

# Pathophysiology

## Lec. 1 + 2

Introduction to pathophysiology\  
Definitions

*Lecturer*

*Dr. Tayseer Sh. Mahmood*

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فَدَلَّلَنَا عَلَى الْبِرِّ إِذْ آمَنَّا بِكَ وَأَكْرَمَنَا إِذْ تَوَلَّيْنَاكَ إِذْ جَاءَنَا

صَدَقَ اللَّهُ الْعَظِيمَ

**Dedication**  
**To Al-Hadi University**  
**College and its students in**  
**Nursing department**

<b>no</b>	<b>subject</b>	<b>page</b>
<b>1</b>	<b>IntroductiPathophysiology on</b>	<b>6</b>
<b>2</b>	<b>types of disease</b>	<b>8</b>
<b>3</b>	<b>Stages of disease</b>	<b>10</b>

## **General objective**

**In the end of lecture, the student must be:**

- 1. Understand what pathophysiology**
- 2. Know the most important terms in pathophysiology**

## **Specific objective**

**In the end of lecture, the student must be:**

- 1. Define pathophysiology**
- 2. Enumerate types of diseases**
- 3. Enumerate the stages of diseases**

## Pathophysiology :

Pathophysiology is the study of functional changes in the body that occur in response to disease or injury. For example, if someone ingests a toxin, that toxin might be associated with a variety of physical changes, such as inflammation ..

-first is **physiology**, the study of the body and its functions.

- The second is **pathology**, the study of disease and its impact on the body.

**DISEASE** :A DISEASE IS A PARTICULAR ABNORMAL, PATHOLOGICAL CONDITION THAT AFFECT PART OR ALL OF AN ORGANISM. IT IS OFTEN CONSTRUED AS A MEDICAL CONDITION ASSOCIATED WITH SPECIFIC SYMPTOMS AND SIGNS. IT MAY BE CAUSED BY FACTORS ORIGINALLY FROM AN EXTERNAL SOURCE, SUCH AS INFECTIOUS DISEASE, OR IT MAY BE CAUSED BY INTERNAL DYSFUNCTIONS, SUCH AS AUTOIMMUNE DISEASES.



# There are four main types of disease:

1. pathogenic disease,
2. deficiency disease,
3. hereditary disease,
4. physiological disease.

Diseases can also be classified as communicable (infectious ) and non-communicable (non-infectious) .



- **Pathogens:** The micro-organisms that cause these diseases are known as pathogens and include varieties of bacteria, viruses, protozoa and fungi

- **Infectious diseases**

can be transmitted, e.g. by hand-to-mouth contact with infectious material on surfaces, by bites of insects or other carriers of the disease, and from contaminated water or food (often via fecal contamination), etc.

- **non-infectious diseases**

Some diseases forms of cancer, heart disease, and mental disorders, are Many non-infectious diseases have a partly or completely genetic basis and may thus be transmitted from one generation to another.

## ○ Stages of disease :

- **Acute disease** : An acute disease is a short-lived disease, like the common cold.

- **Chronic disease** : A chronic disease is one that lasts for a long time , usually at least six months.

## ○ Scope of disease :

- **Localized disease** : a localized disease is one that affects only one part of the body, such as athlete's foot or an eye infection.

- **Disseminated disease** : a disseminated disease has spread to other parts; with cancer, this is usually called **metastatic disease**.

- **Systemic disease** : a systemic disease is a disease that affects the entire body, such as influenza or high blood pressure.

- **Flare-up** : a flare-up can refer to either the recurrence of symptoms or an onset of more severe symptoms.
- **Refractory disease** : A refractory disease is a disease that resists treatment, especially an individual case that resists treatment more than is normal for the specific disease in question.
- **Progressive disease** : Progressive disease is a disease whose typical natural course is the worsening of the disease until death, serious debility, or organ failure occurs.
- **stable disease or static disease**: a medical condition that exists, but does not get better or worse.

- **Cure** : A cure is the end of a medical condition or a treatment that is very likely to end it, while remission refers to the disappearance, possibly temporarily of symptoms. Complete remission is the best possible outcome for incurable diseases.
- **Prevention** : Many diseases and disorders can be prevented through a variety of means. These include proper nutrition, adequate exercise, vaccinations and other self-care and public health measures.

