adalah ilmu yang mempelajari tubuh pada berbagai tingkatan.

- Definisi **anatomi** (“I dissect”):

  ilmu yang mempelajari tentang tubuh manusia atau ilmu tentang bentuk (**morfologi**)

- **Fisiologi** merupakan ilmu yang mempelajari tentang fungsi tubuh. Tema: “*Structure Determines Function*” .

Anatomy Terminology

Menguasai bahasa anatomi sangat penting dalam kesuksesan di pelajaran

A. Perhatikan akar bahasa Yunani dan Latin

B. Cara mempelajari bahasa baru ini:

- Buat kartu kosakata dalam bentuk **flashcards**
- Rajin **Praktik** mengucapkan kosakata baru
- Amati bahwa **kata** berbeda bisa digunakan untuk menerangkan struktur yang sama

Metric System (Appendix A)

Panjang, volume dan berat akan diukur dalam unit metrik

- Panjang
- Volume
- Berat

Variabilitas Anatomis

Gambar struktur yang ditunjukkan dalam buku merupakan gambaran struktur yang ditemukan pada sebagian besar tubuh manusia.

Keanekaragaman genetik dapat menyebabkan struktur organ tubuh individu belum tentu serupa.

Cabang Anatomi

- **Gross** anatomy → anatomi makroskopis
- **Microscopic** (histology) anatomy → histologi
- **Developmental** anatomy
- **Embryology** → embriologi
- **Pathological** anatomy
- **Radiographic** anatomy
- **Functional** morphology

Anatomi Makroskopik & Mikroskopik

- Anatomi **Makroskopis** :
  Teknik **- Diseksi** (memotong)

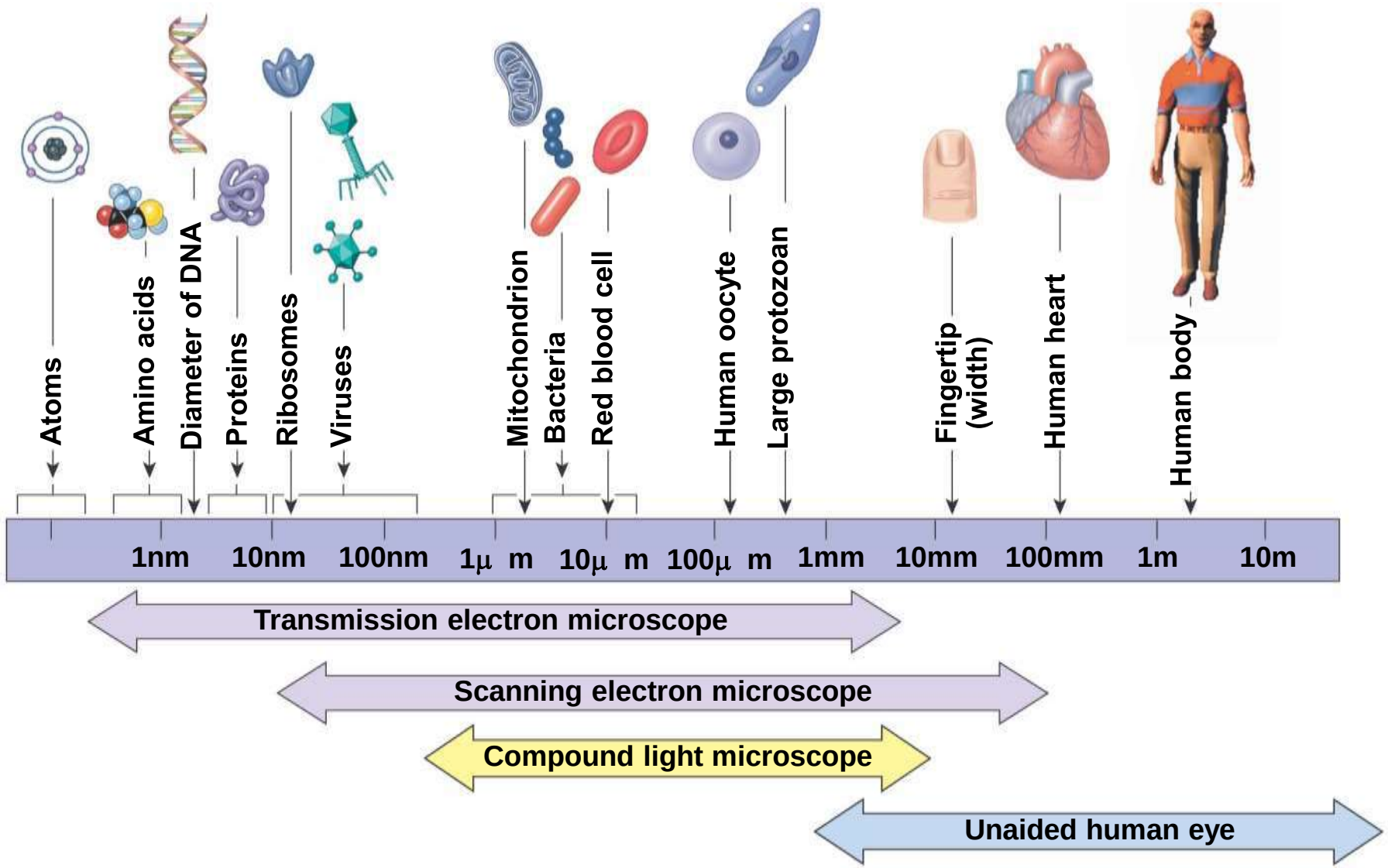
  - Anatomi Regional

  - Anatomi Sistemik

  - Anatomi Permukaan

- **Anatomi Mikroskopik–** mempelajari struktur yang lebih > 0,1 mm
  - Sitologi
  - Histologi

LE 1-1



Tingkat Struktural Organisasi

Kimiawi → unsur penyusun terkecil

Sel → unsur hidup terkecil yang menyusun organisme

Jaringan → kumpulan sel yang sejenis

Organ → kumpulan jaringan yang berbeda

Sistem Organ → kumpulan organ yang berbeda dan menjalankan fungsi tugas tertentu

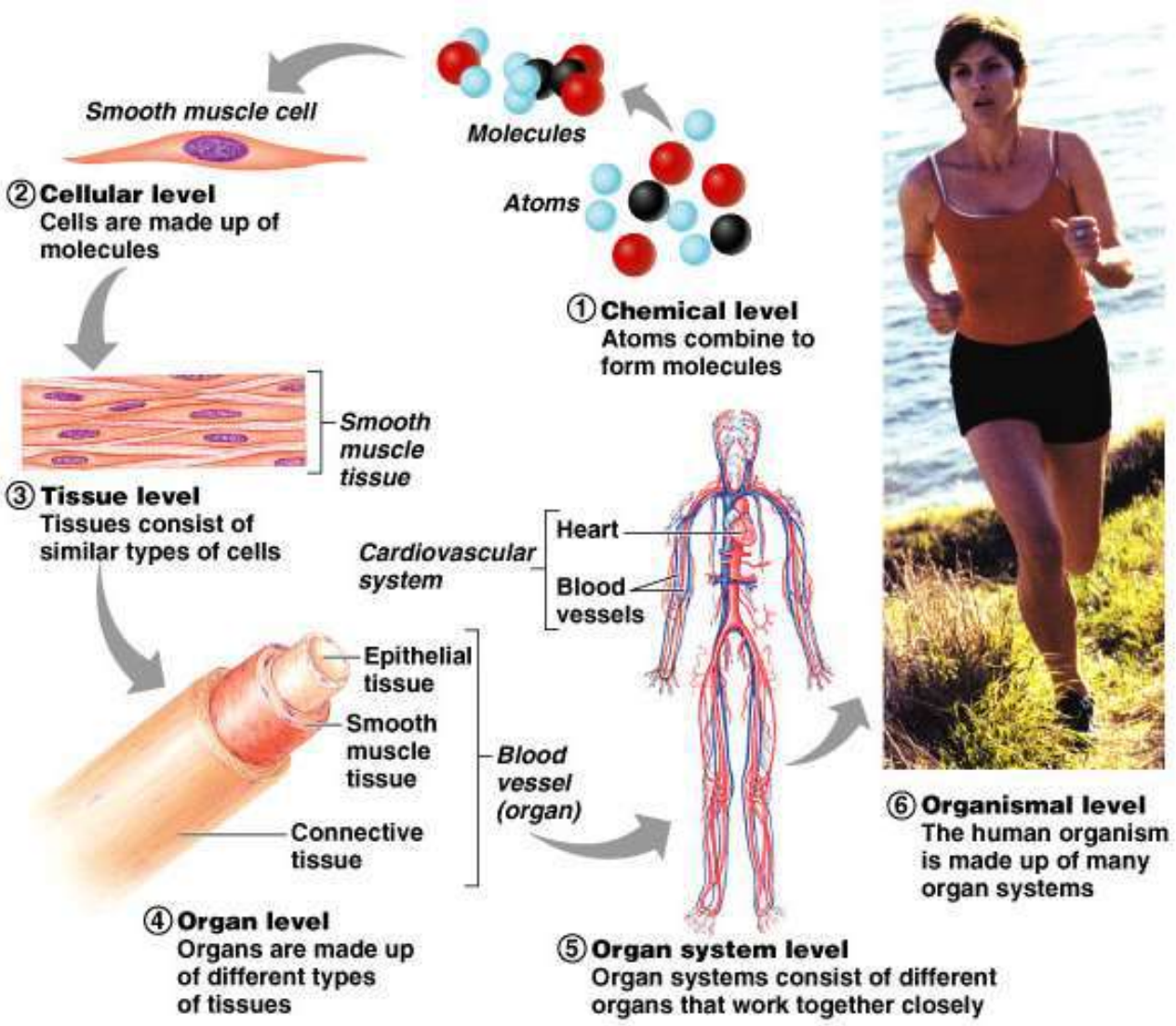
Organisme

- kumpulan dari sistem organ bergabung bersama menjalankan fungsi kehidupan.

- Homeostasis (homeo, unchanging + stasis, standing)

- **Sakit** = kegagalan dalam menjaga homeostasis

Struktur Organisasi



Tingkatan Kimia dan Seluler

- **Tingkatan Kimiawi:**

  Atom - penyusun terkecil dari suatu benda → molecules → gabungan atom.

  Makromolekul - penyusun struktural pada tingkat seluler → Ada empat kelas

- **Tingkatan seluler:**

  Sel– merupakan unit hidup terkecil

Organisasi Seluler

- **Sel-** tersusun dari organela dan sitoplasma yang dikelilingi oleh membran plasma

- Tubuh manusia terdiri dari berbagai tipe sel

  - Sel-sel memiliki spesialisasi menjalankan fungsi khusus

  - Contoh: sel kelenjar usus dan sel saraf

- Struktur dari masing-masing sel berhubungan dengan fungsinya

Tingkatan Jaringan

- **Jaringan-** merupakan sekumpulan sel serupa yang menjalankan fungsi yang sama
- Ada 4 tipe jaringan utama:
  - **Epitelial** (epithelium)
  - **Ikat**
  - **Otot**
  - **Saraf**
- **Histologi**

Tingkatan Organ

- Sebuah **organ** – merupakan sekumpulan 2 atau lebih jaringan yang berbeda tipe

  - Terdapat satu atau lebih jaringan primer dan beberapa jaringan ssekunder

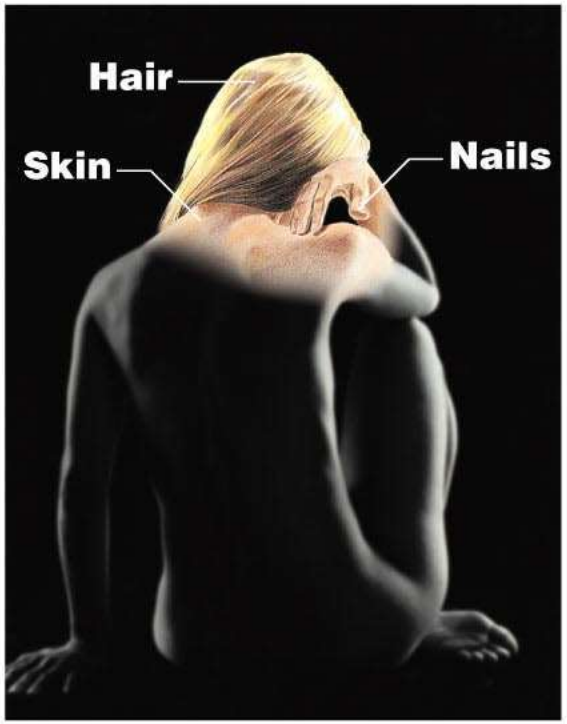
- Contoh: lambung

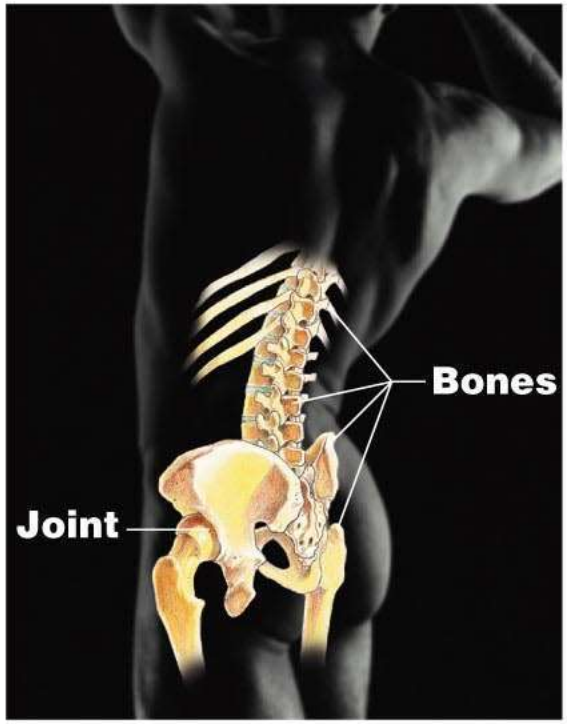
  Jaringan primer – epitel yang melapisi bagian dalam lambung yang terlibat untuk sekresi dan absorpsi.

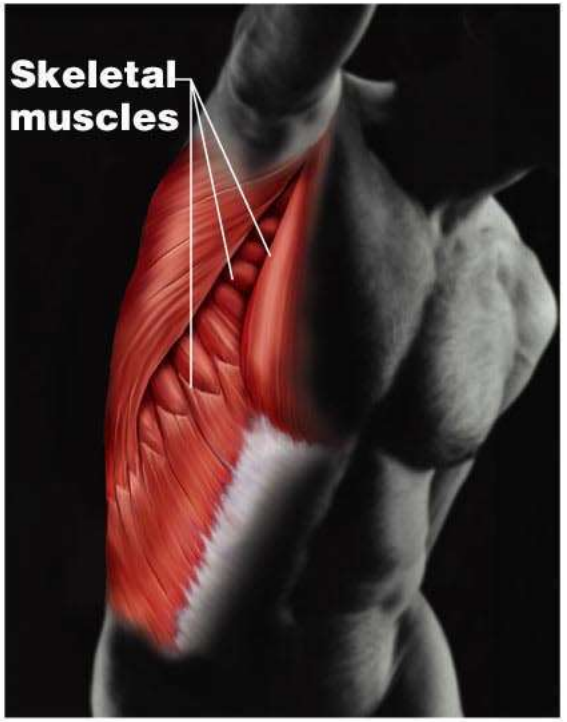
  Jaringan sekunder – jaringan ikat, vaskuler, saraf dan otot

Tingkatan Sistem Organ (Tubuh)

- Sebuah sistem organ atau tubuh terdiri dari berbagai macam organ yang menjalankan fungsi yang sama atau serupa
  - bekerja sama untuk menuntaskan tujuan yang sama
- Terdapat 11 **sistem organ utama** dalam tubuh





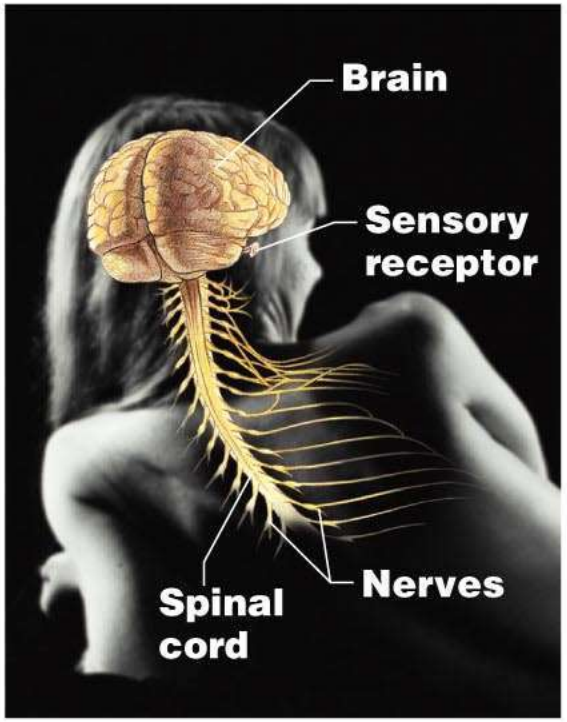


(a) Integumentary System
Forms the external body covering; protects deeper tissues from injury; synthesizes vitamin D; site of cutaneous (pain, pressure, etc.) receptors, and sweat and oil glands.

