



## Pathophysiology-Introduction

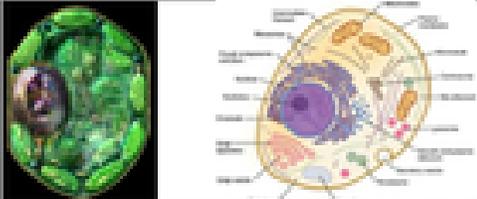
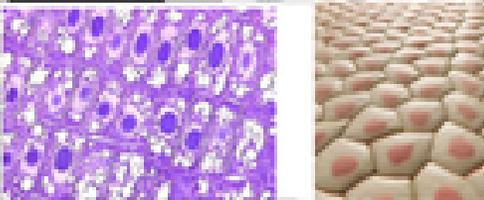
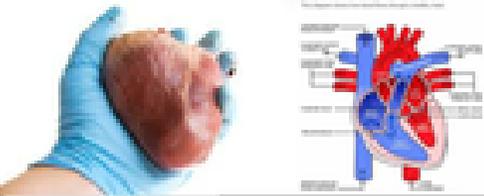
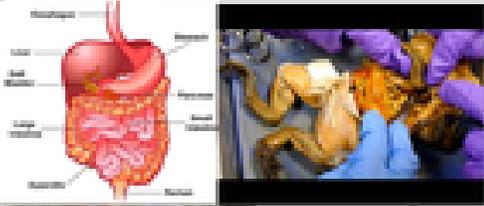
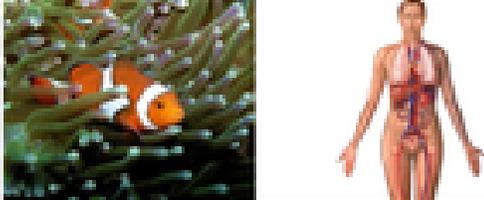
### Faculty of Pharmaceutical Sciences

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Understanding  
pathophysiology  
begins with  
understanding the  
body's basic building  
block: the cell.

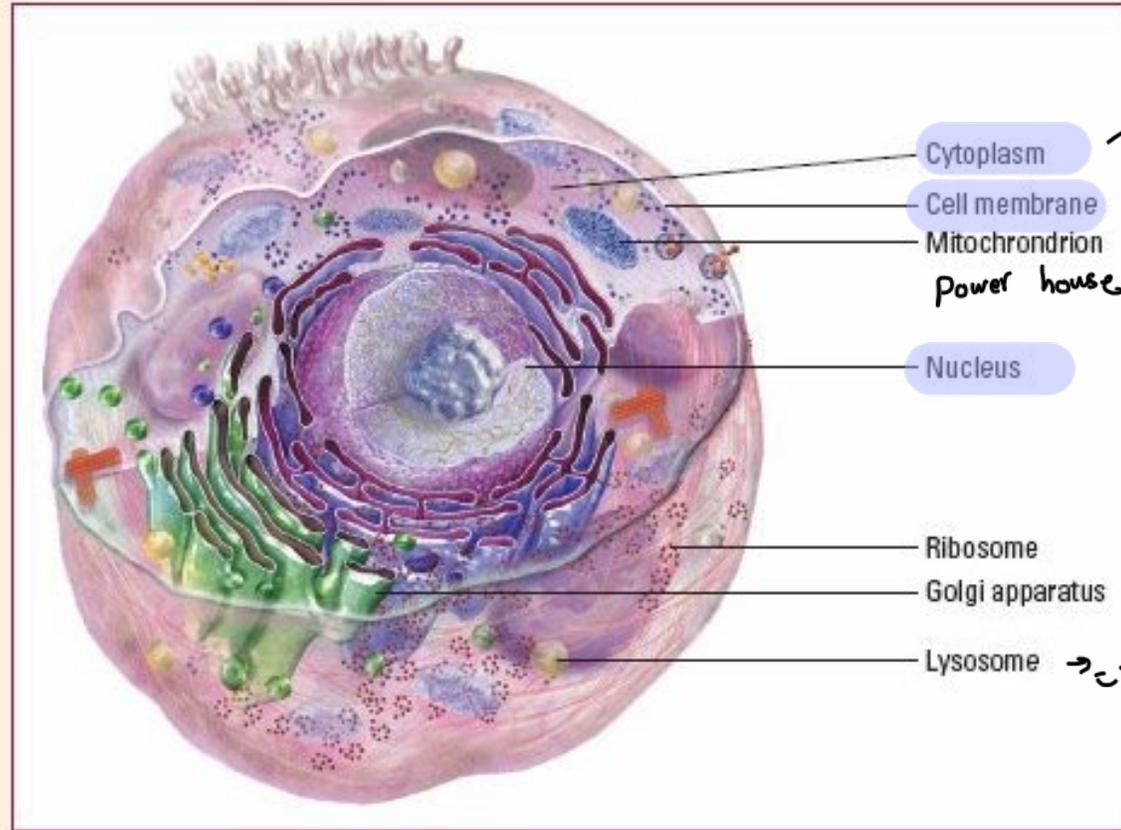


**Pathophysiology made incredibly easy!.—5th ed**

<p>Cell</p>	<p>Basic structural and functional unit of a living organism</p>	
<p>Tissue</p>	<p>Group of cells with similar structures, working together to perform a shared function</p>	
<p>Organ</p>	<p>Structure made up of a group of tissues, working together to perform specific functions</p>	
<p>Organ System</p>	<p>Group of organs with related functions, working together to perform body functions</p>	
<p>Organism</p>	<p>Living thing performing all seven life processes</p>	

## Just your average cell

The illustration below shows cell components and structures. Each part has a function in maintaining the cell's life and homeostasis.



