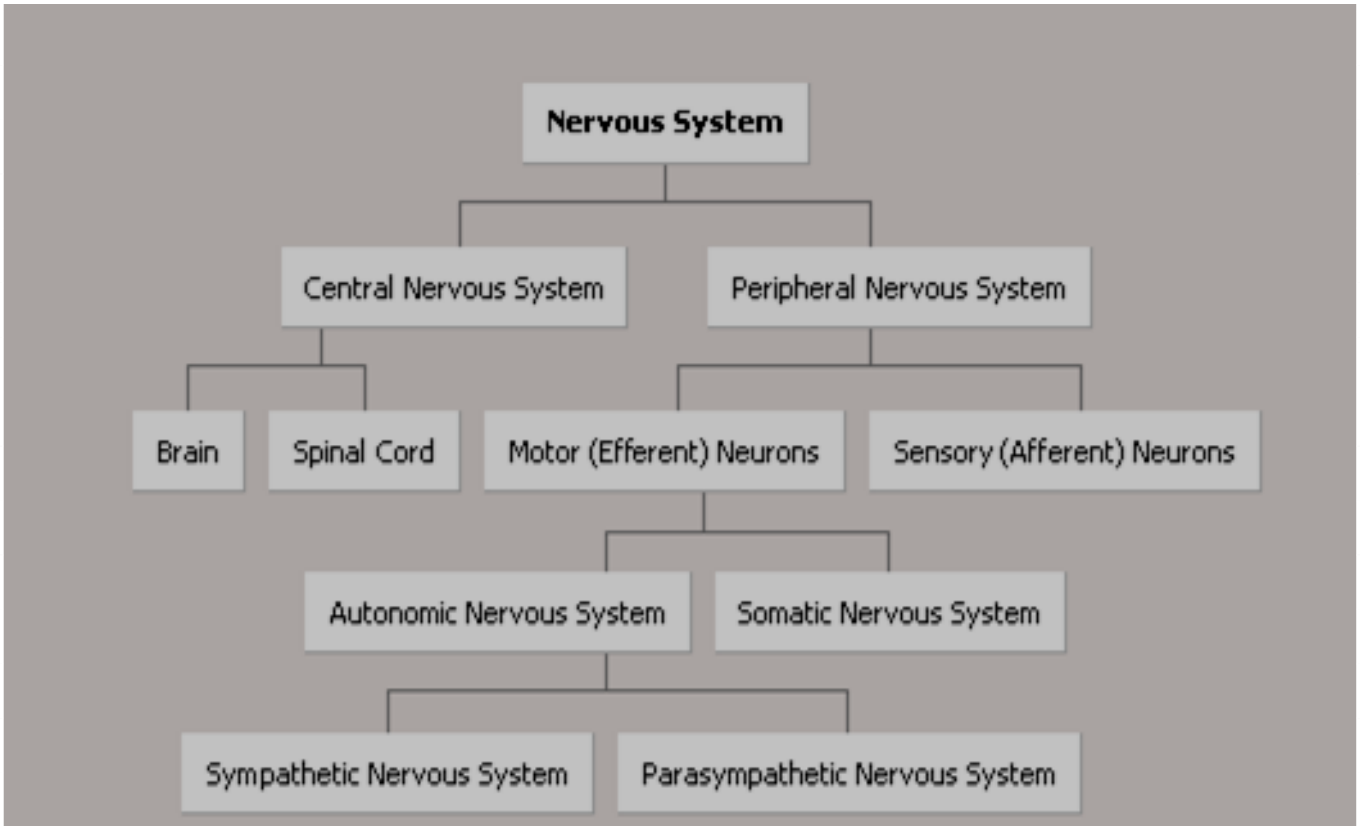
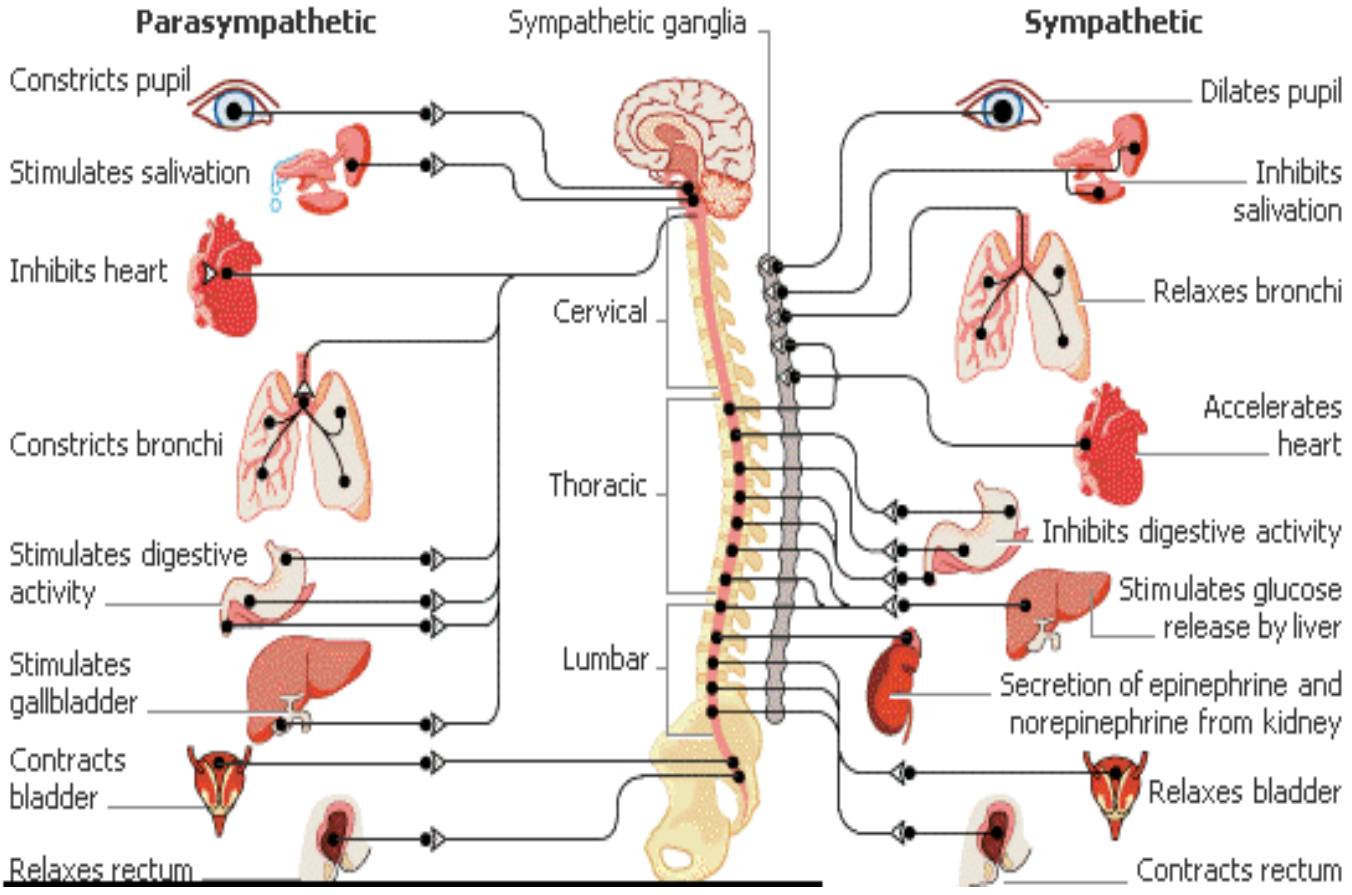
Ph. Yaarub Al Shakargy