- **Treatment** : Medical therapies or treatments are efforts to cure or improve a disease or other health problem. In the medical field, **therapy** is synonymous with the word treatment.

Common treatments include **medications, surgery, medical devices,** and **self-care.**

- **A preventive therapy** : is a way to avoid an injury, sickness, or disease in the first place.
- **Pain management** (also called pain medicine) is that branch of medicine employing relief of pain and improvement in the quality of life.

- Test:
- Q \ what is the difference between physiology and pathophysiology ?
  
- References:
- Porth - Essentials of Pathophysiology 4th Edition

# Pathophysiology

**Lec. 3+4**

## **Cell Damage**

*Lecturer*

*Dr. Tayseer Sh. Mahmood*

<b>no</b>	<b>subject</b>	<b>page</b>
1	Programmed cell-death	4
2	Types of cell damage :	6
3	Causes of cell damage :	7
4	Targets of cell damage	8
5	Repair of cell damage	9
6	Necrosis	9
7	Causes of Necrosis	18
8	Treatment	19



## **General objective**

**In the end of lecture, the student must be:**

- 1. Understand the term apoptosis and necrosis**
- 2. Know the important of theses terms in body cells**

## **Specific objective**

**In the end of lecture, the student must be:**

- 1. Define apoptosis and necrosis**
- 2. Enumerate types of cell damage**
- 3. Explain repair of cell damage**
- ,4 . Identified the causes of necrosis and treatment**

**Programmed cell-death** (or PCD) is death of a cell in any form, mediated by an intracellular program. PCD is carried out in a regulated process, which usually confers advantage during an organism's life-cycle.

For example, the differentiation of fingers and toes in a developing human embryo occurs because cells between the fingers apoptose; the result is that the digits are separate

- **Apoptosis** and **autophagy** are both forms of programmed cell death, but **necrosis** is a non-physiological process that occurs as a result of infection or injury.
- Cell damage can result in death of individual cells, tissue or organ failure and /or death of the organism.
- Harmful molecules cause cell damage such as :
  - free radicals
  - products of energy production.
- These damage the **proteins, fats** and **DNA** that make up cells.

# Types of cell damage :

## 1. Apoptosis or Type I cell-death :

Process of self-destruction of the cell nucleus. In apoptosis the cells shrink from a decrease of cytosol and the nucleus, but the organelles appear normal. The cell disintegrates into fragments referred to as **apoptotic bodies**.

In the average adult between 50 and 70 billion cells die each day due to apoptosis.

**Inhibition of apoptosis** can result in a number of cancers, autoimmune diseases, inflammatory diseases, and viral infections.

**Hyperactive apoptosis** can lead to neurodegenerative diseases, hematologic diseases, and tissue damage.

## 2. Autophagy or Type II cell-death :

Autophagy is generally activated by conditions of nutrient deprivation but has also been associated with physiological as a pathological processes such as development, differentiation, neurodegenerative diseases, stress, infection and cancer.

### Causes of cell damage :

1. **Physical agents** : such as heat or radiation can damage a cell by literally cooking or coagulating their contents.

2. **Impaired nutrient supply** : such as lack of oxygen, or the production of adenosine triphosphate (ATP) may deprive the cell of essential materials needed to survive.

# Targets of cell damage

- □ **DNA damage:** In human cells, both normal metabolic activities and environmental factors such as ultraviolet light and other radiations can cause DNA damage, resulting in as many as one million individual molecular lesions per cell per day.
- □ **Membrane damage:** damage to the cell membrane disturbs the state of cell electrolytes, e.g. calcium, which when constantly increased, induces apoptosis.

## ○ Repair of cell damage :

- When a cell is damaged the body will try to repair or replace the cell to continue normal functions. If a cell dies the body will remove it and replace it with another functioning cell, or fill the gap with connective tissue to provide structural support for the remaining cells.
- **The goal** of the repair process is to fill the gap caused by the damaged cells to regain structural continuity.

## ○ **Regeneration of cell damage:**

,meaning the body can make more cells to replace the damaged cells keeping the organ or tissue intact and fully functional.