→ cyto sol + organelles

المكونات  
الرئيسية للخلية

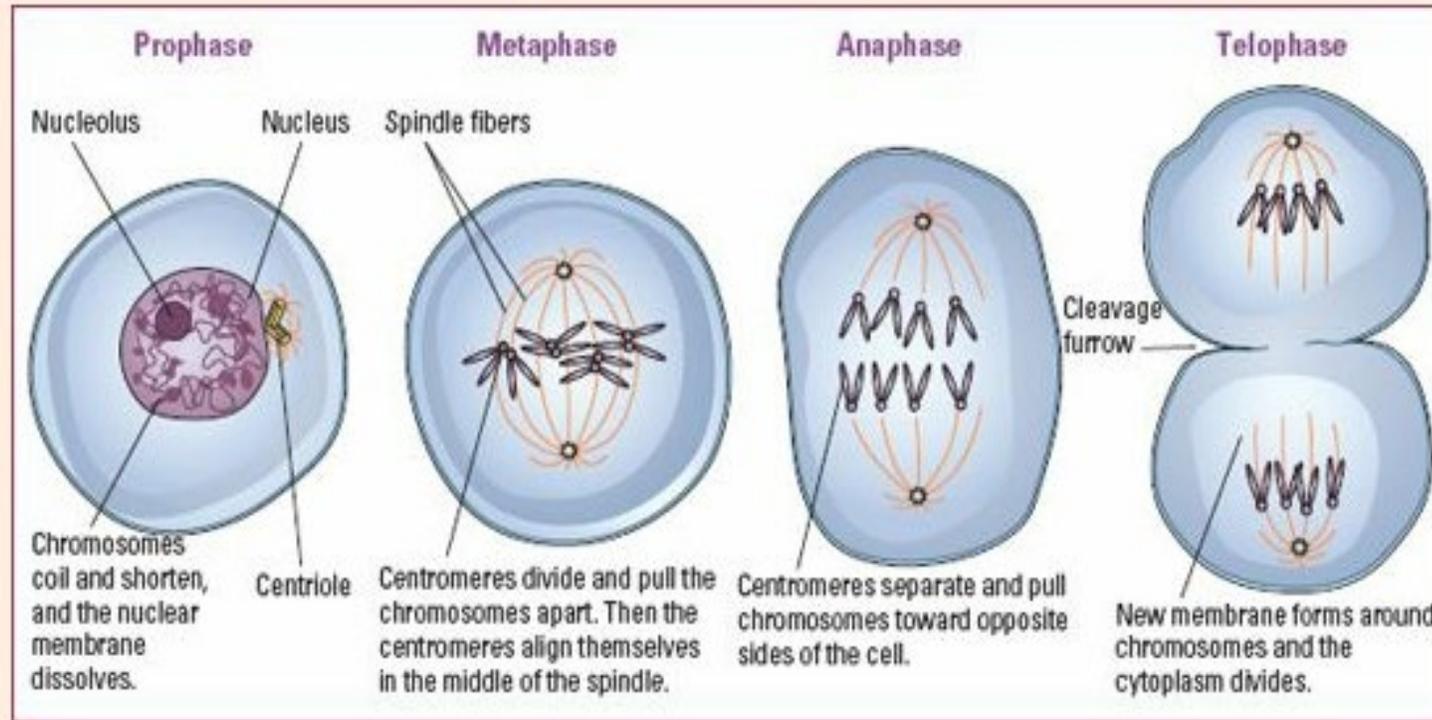
power house

→ محللات

# Replicate and divide

صن بئكل معق .

These illustrations show the different phases of cell reproduction, or *mitosis*.