Autonomic Drugs





Classification:

1. Parasympathomimetic agents [Cholinergic agents]
2. Anti-cholinergic agents
3. Sympathomimetic agents [Adrenergic agents]
4. Sympatholytic agents [Adrenergic Blocking agents]
5. Miscellaneous autonomic drugs

Terms and their meanings

- Enhanced يعزز
- Mimic (memetic) يحاكى
- Lytic يعاكس
- Block يحبط
- Stimulate يحفز
- Agonist المشارك في التأثير
- Antagonist المضاد في التأثير

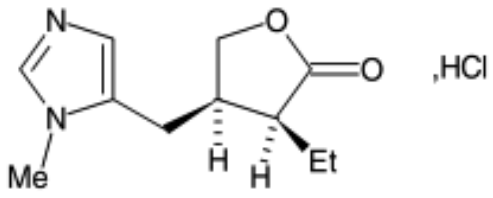
1. Parasympathomimetic agents [Cholinergic agents]:

A parasympathomimetic is a drug that acts by stimulating the parasympathetic nervous system (PSNS).

These chemicals are also called cholinergic because they act like acetylcholine (ACh) which is the neurotransmitter used by the PSNS by either directly stimulating the nicotinic or muscarinic receptors, or they can act indirectly by inhibiting cholinesterase, promoting acetylcholine release, or other mechanisms.

a) directly stimulating:

e.g., Pilocarpine Hydrochloride:



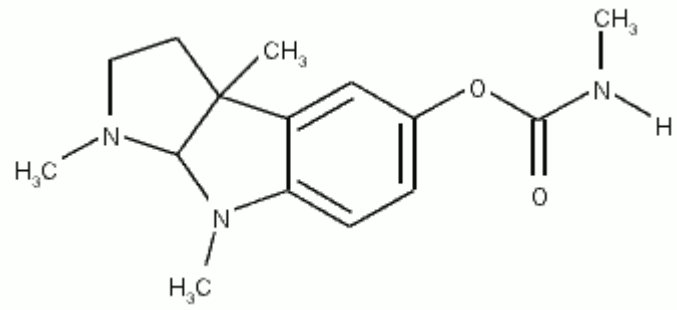
Eye Drops are a sterile solution of Pilocarpine Hydrochloride in Purified Water.

It acts as a muscarinic receptor agonist in the parasympathetic nervous system.

b) Cholinesterase inhibitors:

e.g.

i. Physostigmine:



Chemical formula: C15H21N3O2

Physostigmine was used first as a topical application in the treatment of glaucoma (الزراق, الماء الأزرق). Acting by inhibiting Cholinesterase enzyme reversibly and thus increasing the level of Ach.