## ○ **Replacement of cell damage :**

When a cell cannot be regenerated the body will replace it with stromal connective tissue to maintain tissue/organ function.

○ **Stromal cells** : are the cells that support the functional cells in any organ ; fibroblasts, immune cells, pericytes, and inflammatory cells are the most common types of stromal cells.



**Necrosis** : is a form of cell injury that results in the premature death of cells in living tissue by autolysis.

Necrosis is caused by factors external to the cell or tissue, such as infection, toxins, or trauma that result in the unregulated digestion of cell components.

In contrast, **apoptosis** is a naturally occurring programmed and targeted cause of cellular death. While apoptosis often provides beneficial effects to the organism, necrosis is almost always harmful and can be fatal.

- it is necessary to remove necrotic tissue surgically, because necrotic cell making a surrounding tissue by an inflammatory response, this prevents phagocytes from removing the dead cells by phagocytosis. a procedure known as **debridement**.
- Untreated necrosis results in a build-up of decomposing dead tissue and cell debris at or near the site of the cell death. A typical example is **gangrene**.

## ○ There are five morphological patterns of necrosis:

1. Coagulative necrosis : is characterized by the formation of a gelatinous substance (gel-like) in dead tissues and can be observed by light microscopy. Coagulation occurs as a result of proteins denaturation, causing the albumin in proteins to form a firm and opaque state.

○ This pattern of necrosis is typically seen in **hypoxic (low-oxygen)** environments, such as infarction.

Coagulative necrosis occurs primarily in tissues such as the **kidney, heart and adrenal glands**.

○ Severe ischemia most commonly causes necrosis of this form.

2. Liquefactive necrosis : is characterized by the digestion of dead cells to form a viscous liquid mass.

This is typical of bacterial, or sometimes fungal infections because of their ability to stimulate an inflammatory response.

The necrotic **liquid mass** is often **creamy yellow** due to the presence of dead leukocytes and is commonly known as **pus**.

- **Hypoxic infarcts** in the brain presents as this type of necrosis, **because** the brain contains little connective tissue but high amounts of digestive enzymes and lipids, and cells therefore can be readily digested by their own enzymes.

3. Caseous necrosis : can be considered a combination of coagulative and liquefactive necrosis, typically caused by **mycobacteria** (e.g. tuberculosis), **fungi** and some foreign substances.

The necrotic tissue appears as **white and friable, like clumped cheese**. Dead cells disintegrate but are not completely digested, leaving granular particles.

Microscopic examination shows shapeless granular debris enclosed within a distinctive inflammatory border.

**Granuloma** has this characteristic

- 4. Fat necrosis : is specialized necrosis of fat tissue resulting from the action of activated lipases on fatty tissues such as the pancreas ; in the pancreas it leads to acute pancreatitis, a condition where the pancreatic enzymes leak out into the peritoneal cavity, and liquefy the membrane by splitting the triglyceride esters into fatty acids through fat saponification. --Calcium, magnesium or sodium may bind to these lesions (injuries) to produce a chalky-white substance.
- To the naked eye, calcium deposits appear as **gritty white flecks.**

- 5. Fibrinoid necrosis : is a special form of necrosis usually **caused by** immune-mediated vascular damage. It is marked by complexes of antigens and antibodies, sometimes referred to as immune complexes” placed within arterial walls together with fibrin.

## ○ Causes of Necrosis :

**External factors** : may involve ;

- **mechanical trauma** (physical damage to the body that causes cellular breakdown),
- **damage to blood vessels** (which may disrupt blood supply to associated tissue) and ischemia.
- **Thermal effects** (extremely high or low temperature) can result in necrosis due to the disruption of cells.

**Internal factors** : causing necrosis include

- **trophoneurotic disorders** : injury and paralysis of nerve cells. Pancreatic enzymes (lipases) are the major cause of fat necrosis.
- **Necrosis** can be activated by components of the immune system, such as the complement system ; bacterial toxins ; activated natural killer cells and peritoneal macrophages.
- **Toxins and pathogens** may cause necrosis; toxins such as snake venoms may inhibit enzymes and cause cell death.