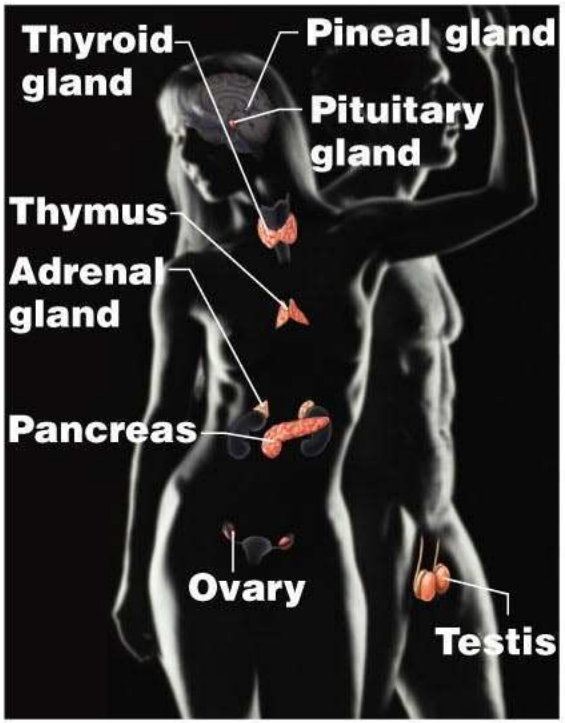
(b) Skeletal System
Protects and supports body organs; provides a framework the muscles use to cause movement; blood cells are formed within bones; stores minerals.

(c) Muscular System
Allows manipulation of the environment, locomotion, and facial expression; maintains posture; produces heat.

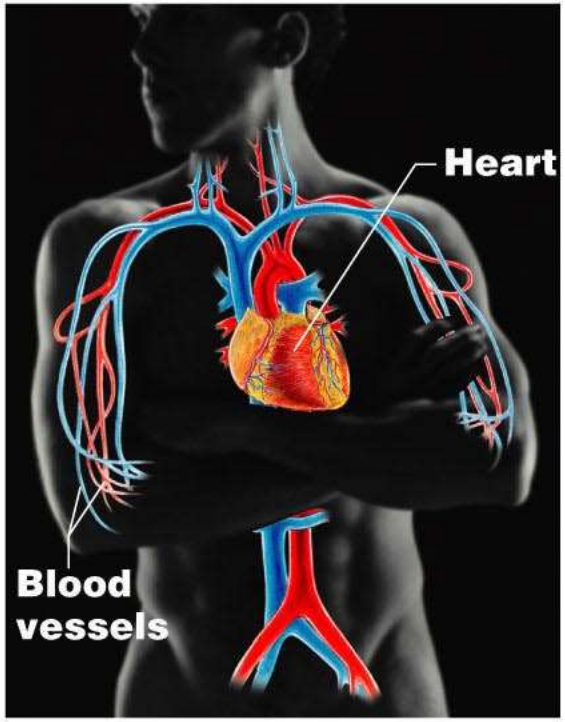
Figure 1.2a–c



(d) Nervous System
Fast-acting control system of the body; responds to internal and external changes by activating a ppropriate muscles and glands.

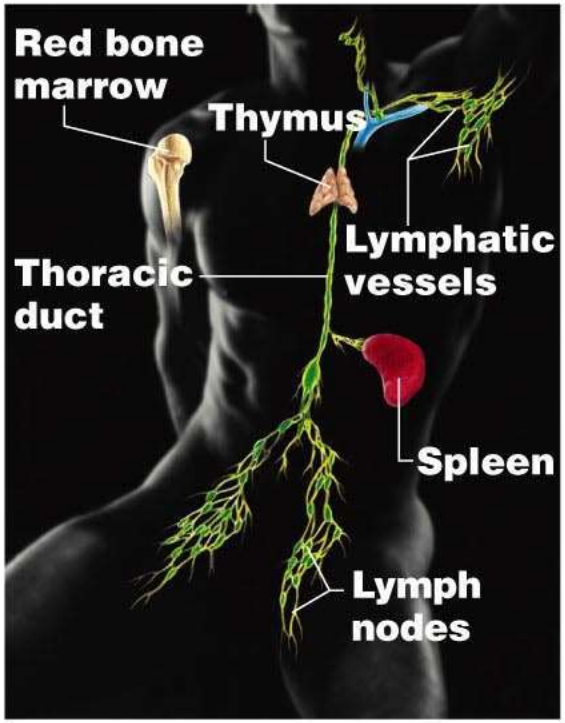


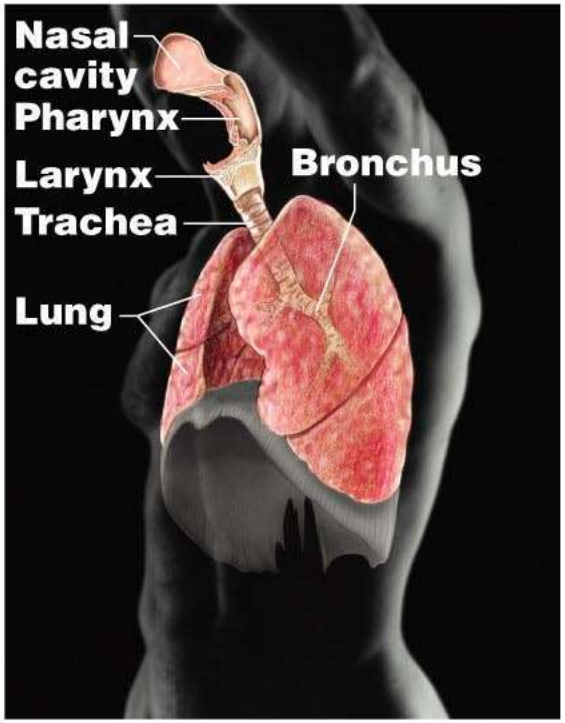
(e) Endocrine System
Glands secrete hormones that regulate processes such as growth, reproduction, and nutrient use (metabolism) by body cells.

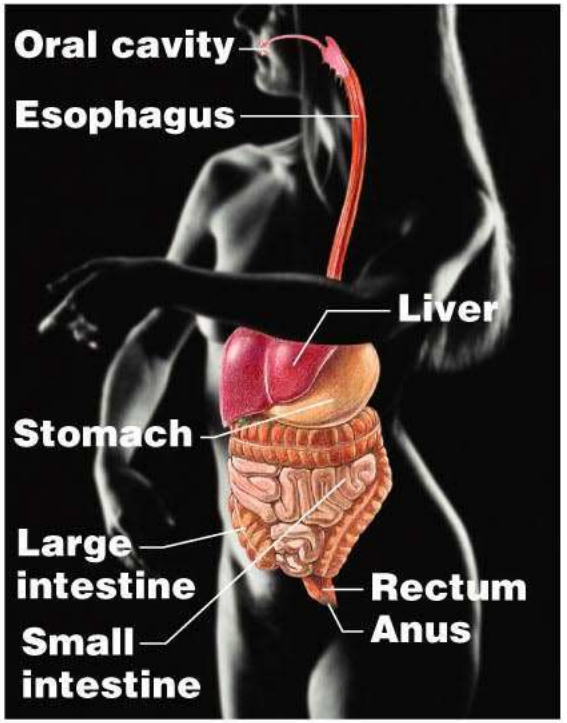


(f) Cardiovascular System
Blood vessels transport blood, which carries oxygen, carbon dioxide, nutrients, wastes, etc.; the heart pumps blood.

Figure 1.2d–f





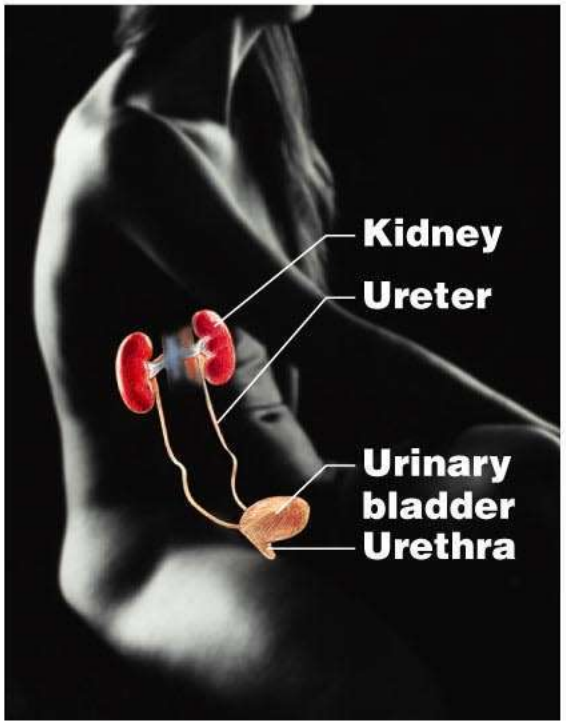


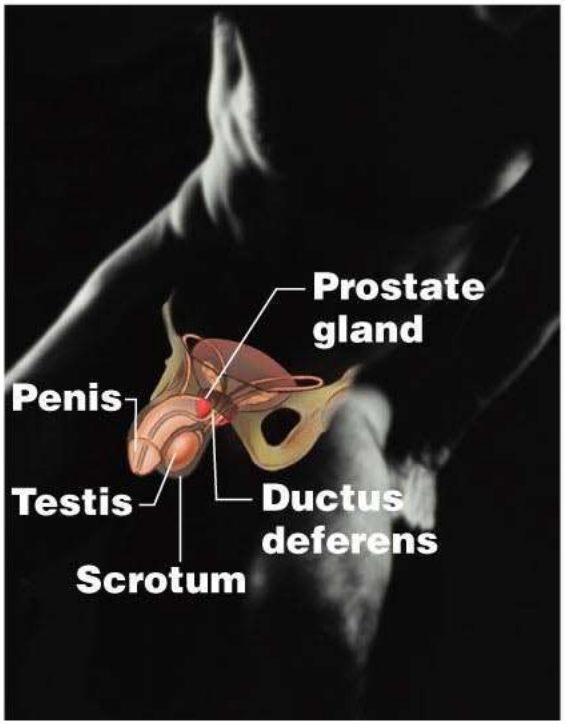
(g) Lymphatic System/ Immunity
Picks up fluid leaked from blood vessels and returns it to blood; disposes of debris in the lymphatic stream; houses white blood cells (lymphocytes) involved in immunity. The immune response mounts the attack against foreign substances within the body.

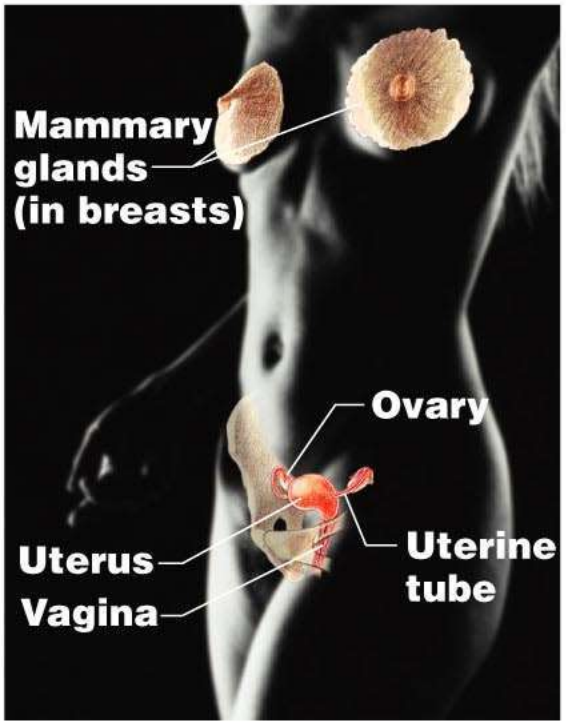
(h) Respiratory System
Keeps blood constantly supplied with oxygen and removes carbon dioxide; the gaseous exchanges occur through the walls of the air sacs of the lungs.

(i) Digestive System
Breaks down food into absorbable units that enter the blood for distribution to body cells; indigestible foodstuffs are eliminated as feces.

Figure 1.2g–i







(j) Urinary System
Eliminates nitrogenous wastes from the body; regulates water, electrolyte and acid-base balance of the blood.

(k) Male Reproductive System

(l) Female Reproductive System

Overall function is production of offspring. Testes produce sperm and male sex hormone; ducts and glands aid in delivery of sperm to the female reproductive tract. Ovaries produce eggs and female sex hormones; remaining structures serve as sites for fertilization and development of the fetus. Mammary glands of female breasts produce milk to nourish the newborn.

