

Anatomy (解剖學)

【dissection】

一門研究身體結構及其相對位置的科學

What are their forms? How are they arranged?

Physiology (生理學)

一門研究這些身體結構功能的科學

What do they do? How do they do it?

the Greek words “physis” meaning *nature* and
“logia” meaning *knowledge*

3 Human
4 Animal
5 Comparative

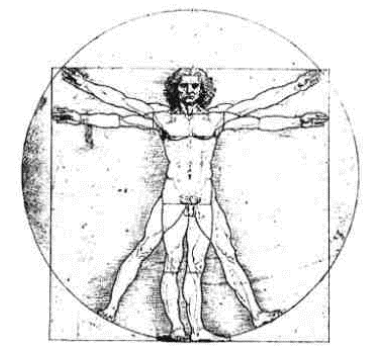
1 General
2 Systemic

TABLE 1.1 Selected Subdisciplines of Anatomy and Physiology

Subdisciplines of <u>Anatomy</u>		Study of	Subdisciplines of <u>Physiology</u>		Study of	
Embryology (em'-brē-OL-ō-jē; <i>embry-</i> = embryo; <i>-logy</i> = study of)	Teratology	Structures that emerge from the time of the fertilized egg through the eighth week in utero.	Neurophysiology (NOOR-ō-fiz-ē-ol'-ō-jē; <i>neuro-</i> = nerve)		Functional properties of nerve cells.	
❖ Developmental biology		Structures that emerge from the time of the fertilized egg to the adult form.	Endocrinology (en'-dō-kri-NOL-ō-jē; <i>endo-</i> = within; <i>-crin</i> = secretion)		Hormones (chemical regulators in the blood) and how they control body functions.	
❖ Microscopic anatomy:		<u>Microscopic structure of tissues.</u>	Cardiovascular physiology (kar-dē-ō-VAS-kū-lar; <i>cardi-</i> = heart; <i>-vascular</i> = blood vessels)		Functions of the heart and blood vessels.	
Histology (his'-TOL-ō-jē; <u><i>hist-</i> = tissue</u>)	Cytology	Anatomical landmarks on the surface of the body through visualization and palpation.	Immunology (im'-ū-NOL-ō-jē; <i>immun-</i> = not susceptible)		How the body defends itself against disease-causing agents.	
Surface anatomy	}	Structures that can be examined <u>without using a microscope.</u>	Respiratory physiology (RES-pir-a-to'-rē; <i>respira-</i> = to breathe)		Functions of the air passageways and lungs.	
❖ Gross anatomy		Structure of specific systems of the body such as the nervous or respiratory systems.	Renal physiology (RĒ-nal; <i>ren-</i> = kidney)		Functions of the kidneys.	
Systemic anatomy		Specific regions of the body such as the head or chest.	}	Exercise physiology		Changes in cell and organ functions as a result of muscular activity.
Regional anatomy		Body structures that can be visualized with x rays.		Pathophysiology (PATH-ō-fiz-ē-ol'-ō-jē)		Functional changes associated with disease and aging.
❖ Radiographic anatomy (rā-dē-ō-GRAF-ik; <i>radio-</i> = ray; <i>-graphic</i> = to write)		Structural changes (from gross to microscopic) associated with disease.	Environmental physiology			
❖ Pathological anatomy (path'-ō-LOJ-i-kal; <u><i>path-</i> = disease</u>)						

6 Apply

History of Physiology



◆ B.C.

- at least 420 B.C. **Hippocrates** (the father of **medicine**)
- 384-322 B.C. **Aristotle** (speculated on function of the human body)
- 304-250 B.C. **Erasistratus** (the father of **physiology**)

◆ A.D.

- A.D. 130-201 **Galen** (basis of human anatomy)

◆ 16th century

- **Jean Fernel** (introduced the term “**physiology**” to describe the study of the body's function)

◆ 17th century (modern physiology): scientific methods of observation and experimentation were used to study the body's functions.

- **William Harvey**, 1578-1657 (heart pumps blood through a closed system of vessels)

◆ 19th century

- **Claude Bernard**, 1813-1878 (father of **modern physiology**)
- **Walter Cannon**, 1871-1945 (coined the term “**homeostasis**” to describe the internal constancy)

Basic Research ↔ Clinical Apply

❖ 生理學與醫學具有密切的聯繫。

➤ 醫學中關於疾病問題的理論研究是以人體生理學的基本理論為基礎（**學術研究**）。

➤ 經由醫學實踐又可以檢驗生理學理論是否正確，並不斷以新的內容和新的問題豐富生理學理論和推動生理學研究（**臨床應用**）。

➤ 人體生理學是醫學的一門基礎理論科學。

❖ 生理學的每一個進展都會對醫學產生巨大的推動作用。

➤ 糖尿病發病機制是在胰島內分泌生理研究中闡明的；而心肺製備生理實驗方法的建立則為心臟外科手術的體外循環技術提供了基礎。

❖ 1628年：英國的生理學家**William Harvey**撰寫



《心臟與血液的運動》一書(生理學成為一門獨立學科之里程碑)。

❖ 1902年：英國生理學家**William Bayliss**和**Ernest Starling**發現激素「胰泌素」(secretin)。

❖ 1921年：加拿大的**Frederick Banting**和其學生**Charles Best**發現胰島素(insulin)。

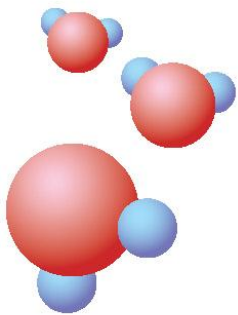
❖ 1982年：澳洲醫生**Barry Marshall**和病理學家



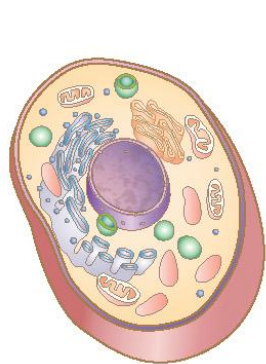
Robin Warren證實幽門螺旋桿菌(*Helicobacter pylori*)引起消化性潰瘍。

生理功能之結構層次

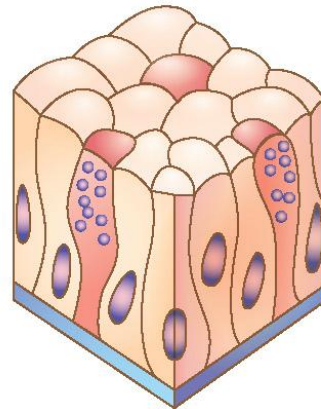
- ❖ 化學層次 (chemical level)
- ❖ 細胞層次 (cellular level)
- ❖ 組織層次 (tissue level)
- ❖ 器官層次 (organ level)
- ❖ 系統層次 (system level)
- ❖ 生物體層次 (organism level)



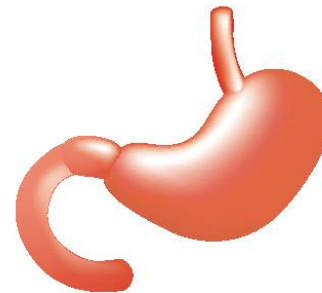
原子及分子



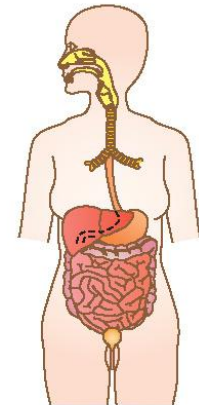
細胞



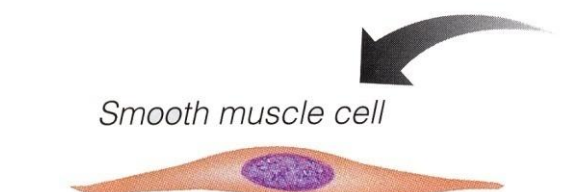
組織



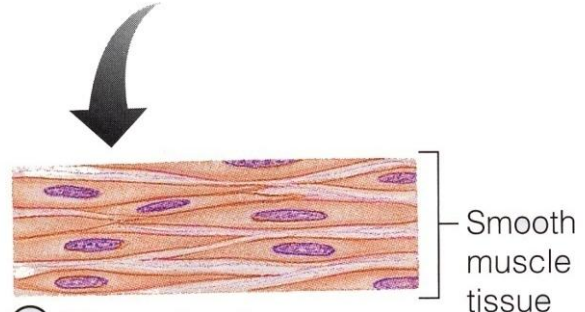
器官



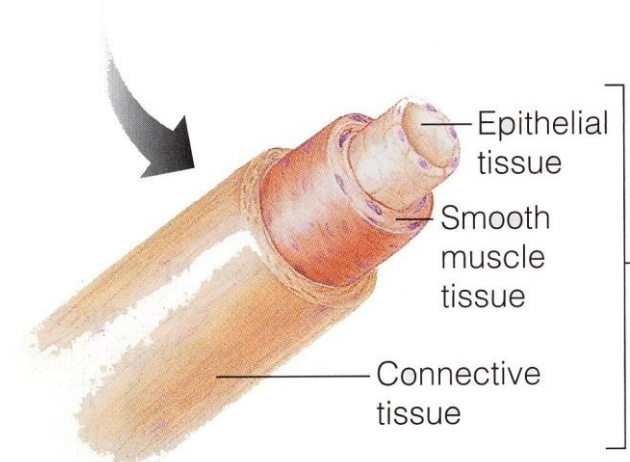
器官系統



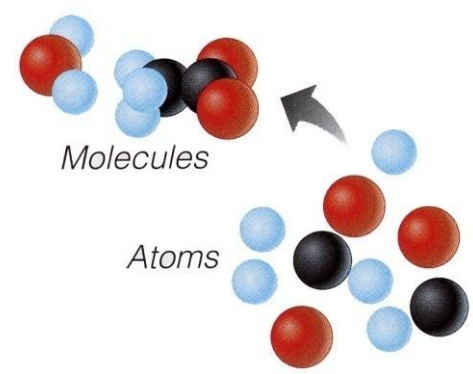
② **Cellular level**
Cells are made up of molecules



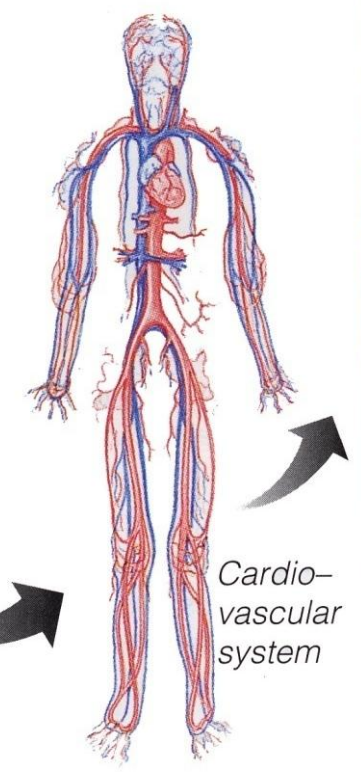
③ **Tissue level**
Tissues consist of similar types of cells



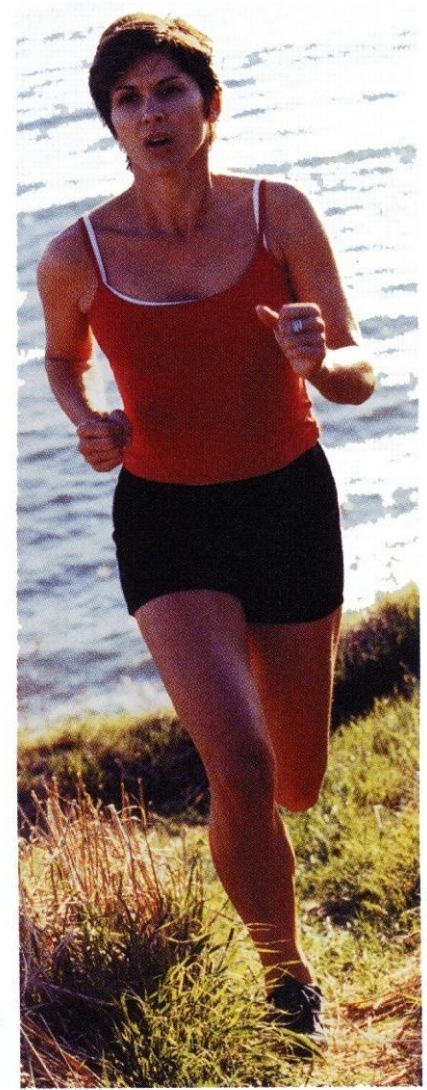
④ **Organ level**
Organs are made up of different types of tissues



① **Chemical level**
Atoms combine to form molecules



⑤ **Organ system level**
Organ systems consist of different organs that work together closely