# ○ Treatment :

- **Debridement**, removal of dead tissue by surgical or non-surgical means, is the standard therapy for necrosis. Depending on the severity of the necrosis, this may range from removal of small patches of skin, to complete amputation of affected limbs or organs.
- **ischemia**, creation of reactive oxygen species (ROS), and damage to proteins and membranes. Antioxidant treatments can be applied to scavenge the ROS.
- **Wounds** ; treated with antibiotics and anti-inflammatory drugs to prevent bacterial infection and inflammation. Keeping the wound clean from infection also prevents necrosis.
- **Chemical and toxic agents** (e.g. pharmaceutical drugs, acids, bases); treatment involves identification and discontinuation of the harmful agent, followed by treatment of the wound, including prevention of infection and possibly the use of immunosuppressive therapies such as anti-inflammatory drugs or immunosuppressants.

In the example of **a snake bite**, the use of **anti-venom** halts the spread of toxins while receiving antibiotics to impede infection.

- Test:
- Q \ what is the difference between PCD and necrosis ?
- Q \ how to treat necrotic area ?
- References:
- Porth - Essentials of Pathophysiology 4th Edition

# Pathophysiology

## Lec. 5

### Gene disorder

*Lecturer*

*Dr. Tayseer Sh. Mahmood*

<b>no</b>	<b>subject</b>	<b>page</b>
1	Gene and Chromosome	4
2	Gene component	5
3	The DNA	6
4	Chromosomes :	6
5	Alteration of gene :	7
6	Genetic Disorder	9
7	Dignosis	10

## **General objective**

**In the end of lecture, the student must be:**

- 1. Understand what gene**
- 2. Know the disorders that affect normal function of gene**

## **Specific objective**

**In the end of lecture, the student must be:**

- 1. Define gene and chromosomes**
- 2. Enumerate gene component**
- 3. Enumerate the alteration of gene**
- 4. Explain gene disorders**

# Gene and Chromosome

A **gene** : is the basic physical and functional unit of heredity .Genes , which are made up of DNA , In humans, genes vary in size from a few hundred DNA bases to more than 2 million bases.

Different forms of genes, called **alleles**, determine how these characters are expressed in a given individual.

Humans are thought to have about 35,000 genes, while bacteria<sup>4</sup> have between 500 and 6,000. Humans have 23 pairs of chromosomes or a total of 46 , anything that lives depends on genes

## GENE COMPONENT :

A GENE CONSISTS OF A LONG COMBINATION OF FOUR DIFFERENT NUCLEOTIDE BASES (CHEMICALS) , THE FOUR NUCLEOTIDES ARE:

A(ADENINE) C(CYTOSINE) G(GUANINE) T(THYMINE). DIFFERENT

COMBINATIONS OF THE LETTERS ACGT GIVE PEOPLE DIFFERENT CHARACTERISTICS.



## The DNA :

deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms.

DNA bases pair up with each other, **A with T and C with G**, to form units called base pairs.

## Chromosomes :

A chromosome consists of DNA a humans have 23 pairs of chromosomes.



## ○ Alteration of gene :

The alteration (mutation) : means that the information contained in the particular gene is either changed or absent.

1. **Autosomal dominant** – This is because the altered copy of the gene is dominant over the healthy copy. Examples include : Huntington's disease and familial hypercholesterolaemia (genetically linked high cholesterol levels).
2. **Autosomal recessive** – the affected person has two copies of the altered gene (they have inherited an altered copy of the gene from both parents). Examples include cystic fibrosis, phenylketonuria (PKU) and sickle cell anaemia .

3. **X-linked dominant** – this type of disorder generally occurs **in females**. have one altered copy and one normal copy of a gene that is on the X chromosome. (**XX**). An example is a rare form of rickets known as hypophosphataemic or vitamin D resistant rickets.

4. **X-linked recessive** – this type of disorder is more common **in males**. It is caused by an alteration in a gene on the X chromosome. (**XY**) Examples include: Duchenne muscular dystrophy and hemophilia.

# Genetic Disorder

**Single gene disorder:** Single gene disorders can be passed on to subsequent generations in several ways for example sickle cell disease, Fragile X syndrome, muscular dystrophy, or Huntington disease.