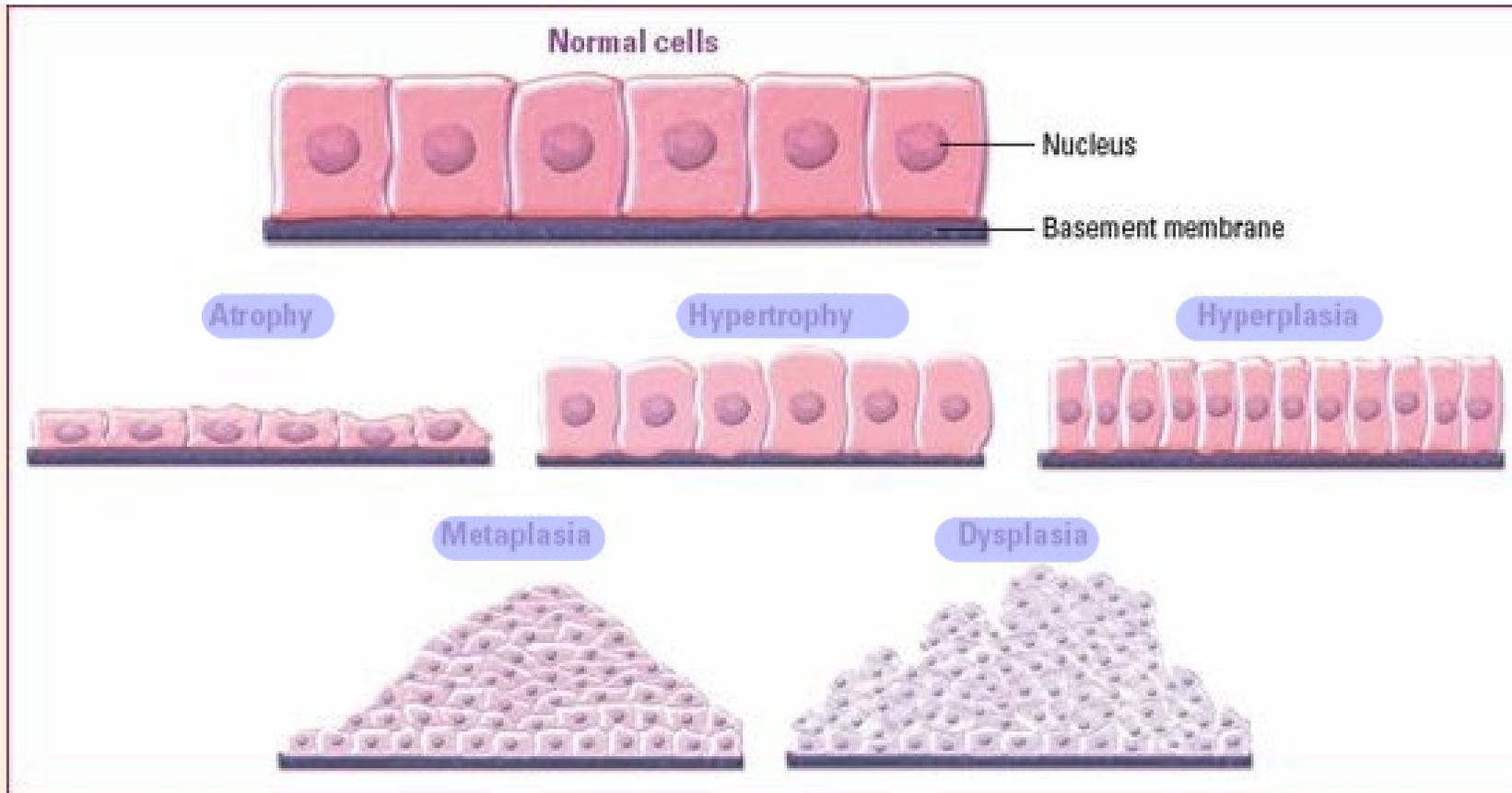


# Pathophysiologic concepts

Stressors, changes in the body's health, disease, and other extrinsic and intrinsic factors can alter the cells' normal functioning.

Cells generally continue functioning despite challenging conditions or stressors. However, severe or prolonged stress or changes may injure or destroy cells. When cell integrity is threatened, the cell reacts by drawing in its reserves to keep functioning, by adaptive changes or by cellular dysfunction. If the cellular reserve is insufficient, the cell dies (cell death (necrosis, is usually localized and easily identifiable, occurs). If enough reserve is available and the body doesn't detect abnormalities, the cell adapts by atrophy, hypertrophy, hyperplasia, metaplasia, or dysplasia.

# Adaptive cell changes



## Atrophy

Size الخلية أقل مما هو عليه في الحالة الطبيعية، مثل الـ aging، وnormal، وmalnutrition، وabnormal مثل

Atrophy is a reversible reduction in the size of the cell. It results from disuse, insufficient blood flow, malnutrition, denervation, or reduced endocrine stimulation.

## Hypertrophy

Size الخلية زاد وnormal body build، وabnormal حالة مرضية \* pathological

Hypertrophy is an increase in the size of a cell due to an increased workload. It can result from normal physiologic conditions or abnormal pathologic conditions.

## Hyperplasia

زيادة عدد الخلايا الفئوج او ال pregnancy، وnormal a b ← تفعم بالعدة الدرقية

Hyperplasia, an increase in the number of cells, is caused by increased workload, hormonal stimulation, or decreased tissue.

## Metaplasia

مثال المدخنين: يتبدل خلايا الرئة لـ squamous بدل ال epithelial cells، وDysplasia بعدين بير من metaplasia → متسرطان الرئة.

Metaplasia is the replacement of one adult cell with another adult cell that can better endure the change or stress. It's usually a response to chronic inflammation or irritation.

## Dysplasia

ال cancer مش يتبدل الخلايا بتغير خصائصها

In dysplasia, deranged cell growth of specific tissue results in abnormal size, shape, and appearance. Although dysplastic cell changes are adaptive and potentially reversible, they can precede cancerous changes.



## Memory jogger

To remember the four causes of cell injury, think of how the injury tipped (or **TIPD**) the scale of homeostasis:

**T**oxin or other lethal (cytotoxic) substance

**I**nfection

**P**hysical insult or injury

**D**eficit, or lack of water, oxygen, or nutrients.

Degeneration occurs in the cytoplasm of the cell; the nucleus remains unaffected.



موت الخلايا

injury إصابة شغل عن  
 ← degeneration ← سبب injury ليس عن degeneration  
 بسن اذا كان ار injury مستمر ليس اسمه necrosis  
 = unprogramme pathway  
 غير مبرمج  
 ما بينا الخلايا بنو تنو .  
 ما يحتاج activation necrosis  
 ل pathway حين .  
 programme death cell  
 (Programme)  
 activation بعمل  
 \* قتل الخلايا الزيادة  
 مثل الخلايا السرطانية  
 ل pathway  
 ميتين بالجسم لحتى تقفل الخلية نفسها .