⑥ **Organismal level**
Human organisms are made up of many organ systems

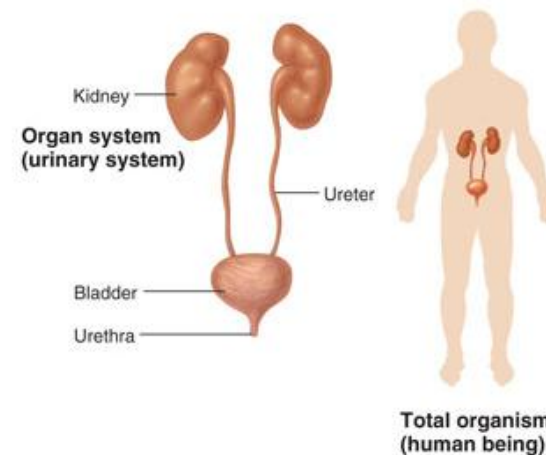
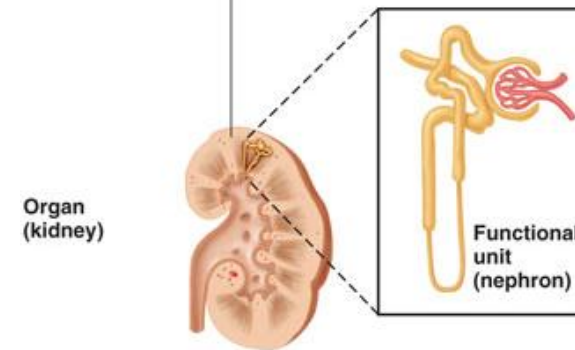
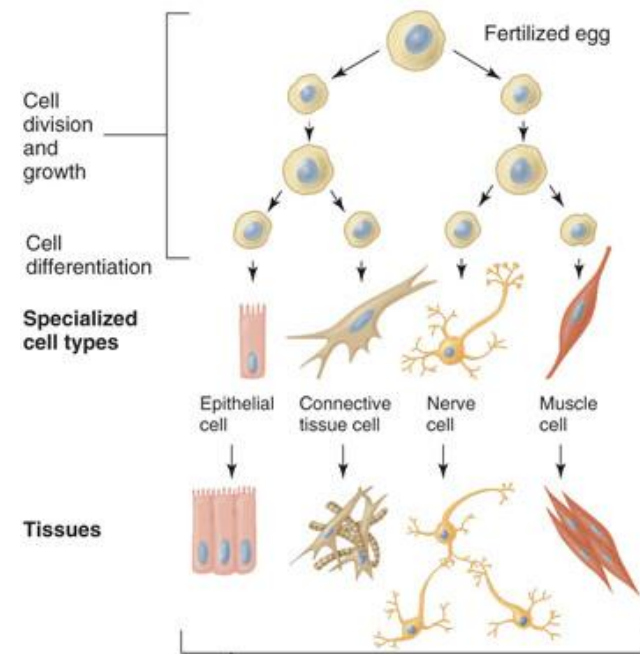
↓ **Cellular level**

↓ **Tissue level**

↓ **Organ level**

↓ **System level**

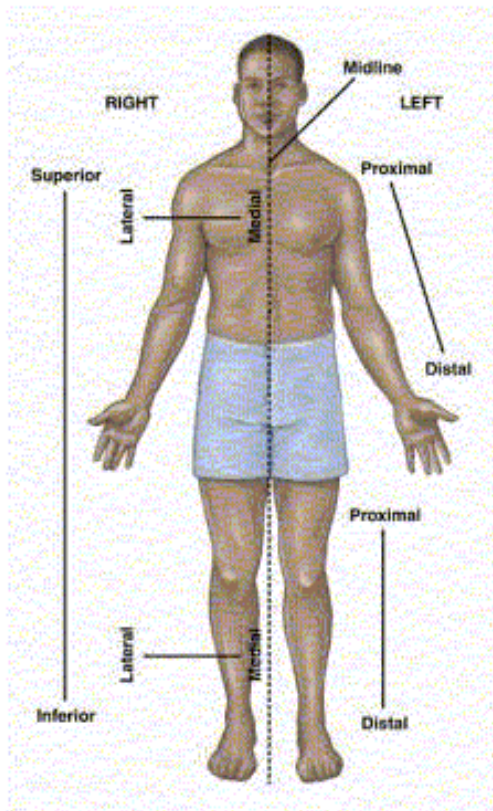
↓ **Organism level**



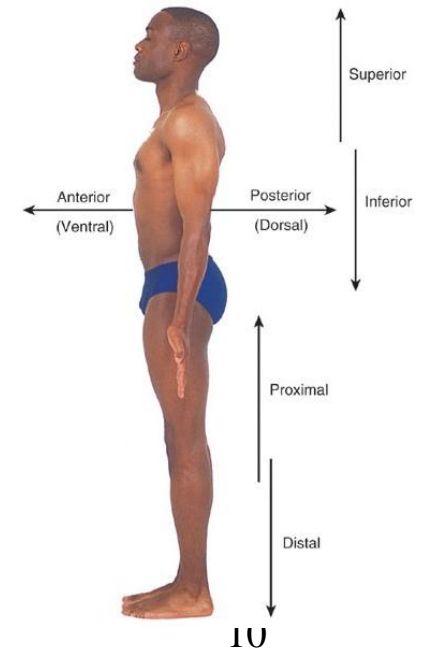
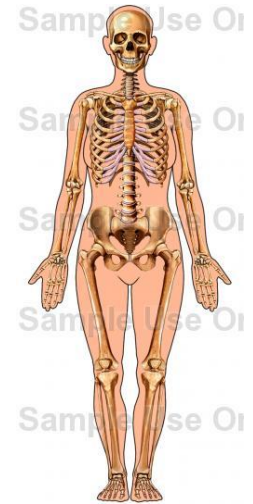
System	Major Organs or Tissues	Primary Functions
Circulatory	Heart, blood vessels, blood	Transport of blood throughout the body's tissues
Digestive	Mouth, salivary glands, pharynx, esophagus, stomach, large and small intestines, pancreas, liver, gallbladder	Digestion and absorption of nutrients and water; elimination of wastes
<u>Endocrine</u>	All glands or organs secreting hormones: Pancreas, testes, ovaries, hypothalamus, kidneys, pituitary, thyroid, parathyroid, adrenal, intestinal, thymus, heart, and pineal, and endocrine cells in other locations	Regulation and coordination of many activities in the body, including growth, metabolism, reproduction, blood pressure, electrolyte balance, and others
Immune	White blood cells, spleen, thymus (also see: Lymphatic system)	Defense against pathogens
Integumentary	Skin	Protection against injury and dehydration; defense against pathogens; regulation of body temperature
Lymphatic	Lymph vessels, lymph nodes	Collect extracellular fluid for return to circulation; participate in immune defenses
Musculoskeletal	Cartilage, bone, ligaments, tendons, joints, skeletal muscle	Support, protection, and movement of the body; production of blood cells
<u>Nervous</u>	Brain, spinal cord, peripheral nerves and ganglia, sense organs	Regulation and coordination of many activities in the body; detection of changes in the internal and external environments; states of consciousness; learning; cognition
Reproductive	Male: Testes, penis, and associated ducts and glands Female: Ovaries, fallopian tubes, uterus, vagina, mammary glands	Production of sperm; transfer of sperm to female Production of eggs; provision of a nutritive environment for the developing embryo and fetus; nutrition of the infant
Respiratory	Nose, pharynx, larynx, trachea, bronchi, lungs	Exchange of carbon dioxide and oxygen; regulation of hydrogen ion concentration
Urinary	Kidneys, ureters, bladder, urethra	Regulation of plasma composition through controlled excretion of salts, water, and organic wastes

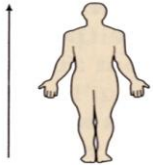
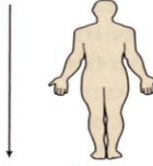


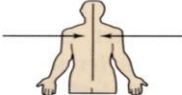
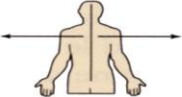

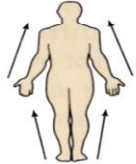
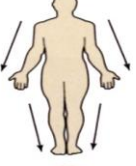
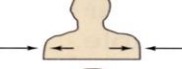

Anatomical Terminology

- ❖ Anatomical position
- ❖ Anatomical direction



1. Superior & Inferior
(Cranial) (Caudal)
2. Anterior (ventral) & Posterior (dorsal)
3. Medial & Lateral
4. Proximal & Distal
5. Superficial & Deep



Term	Definition	Illustration	Example
Superior (cranial or cephalad)	Toward the head end or upper part of a structure or the body; above		The forehead is superior to the nose.
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 breastbone.
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 backside of the body; behind		The heart is posterior to the breastbone.
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.
Intermediate	Between a more medial and a more lateral structure		The armpit is intermediate between the breastbone and shoulder.
Proximal	Close 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 (meaning that the elbow is closer to the shoulder or attachment point of the arm than the wrist is).
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.
Superficial	Toward or at the body surface		The skin is superficial to the skeleton.
Deep	Away from the body surface; more internal		The lungs are deep to the rib cage.