**Chromosome abnormalities :** change in either the structure or the number of chromosomes.

**Chromosomal aberrations:** The gain or loss of DNA from chromosomes can lead to a variety of genetic disorders. Human examples include :

- Down syndrome : the most common trisomy, usually caused by **an extra copy of chromosome 21 (trisomy 21)**. Characteristics include decreased muscle tone, stockier build, asymmetrical skull, slanting eyes and mild to moderate developmental disability.
- Edwards syndrome : or **trisomy-18**, the second most common trisomy. Symptoms include motor retardation, developmental disability and numerous congenital anomalies causing serious health problems. Ninety percent of those affected die in infancy. They have characteristic : clenched hands and overlapping fingers .

- **Dignosis :**
- Prenatal diagnosis can detect the presence of characteristic abnormalities in fetal development through ultrasound, or detect the presence of characteristic substances via invasive procedures which involve inserting probes or needles into the uterus such as in amniocentesis.

- Test:
- Q \ what is characteristics of mutated gene ?
  
- References:
- Porth - Essentials of Pathophysiology 4th Edition

# Pathophysiology

## Lec. 6+7

### Neoplasia and cancer

*Lecturer*

*Dr. Tayseer Sh. Mahmood*

<b>no</b>	<b>subject</b>	<b>page</b>
1	Neoplasia and Cancer Neoplasm :	4
2	types of neoplasia	5
3	Causes of Neoplasms	8
4	Cancer	9
5	An oncogene	10
6	Classification :	11
7	Treatment	12

## **General objective**

**In the end of lecture, the student must be:**

- 1. Understand what neoplasia and cancer**
- 2. Know the effect of mutant gene of normal function of cells**

## **Specific objective**

**In the end of lecture, the student must be:**

- 1. Define neoplasia and cancer**
- 2. Enumerate causes of neoplasia**
- 3. Enumerate the type of neoplasia**
- 4. Identified the causes of cancer**



## Neoplasia and Cancer Neoplasm :

An abnormal tissue that grows by cellular proliferation more rapidly than normal and continues to grow after the stimuli that initiated the new growth cease. Neoplasms show partial or complete lack of structural organization and functional coordination with the normal tissue, and usually form a distinct mass of tissue that may be either benign (benign tumor) or malignant

# THERE ARE 3 TYPES OF NEOPLASIA

- • **Benign neoplasm** :
- is tumor that does not metastasize or spread to other cells, tissues or organs. Of the three types, this is the **safest** because it is non-progressive and does not invade other parts of the body.
- The reason that this type of neoplasm does not spread is that it is surrounded by a layer of cells, or a fibrous sheath, that contain the abnormal cells. Health problems related to benign neoplasm include compression of neighboring organs and blood .

## Pre-malignant neoplasm :

Like a benign neoplasm, a pre-malignant neoplasm does not spread to other organs and tissues that surround it. The cells that make up this neoplasm usually grow within the organ where the initial abnormal growth began, and lead to lesions on the surface or lining of the organ itself, such as those seen with skin cancer. In some cases, these types of neoplasm do form tumors, depending on the organ in which they are found, such as within the breast.

# Malignant neoplasm :

is basically **cancer**. Of the various types of neoplasm, this is the most severe as it can invade surrounding organs and tissues and also spread to other parts of the body through metastasis. During this process, cells break off of the neoplasm and travel through the blood vessels to other parts of the body. When the cancerous cell reaches the new tissue or organ, it continues to replicate and creates a new neoplasm at that site. Early detection and treatment are the keys to successfully beating a malignant neoplasm.

## Causes of Neoplasms may include:

- Genetic
- Lymphoid neoplasm
- Idiopathic
- UV rays
- X rays
- Diet rich in red meat
- Smoking and Alcohol

## Cancer :

Cancer also known as a malignant tumor, that involve abnormal cell growth with the potential to invade or spread to other parts of the body.

Cancer can spread from its original site by local spread, lymphatic spread to regional lymph nodes or by blood to distant sites , known as metastasis .

## ○ An oncogene :

- is a gene that has the potential to cause cancer , in tumor cells they are often mutated or expressed at high levels. Most of the normal cells undergo a programmed form of rapid cell death (apoptosis). Activated oncogenes can cause those cells designated for apoptosis to survive and proliferate instead.