Figure 1.2j–l

Posisi Anatomis

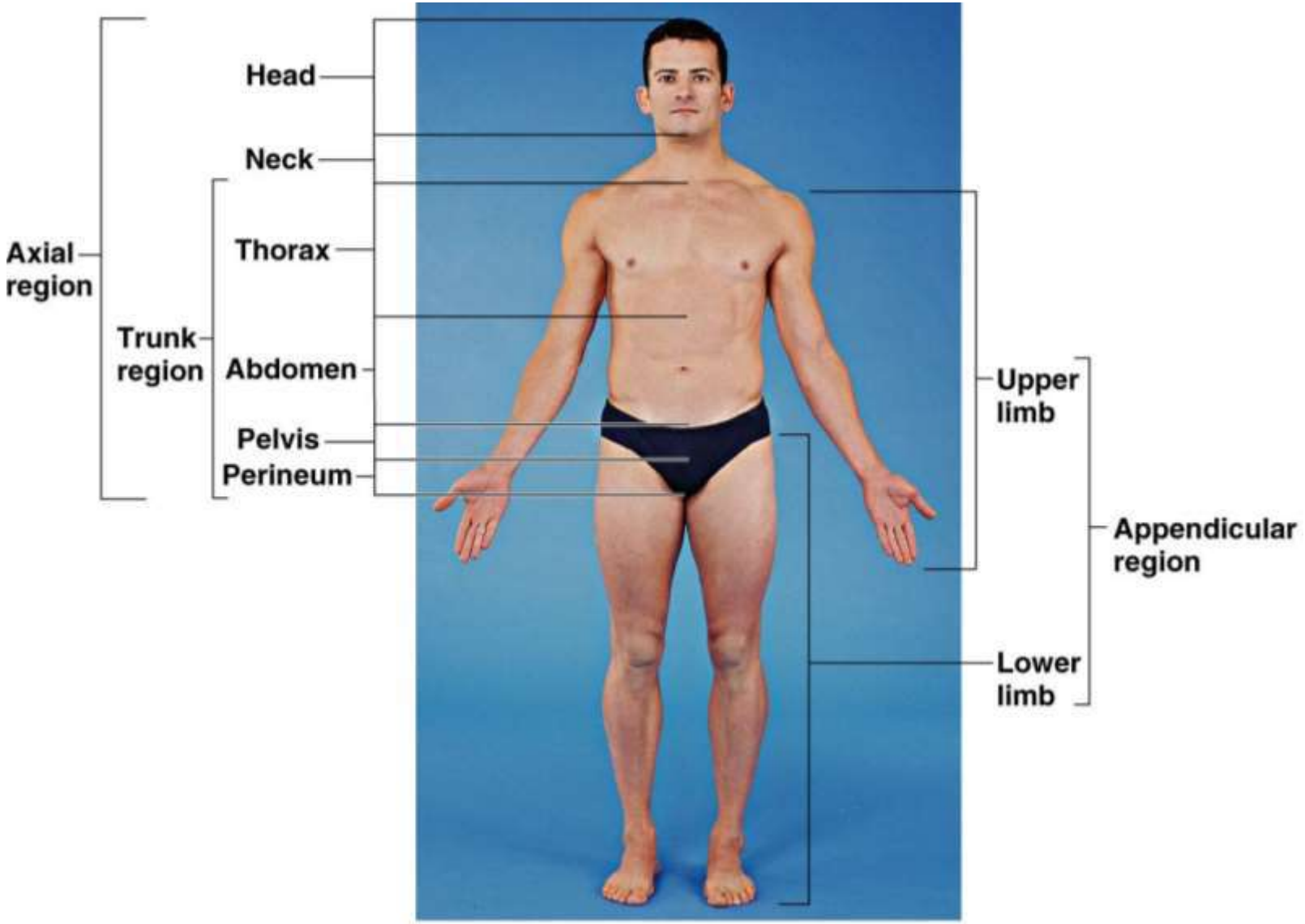


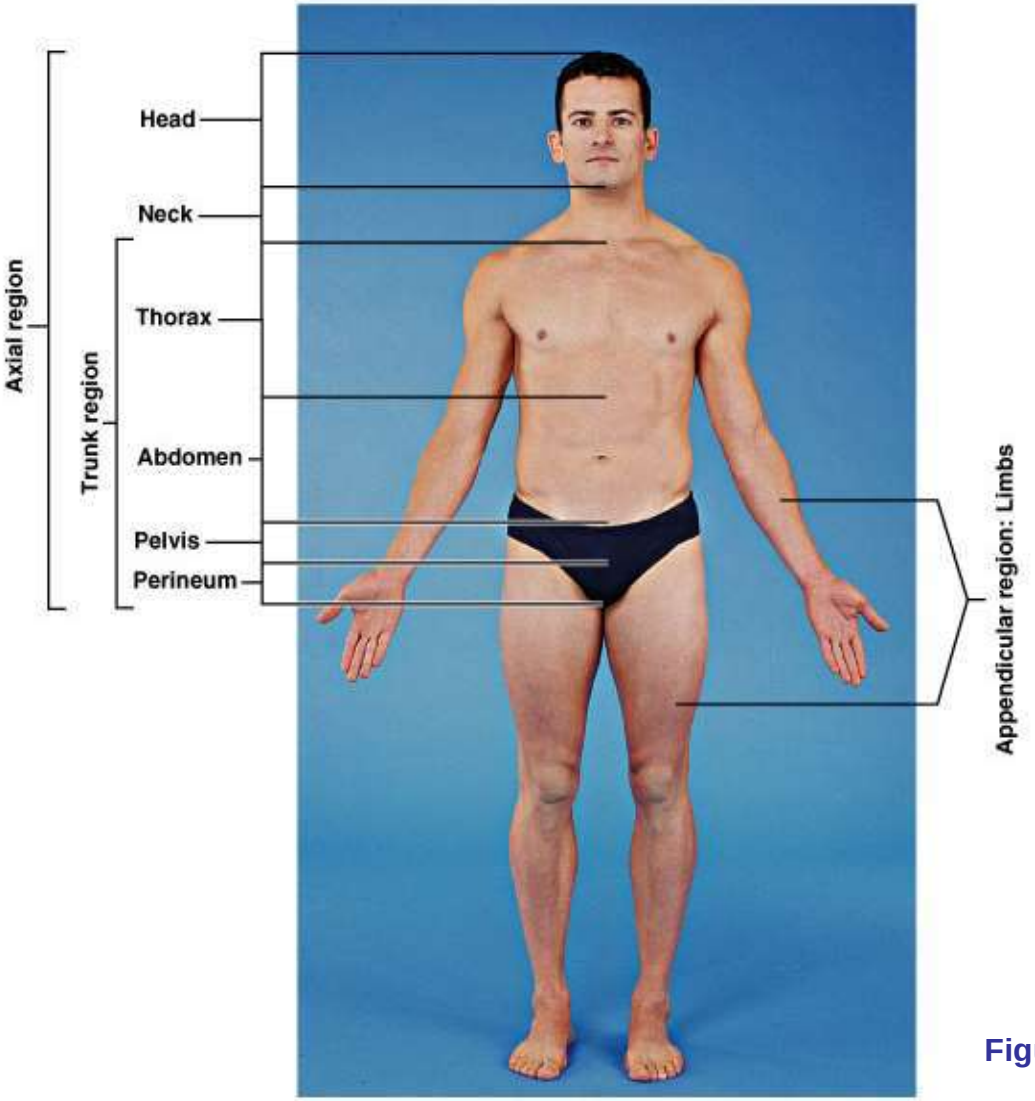
Figure 1.3

Posisi Anatomis

- Seseorang berdiri tegak dengan kaki merapat dan mata melihat ke depan
- Palmar mengahdap depan dengan jempol abduksi
- Sisi sebelah kanan dan kiri ditinjau dari sisi kanan dan kiri si orang atau spesimen yang dilihat – bukan si pengamat

Terminologi Regional

- nama-nama dari area tubuh khusus



Regio Axial (axis utama):

Trunkus dibagi menjadi:

- **Thorax**
- **Abdomen**
- **Pelvis**
- **Perineum**

Regio Appendicularis– Anggota tubuh tambahan/ ekstremitas

- Fundamental subdivisions

Figure 1.3

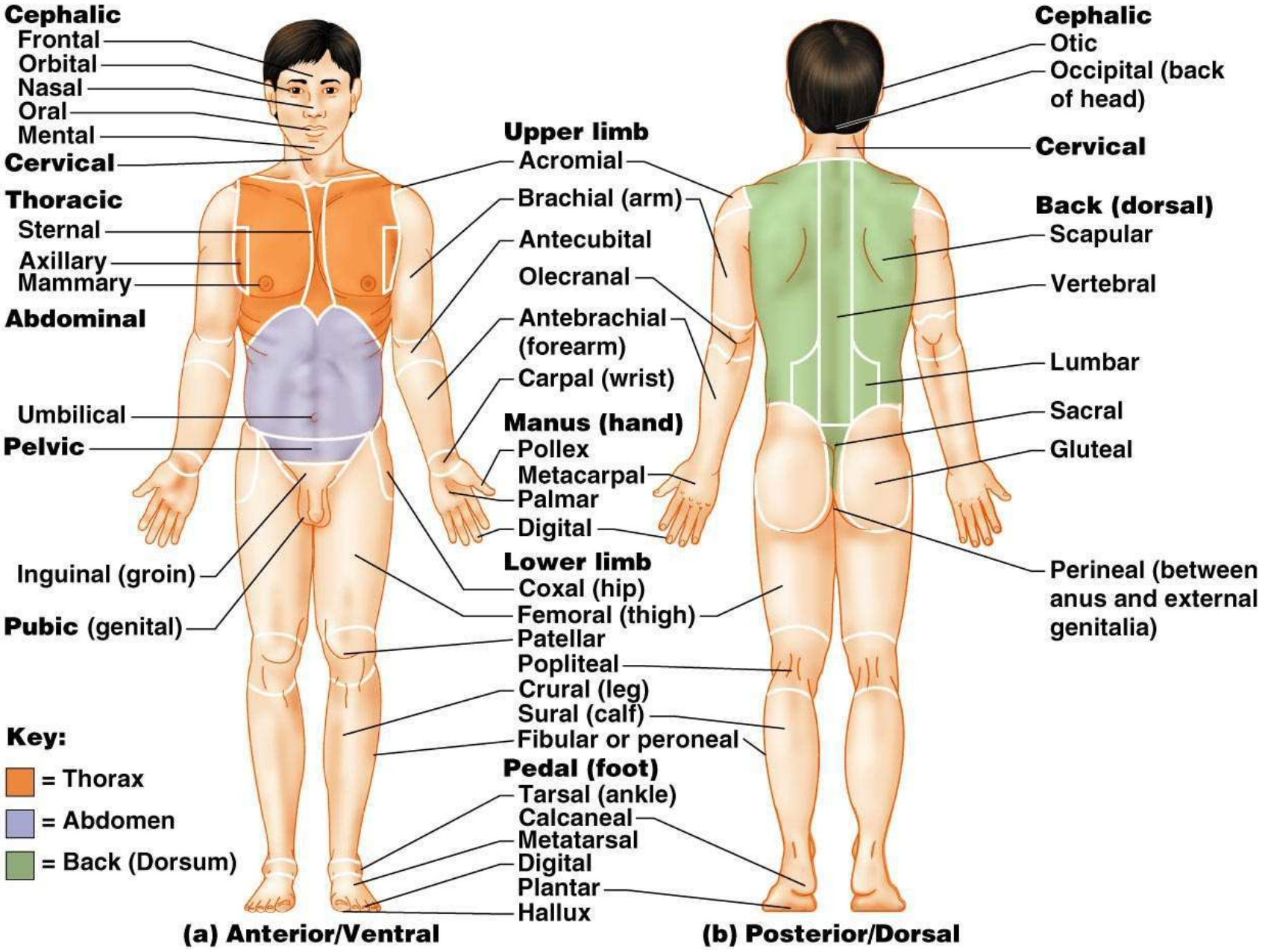

Cephalic
Frontal
Orbital
Nasal
Oral
Mental
Cervical
Thoracic
Sternal
Axillary
Mammary
Abdominal
Umbilical
Pelvic
Inguinal (groin)
Pubic (genital)
Upper limb
Acromial
Brachial (arm)
Antecubital
Olecranal
Antebrachial (forearm)
Carpal (wrist)
Manus (hand)
Pollex
Metacarpal
Palmar
Digital
Lower limb
Coxal (hip)
Femoral (thigh)
Patellar
Popliteal
Crural (leg)
Sural (calf)
Fibular or peroneal
Pedal (foot)
Tarsal (ankle)
Calcaneal
Metatarsal
Digital
Plantar
Hallux
Key:
= Thorax
= Abdomen
= Back (Dorsum)
(a) Anterior/Ventral
Cephalic
Otic
Occipital (back of head)
Cervical
Back (dorsal)
Scapular
Vertebral
Lumbar
Sacral
Gluteal
Perineal (between anus and external genitalia)
(b) Posterior/Dorsal

Figure 1.4

Regio Thoracica

- Bagian atas dari trunkus:
  Mammaria
  Sternalis - thoracica/thoracis/dada
  Axillaris - axilla/ketiak
- **Vertebralis**

Regio Ekstremitas Superior

- **Acromialis** (acromion)
- **Brachialis** (brachium)
- **Cubitalis** (cubitis)
- **Antebrachialis** (antebrachium)
- **Manual** (manus) **- palmaris** and **dorsum**

The manus has 3 main regions:

- **Carpal** (carpus)
- **Metacarpalis**
- **Digitatum atau phalangeal** (jari-jari atau phalanges) **– Pollex** (jempol tangan)

Regio ekstrimitas Inferior

- **Femoralis**/femur
- **Patellar /**patella
- **Popliteal/**popliteus /lutut
- **Crural/**cruris (betis)
  - **suralis/**sura **(**calf), per**oneal/is**peroneus (fibular)
- **Pes** (feet)/ **Pedal** (foot)
  - **planta/**plantar, **dorsum**, **calcaneal/**calcaneus (heel)

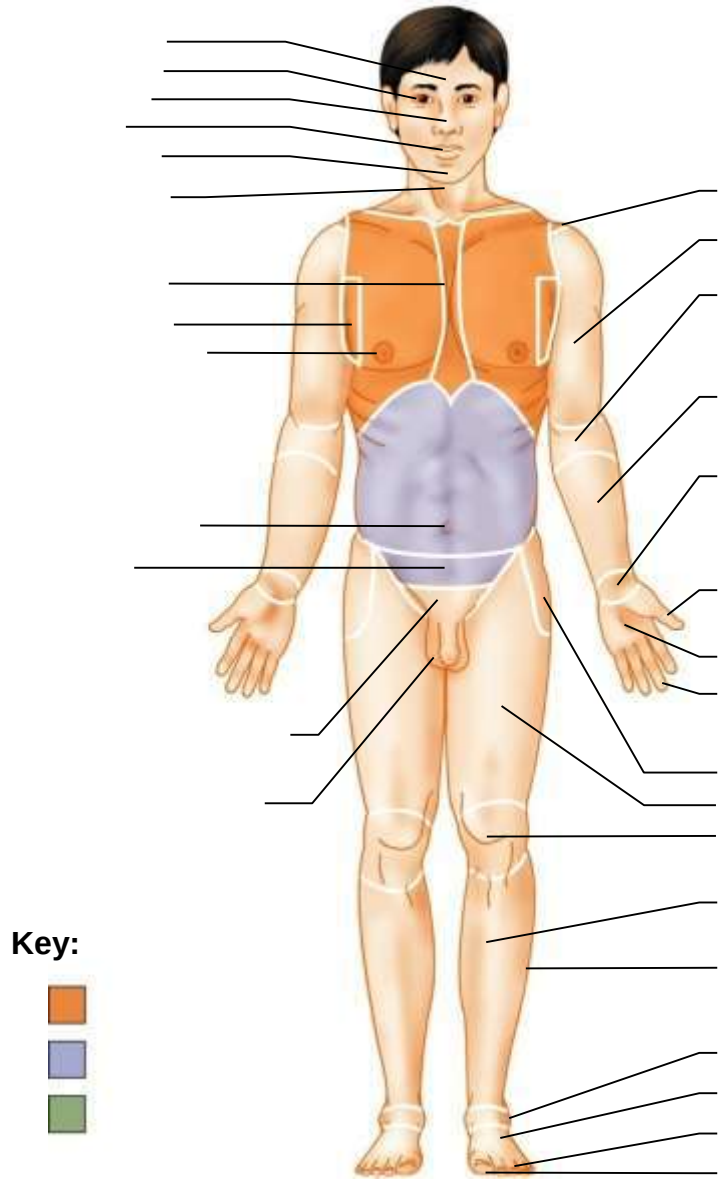
Kaki memiliki 3 sub bagian:

- **Tarsal (**tarsus)
- **Metatarsal**
- **Digitatum atau phalangeal** (jari-jari atau phalanges) **– Hallux** (jempol kaki)

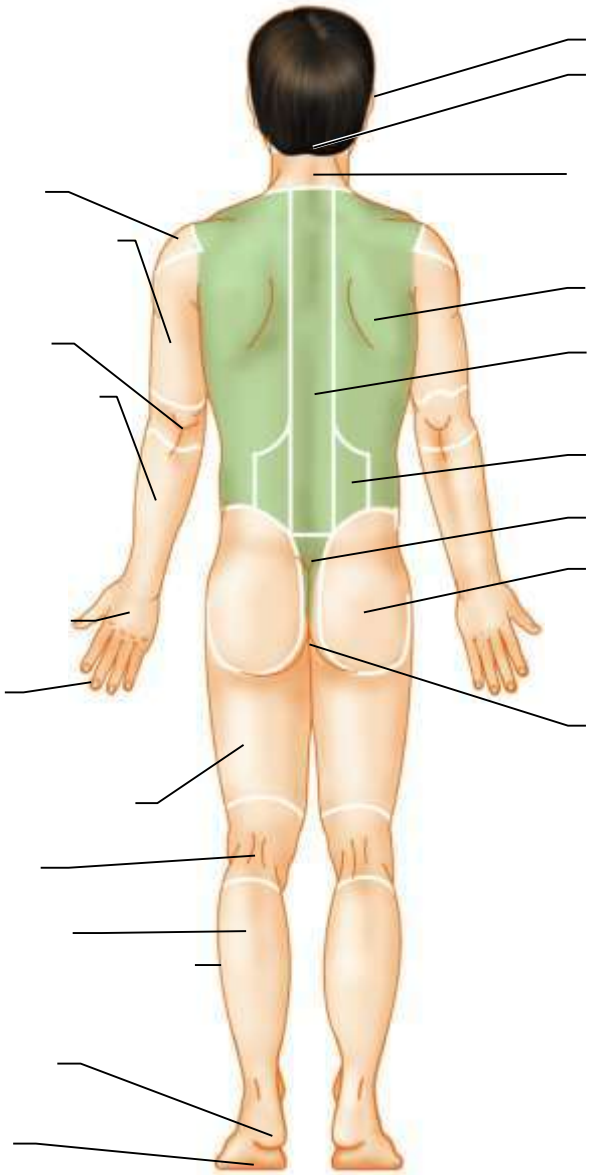
Regio Pelvic/Pelvis

Sebelah inferior dari trunkus:

- **Inguinalis** (inguen)
- **Pubic** (pubis)
- **Perinealis (perineum)**
- **Lumbaris** (lumbus) = pinggang
- **Sacral**
- **Glutealis** (gluteus) = bokong



(a) Anterior/Ventral



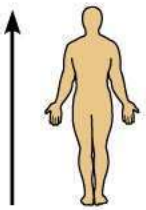
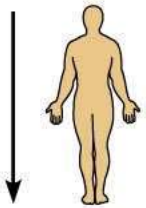
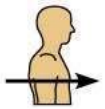
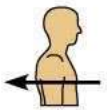
(b) Posterior/Dorsal

Terminologi Direksional

Terms to locate structures and regions - anatomical position:

- **Superior** (cranialis, cephalica)
- **Inferior** (caudalis)
- **Anterior** (ventralis)
- **Posterior** (dorsalis)
- **Medial**
- **Lateral**
- **External** (superficialis)
- **Internal** (ke dalam/profunda)
- **Proximal**
- **Distal**

TABLE 1.1 Orientation and Directional Terms

Term	Definition		Example
Superior (cranial)	Toward the head end or upper part of a structure or the body; above		The head is superior to the abdomen.
Inferior (caudal)	Away from the head end or toward the lower part of a structure or the body; below		The navel is inferior to the chin.
Anterior (ventral)*	Toward or at the front of the body; in front of		The breastbone is anterior to the spine.
Posterior (dorsal)*	Toward or at the back of the body; behind		The heart is posterior to the breastbone.