Ipsilateral
Contralateral

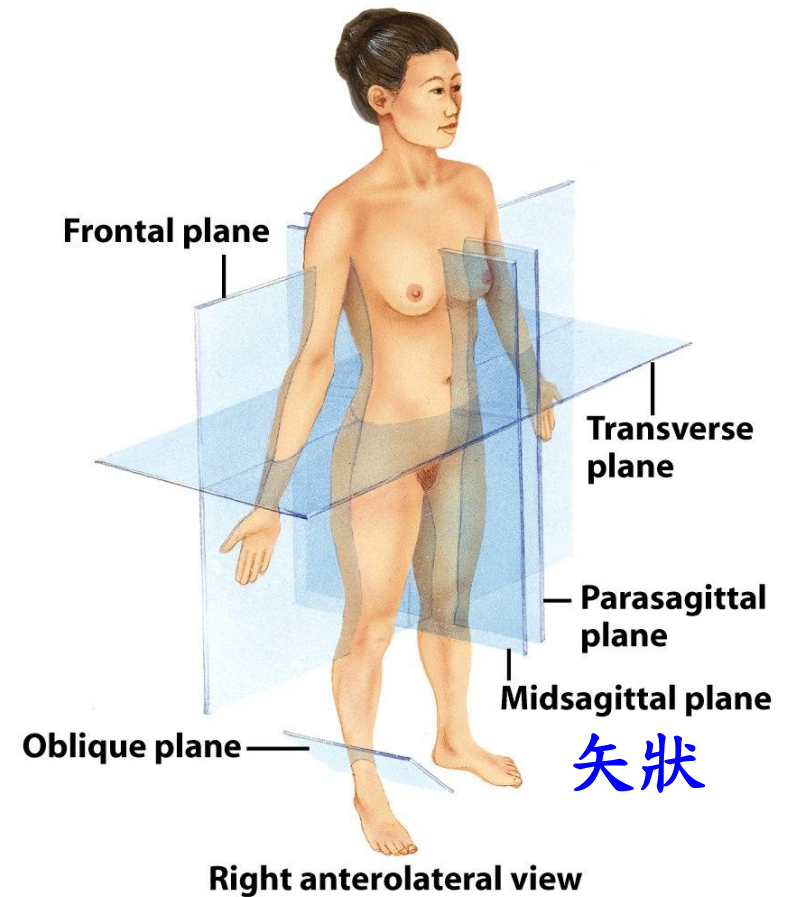
Anatomical Terminology

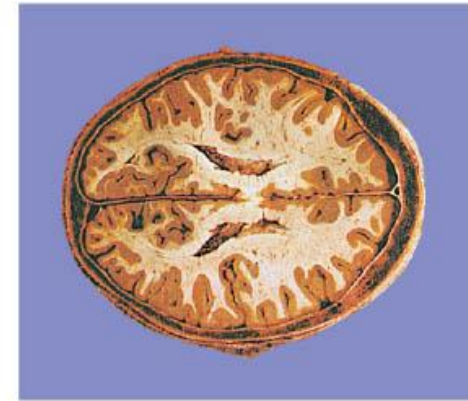
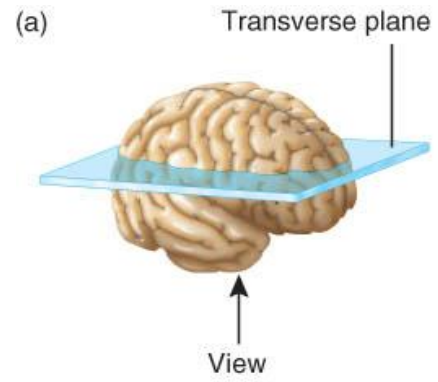
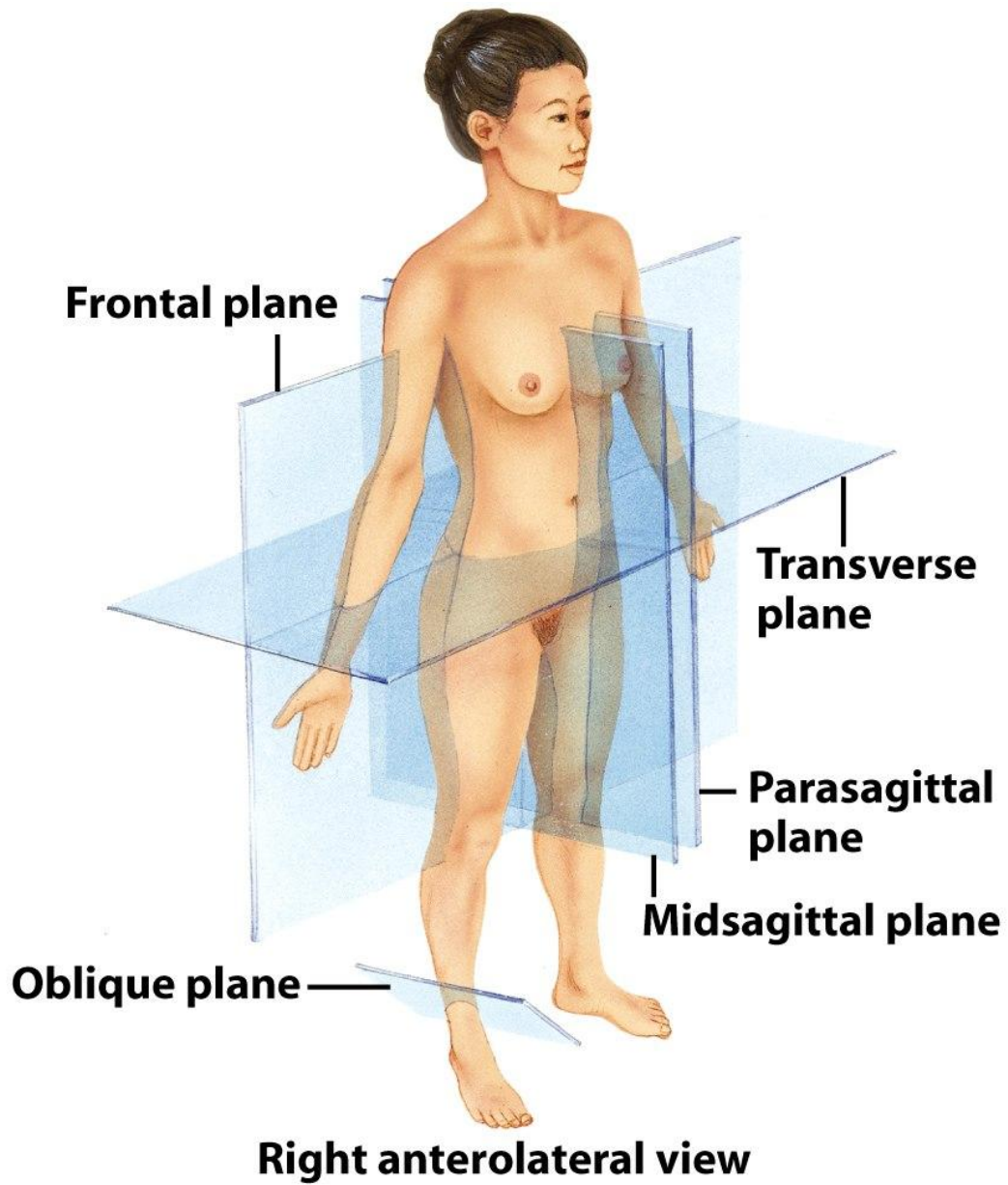
❖ Anatomical section

1. Midsagittal plane &
Sagittal (Vertical) plane

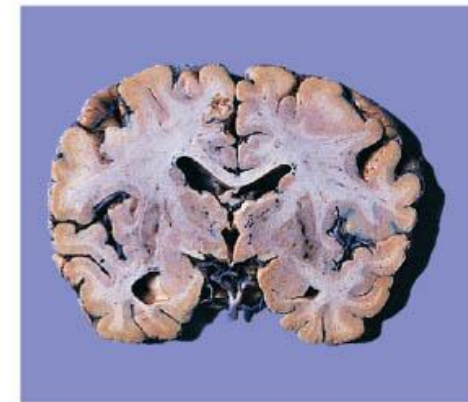
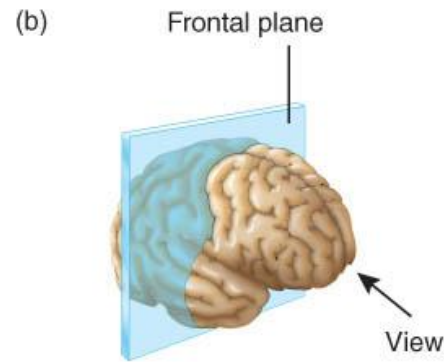
2. **Frontal** plane
(**Coronal** plane)

3. **Transverse** plane
(**Horizontal** plane)

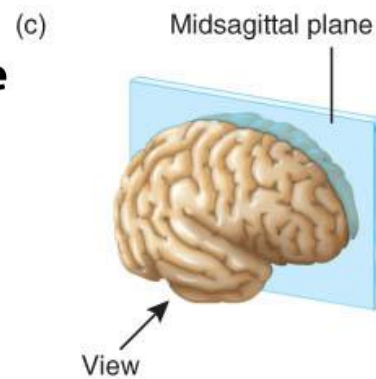




Transverse section



Frontal section



Midsagittal section

Body Cavities

❖ Ventral body cavities:

-- Thoracic cavity (胸腔)

Mediastinum cavity (縱膈腔)

Pleural cavity (胸膜腔)

Pericardial cavity (心包腔)

-- Abdominal cavity (腹腔)

-- Pelvic cavity (骨盆腔)

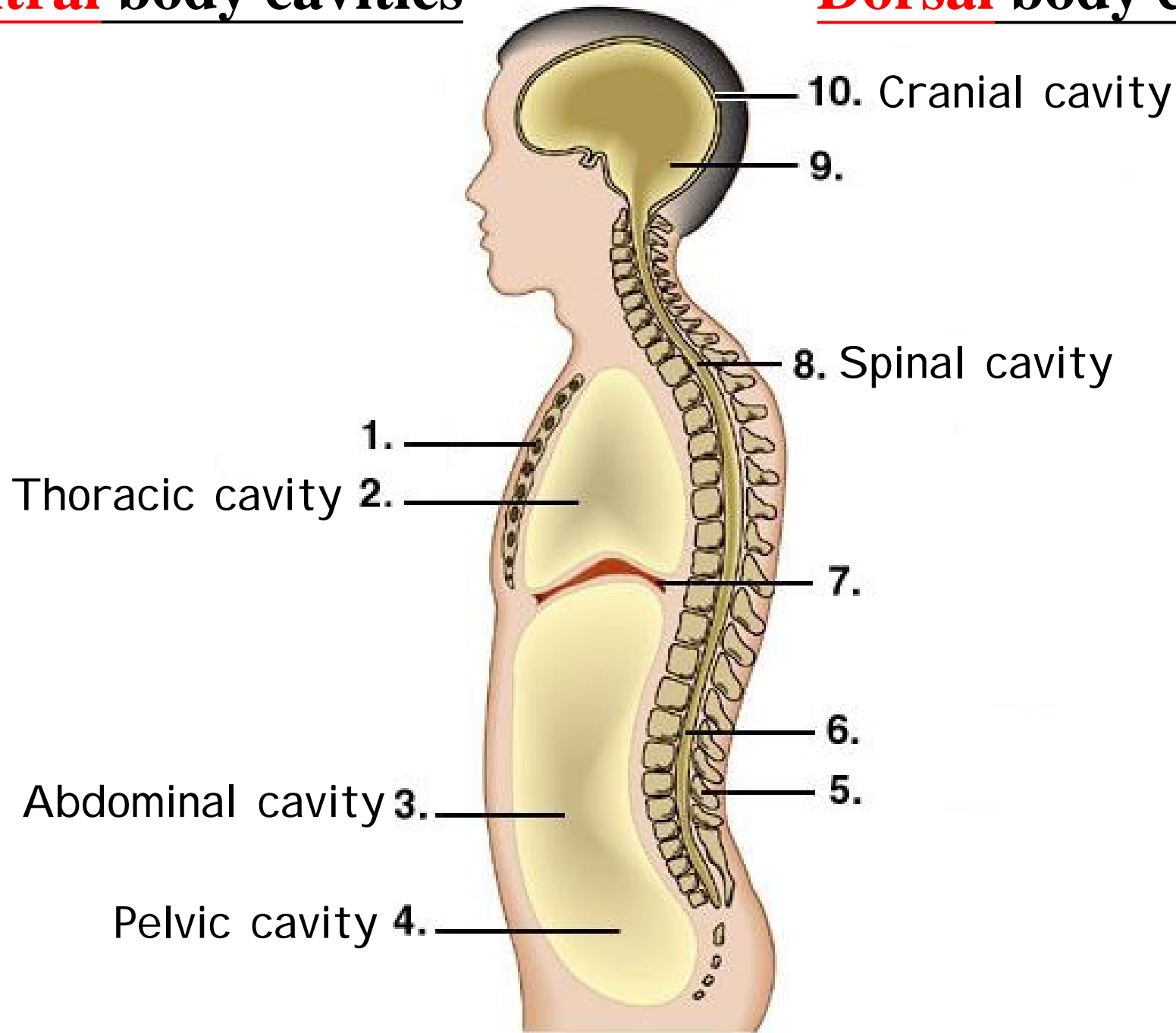
❖ Dorsal body cavities:

-- Cranial cavity (顱腔)

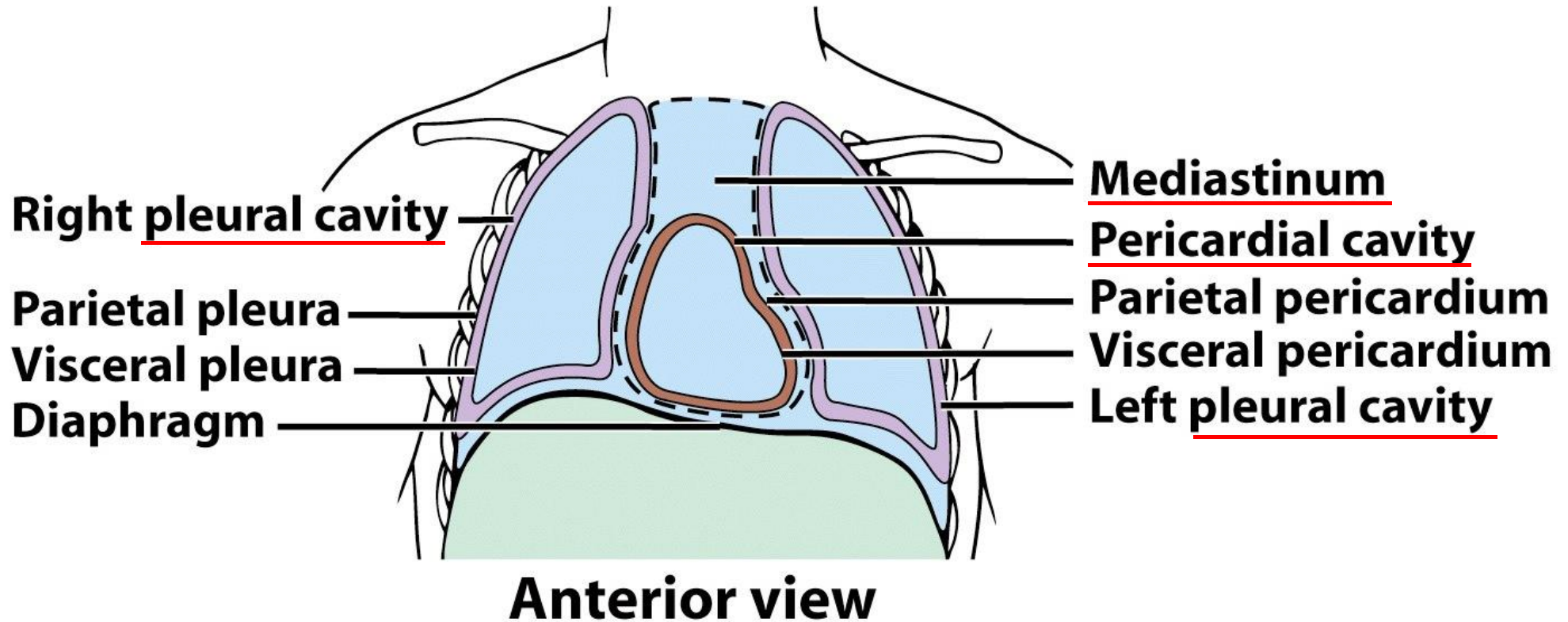
-- Spinal cavity (脊髓腔)