في حالة ال Dysplasia ما يشغل ك degeneration ولا necrosis عشا هيك مرفا ال  
 Cancer بعلمهم سيماري  
 عننا بغير ل activation  
 ل pathway  
 بيجنز ال ال المتحول للخلايا

# A type of nonlethal cell damage known as degeneration

# Degeneration

When changes within cells are identified, degeneration may be slowed or cell death prevented through prompt treatment. An electron microscope makes the identification of changes within cells easier.

patient + انه معنى تاري : الشخص يكون مشحون بمرضاة و ظاهره عليه الامراض

When a disease is diagnosed before the patient complains of any symptoms, it's termed subclinical identification. Unfortunately, many cell changes remain unidentifiable even under a microscope, making early detection impossible.

Signs, symptoms

مش ظاهرين مع انه عنده المرض

مثل شخص علمنا له blood test وتأكدنا من وجود المرض  
نكن ما عليه اية امراض

# Cell aging

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- During the normal process of cell aging, cells lose structure and function. Lost cell structure may cause a decrease in size or wasting away, a process called atrophy.

## **In's and out's of cell aging**

Factors that affect cell aging may be intrinsic or extrinsic, as outlined here.

### **Intrinsic factors**

- Psychogenic
- Inherited
- Congenital
- Metabolic
- Degenerative
- Neoplastic
- Immunologic
- Nutritional

### **Extrinsic factors *Physical agents***

- Force
- Temperature
- Humidity
- Radiation
- Electricity
- Chemicals

### ***Infectious agents***

- Viruses
- Bacteria
- Fungi
- Protozoa
- Insects
- Worms

# HOMEOSTASIS

التوازن الداخلي

- The body is constantly striving <sup>سعي</sup> to maintain a dynamic, steady-state of internal balance called homeostasis. Every cell in the body is involved in maintaining homeostasis, both on the cellular level and as part of an organism.
- Any change or damage at the cellular level can affect the entire body. When an external stressor disrupts homeostasis, illness may occur. A few examples of external stressors include injury, lack of nutrients, and invasion by parasites or other organisms. Throughout the course of a person's life, many external stressors affect the body's internal equilibrium.

Pathophysiology made incredibly easy!.—5th ed

Every cell in the body is involved in maintaining *homeostasis*, a dynamic, steady state of internal balance.



Pathophysiology made incredibly easy!.—5th ed

## Maintaining the balance

Three structures in the brain are responsible for maintaining homeostasis:



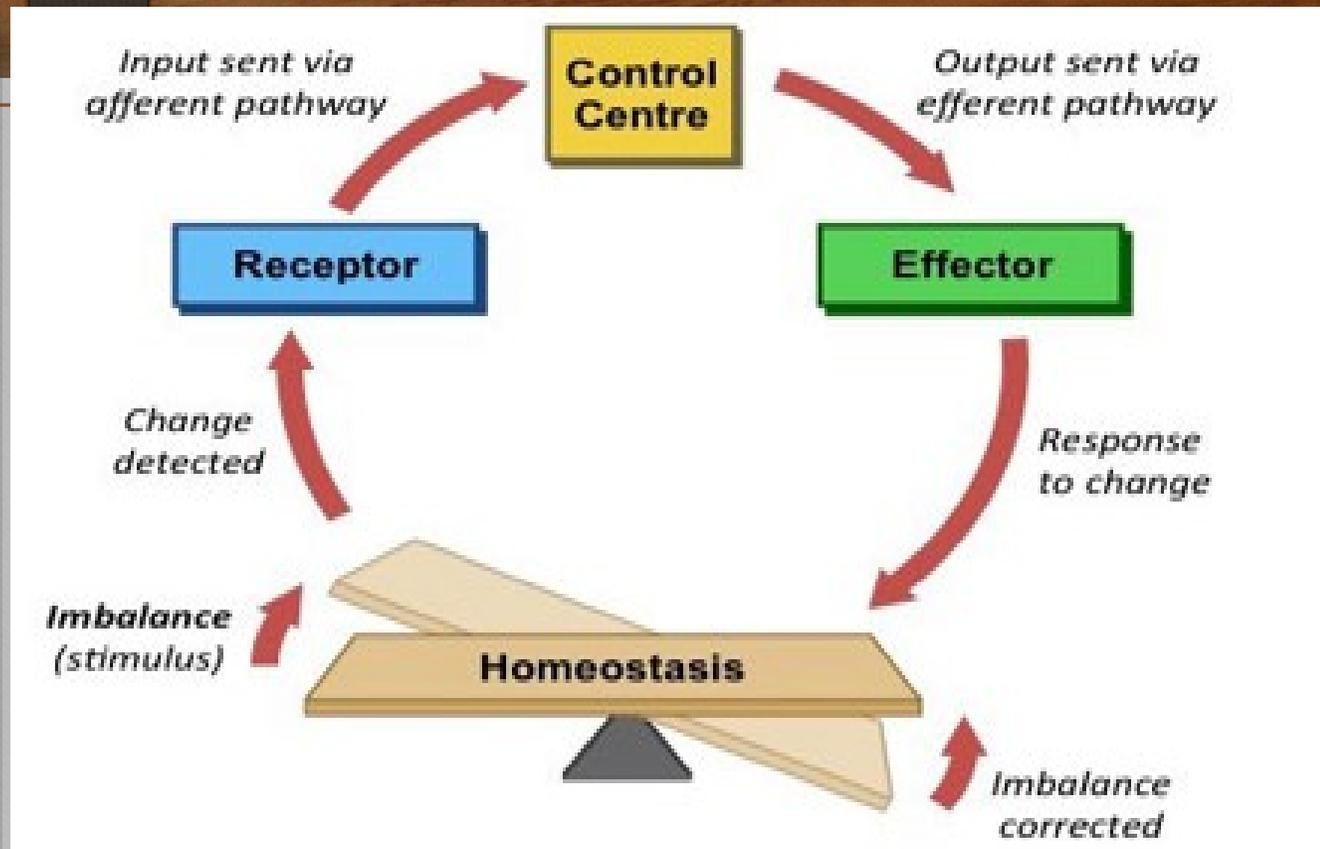
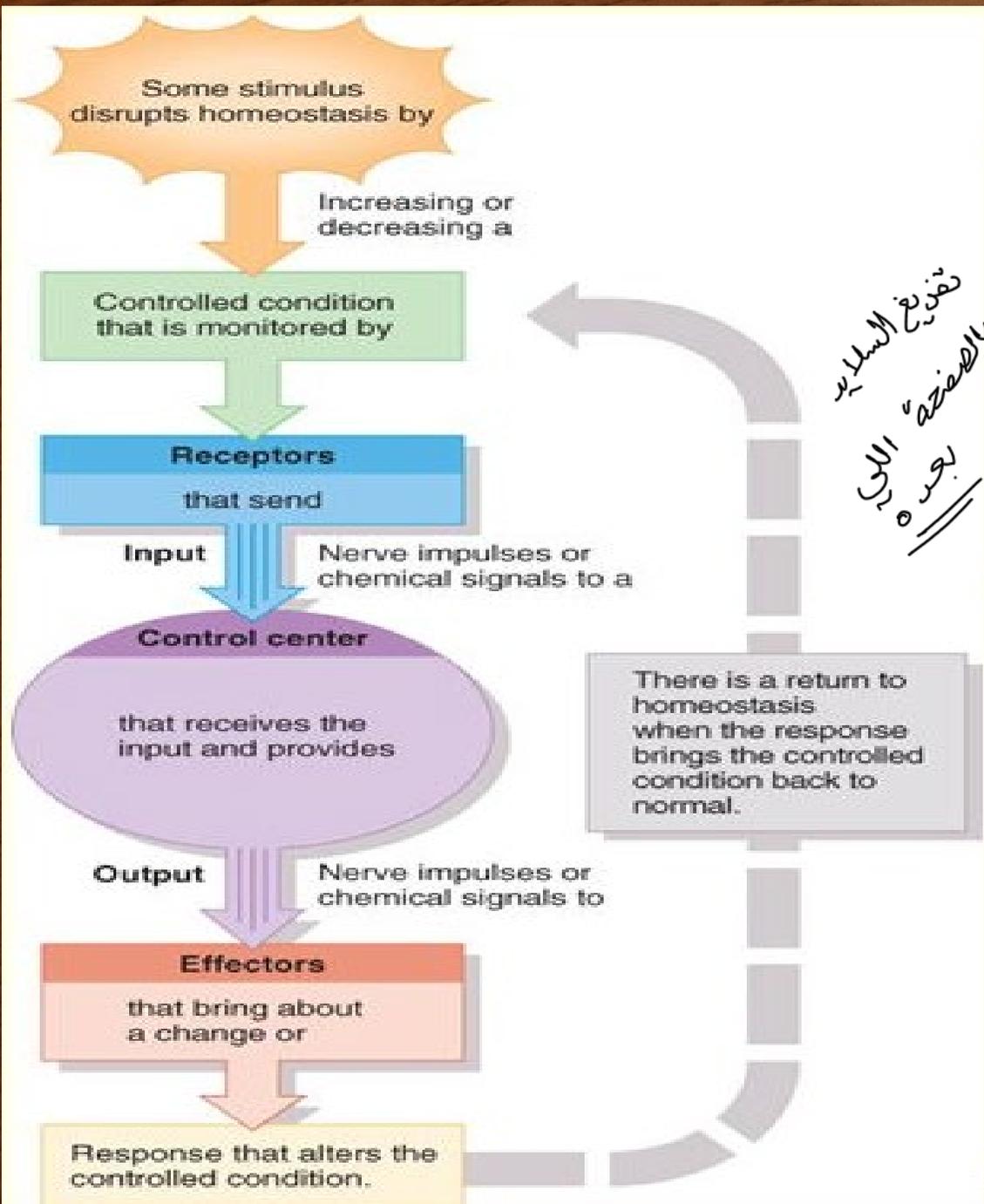
the medulla oblongata, the part of the brain stem that's associated with vital functions, such as respiration and circulation



the pituitary gland, which regulates the function of other glands and thereby a person's growth, maturation, and reproduction



the reticular formation, a group of nerve cells or nuclei that form a large network of connected tissues that help control vital reflexes, such as cardiovascular function and respiration.