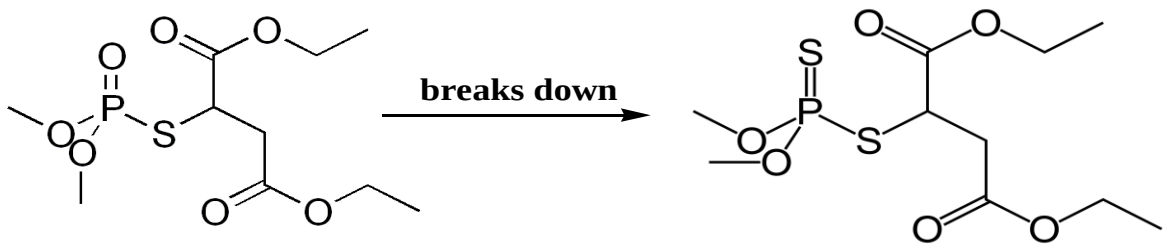
ii. Malathion:

Malathion is a poor inhibitor of cholinesterase. Malathion breaks down into malaoxon, which is 60 times more toxic than malathion. Its effectiveness as a safe insecticide is due to the different rates at which humans and insects metabolize the chemical.

Malathion is an organophosphate parasympathomimetic, which binds irreversibly to cholinesterase.

Uses:

Malathion is used as a treatment for head lice, body lice and scabies. It effectively kills both the eggs and the adult lice.



Malathion **malaoxon**

60 times more toxic

Malathion breaks down into malaoxon

2. Anti-cholinergic agents:

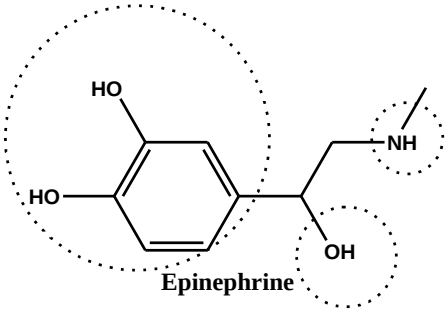
An anticholinergic agent is a member of a class of pharmaceutical compounds which serve to reduce the effects mediated by acetylcholine in the central nervous system and peripheral nervous system.

Anticholinergics are typically reversible competitive inhibitors of acetylcholine receptors , e.g. ATROPINE

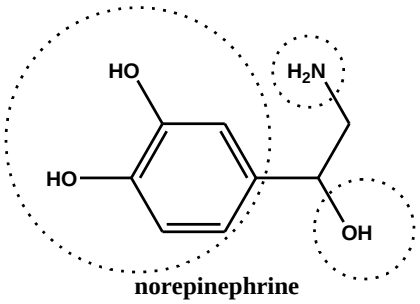
3. Sympathomimetic agents [Adrenergic agents]:

Substances that mimic the effects of the hormone epinephrine (adrenaline) and the hormone/neurotransmitter norepinephrine (noradrenaline).

They all raise blood pressure and are all weak bases.



Epinephrine



norepinephrine

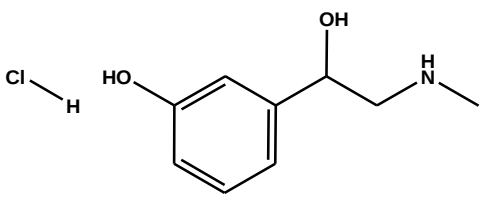
a) Epinephrine:

The adrenal مجاور للكلية medulla which composed of cells secretes endogenous hormone epinephrine, also called adrenaline, which stimulate the sympathetic nervous system at times of stress.

Epinephrine stimulates the heart, constricts the small blood vessels, raises the blood pressure, liberates sugar stored in the liver, and relaxes certain involuntary لا إرادي muscles while contracting others. It is widely used as a drug to stimulate the heart in cases of shock, to prevent bleeding, and in acute asthma attacks.

Examples:

i. Phenylephrine Hydrochloride



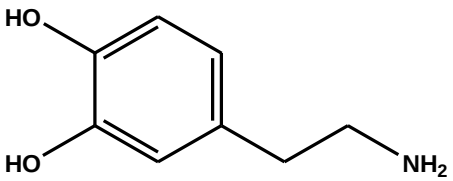
Phenylephrine Hydrochloride

Iupac:

3-(1-hydroxy-2-methylamino-ethyl) phenol

α-adrenergic receptor agonist used primarily as a decongestant, as an agent to dilate the pupil and to increase blood pressure. Phenylephrine has recently been marketed as a substitute for pseudoephedrine.

ii. Dopamine



Dopamine

Dopamine, chemical known as a neurotransmitter essential to the functioning of the central nervous system. Parkinson and schizophrenia diseases are a brain disorder in which dopamine is involved.

4. Sympatholytic agents [Adrenergic Blocking agents]:

Chemicals that exert their principal pharmacologic and therapeutics by reducing the activity of the various components of the sympathetic division of the autonomic nervous system, or drug or agent that acts against the sympathetic nervous system.

These drugs interfere with actions of the sympathetic nervous system, which controls involuntary muscle movement. They slow the heart rate, relax pressure in blood vessel walls, and decrease the force of heart contractions. In the eye they reduce the formation of excess fluid.