*Whereas the terms *ventral* and *anterior* are synonymous in humans, this is not the case in four-legged animals. *Ventral* specifically refers to the "belly" of a vertebrate animal and thus is the inferior surface of four-legged animals. Likewise, although the dorsal and posterior surfaces are the same in humans, the term *dorsal* specifically refers to an animal's back. Thus, the dorsal surface of four-legged animals is their superior surface.

TABLE

1.1 Orientation and Directional Terms

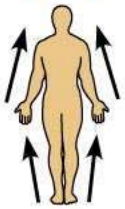
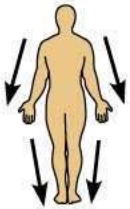
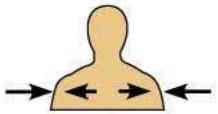
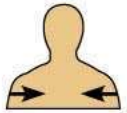
Term	Definition		Example
Medial	Toward or at the midline of the body; on the inner side of		The heart is medial to the arm.
Lateral	Away from the midline of the body; on the outer side of		The arms are lateral to the chest.
Proximal	Closer to the origin of the body part or the point of attachment of a limb to the body trunk		The elbow is proximal to the wrist.
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk		The knee is distal to the thigh.

TABLE 1.1 Orientation and Directional Terms

Term	Definition		Example
Superficial (external)	Toward or at the body surface		The skin is superficial to the skeletal muscles.
Deep (internal)	Away from the body surface; more internal		The lungs are deep to the skin.
Ipsilateral	On the same side		The right hand and right foot are ipsilateral.
Contralateral	On opposite sides		The right hand and left foot are contralateral.

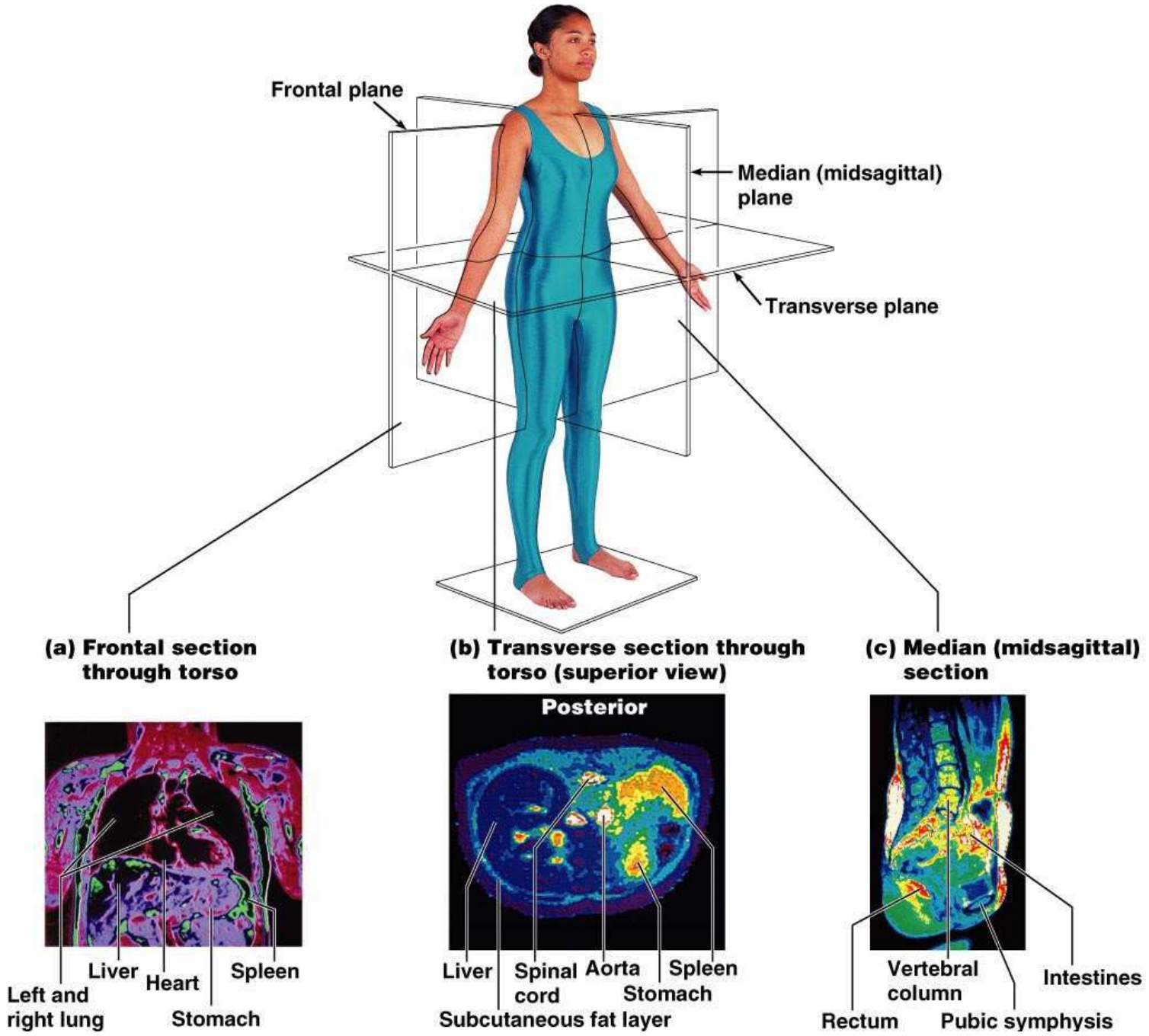
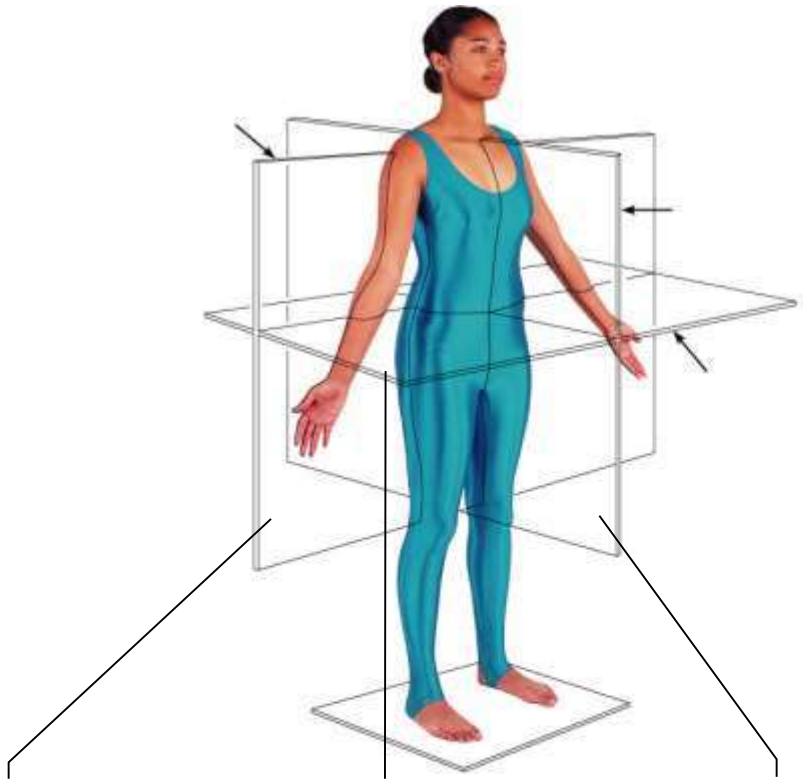

Frontal plane
Median (midsagittal) plane
Transverse plane
(a) Frontal section through torso
(b) Transverse section through torso (superior view)
(c) Median (midsagittal) section
Posterior
Liver
Heart
Spleen
Left and right lung
Stomach
Liver
Spinal cord
Aorta
Spleen
Stomach
Subcutaneous fat layer
Vertebral column
Intestines
Rectum
Pubic symphysis

Figure 1.5

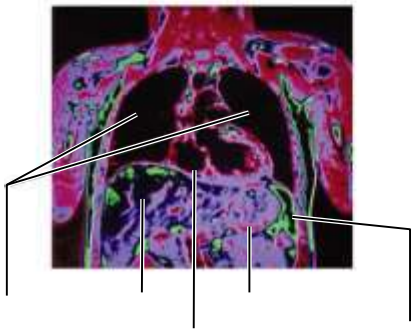
Bidang Tubuh

Irisan tubuh – terdapat 4 **planum utama**:

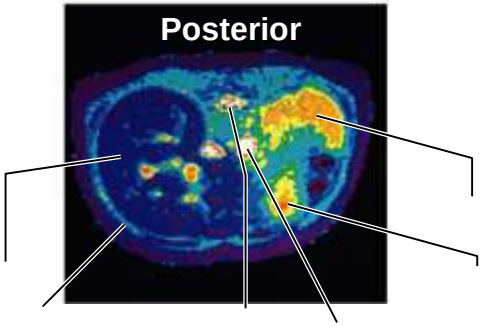
- **Planum sagittalis – Midsagittal/Parasagital**
- **Planum Coronalis** (frontalis)
- **Planum Transversum**
- **Sectio Obliqua**



(a)



(b)



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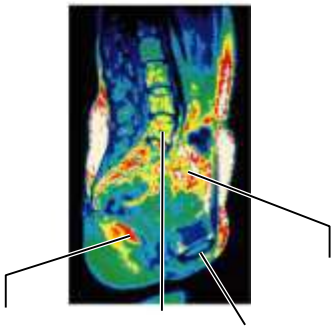