Ventral body cavities

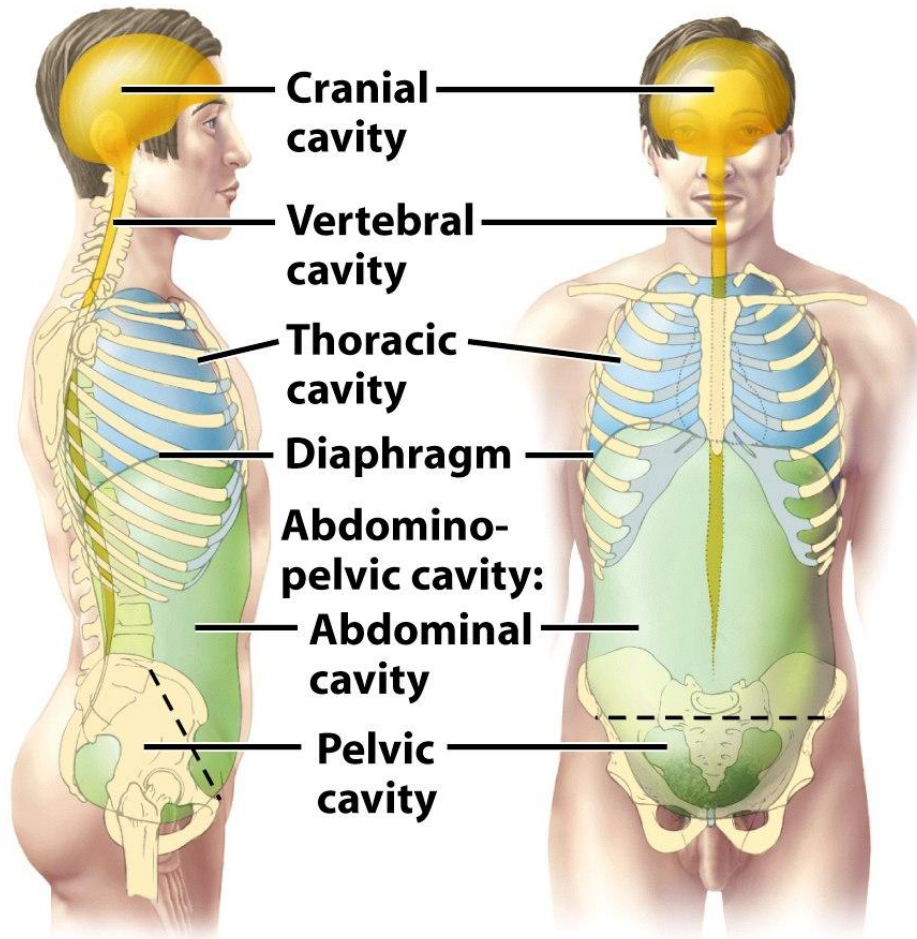
Dorsal body cavities



Thoracic Cavity



Body Cavities



(a) Right lateral view

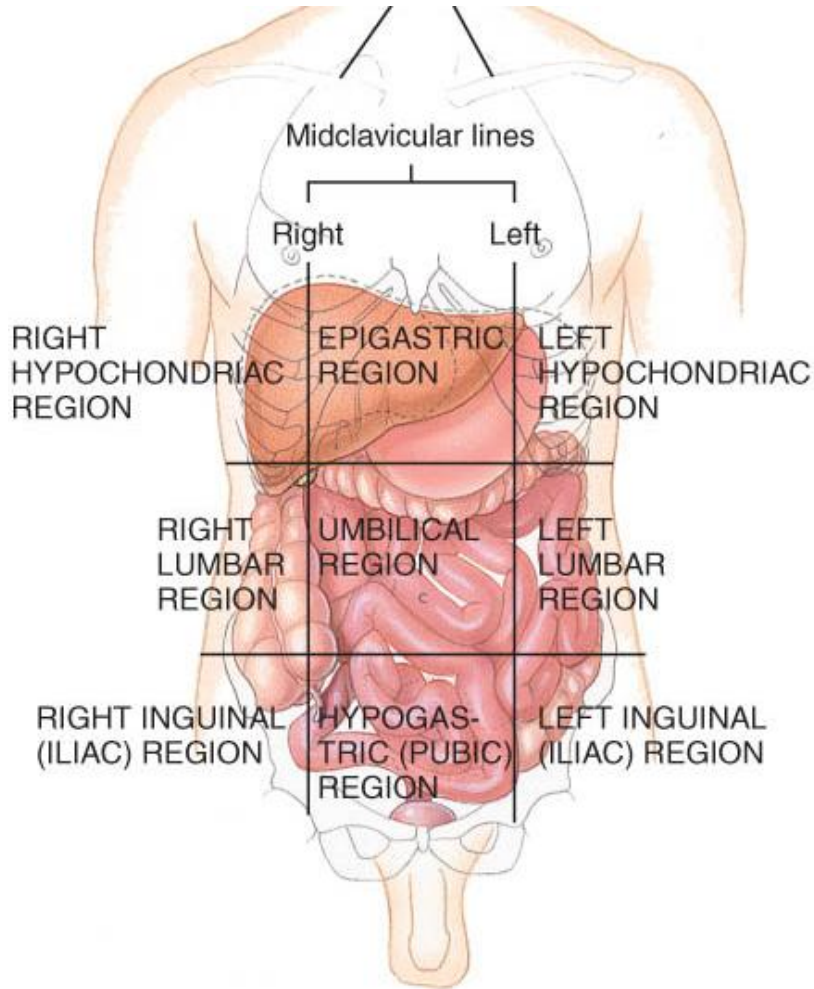
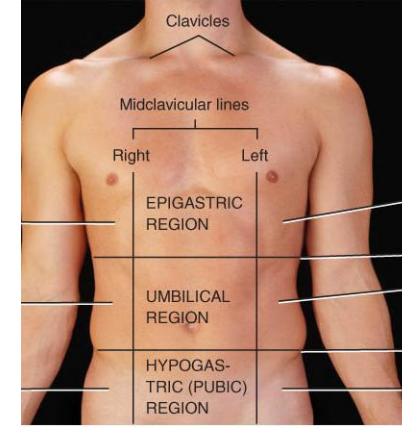
(b) Anterior view

CAVITY	COMMENTS
Cranial cavity	Formed by cranial bones and contains brain.
Vertebral cavity	Formed by vertebral column and contains spinal cord and the beginnings of spinal nerves.
Thoracic cavity*	Chest cavity; contains pleural and pericardial cavities and mediastinum.
<i>Pleural cavity</i>	Each surrounds a lung; the serous membrane of the pleural cavities is the pleura.
<i>Pericardial cavity</i>	Surrounds the heart; the serous membrane of the pericardial cavity is the pericardium.
<i>Mediastinum</i>	Central portion of thoracic cavity between the lungs; extends from sternum to vertebral column and from neck to diaphragm; contains heart, thymus, esophagus, trachea, and several large blood vessels.
Abdominopelvic cavity	Subdivided into abdominal and pelvic cavities.
<i>Abdominal cavity</i>	Contains stomach, spleen, liver, gallbladder, small intestine, and most of large intestine; the serous membrane of the abdominal cavity is the peritoneum.
<i>Pelvic cavity</i>	Contains urinary bladder, portions of large intestine, and internal organs of reproduction.

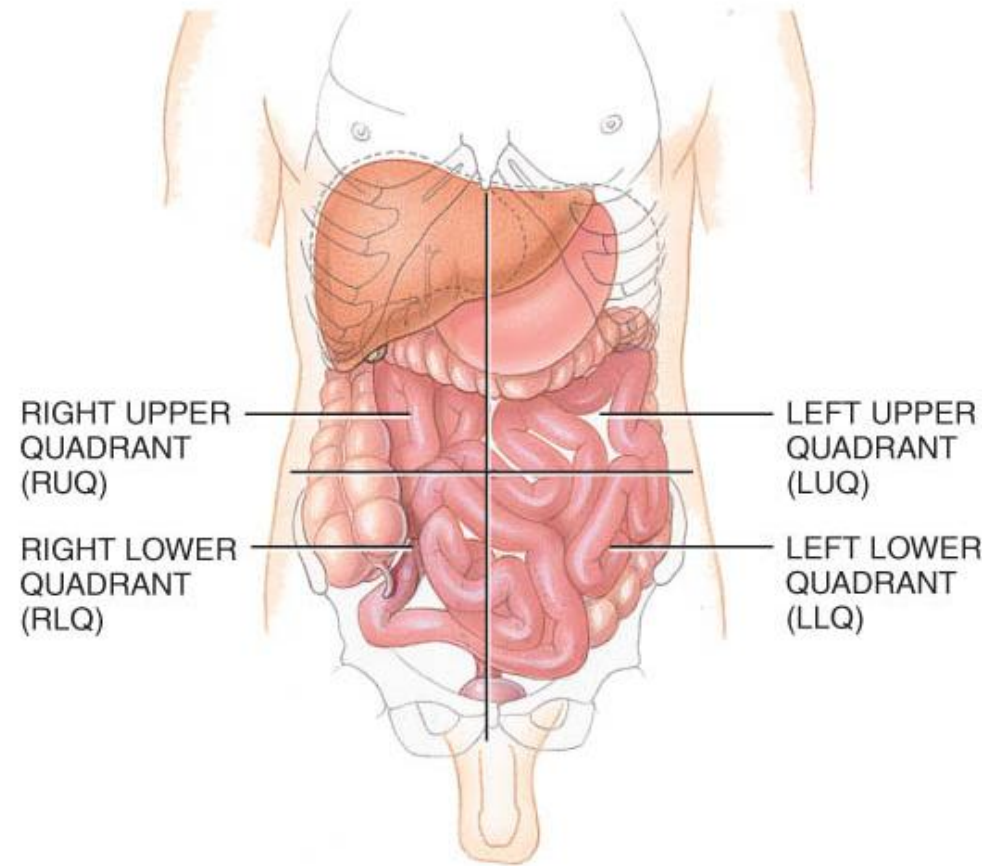
Abdominopelvic Cavity (腹骨盆腔)

- ❖ **Upper** abdominopelvic regions
 - 左右季肋區及上腹區 (epigastric region)
- ❖ **Middle** abdominopelvic regions
 - 左右腰區及臍區 (umbilical region)
- ❖ **Lower** abdominopelvic regions
 - 左右鼠蹊區 (腹股溝區) 及下腹區 (hypogastric region)

Abdominopelvic Cavity (腹骨盆腔)



九個區域



四個象限

RUQ

LUQ

RLQ

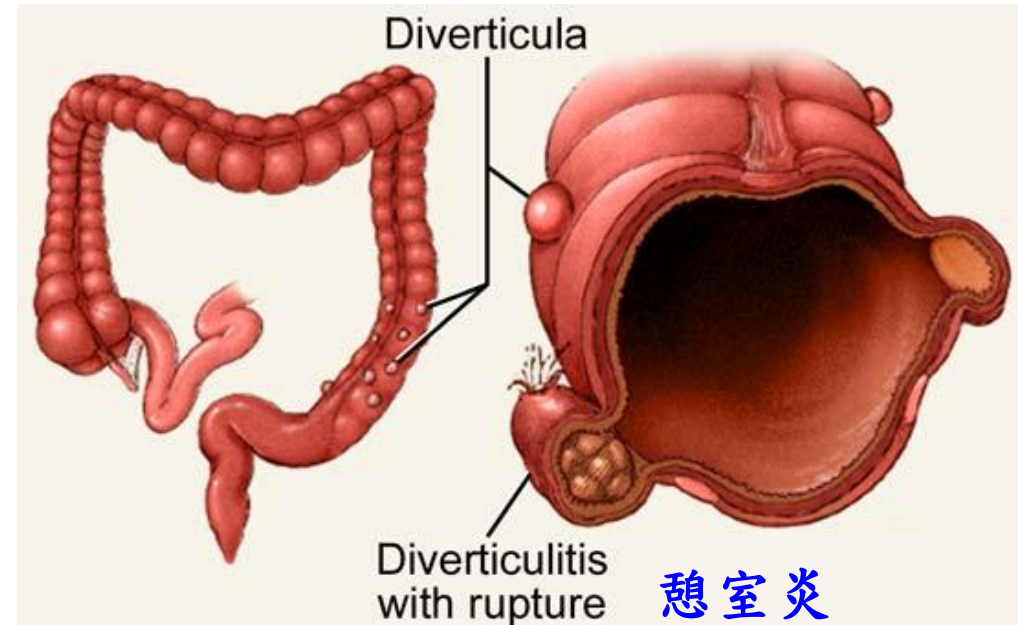
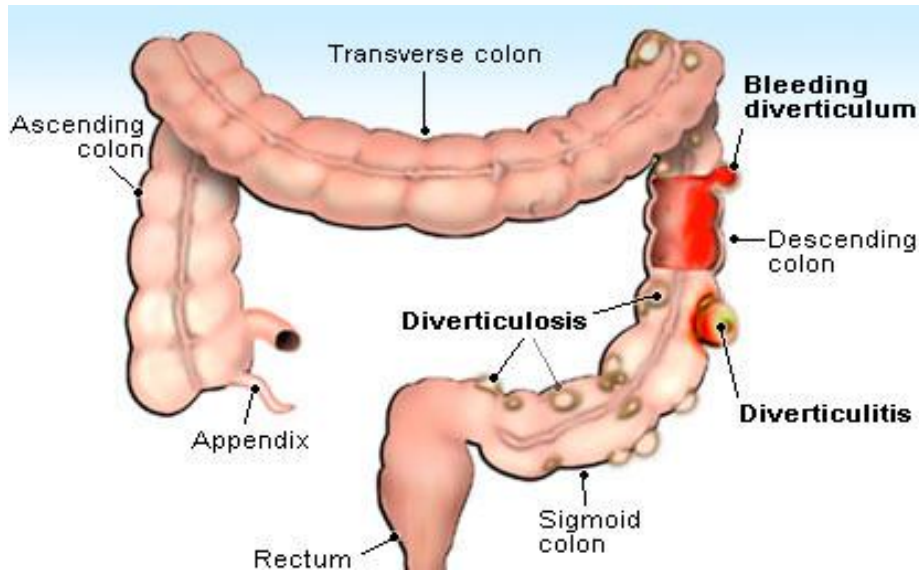
LLQ