Two kinds of Adrenergic Blocking:

a) α - Blocking (Postsynaptic):

is a competitive α-adrenergic receptor antagonist. It is a vasodilator that is used to treat spasms of peripheral blood vessels.

b) β-Blocking (Presynaptic):

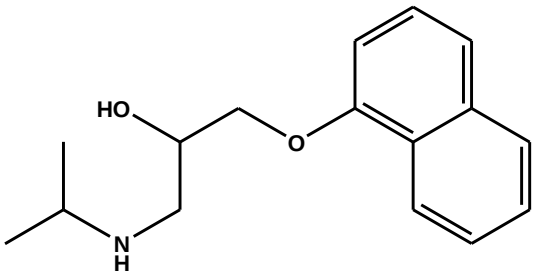
Any of a group of drugs used to treat various disorders associated with the circulatory system.

These disorders include:

i. high blood pressure (hypertension)
ii. angina pectoris (chest pains caused by reduced oxygen flow to the heart muscle)
iii. irregular heartbeat
iv. migraine headache.
v. glaucoma, an eye disorder characterized by excessive pressure within the eye.

Examples:

a) Propranolol [Inderal]



Propranolol

One of the most widely used beta-blockers agents

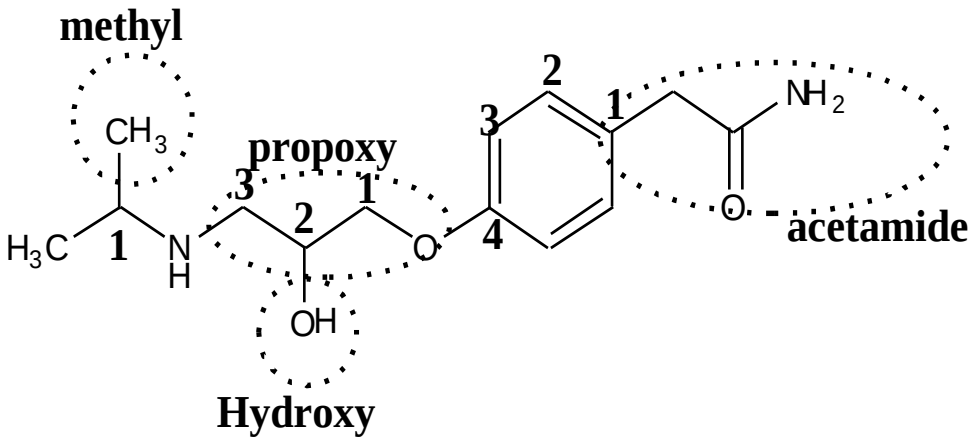
used for:

i. Hypertension
ii. Cardiac arrhythmias
iii. Angina pectoris الذبحة الصدرية
iv. post myocardial infarction بعد احتشاء العضلة القلبية
v. Migraine prophylaxis الوقاية من الشقيقة
vi. Essential tremor الرعاش
vii. Anxiety
viii. Schizophrenia and
ix. Alcohol with drawl syndrome

[It blocks the β receptors of the heart, slows the heart, decrease the force of contraction decrease cardiac output]

b) Atenolol Brand Name: Tenormin

prescription drug used to treat heart and blood vessel (cardiovascular) problems, including high blood pressure, angina, and heart attack. It is also sometimes used for migraine headaches, anxietyالقلق and symptoms of alcohol withdrawal.



4-[2-Hydroxy-3-[(1-methylethyl)amino]propoxy]benzeneacetamide

MODE OF ACTIONS:

Atenolol affects the autonomic nervous system which controls the involuntary muscles لا إرادي and glands of the body, slowing the heartbeat and decreasing the force of heart contractions. These changes ease the strain on the heart and result in lower blood pressure.

DOSAGES:

Atenolol is taken orally in tablet form once a day, usually in 50 or 100 mg doses, with or without food. Relief of high blood pressure or angina pain (caused by lack of oxygen to the heart muscle) usually occurs one or two weeks after treatment begins. (An injectable, liquid form of this drug—effective within 5 minutes—may be used to treat a heart attack.) Because atenolol controls rather than cures يشفي cardiovascular problems, treatment should continue even after symptoms disappear.

Contraindications:

Patients with certain medical conditions should use this drug with caution or should avoid it altogether. These conditions include severe congestive heart failure, heart blockage, asthma, allergies, kidney disease, coronary artery disease, or a slow heartbeat. Diabetics should be aware that atenolol may interfere with blood-sugar tests. This drug should not be used by pregnant or nursing women. Its safety for use in children is not known.

Side effects

Potential side effects include dizzinessدوار fatigue, nausea, or slow heartbeat. Less common side effects are diarrhea, drowsiness headache, impotence skin rash or itching, depression, hair loss, and breathing difficulties. Patients ending treatment with this drug should

do so over a period of several weeks rather than stopping its use abruptly بشكل فجائي.