Cavitas Tubuh

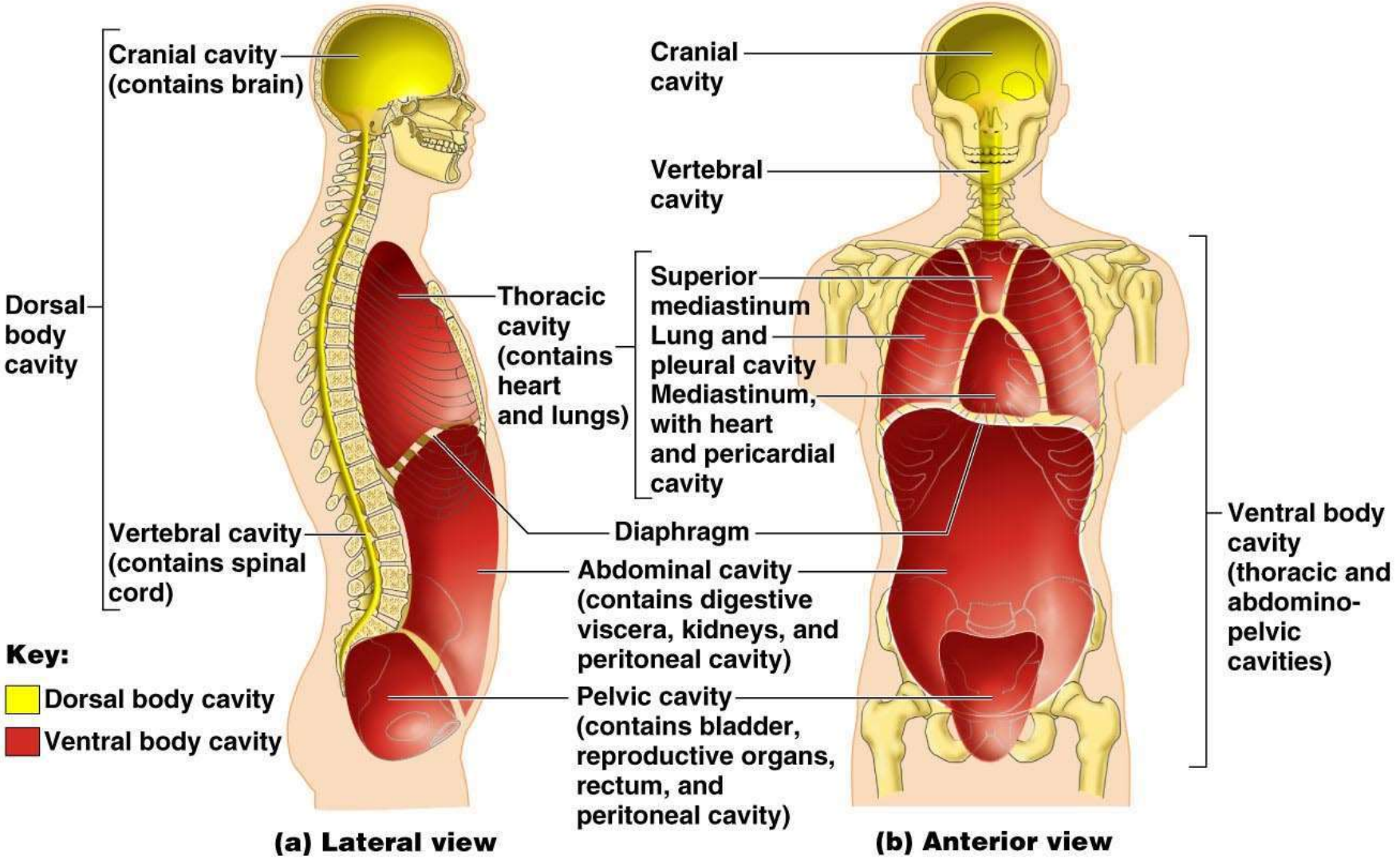


Figure 1.9

Rongga Tubuh **Dorsal**

- Cavitas **Cranialis**
- Cavitas **Vertebral**

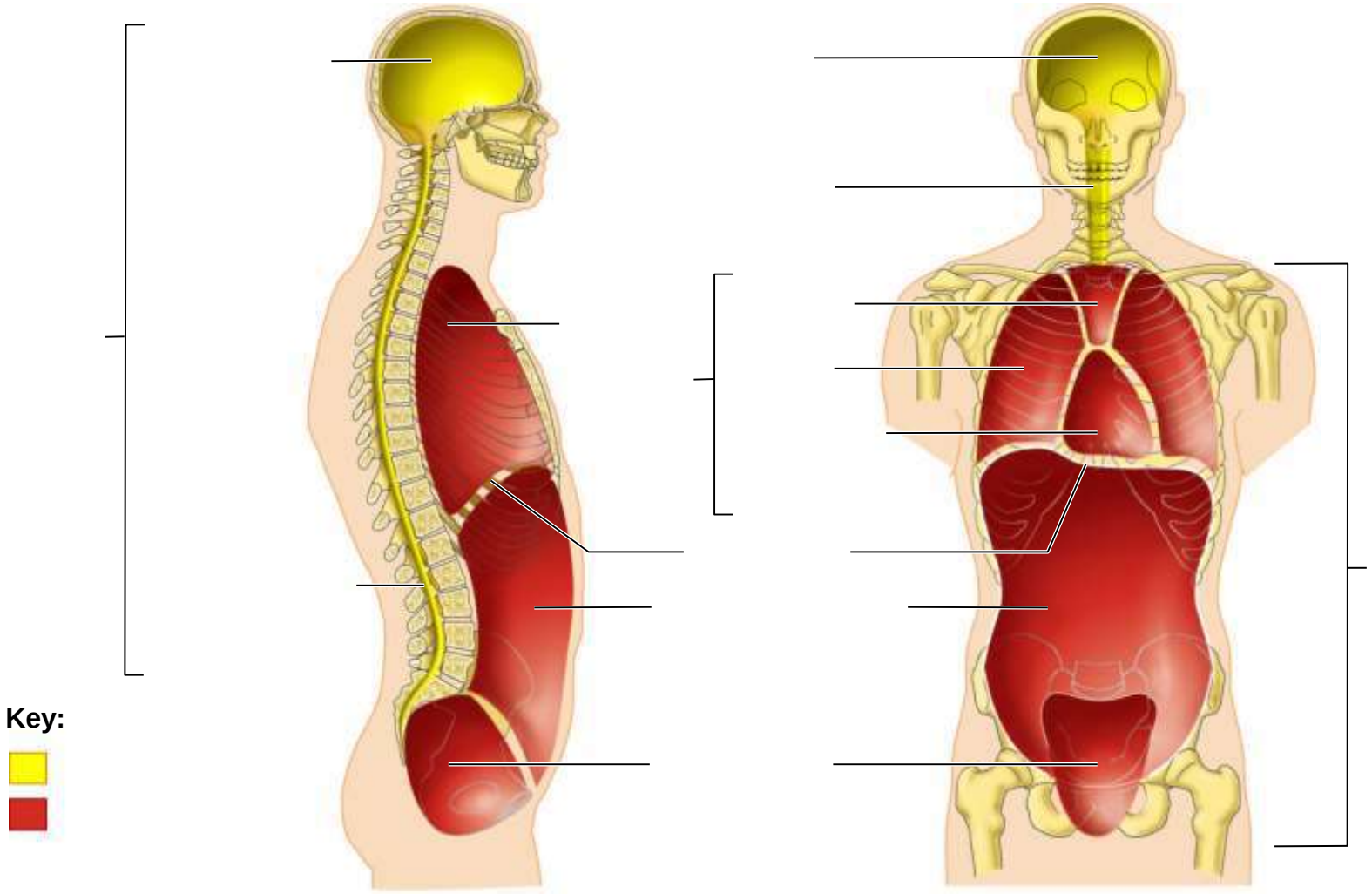
Rongga Tubuh **Ventral–** berisi organ visera

Terdiri dari 2 sub bagian :

- Cavitas **Thoracica** berisi cavitas **pleuralis** dan **mediastinum**

- Cavitas **Abdominopelvicalis** (dibatasi oleh dinding abdomen dan cincin pelvis)

  dibagi menjadi 2 bagian: cavitas **abdominalis** dan **pelvis**



(a) Lateral view

(b) Anterior view

Cavitas Diafragma dan Peritonealis

- Otot **Diafragma**

  - memisahkan cavitas thoracica dan abdominopelvicalis

- Cavitas **Abdominopelvicalis**

  – banyak organ dikelilingi oleh **cavitas peritonealis**

- Cavitas **Serosa** - ruangan yang dibatasi oleh membrana serosa
  - Cavitas **Pleural**
  - Cavitas **Pericardium**
  - Cavitas **Peritoneum**
- Serosa **Parietalis**– bagian dinding terluar dari cavitas dan berhubungan dengan serosa interna
- Serosa **Visceralis**– menutupi organ-organ viseralis
- **Cairan Serous**– pelumas berair yang disekresi oleh kedua membran serosa

Pericardialis, Pleuralis, Peritonealis

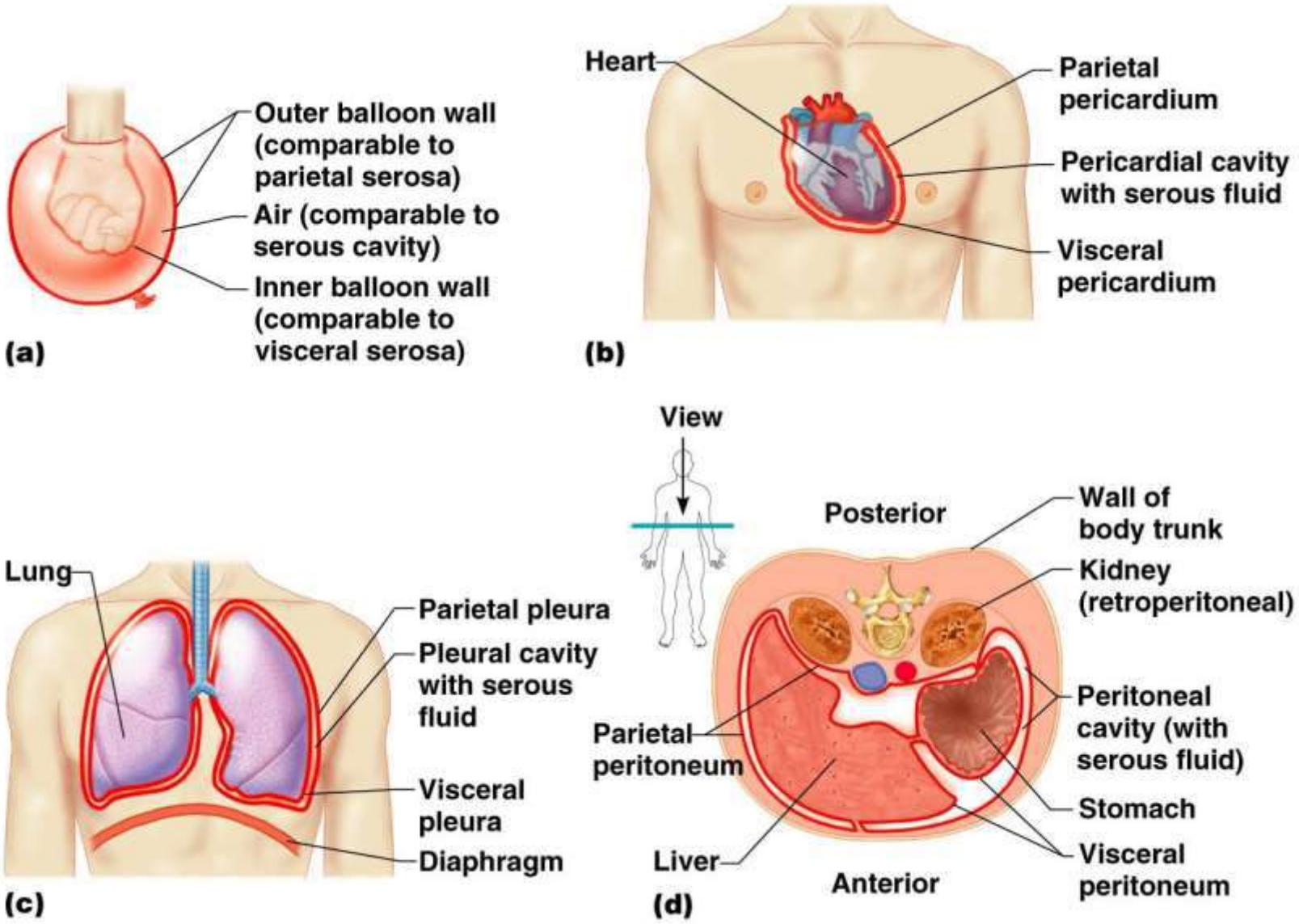
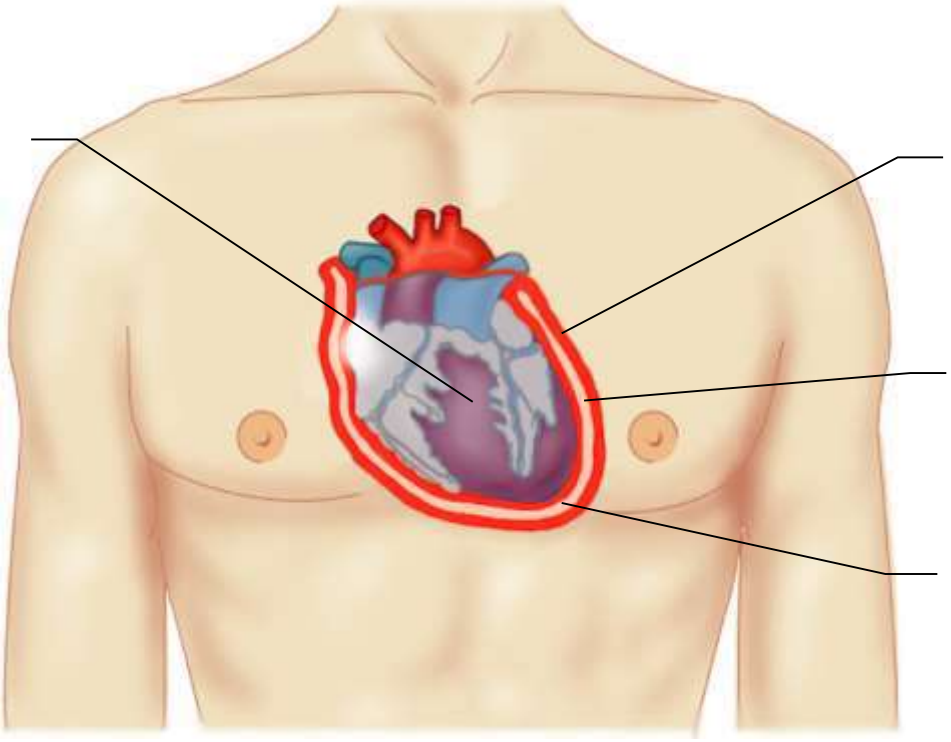
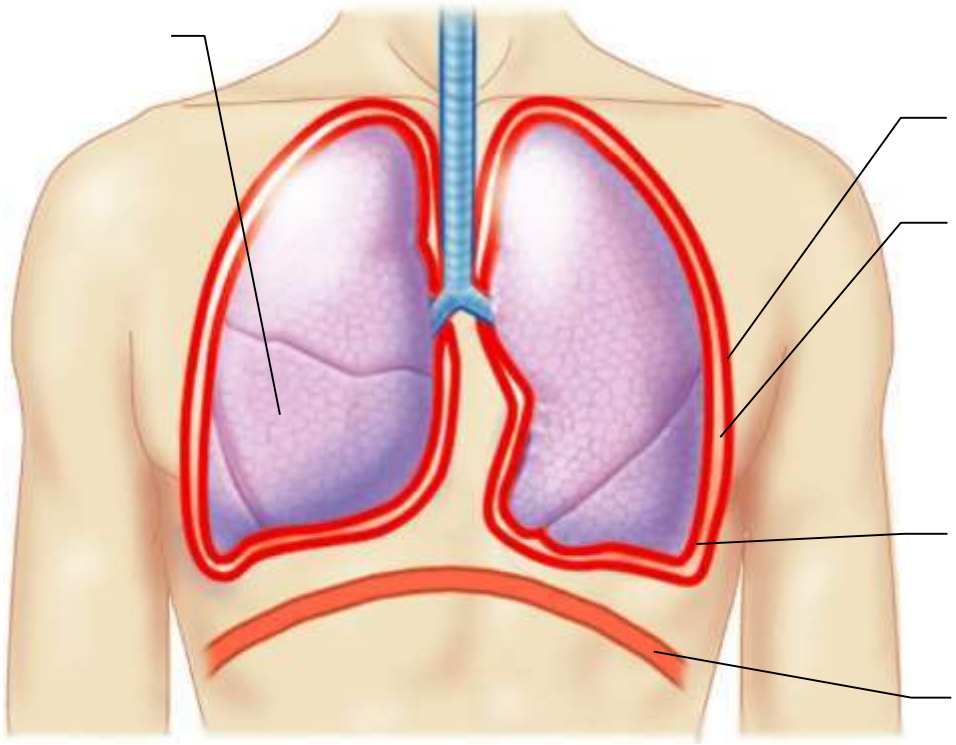


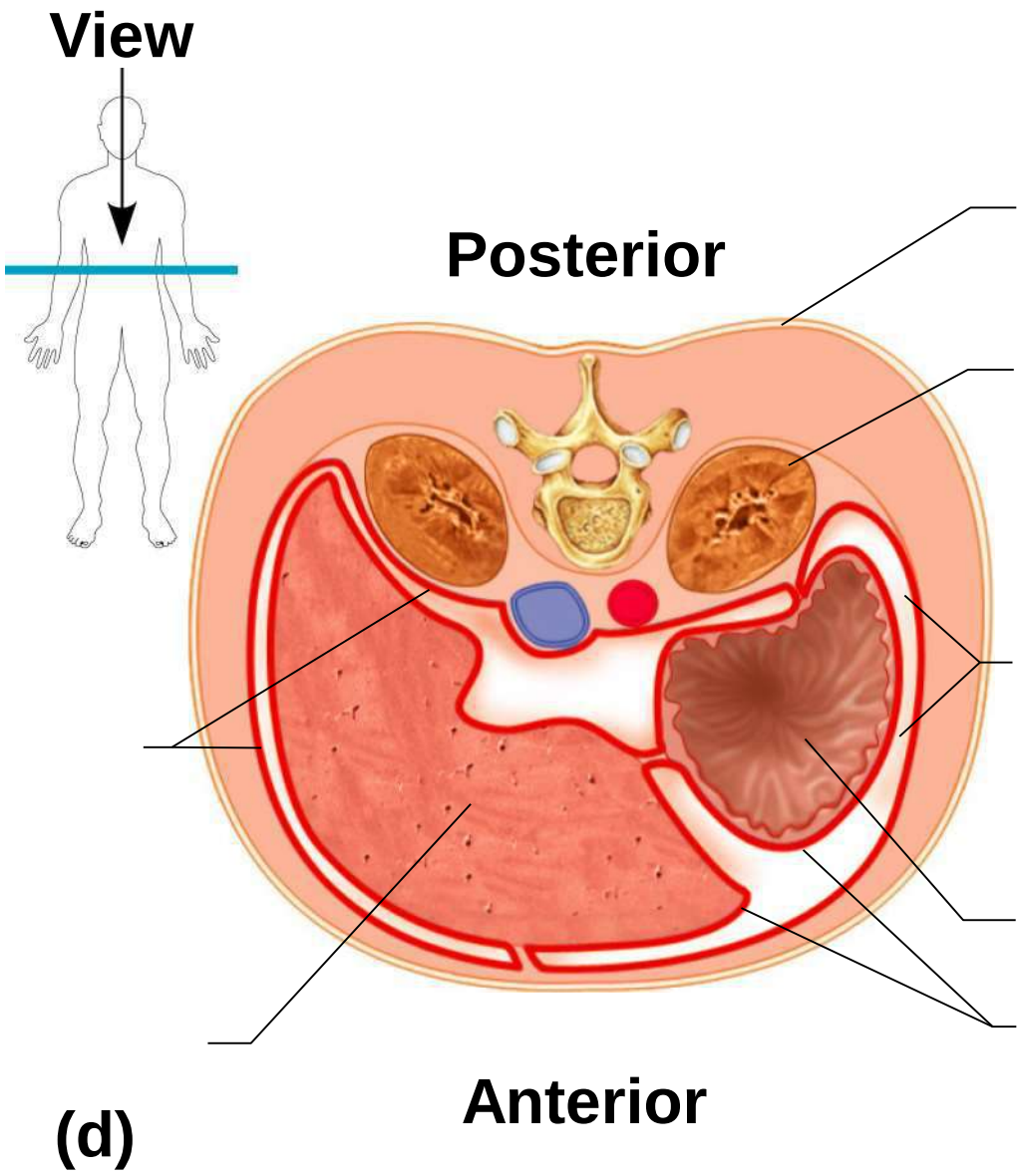
Figure 1.10



(b)