# Classification :

- **Carcinoma** : Cancers derived from epithelial cells. This group includes many of the most common cancers, particularly in the aged, and include nearly all those developing in **the breast, prostate, lung, pancreas, and colon**.
- **Sarcoma** : Cancers arising from connective tissue (i.e. **bone, cartilage, fat, nerve**), each of which develops from cells originating in mesenchymal cells outside the bone marrow.
- **Lymphoma and leukemia** : These two classes of cancer arise from **hematopoietic (blood-forming) cells** that leave the marrow and tend to mature in the lymph nodes and blood, respectively. Leukemia is the most common type of cancer in children accounting for about 30%.
- **Germ cell tumor** : Cancers derived from pluripotent cells, most often presenting in **the testicle or the ovary**.
- **Blastoma** : Cancers derived from immature "precursor" cells **or embryonic tissue**. Blastomas are more common in children than in older adults.



# TREATMENT

- □ Chemotherapy
- □ Gene therapy
- □ Photodynamic therapy
- □ Radiation therapy
- □ Targeted therapy

- Test:
- Q \ what is the difference between neoplasia and cancer?
  
- References:
- Porth - Essentials of Pathophysiology 4th Edition

# Pathophysiology

## Lec. 8+9

# Inflammation

*Lecturer*

*Dr. Tayseer Sh. Mahmood*

<b>no</b>	<b>subject</b>	<b>page</b>
<b>1</b>	Inflammation	<b>4</b>
<b>2</b>	Causes The inflammatory response	<b>6</b>
<b>3</b>	The physiologic changes that occur during the inflammatory process	<b>7</b>
<b>4</b>	Chemical mediators of the inflammatory :	<b>8</b>
<b>5</b>	Classification of inflammation	<b>9</b>
<b>6</b>	Anti-inflammatory medications :	<b>15</b>

## **General objective**

**In the end of lecture, the student must be:**

- 1. Understand what inflammation**
- 2. Know the most important functional changes occur during inflammation**

## **Specific objective**

**In the end of lecture, the student must be:**

- Define inflammation**
- 2. Enumerate causes and classification of inflammation**
- 3. Give the symptoms of inflammation**
- 4. Identified the treatment of inflammation**

# Inflammation

is part of the complex biological response of vascular tissues to harmful stimuli, such as pathogens, damaged cells, or irritants.

○ Or ,

a protective immunovascular response that involves immune cells, blood vessels, and molecular mediators. The purpose of inflammation is to eliminate the initial cause of cell injury, clear out necrotic cells and tissues damaged from the original insult and the inflammatory process, and to initiate tissue repair

## □ Causes The inflammatory response

can be motivated by physical, chemical, and biologic agents :

- **Physical:** Burns ,Frostbite, Physical injury, blunt or penetrating ,Foreign bodies, including splinters, dirt and debris  
Trauma, Ionizing radiation
- **Biological:** Infection by pathogens  
Immune reactions due to hypersensitivity  
Stress
- **Chemical:** Chemical irritants Toxins  
Alcohol



# The physiologic changes that occur during the inflammatory process

- changes in the caliber of blood vessels and the rate of blood flow through them (hemodynamic changes)
- Increased permeability
- Leukocytic exudation

## Chemical mediators of the inflammatory :

- 1- vasoactive amines, such as HISTAMINE and SEROTONIN .
- 2- plasma endopeptidases
- 3- PROSTAGLANDINS, which can reproduce several aspects of the inflammatory process .
- 4- neutrophil products .
- 5- lymphocyte factors .
- 6- other mediators, such as slow-reacting SUBSTANCE of anaphylaxis and endogenous PYROGEN .

Inflammation can be **classified as** either acute or chronic

**Acute inflammation** : Acute inflammation is a short-term process, usually appearing within a few minutes or hours and ceasing upon the removal of the injurious stimulus.

It is characterized by five cardinal signs:

1. Pain
2. Redness
3. Immobility
4. Swilling
5. Heat

**Chronic Inflammation** : chronic inflammation prolonged and persistent inflammation marked chiefly by new connective tissue formation; it may be a continuation of an acute form or a prolonged low-grade form. It can result from :

1. Failure to eliminate whatever was causing an acute inflammation .
2. An autoimmune response to a self antigen - the immune system attacks healthy tissue, mistaking it (them) for harmful pathogens .
3. A chronic irritant of low intensity that persists .