		可能病因	處置方式
<p>★右上腹</p> <ol style="list-style-type: none"> 1. 肝炎 2. 心臟衰竭引起的肝臟腫大 3. 膽囊病變 4. 胰臟癌 5. 胰臟炎 6. 憩室炎 7. 結腸炎 8. 肺炎 9. 帶狀疱疹 10. 腎臟的毛病 	<p>★左上腹</p> <ol style="list-style-type: none"> 1. 脾臟腫大 2. 憩室炎 3. 胃炎 4. 胃潰瘍 5. 胃癌 6. 裂孔赫尼亞 7. 胰臟炎 8. 胰臟癌 9. 肋膜炎 10. 肺炎 	<ul style="list-style-type: none"> ● 依各種不同的病因給予適當的治療 ● 接受醫療 ● 注意飲食，使用抗生素，外科手術，較先進的非手術性治療。 ● 支持療法（妥善照顧），無法治癒。 ● 立即急救。 ● 注意飲食，使用抗生素，偶爾也可施行外科手術。 ● 藥物治療，偶爾也可施行外科手術。 ● 使用抗生素 ● 藥物治療 ● 藥物治療 	
<p>★右下腹</p> <ol style="list-style-type: none"> 1. 盲腸炎 2. 腸癌 3. 過敏性腸子 4. 結腸炎 5. 局部性迴腸炎（克隆氏症） 6. 感染性腹瀉 7. 帶狀疱疹 8. 脊椎椎間盤病變 9. 腎結石 10. 子宮外孕 11. 骨盆發炎性疾病 12. 卵巢囊腫及卵巢腫瘤 13. 子宮內膜組織異位 	<p>★左下腹</p> <ol style="list-style-type: none"> 1. 同上所有的項目（盲腸炎除外） 2. 過敏性腸子 	<ul style="list-style-type: none"> ● 立刻動手術 ● 施行外科手術。 ● 藥物治療（防止痙攣的藥物） ● 藥物治療，偶爾也可能施行外科手術。 ● 藥物治療，偶爾也可能施行外科手術。 ● 使用 Azulfidine，類固醇，施行手術。 ● 抗生素治療 ● 藥物治療 ● 物理治療，施行手術。 ● 碎石術、外科手術治療，藥物治療。 ● 立即進行手術 ● 使用抗生素治療 ● 進行外科手術 ● 藥物治療 	
<p>★腹部中央上半部</p> <ol style="list-style-type: none"> 1. 胃潰瘍 2. 十二指腸潰瘍 3. 胃癌 4. 胃炎 	<p>同上所有的處理方式</p>	<ul style="list-style-type: none"> ● 藥物治療 ● 藥物治療 ● 施行外科手術 ● 注意飲食並接受藥物治療 	

Diverticulosis

(憩室病)

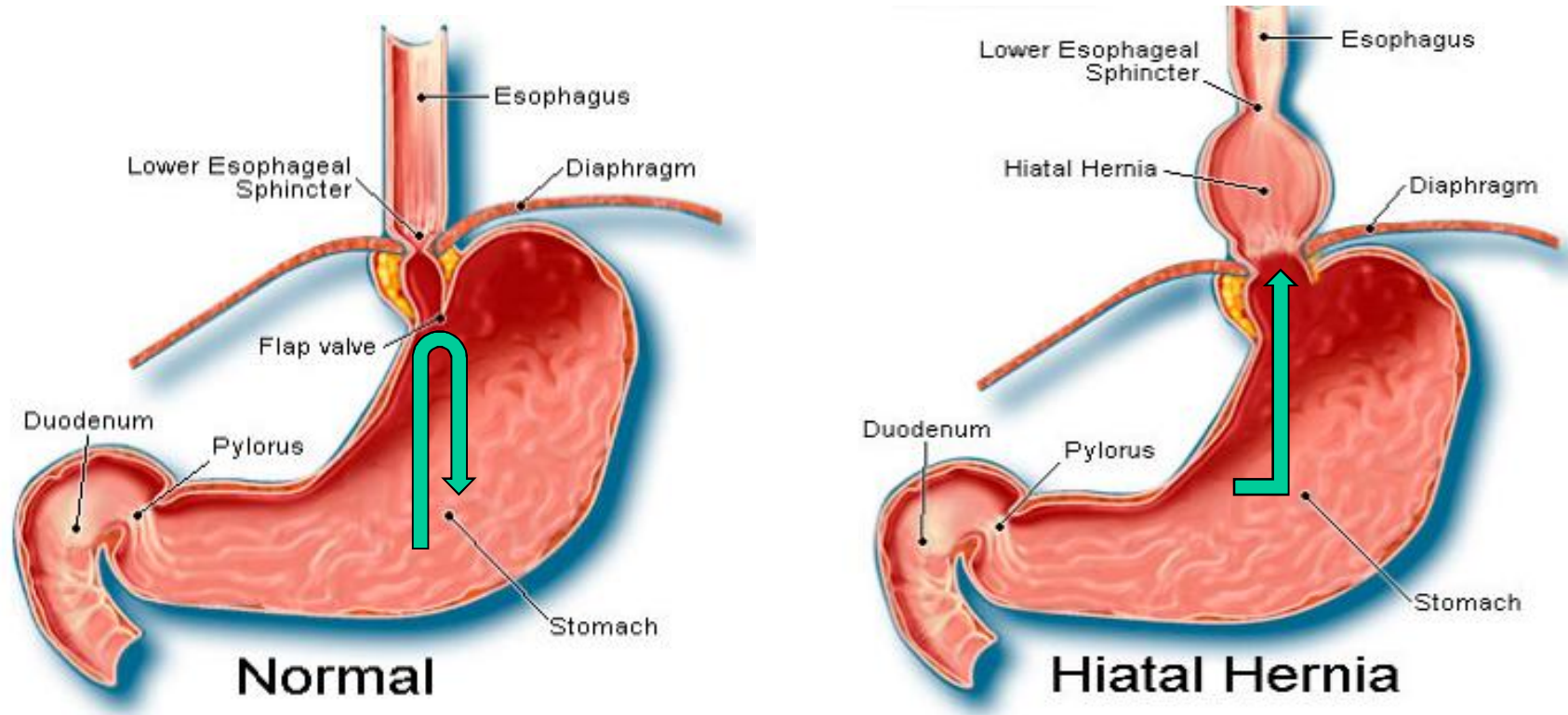
一種結腸黏膜脫出至肌肉層外而形成囊狀突起

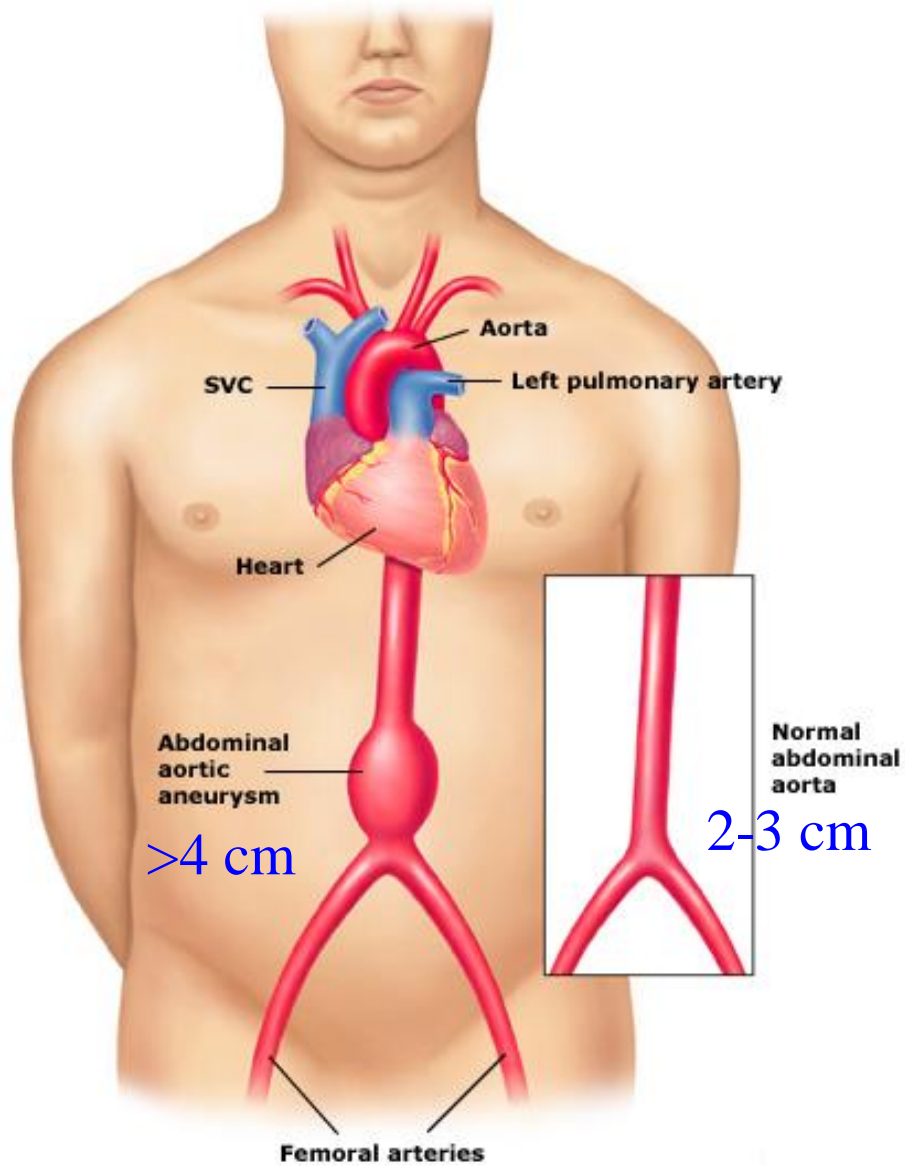


Hiatus Hernia

疝脫

(裂孔赫尼亞)



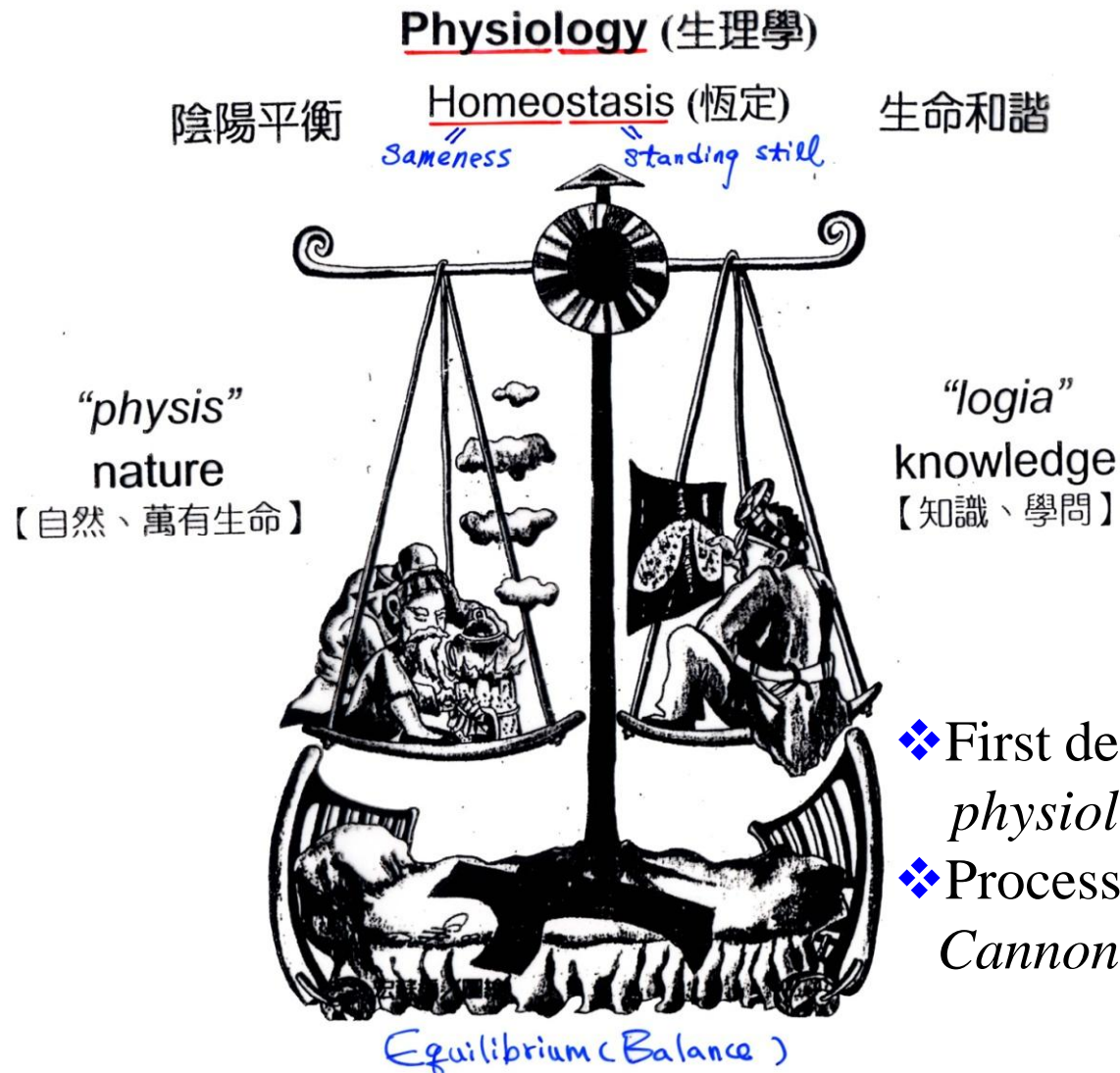


★腹部中央下半部

1. 膀胱受到感染
2. 腎結石
3. 子宮內膜組織異位
4. 骨盆發炎性疾病
5. 子宮頸纖維瘤
6. 子宮頸癌
7. 卵巢癌
8. 過敏性腸子
9. 動脈硬化
10. 腹部動脈瘤