Group of receptors and effectors communicating with their control center forms a feedback system

Stimulus يردح بيجل activation  
لا receptors  
اللي في ال dendrites

لل extension sensory neuron

بعدين بيسر عننا action potential

ولكون عننا املا نوعين من ال receptors :

① ionotropic : قنوات ال ions بتكون بنفس  
ال receptor

② metabotropic : قنوات (لايونات) ما بتكون  
مع ال receptor .

وبتفتح قنوات الوديوم وبتزيد الموجبية وبتوصل  
للعتبة وبتكون قنوات ال بوتاسيوم مغلقة -

و بيسر عندي action potential بدل graded potential

و بتوصل لـ +30 باستثناء cardiac muscle  
depolarization

activation

و بعدين بتسكر قنوات الوديوم وبتفتح ال بوتاسيوم  
contraction

و بيسر عننا Repolarization

inhibition

و بتوصل للسالبية -70

و بتوصل لـ terminals في ال bulb  
و بتخرج النواقل العصبية لترتبط بـ receptors  
في الخلية العصبية  
اللي بعدها .

الـ afferent pathway وبعدين بتنقل المعلومات عبر الـ analysis  
عندي interneurons

و بعدين CNS

يعطي ال

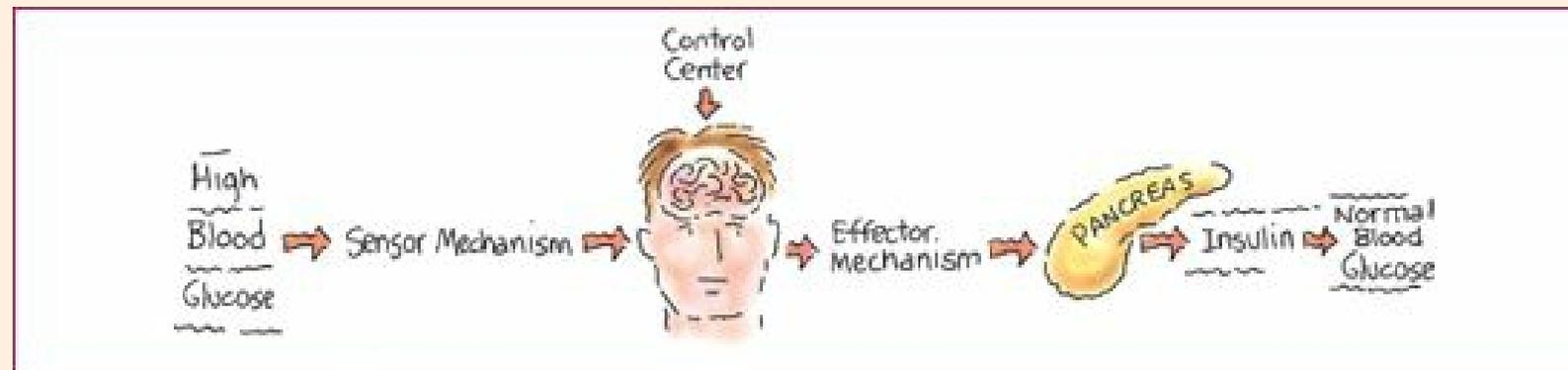
Commands

Negative feedback  
cancels out the  
original response.  
Positive feedback  
exaggerates it.



## Negative feedback, positive result

This flowchart shows how a negative feedback mechanism works to restore homeostasis in a patient with a high blood glucose level.



# POSITIVE FEEDBACK SYSTEM

يعطي نفس ال direction  
ال control variable  
مثلا واحد عنه ارتفاع بالسكري  
واشتغل عنه ال positive  
هنا السكري يعل يرتفع

+ مثلا عملية الولادة : عملية ال Contractions تظل مستمرة بفا positive فبعطوها للأم مخدر بي بعد الولادة عشائ يوقف ال positive . فيعد ما تولد الجنين مع المخدر  
بوقف ال positive .

في ال positive يرتد ال contraction لعقله الجوفن فيزيد ال  
sympathetic و يثبط ال para sympathetic

## ...and the positive

The positive feedback mechanism is far from positive. It takes the original response and exaggerates it. It's said to be positive because the change that occurs proceeds in the same direction as the initial disturbance, causing a further deviation from homeostasis. A positive feedback mechanism is responsible for intensifying labor contractions during childbirth.