(c)


View
Posterior
Anterior
(d)

Cavitas lain

- Cavum **Oris** (mulut)
- Cavum **Nasi**
- Cavum **Orbital**
- Cavitas **Tympanica**
- Cavitas **Synovialis** (sendi)

Cavitas Lain

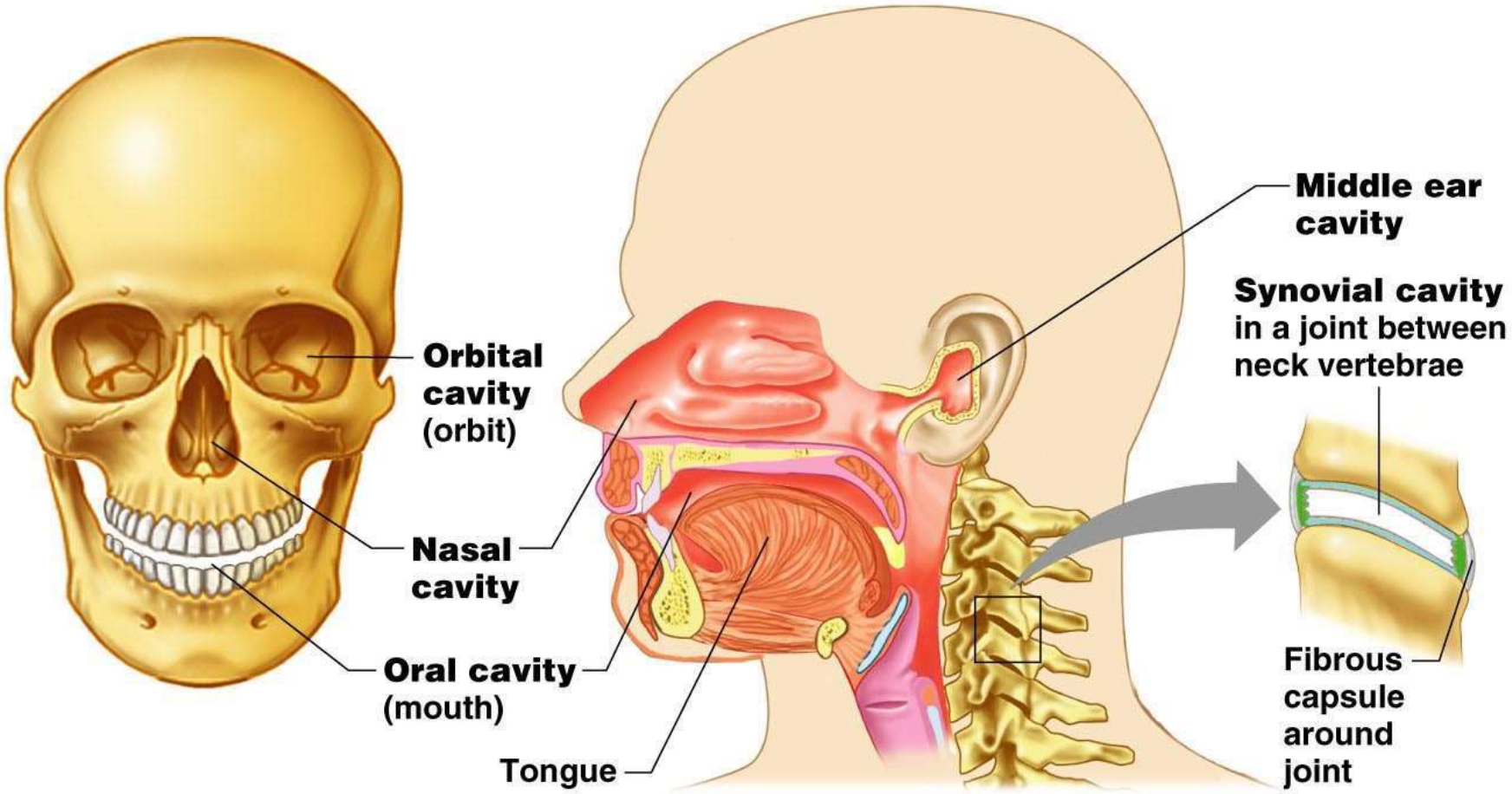
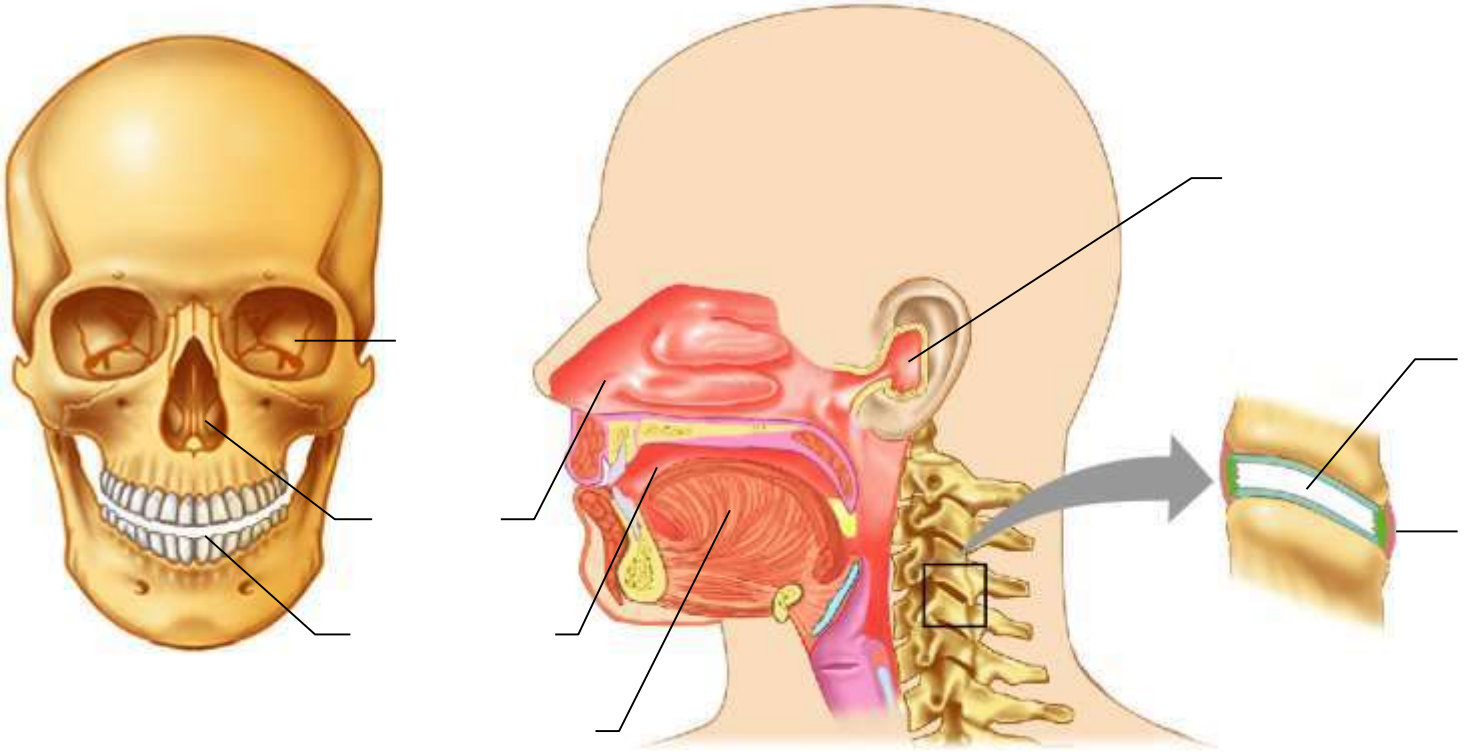


Figure 1.11



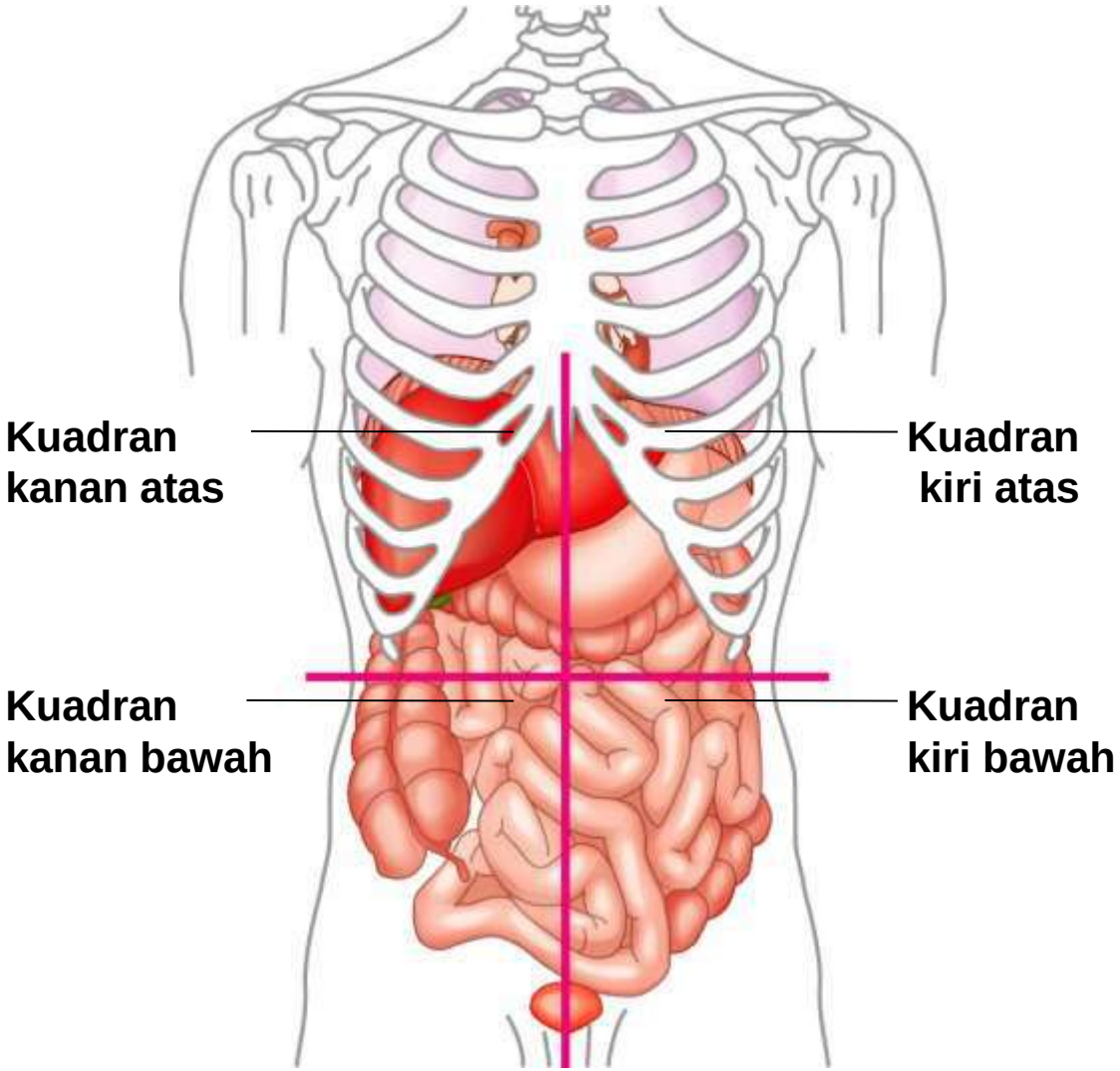
Regio Abdominopelvicalis

- Untuk mempermudah mempelajarinya maka regio abdominopelvicalis dibagi menjadi regio-regio dan kuadran-kuadran
- Ada 4 kuadran:

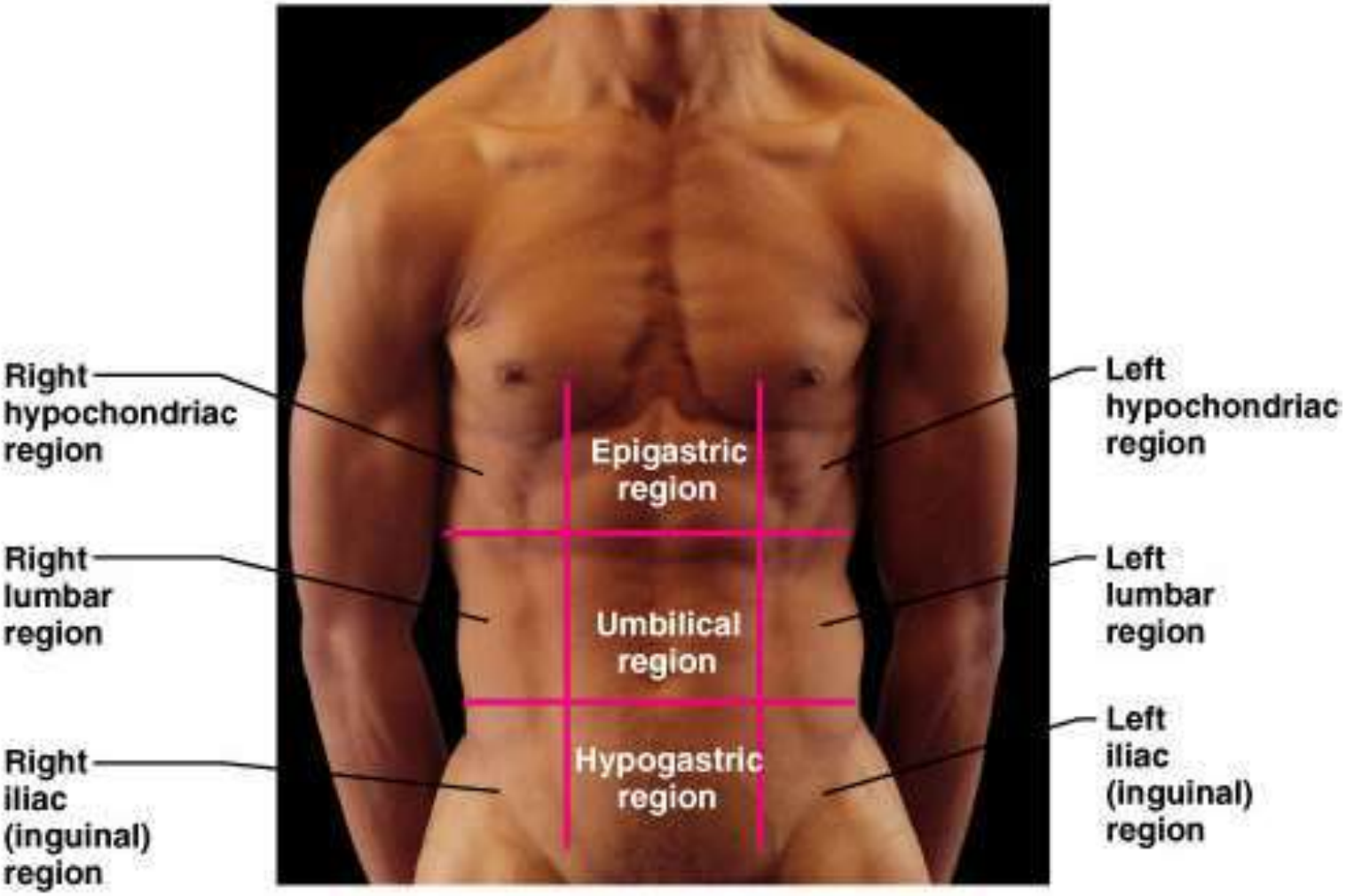
  kuadran kanan atas dan kiri atas

  kuadran kanan bawah dan kiri bawah

Kuadran Abdomen

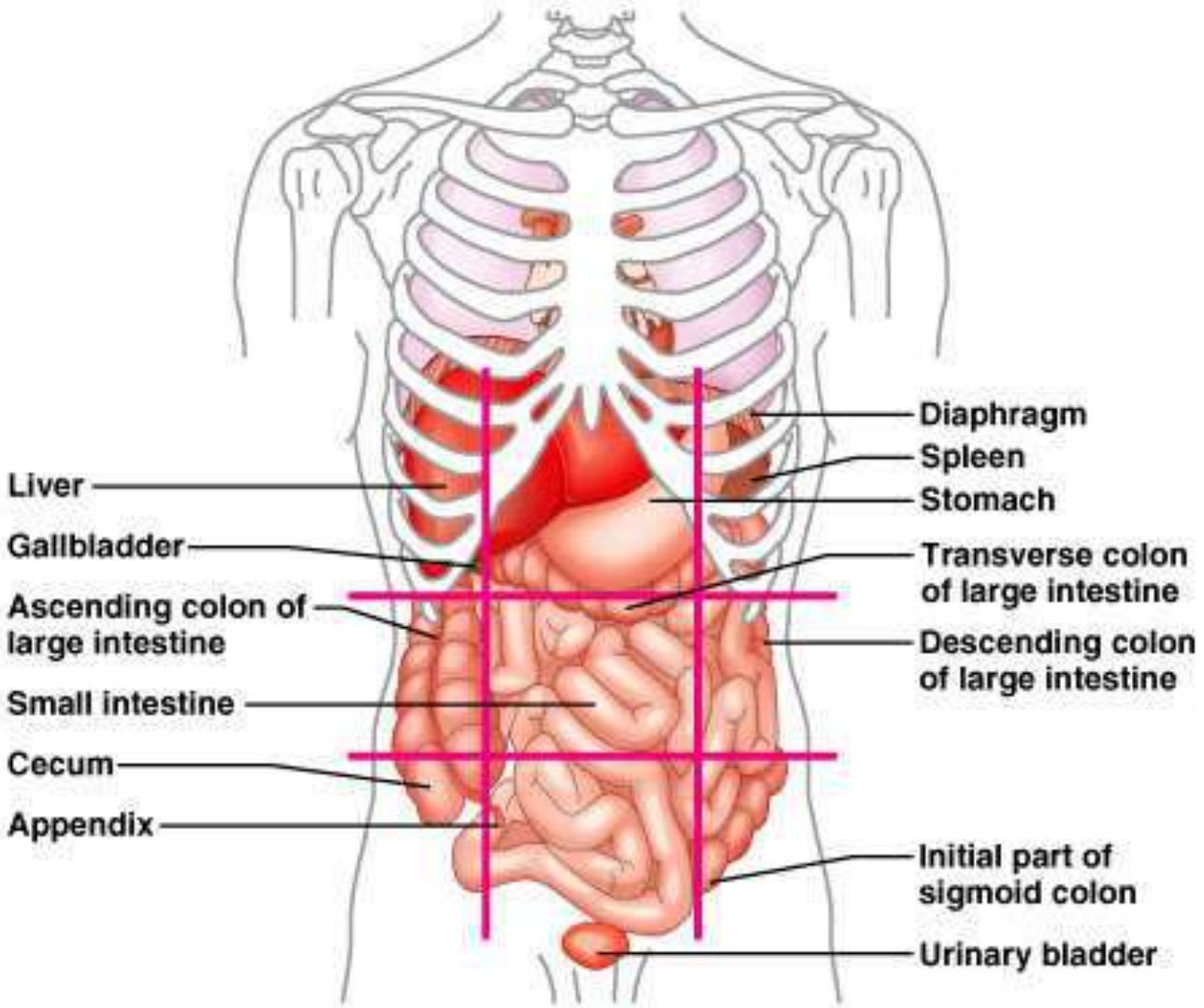


Sembilan Regio Abdomen

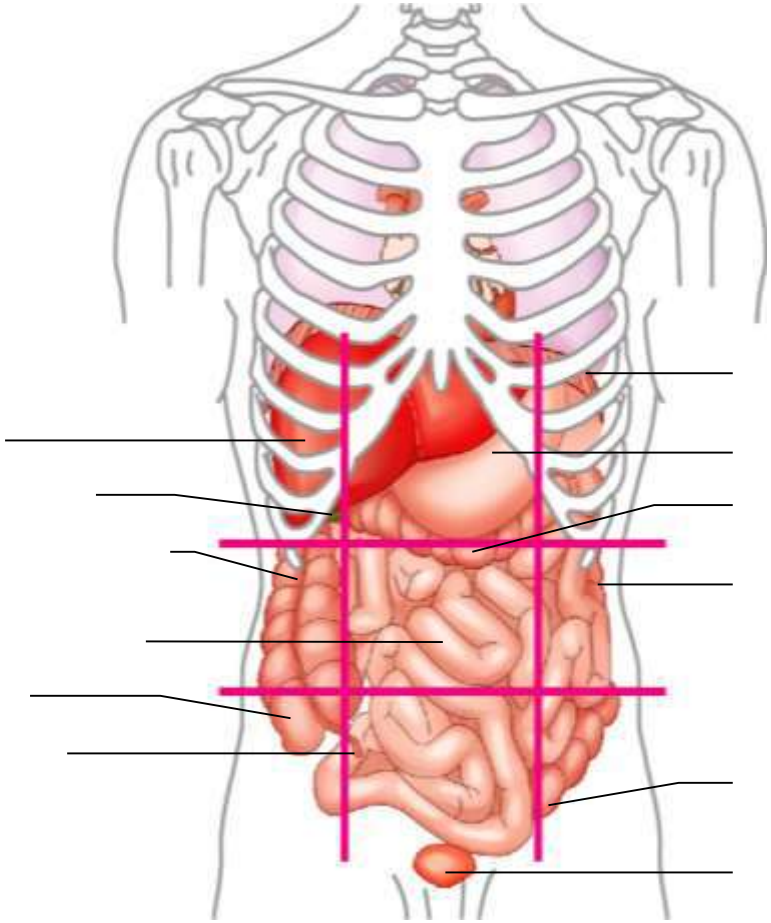


Pembagian 9 regio berfungsi untuk deskripsi letak organ interna

Organ di Regio Abdomen



- **Hypochondriaca dekstra**- right, upper 1/3; gallbladder, liver, r. kidney
- **Epigastrium** - Upper, central 1/3; liver, stomach, pancreas, duodenum
- **Hypochondriaca Sinistra** - left, upper 1/3; spleen, colon, liver, l. kidney, small intestine
- **Lumbaris Dekstra** - right, lateral 1/3; cecum, ascending colon, liver, r. kidney, small intestine
- **Umbilicalis** - center; umbilicus (navel) is located here; jejunum, ileum, duodenum, colon, kidneys, major abdominal vessels
- **Lumbaris Sinistra**- left, lateral 1/3; descending colon, l. kidney, small intestine
- **Iliaca dekstra**(inguinalis) **-** right, lower 1/3; appendix, cecum, small intestine
- **Hypogastrica** (pubis) - lower, center 1/3; urinary bladder, small intestine, sigmoid colon, female reproductive organs
- **Iliaca sinistra**(inguinal) - left, lower 1/3; small intestine, descending colon, sigmoid colon



Microscopic Anatomy

- Form of anatomy known as **histology -** the study of tissue and their cells (**cytology**)
- Microscopy is used to investigate the fine structure of organs, tissues, and cells

Note - specialized cells form different types of tissues, thus different tissues do not look or function in the same way

Illness or physiological problems experienced in the body occur at the cellular level

2 types of microscopes – light and electron

- **Light (LM)**: uses a beam of light

  - produces sharp, detailed images of sectioned tissues and cells but has **low resolution**

- **Electron (TEM or EM)**: uses electron beams

  - much smaller wavelength to produce sharp images

  - show finer detail but are flat and colorless

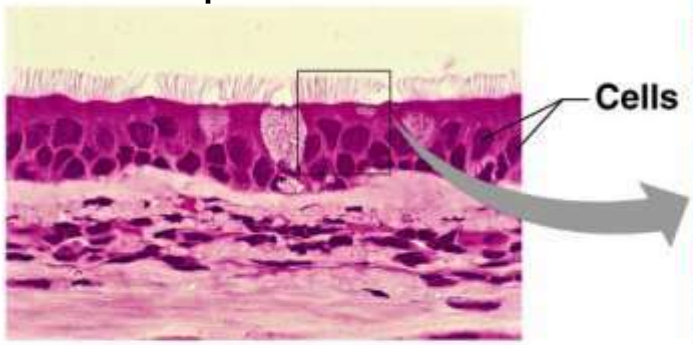
  - Scanning electron microscopes: electron beam scans the specimen causing secondary electrons to be emitted

  - specimens are preserved and coated with metal

  - provides 3-D pictures of whole, unsectioned surfaces

Light and Electron Microscopy

Ciliated epithelium



(a) Light micrograph (330X)

(b) Transmission electron micrograph (1700X)

(c) Scanning electron micrograph (3300X)

Figure 1.13

Preparing Human Tissue

- 1st - specimens are **fixed** (preserved)
- 2nd - **sectioned** (thinly sliced)
- 3rd - **stained** (color stains or metals added)

Note -Type of stain used depends on the microscope

- *Light microscopy – organic dyes*
  - acidic and basic stains
- *Electron microscopy – heavy-metal salts*
  - deflect electrons
  - color property of light

Artifacts (distortions)

- As you study specimens under the microscope or by an unaided eye structures may not strictly represent that of those in living tissue
- Process of preserving and staining alters the tissues and may create artifacts or distortions

Clinical anatomy and medical imaging techniques
- noninvasive diagnostic tools

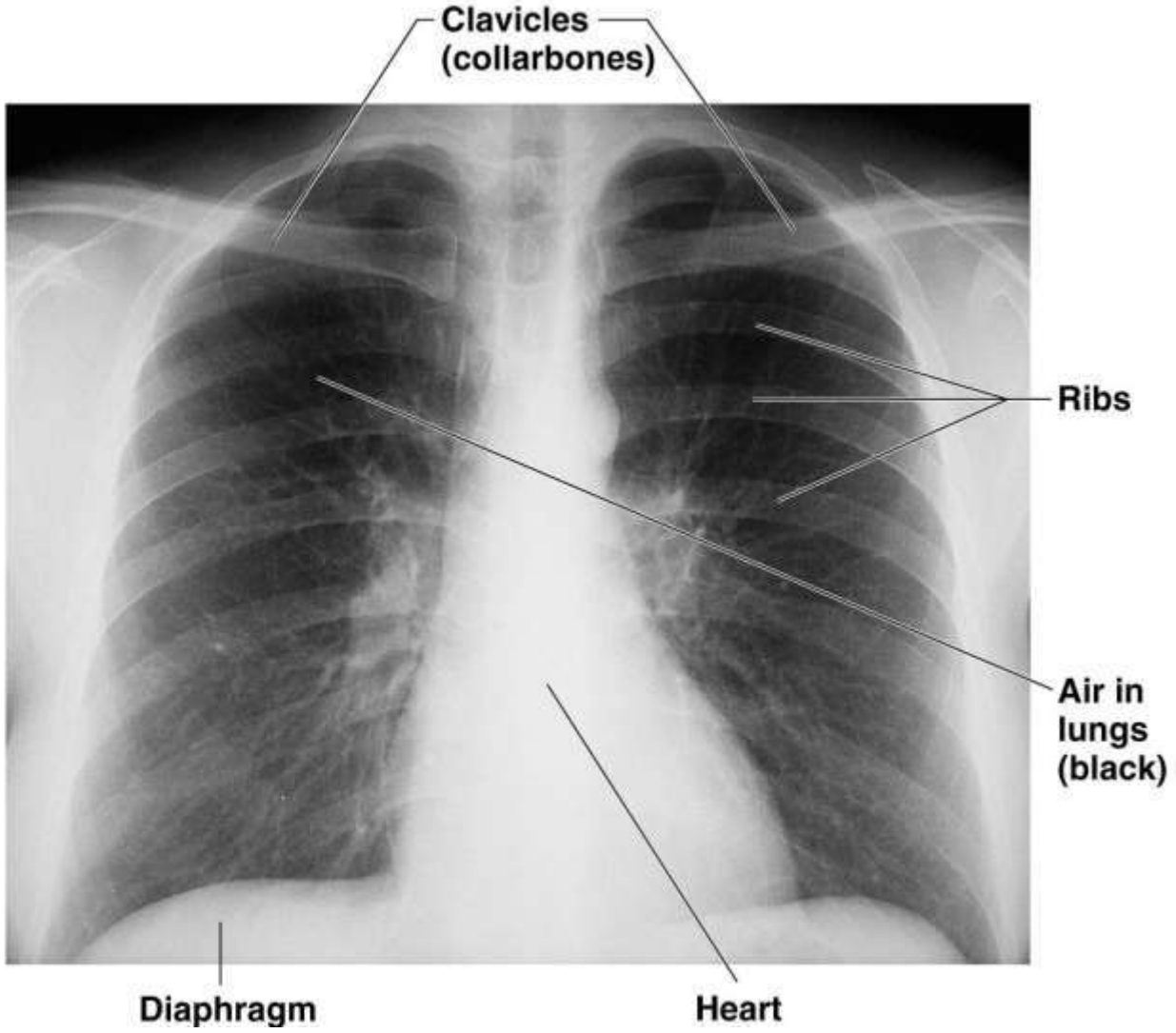


Figure 1.14

X Rays

Traditional more non-invasive method of diagnosis

- X-rays (**electromagnetic waves)** are directed at the body
  - some x-rays are absorbed
  - amount of absorption depends on the density of matter encountered
- **Radiograph** image is a negative:
  - darker exposed areas represent soft organs (easily penetrated)
  - light, unexposed areas correspond to denser structures such as bones
- Contrast medium (solution with heavy elements like barium)
  - used to view soft tissue organs
- Advanced X-Ray techniques use computer-assisted imaging technologies

Computed Tomography (CT) or CAT Scan (axial)

A rotating tube and recorder move around the person as X-rays are taken

A computer processes the images to create a single transverse image that reveals all organs at their best angles with almost no blocking structures

Xenon CT - a CT taken in combination with inhaled xenon. Absence of xenon in the picture indicates a stroke is occurring