- 抗生素治療
- 碎石術、外科手術、藥物治療。
- 藥物治療
- 抗生素治療
- 子宮切除術
- 施行外科手術
- 施行外科手術，化學療法。
- 藥物治療
- 接受醫療並注意控制飲食
- 視腫瘤大小決定是否施行外科手術

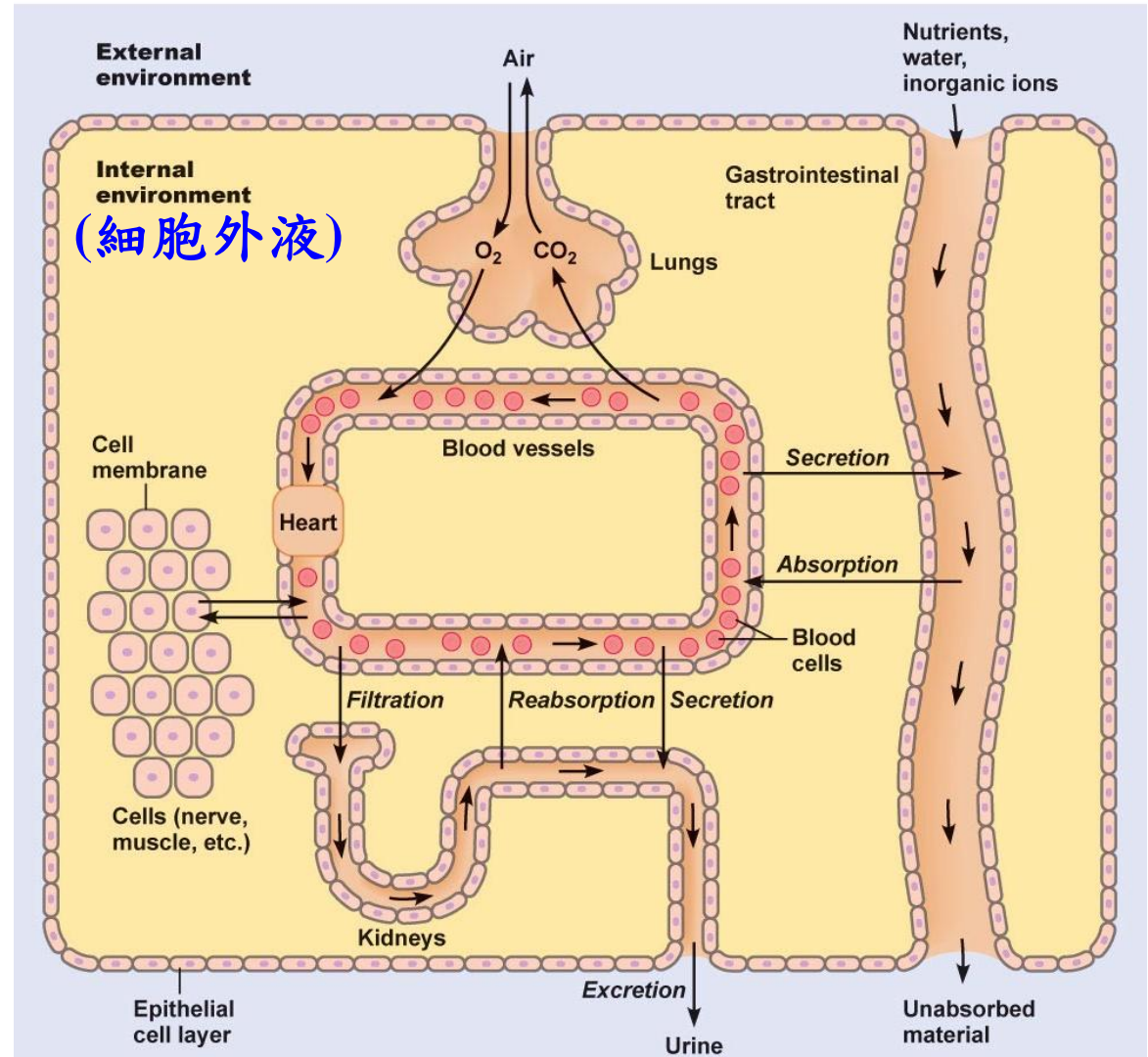
Homeostasis



Homeostasis is a condition of equilibrium in the body's **internal environment** produced by the ceaseless interplay of all the body's regulatory processes

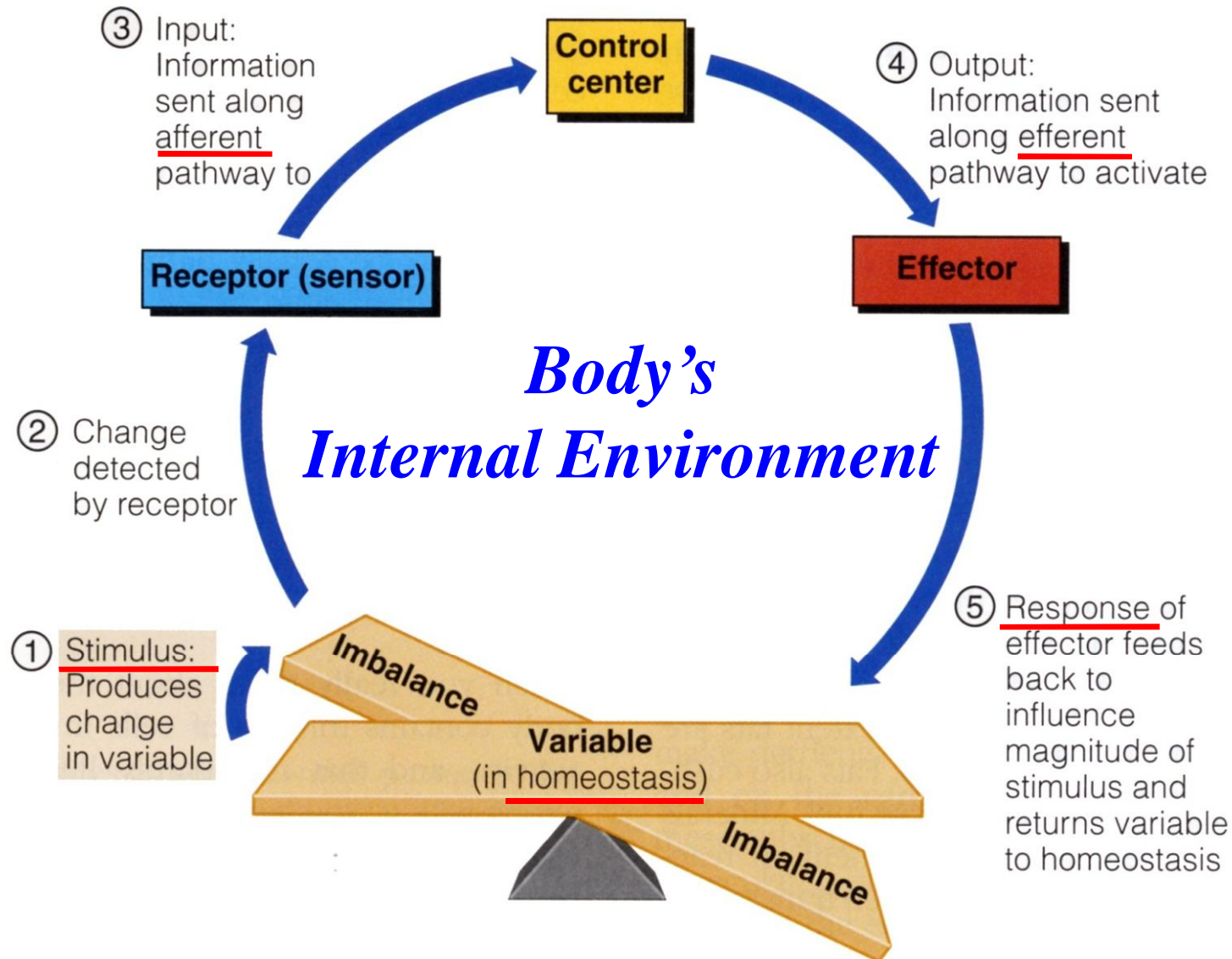
Internal & External Environment

- ❖ 1852年，法國生理學家 Claude **Bernard** 首先提出
- ❖ 內在環境：圍繞在細胞周圍的**細胞外液(ECF)**，以區別於個體所處的外部環境(**動態平衡**)。
- ❖ 外在環境：不斷變化；內在環境：相對穩定。
- ❖ 內在環境的相對穩定(**恆定**)是個體能夠自由和獨立生存的首要條件。

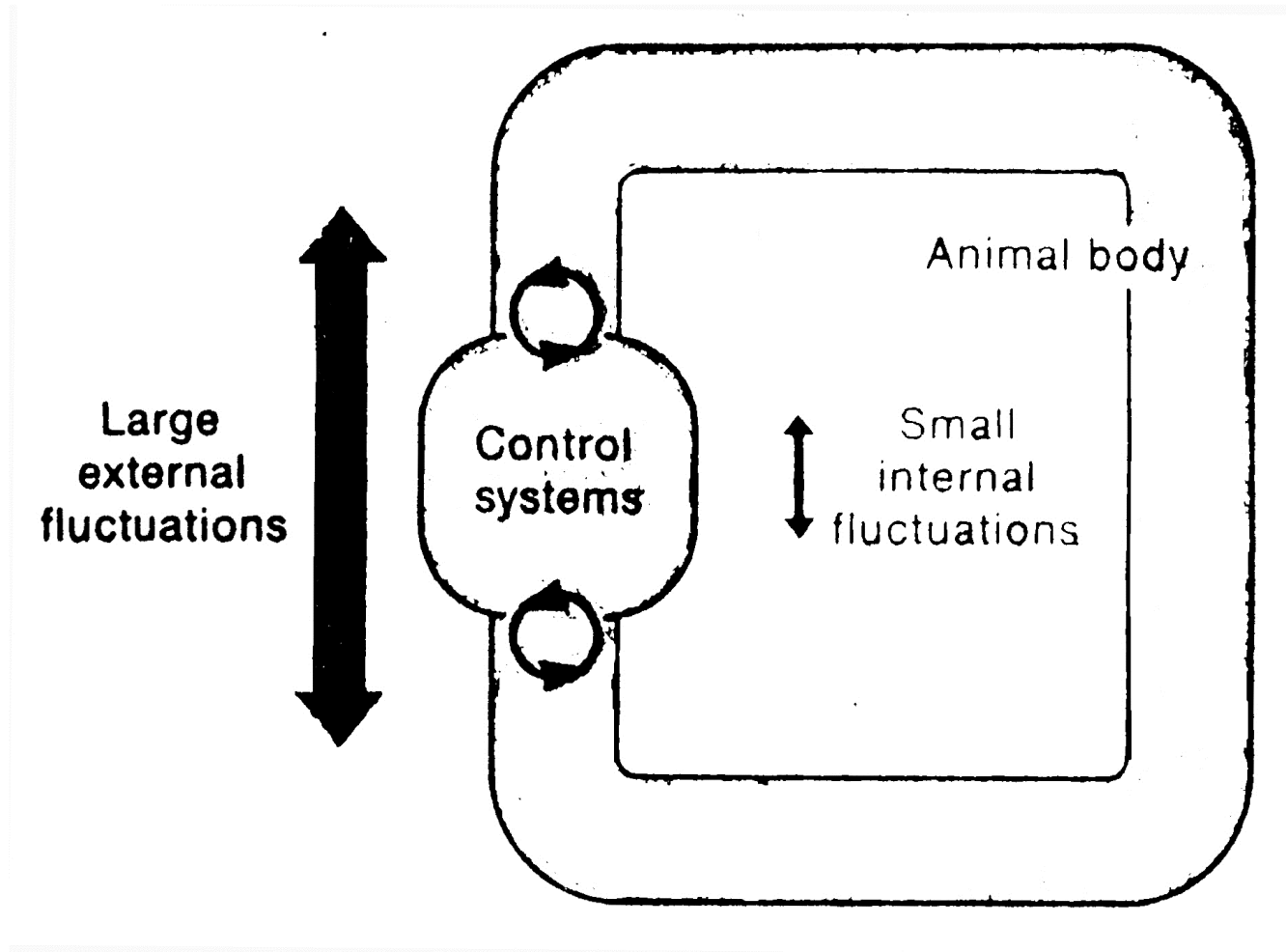


Control Mechanism:

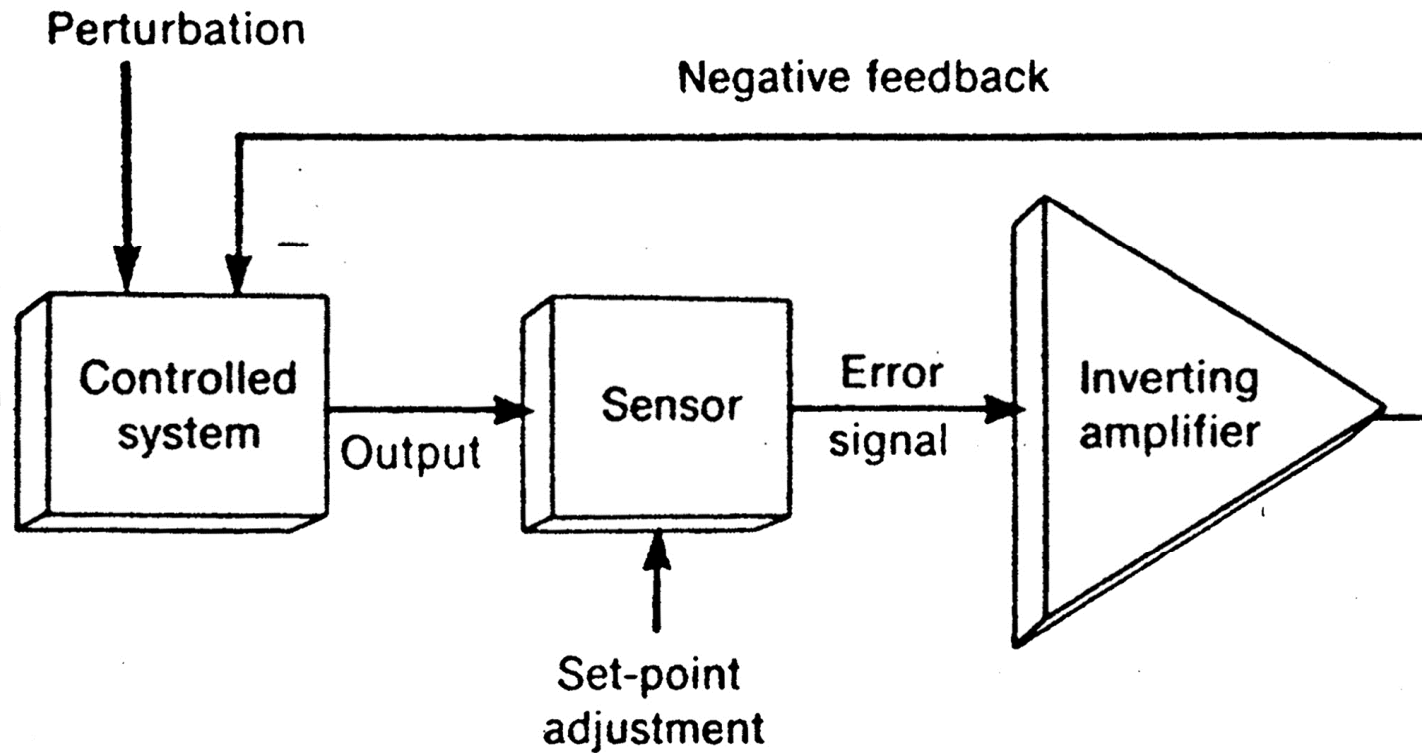
Receptor + Control center + Effector (Integrating center)