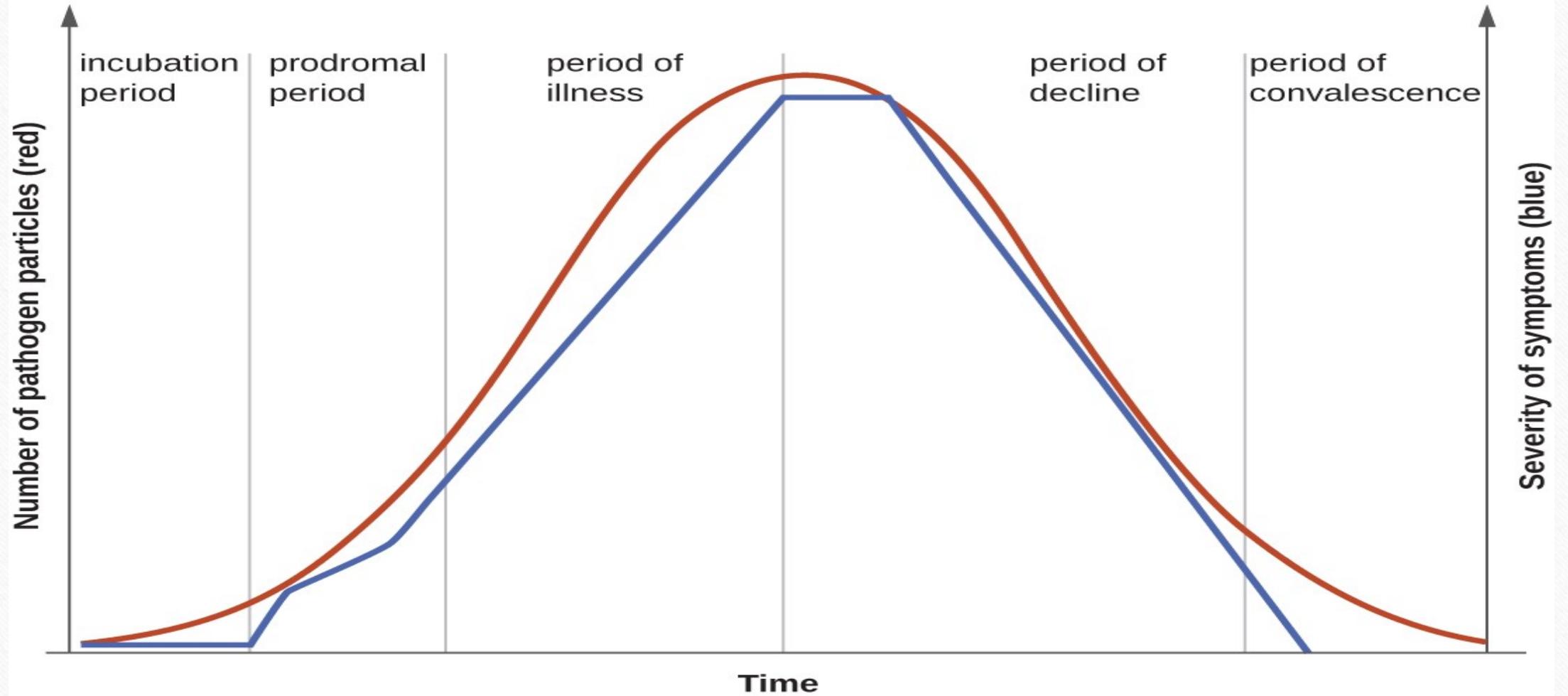
# DISEASE AND ILLNESS

injury جرح  
illness → بقدر يرجع  
طبيعي الريفاتش مشخض بالمرض  
disease نزي عنده المرض  
حاله التي ما معه  
املا جلاله

- Disease occurs when homeostasis isn't maintained.
- One aspect of the disease is its cause (the fancy term is **etiology**).
- Diseases with no known cause are called **idiopathic**.
- A disease's development is called its **pathogenesis**.

مثل شخص ما عنده  
family history  
healthy life style  
وفجأة تم تشخيصه بأنه عنده  
hypertension هو السبب مش معروف عايناً .