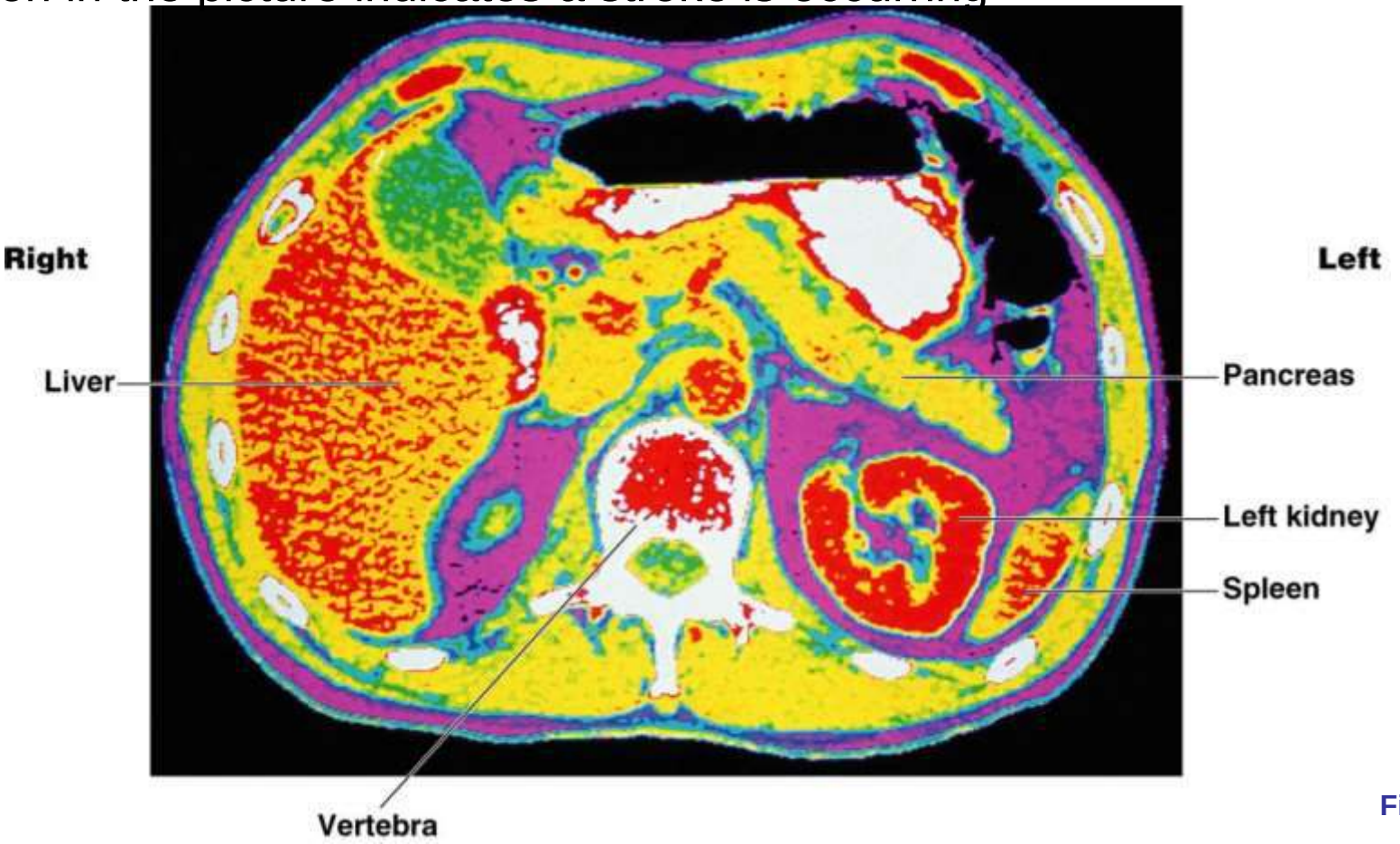


Figure 1.15

Digital Subtraction Angiography (DSA)

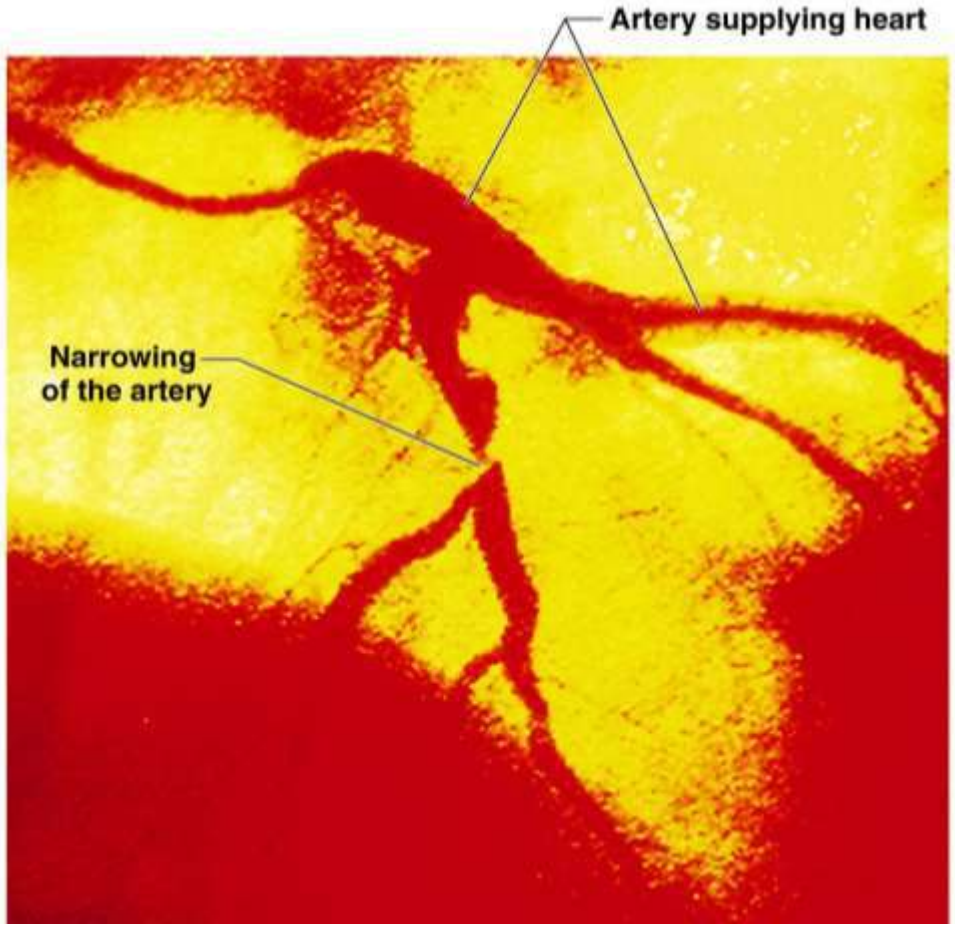


Figure 1.16

- Patient is given a contrast medium - ‘before’ and ‘after’ images
  - computer processes the x-ray images and subtracts the differences
  - eliminates all traces of body structures that obscure the vessel

PET (Positron Emission Tomography)

- access functional flow of blood to the heart & brain

Produces images by detecting radioactive isotopes injected into the body

These isotopes are used as tags to follow the flow of blood to the brain and heart

As the isotope decays it emits a gamma ray detected by sensors, translated into impulses and sent to a computer

There will be a greater concentration in areas that are more active or are receiving more blood

Due to cost and other limitations it is being replaced with the MRI.

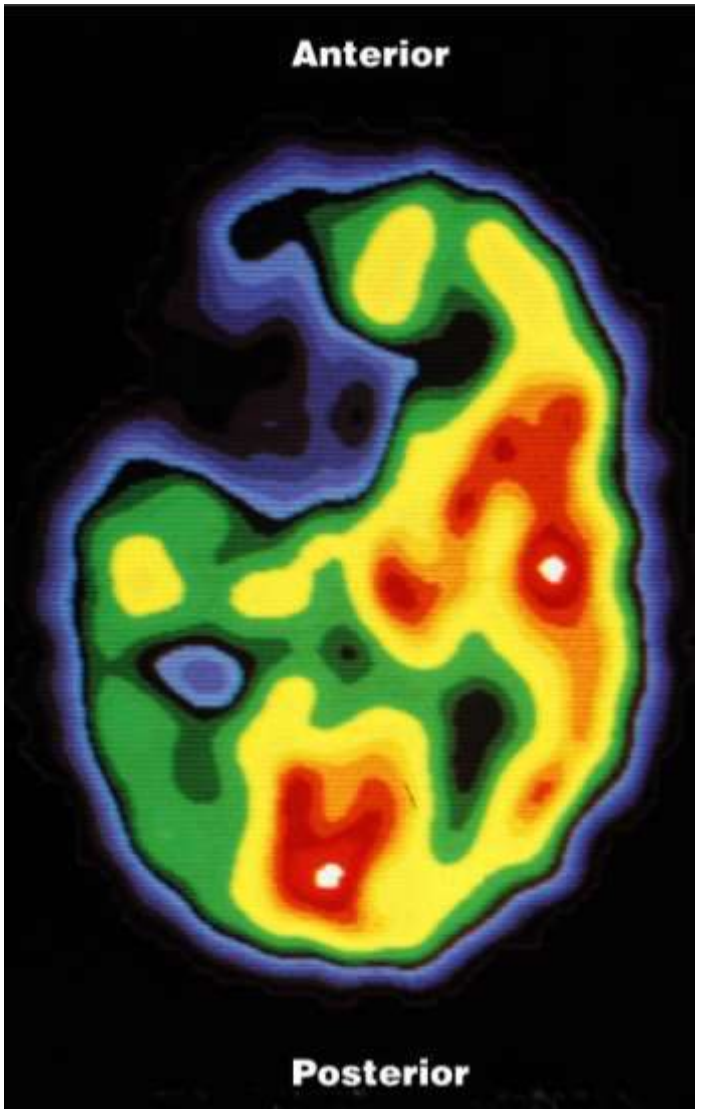


Figure 1.17

Sonography or Ultrasound Imaging

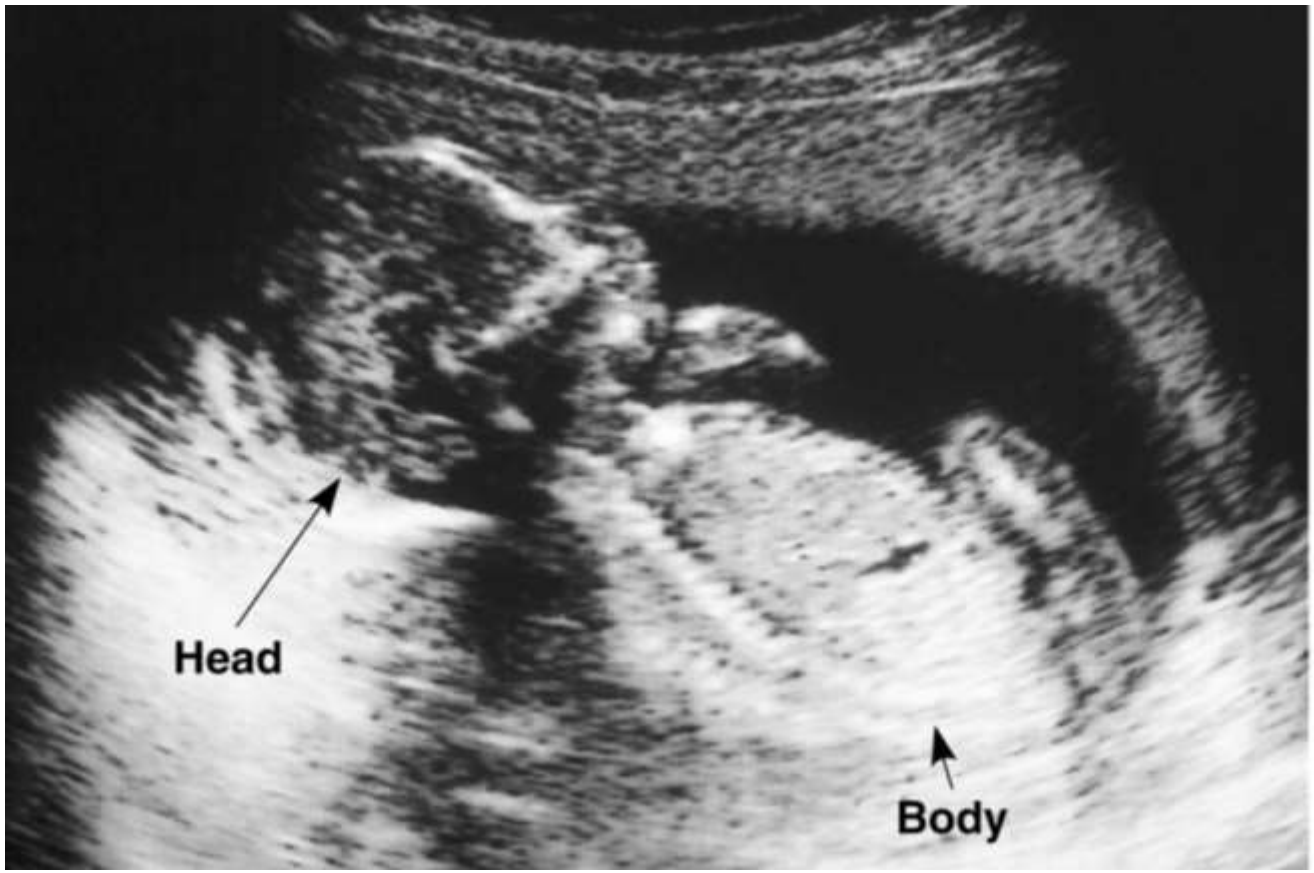


Figure 1.18

Pulses of high frequency (ultrasonic) sound waves reflect (echo) off tissue

Computer analyzes the echoes to construct sectional images

Equipment –inexpensive/safer technique can detect developing fetuses

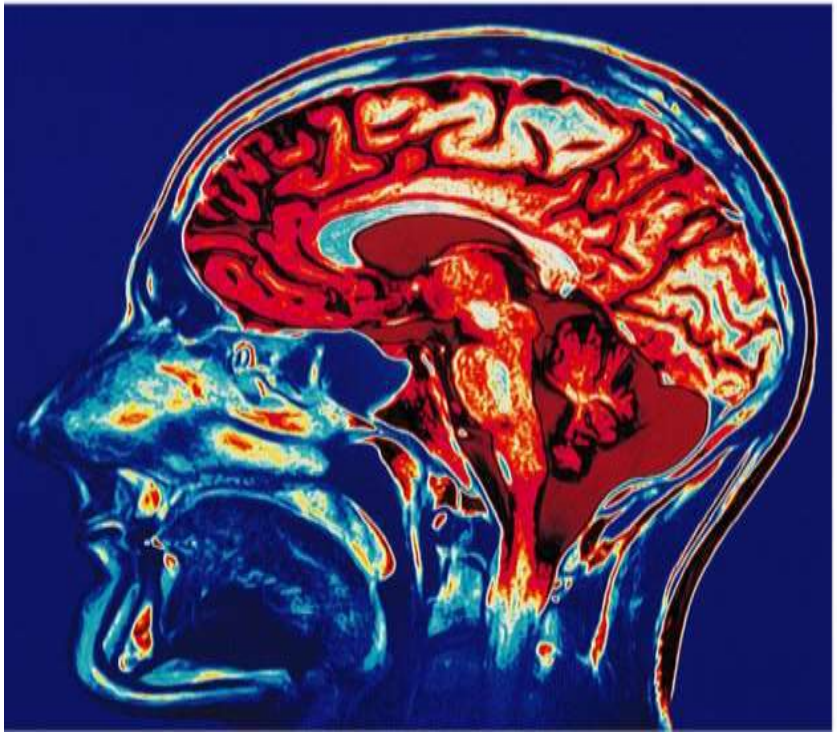
Not used for viewing air-filled structures or structures surrounded by bone

Magnetic Resonance Imaging (MRI)

1° detects levels of H to produce high-contrast images of soft tissues

H+ (body's water) aligns with the magnet - a radio frequency is emitted to misalign them as they realign with the magnet a radio wave is again emitted

Sensors detect the waves, computerized signals produce detailed images of soft tissues



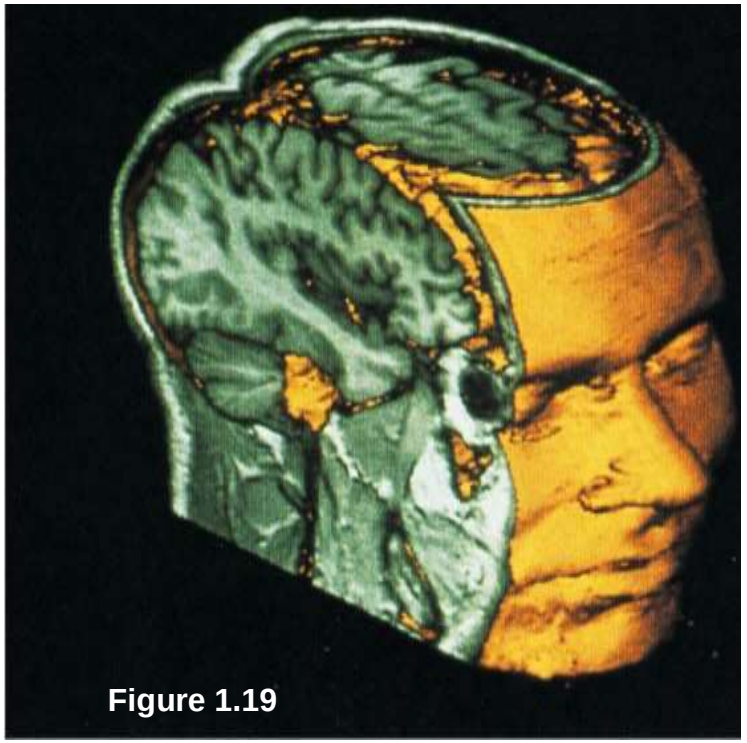


Figure 1.19