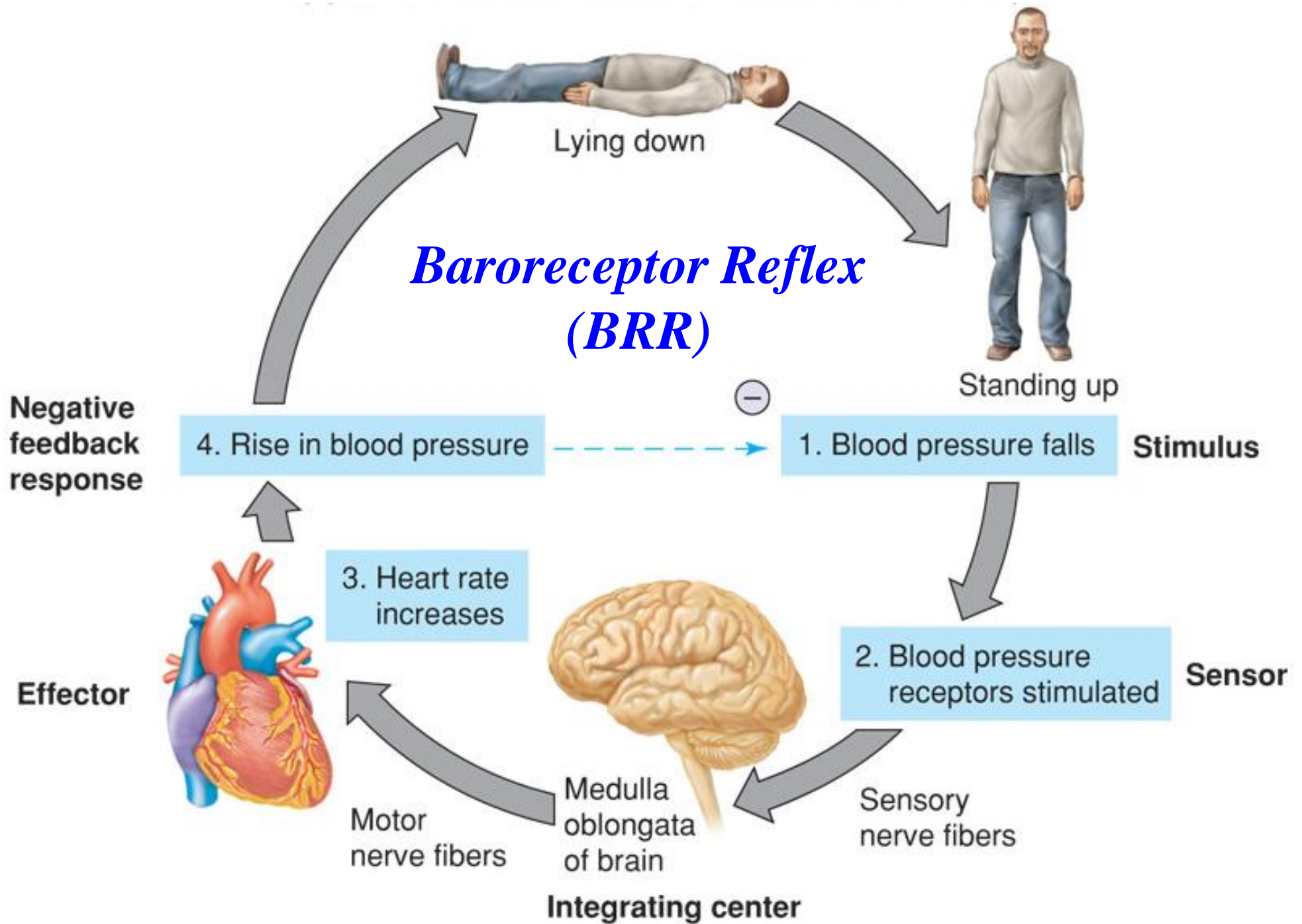


Control Mechanism: Receptor + Control center + Effector

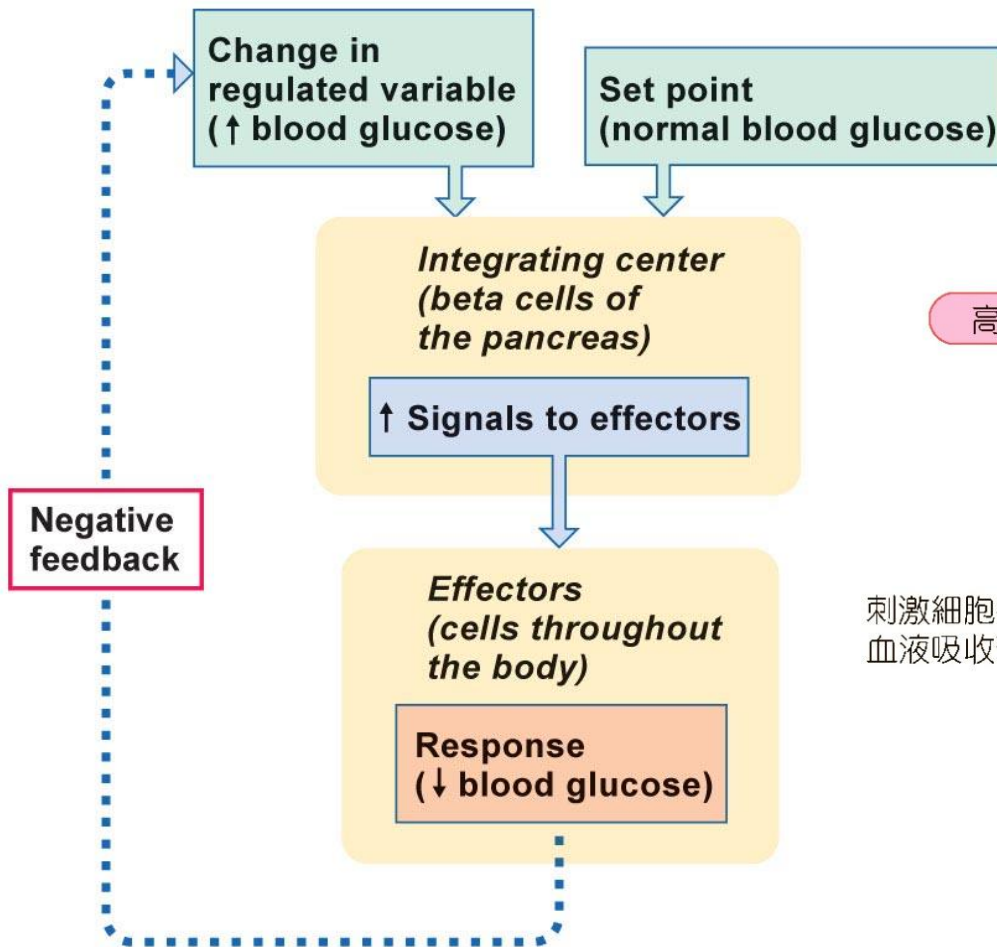


Negative Feedback

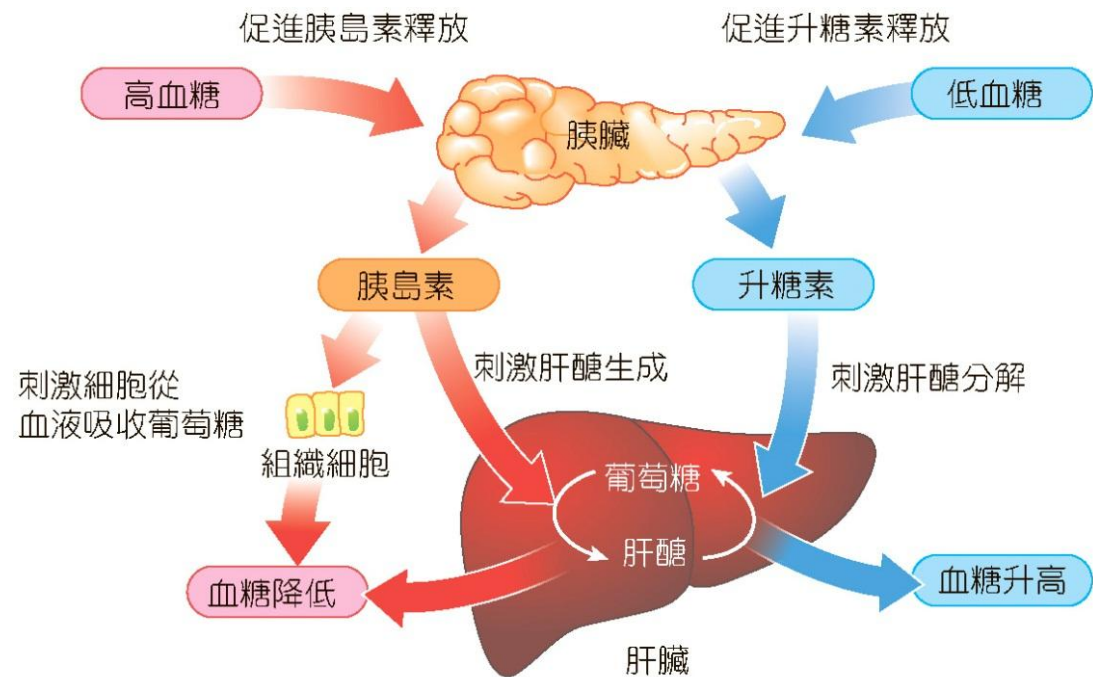




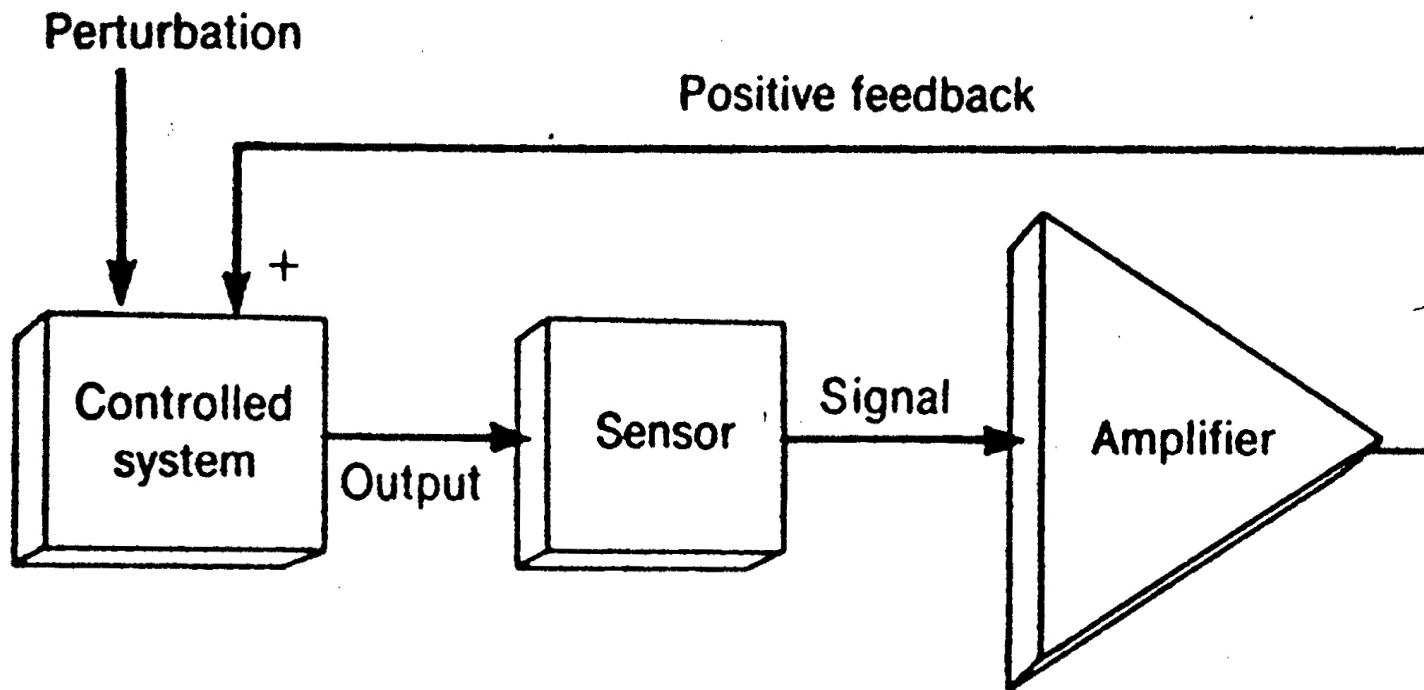
Negative Feedback: Blood Glucose



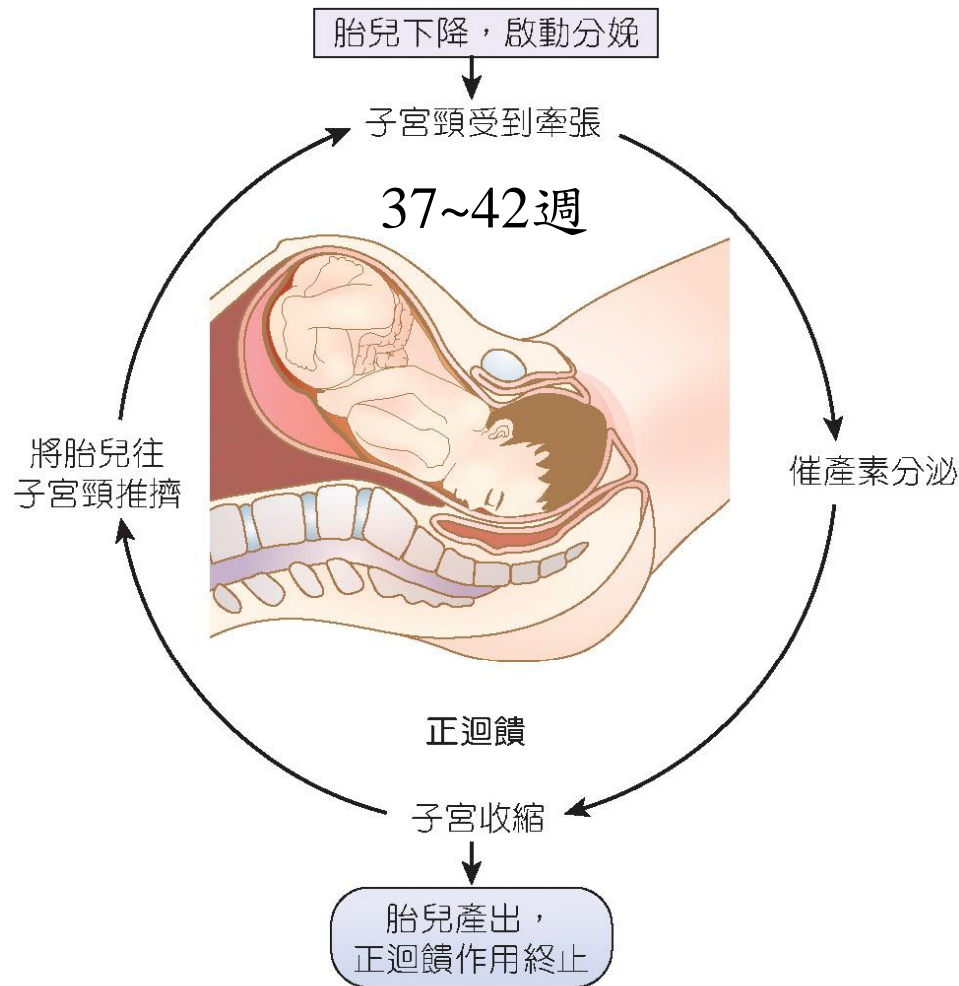
- Initial stimulus
- Physiological response
- Result



Positive Feedback

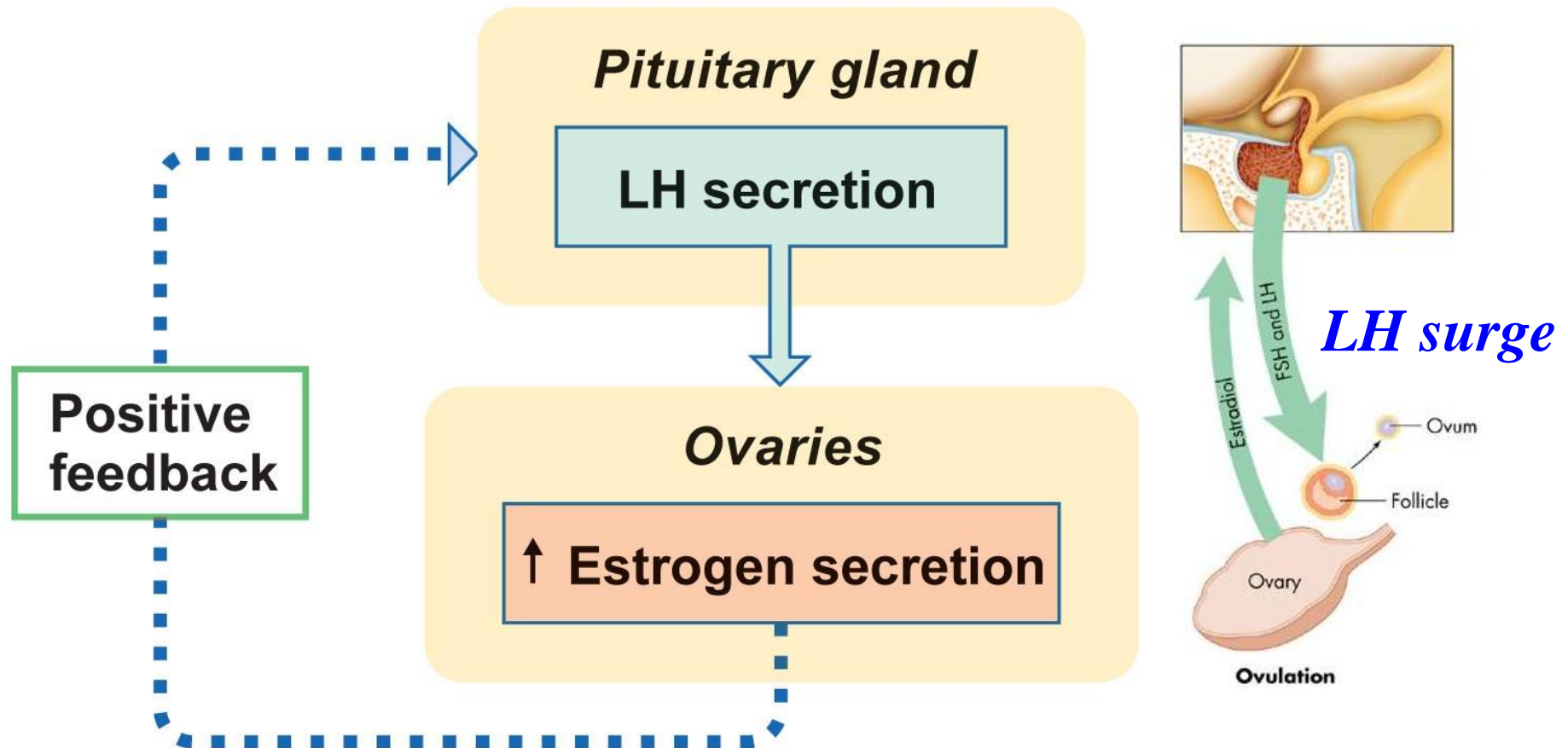


Positive Feedback: Parturition



- ❖ Stretch receptors in walls of the uterus send signals to the brain
- ❖ Brain releases a hormone (oxytocin) into bloodstream
- ❖ Uterine smooth muscle contracts more forcefully
- ❖ More stretch → more hormone → more contraction → etc.
- ❖ The cycle ends with birth of the baby & decrease in stretch

Positive Feedback: Ovulation



 Initial stimulus

 Result

LH: luteinizing hormone

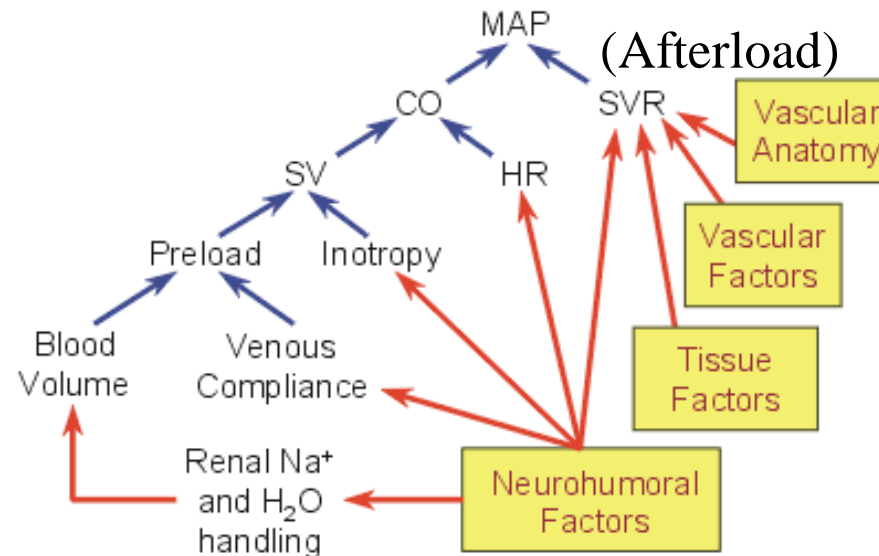
Negative & Positive Feedback

表 1-3 負迴饋與正迴饋的比較

比較項目	負迴饋	正迴饋
迴饋資訊方向	與控制資訊相反	與控制資訊相同
對控制系統的作用	制約、抑制、減弱其活動	再生、促進、加強其活動
調節作用方向	雙向可逆	單向不可逆
作用效果	減小偏差資訊、減弱控制資訊、減小輸出變數	增大偏差資訊、增強控制資訊、加大輸出變數
輸出與輸入關係	輸出制約輸入	輸出強化輸入

Neurohumoral Regulation: Blood Pressure

神經—體液(內分泌)調節



- **Neural (autonomic) factors**
- **Humoral (circulating or hormonal) factors**
Catecholamines, renin-angiotensin system, vasopressin (antidiuretic hormones), atrial natriuretic peptide, endothelin, etc.

表 1-5 神經調節和內分泌調節的比較

比較項目 \ 調節方式	神經調節	內分泌調節
訊息	有	有
傳遞方式	神經衝動沿神經元傳導，神經傳遞物質越過突觸間隙	經血液運輸
發揮作用速度	迅速	緩慢
作用維持時間	短暫（記憶儲存除外）	持久
作用範圍與精確度	局限、精確	廣泛分散、不很精確
作用距離	短	長
作用的靈敏性	靈活	不靈活
其他	有預見性。人類還有語言、文字，擴大感覺範圍	自我穩定較明顯

Homeostatic Imbalances

- ❖ Disruption of homeostasis can lead to disease and death.
- ❖ *Disorder* is a general term for any derangement of abnormality of function.
- ❖ *Disease* is a more specific term for an illness characterized by a recognizable set of signs and symptoms.
 - A local disease is one that affects one part or a limited region of the body.
 - A systemic disease affects either the entire body or several parts.

幸福的地方

有一天，小獅子問它的媽媽：「幸福在什麼地方？」

獅子媽媽說：「幸福就在你的尾巴上。」

於是，小獅子不停地追著自己的尾巴。

不過，它追了一整天也追不到...

它把這情形告訴媽媽。

獅子媽媽笑說：「其實你不用刻意找尋幸福，只要你一直向前走，幸福便會自然的跟著你！」