Atenolol is often prescribed in conjunction with other medications, such as diuretics (medication that increases urination). However, it may interact adversely with certain drugs including epinephrine, insulin, and other drugs used to treat diabetes, other blood pressure medications, and antacids that contain calcium.

the role for beta-blockers in hypertension was downgraded in June 2006 in the United Kingdom because there is increasing evidence that the most frequently used beta-blockers at usual doses carry an unacceptable risk of type 2 diabetes.

DRUGS AFFECTING C.N.S

A. CNS Depressants:
   1. General Anesthetics.
   2. Sedative-Hypnotics.
   3. Anxiolytics. مزيل للقلق
   4. Anticonvulsants.
   5. Antipsychotics.

It is useful to remember that there is considerable overlap among them, the first four groups, for example, have much in common.

Thus, most sedative-hypnotics also possess anxiolytic and anticonvulsant properties and at higher concentrations are general anesthetics.

Antipsychotics are unique among the classes listed; they are able to ameliorate تحسينthe thought disorder that underlies schizophrenia.

Additionally, their mechanism of action is quite distinct from the other four classes.

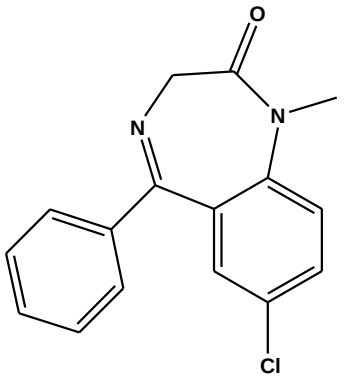
However, although mechanisms of action are different, antipsychotic drugs have important anxiolytic properties, and many of them are sedative as well.

1. General Anesthetics:

(From Greek an- “without” aesthesis “sensation”)

2. sedative-hypnotics, anxiolytics and anticonvulsants:

i. Benzodiazepines:



7-chloro-1-methyl-5-phenyl-1,3 -dihydro-2H-1,4-benzodiazepin-2-one

The benzodiazepines are a class of drugs with hypnotic, anxiolytic, anticonvulsive, amnestic اضطرابات نفسية and muscle relaxant properties.

The relative strength of each of these properties in any given benzodiazepine varies greatly and influences the indications for which it is prescribed.

Long-term use can be problematic due to the development of tolerance and dependency.

Of the many drugs in this class, only a few are used to treat epilepsy

Examples:

a) Clobazam.
b) Clonazepam.
c) Clorazepate.
d) Diazepam (Valium).

Diazepam is a benzodiazepine derivative with anti-anxiety, sedative, hypnotic and anticonvulsant properties.

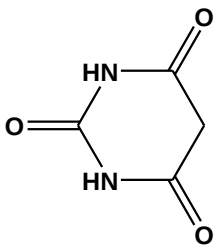
Chemical formula: C16H13ClN2O.

IUPAC name: 7-Chloro-1,3-dihydro-1-methyl-5-phenyl-3H-1,4-benzodiazepin-2-one.

Mode of action:

Diazepam potentiates the inhibitory activities of gamma-aminobutyric acid (GABA) by binding to the GABA receptor, located in the limbic system and the hypothalamus. This increases the frequency of chloride channel opening, allowing the flow of chloride ions into the neuron and ultimately leading to membrane hyperpolarization and a decrease in neuronal excitability.

ii. Barbiturates:



Barbituric acid

Barbiturates are drugs that act as central nervous system (CNS) depressants, they produce a wide spectrum of effects, from mild sedation to anesthesia and are classified mostly as anticonvulsants.

Examples:

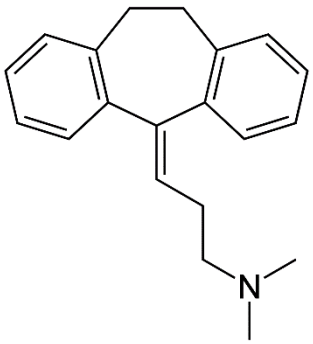
a) Phenobarbital.
b) Mephobarbital.
c) Metharbital.
d) Barbexaclone.

B. CNS Stimulants:

Stimulants are drugs that increase the activity of the central nervous system (CNS).

Some stimulants produce a sense of euphoria النشوة او الشعور بالسعادة, in a particular.

i. Tricyclic Antidepressants:



are a class of medications that are used primarily as antidepressants, which is important for the management of depression.

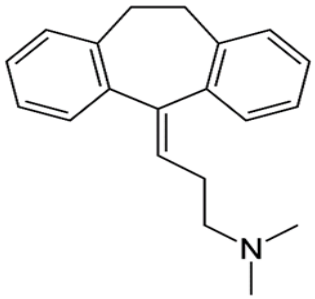
They are named after the drugs' molecular structure, which contains three rings of atoms.

The term 'tricyclic antidepressant' is sometimes abbreviated to TCA.

Mode of actions:

These compounds inhibit the uptake of the monoamine's dopamine and norepinephrine into storage vesicles, effectively increasing their amounts in the brain and causing a stimulating effect.