**Examples** of diseases and conditions with chronic inflammation

include :

- ❑ Asthma
- ❑ Chronic peptic ulcer
- ❑ Tuberculosis
- ❑ Rheumatoid arthritis
- ❑ Chronic periodontitis
- ❑ Ulcerative colitis and Crohn's disease
- ❑ Chronic sinusitis
- ❑ Chronic active hepatitis (there are many more).

	acute	chronic
Causative agent	Bacterial pathogens, injured tissues	Persistent acute inflammation Due to non-degradable pathogens, viral infection, persistent foreign bodies, or autoimmune reactions
Major cells Involved	neutrophils (primarily), basophils (inflammatory response), and eosinophils (response to helminth worms and parasites), mononuclear cells (monocytes, macrophages)	Mononuclear cells (monocytes, macrophages, lymphocytes, plasma cells), fibroblasts

<b>Primary mediators</b>	<b>Vasoactive amines, eicosanoids</b>	<b>IFN-<math>\gamma</math> and other cytokines, growth factors, reactive oxygen species, hydrolytic enzymes</b>
<b>Onset</b>	<b>Immediate</b>	<b>Delayed</b>
<b>Duration</b>	<b>Few days</b>	<b>Up to many months, or years</b>
<b>Outcomes</b>	<b>Resolution, abscess formation, chronic inflammation</b>	<b>Tissue destruction, fibrosis, necrosis</b>

- Fast facts on inflammation ,
- Inflammation is the body's attempt at self-protection to remove harmful stimuli and begin the healing process.
- Inflammation is part of the body's immune response.
- Our infections, wounds and any damage to tissue would never heal without inflammation - tissue would become more and more damaged and the body, or any organism, would eventually perish.
- Chronic inflammation can eventually cause several diseases and conditions, including some cancers, rheumatoid arthritis, atherosclerosis, periodontitis, and hay fever.
- It should be remembered that inflammation is part of the healing process. Sometimes reducing inflammation is necessary, but not always.



## TREATMENTS FOR INFLAMMATION :

### ○ Anti-inflammatory medications :

NSAIDs (non-steroidal antiinflammatory drugs) are taken to alleviate pain caused by inflammation , they counteract the COX (cyclooxygenase) enzyme, which synthesizes prostaglandins which create inflammation. If prostaglandin synthesis can be blocked, pain is either eliminated or reduced ; examples of NSAIDs include naproxen, ibuprofen and aspirin.

- People should not use NSAIDs long-term without being under the supervision of a doctor, because there is a risk of stomach ulcers, and even severe and life-threatening hemorrhage. NSAIDs may also worsen asthma symptoms and cause kidney damage. NSAID medications, with the exception of aspirin, can also increase the risk of stroke and myocardial infarction (heart attack).

- Acetaminophen (paracetamol, Tylenol)

can reduce pain associated with inflammatory conditions, but have no anti-inflammatory effects. They may be ideal for those wishing to treat just the pain, while allowing the inflammation to run its course.

## ○ Corticosteroids –

these are a class of steroid hormones naturally produced in the cortex (outer portion) of the adrenal gland. They are synthesized in laboratories and added to medications. Corticosteroids, such as cortisol are anti-inflammatory; they prevent phospholipid release, which undermines eosinophil action and a number of other mechanisms involved in inflammation.

## ○ Other treatments for inflammation :

- □ **Applying ice** - do not place the ice in direct contact with skin, wrap it in a cloth or a purpose-made ice bag. Applying ice has been shown to reduce inflammation. Athletes commonly use ice treatment for managing pain and inflammation. Inflammation can go down more rapidly if you rest, apply ice, compression, and elevate the affected area (have your ankle raised if the swelling is there, for example).
- □ **Green tea** - researchers appear regular green tea drinking enhances bone health and reduces inflammation in postmenopausal women.
- □ **Fish oil (Omega-3)** - the daily consumption of fish oil, omega-3 reduced both inflammation and anxiety in a group of young healthy people.

- Test:
- Q \ what is the change in the cell that indicated of inflammation ?
  
- References:
- Porth - Essentials of Pathophysiology 4th Edition