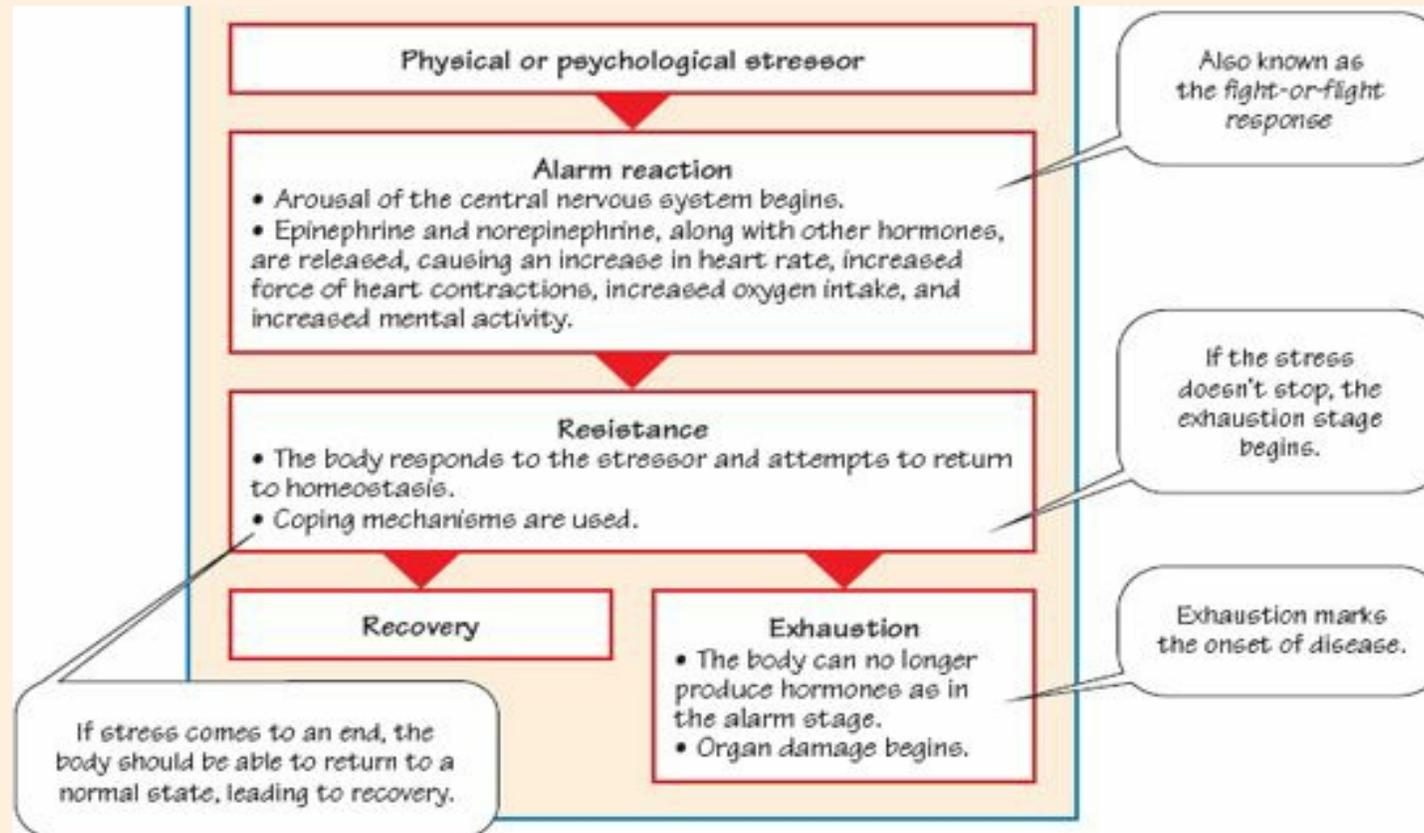
## Periods of Disease



<https://courses.lumenlearning.com/microbiology/chapter/characteristics-of-infectious-disease/>

## When stress strikes

According to Hans Selye's General Adaptation Model, the body reacts to stress in the stages depicted below.





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## *Quick quiz*

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1. The organelle that contains the cell's DNA is the:

- A. mitochondria.
- B. Golgi apparatus.
- C. ribosome.
- D. nucleus.

2. When a cell gets injured, the first sign is:

- A. a biochemical lesion.
- B. an area of hyperplasia.
- C. a chromatid.
- D. cellular necrosis.

3. An extrinsic factor that can cause cell aging and death is:

A. Down syndrome.

B. sickle cell anemia.

C. ultraviolet radiation.

D. person's advanced age.

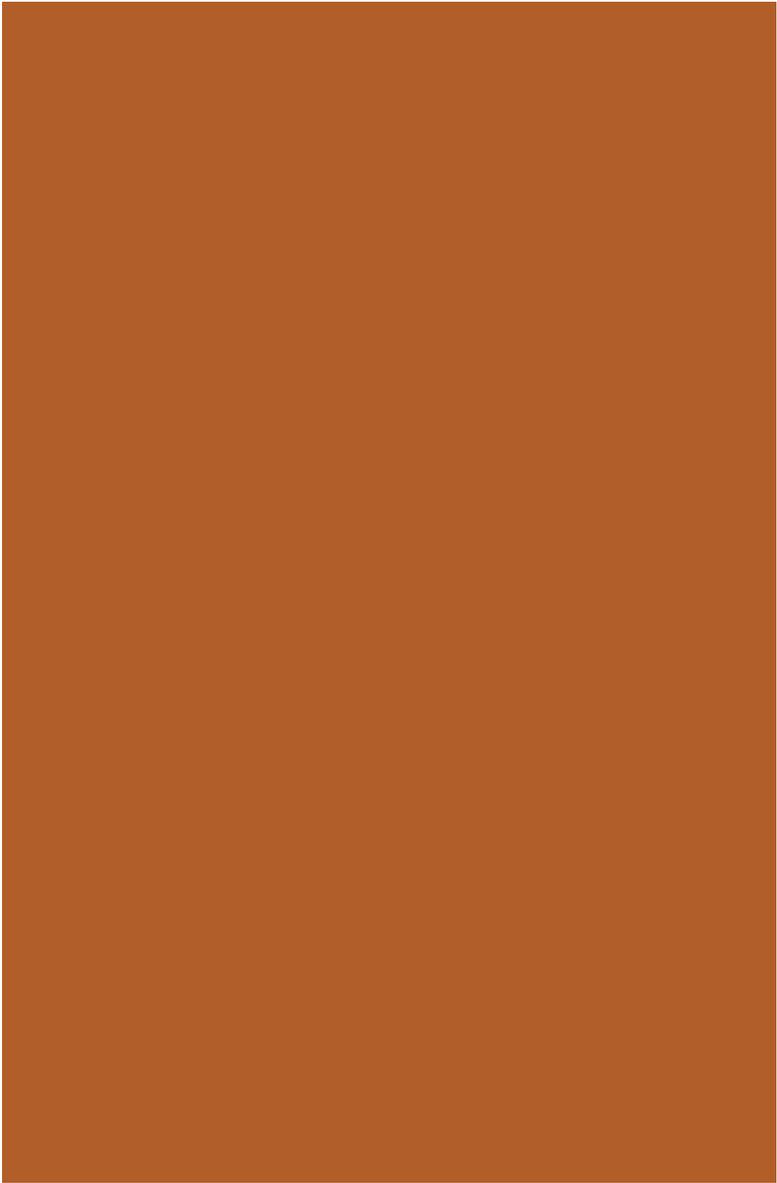
4. Homeostasis can be defined as:

A. a steady, dynamic state.

B. a state of flux.

C. an unbalanced state.

D. an exaggeration of an original response.



**Thank You**