Example:



Amitriptyline hydrochloride (Tryptizol):

Molecular Formula: C20H24ClN

IUPAC name: N,N-dimethyl-3-(2-tricyclo[9.4.0.03,8]pentadeca-1(15),3,5,7,11,13-hexaenylidene)propan-1-amine;hydrochloride

Used in treatment of endogenous depression and involutional melancholia حزن لا ارادي (depression of late life, which is no longer seen as a disease in its own right now.) Adult typical dosages are 25 to 150 mg daily

It may also be used to treat nocturnal enuresis (bed wetting). Children between the ages of 7 to 10 years having a dose of 10 to 20 mg, older children 25 to 50 mg at night. It should be gradually withdrawn at the end of the course, which overall should be of no more than 3 months.

In some European countries it is also approved as prophylaxis for patients with frequent migraines الشقيقة (usually 25 to 75 mg).

Other CNS Stimulants includes:

ii. Caffeine

Caffeine is a drug that is found naturally in coffee, tea, and to a small extent cocoa. It is also found in many soft drinks particularly energy drinks.

Caffeine stimulates the body, increasing heart rate and blood pressure, and alertness, making some people feel better and able to concentrate.

Caffeine is also a diuretic مدرر.

The vast majority (over 80%) of people in the United States consume caffeine on a daily basis.

Caffeine is also sold in some countries as an isolated drug (as opposed to its natural occurrence in many foods). It serves as a mild stimulant to ward off sleepiness and sees wide use among people who must remain alert in their work (e.g., truck drivers).

Some medications contain caffeine as one of their minor active ingredients, often for the purpose of enhancing the effect of the main ingredient or reducing one of its side effects.

iii. Nicotine

Nicotine is an alkaloid found in predominantly in tobacco, and in lower quantities in tomato, potato, eggplant (باذنجان), and green pepper الفلفل الاخضر.

Nicotine alkaloids are also found in the leaves of the coca plant.

Although pure nicotine is noncarcinogenic, its presence may inhibit the body's ability to cull aberrant cells (اعدام الخلايا الشاذة).

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Diuretics

A chemical that increases the rate of urine formation, by inhibition of sodium transport at one or more of the four major anatomic sites along the nephron where sodium re-absorption takes place.

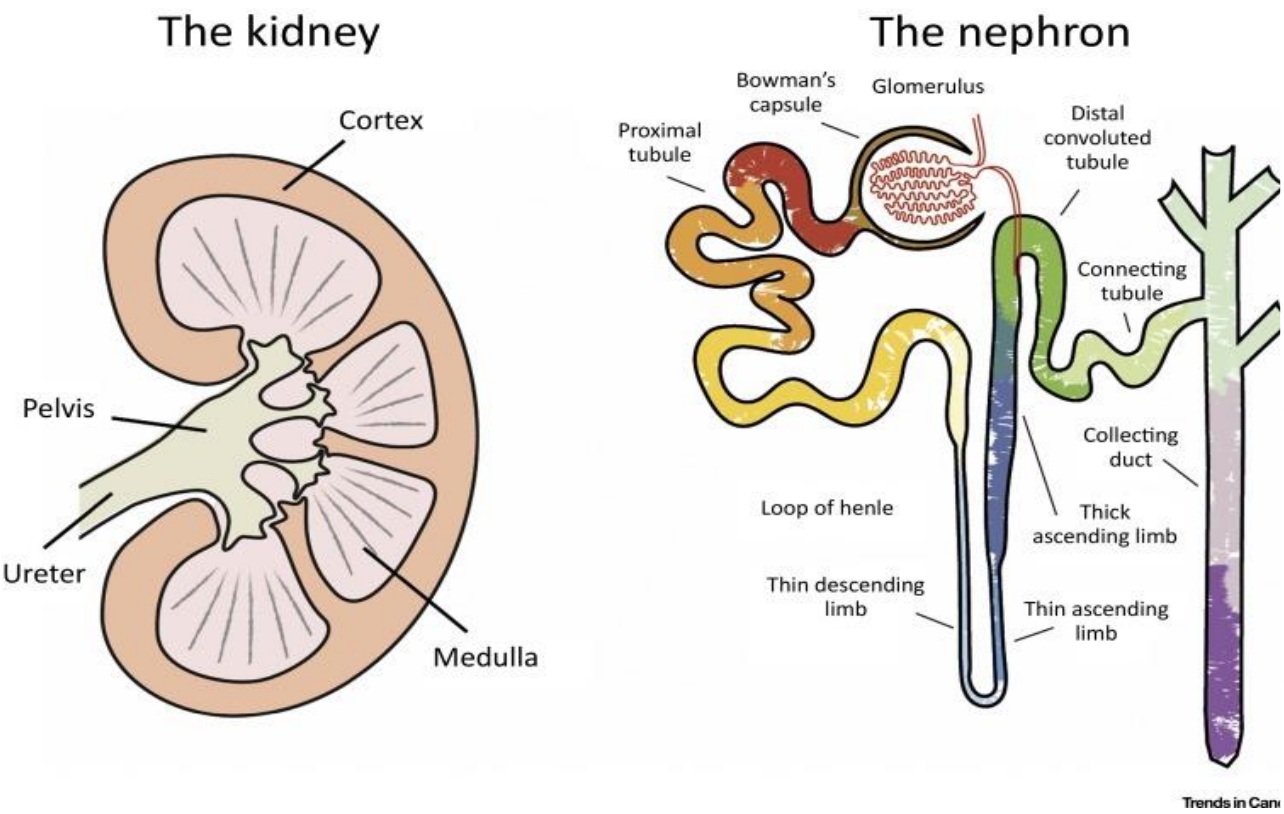
A nephron is the basic structural and functional unit of the kidney. Its chief function is to regulate the concentration of water and soluble substances like sodium salts by: 1-filtering the blood, 2-reabsorbing what is needed and 3-excreting the rest as urine.

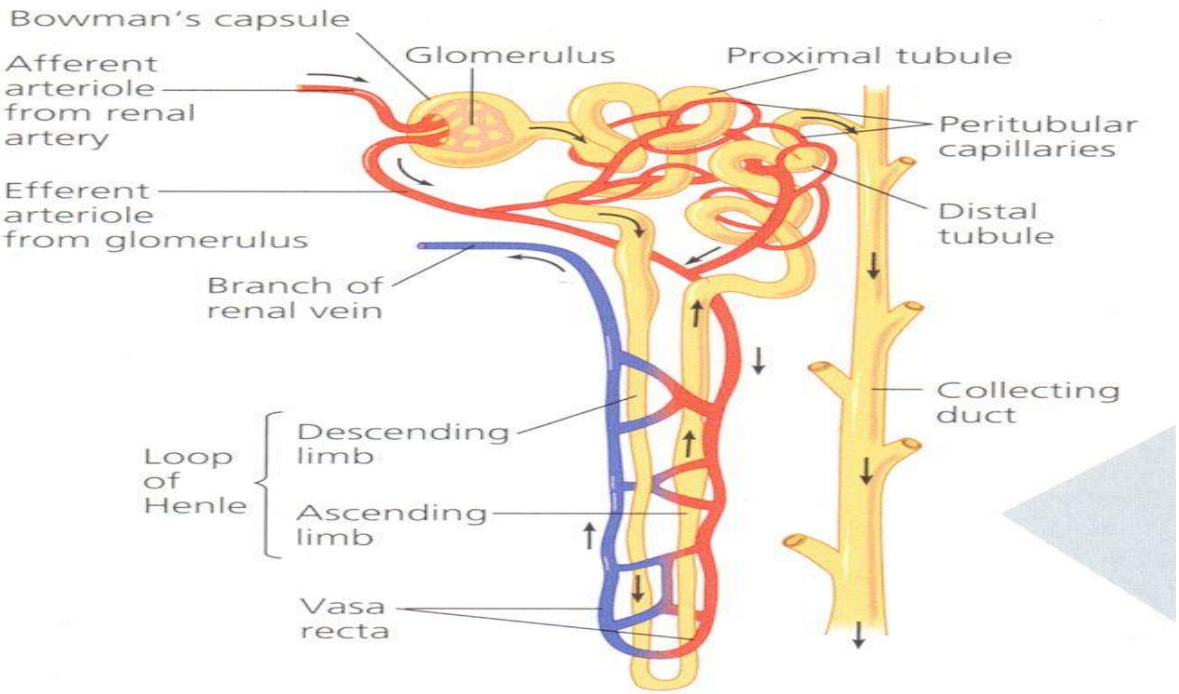
A nephron eliminates wastes from the body, regulates blood volume and pressure, controls levels of electrolytes and metabolites, and regulates blood pH. Its functions are vital to life and are regulated by the endocrine system by hormones such as antidiuretic hormone, aldosterone, and parathyroid hormone.

There are approximately one million nephrons in each kidney. The blood (or, more appropriately, the plasma), from which all urine is formed, is brought to each nephron within the glomerular capillary network.

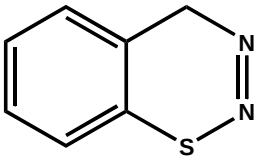
- Most of the plasma components are filtered into Bowman's space. During the process of urine formation,
- the resulting glomerular filtrate flows through the proximal tubule (convoluted and straight),
- and then it flows through the descending limb of Henle's loop, and the thin and thick ascending limbs of Henle's loop,
- and then to the distal convoluted tubule, the connecting tubule (sometimes referred to as the late or terminal distal tubule), and the cortical and medullary collecting tubules.

Each of these nephron segments consists of ultra-structurally and functionally unique cell types.





THIAZIDE AND THIAZIDE-LIKE DIURETICS



benzothiadiazine

Thiazides are a class of diuretics most of whose members are derived from benzothiadiazine. The chemical structure of the original thiazide diuretics contained a thiazide ring system.

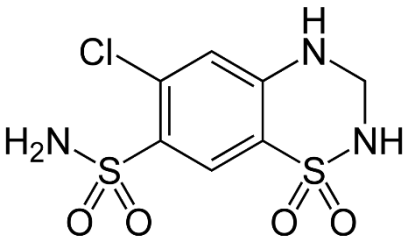
Mode of action:

They inhibit Na+/Cl- reabsorption from the distal convoluted tubules in the kidneys by blocking the thiazide-sensitive Na+-Cl- co-transporter.

Thiazides also cause loss of potassium and an increase in serum uric acid.

PRODUCTS:

i. Benzthiazide, USP



Benzthiazide is used to treat hypertension and edema. Like other thiazides, benzthiazide promotes water loss from the body (diuretics).

They inhibit Na+/Cl- reabsorption from the distal convoluted tubules in the kidneys.

ii. Hydrochlorothiazide, USP

a popular diuretic drug that acts by inhibiting the kidneys' ability to retain water.

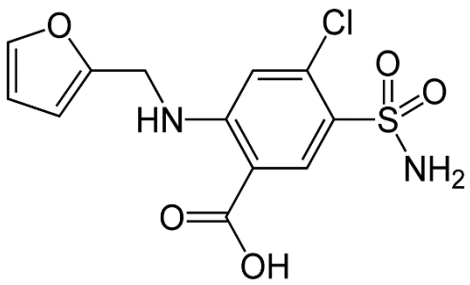
This reduces the volume of the blood, decreasing blood return to the heart and thus cardiac output and, by other mechanisms, is believed to lower peripheral vascular resistance.

iii. Hydroflumethiazide, USP
iv. Trichlormethiazide, USP

HIGH-CEILING OR LOOP DIURETICS

are diuretics that act on the ascending loop of Henle in the kidney. They are primarily used in medicine to treat hypertension and edema often due to congestive heart failure or renal insufficiency.

Furosemide: (Lasix).



used in the treatment of congestive heart failure and edema.

iupac name: 4-Chloro-N-furfuryl-5-sulfamoylanthranilic acid

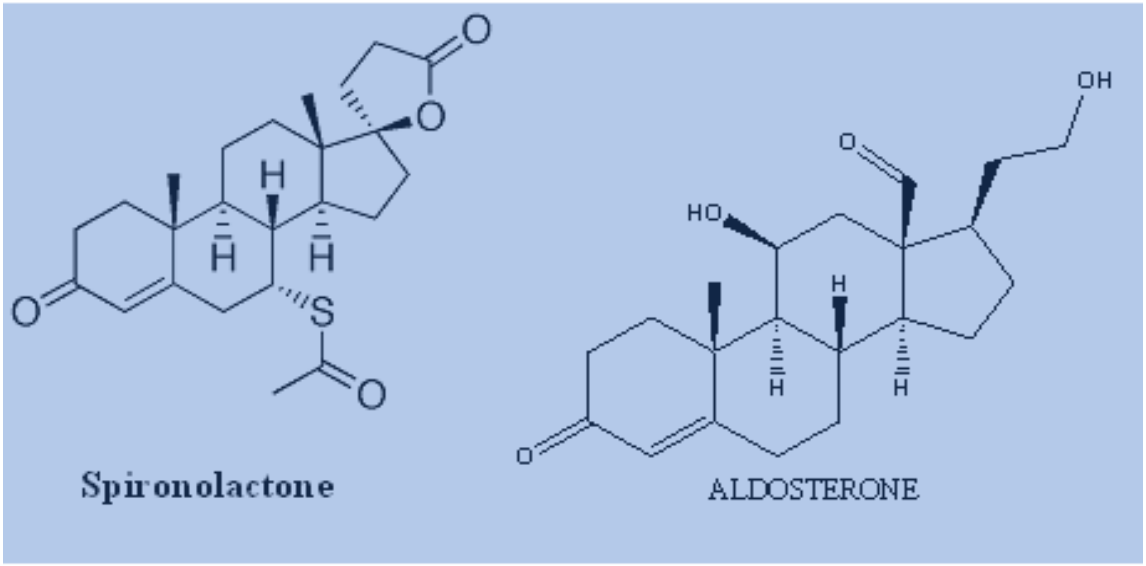
POTASSIUM-SPARING DIURETICS

A negative feature of all of the previously discussed classes of diuretics is that they induce an increase in the renal excretion rate of potassium.

Over the years, three chemically distinct diuretics have emerged that increase sodium and chloride excretion, without a concomitant increase in the urinary excretion rate of potassium. These agents are known as potassium-sparing diuretics or antikaliuretic agents.

SPIRONOLACTONES:

(ALDOSTERONE ANTAGONISTS)



Aldosterone is a steroid hormone produced by the outer-section of the adrenal cortex in the adrenal gland to regulate sodium and potassium balance in the blood.

It is essential for sodium conservation in the kidney, salivary glands, sweat glands, and colon.

It plays a central role in the homeostatic regulation of blood pressure, plasma sodium, and potassium levels.

It does so primarily by acting on the mineralocorticoid receptors in the distal tubules and collecting ducts of the nephron.

It influences the reabsorption of sodium and excretion of potassium of the kidney, thereby indirectly influencing water retention or loss, blood pressure and blood volume.

When dysregulated, aldosterone is pathogenic and contributes to the development and progression of cardiovascular and kidney disease. Aldosterone has exactly the opposite function of the atrial natriuretic hormone secreted by the heart

Aldosterone may act on the central nervous system via the posterior pituitary gland to release vasopressin (ADH) which serves to conserve water by direct actions on renal tubular resorption.

Spironolactone [Aldactone]

Mechanism of Action

Spironolactone inhibits the effect of aldosterone by competing for intracellular aldosterone receptor (mineralocorticoid receptors) in the distal tubule cells. This increases the secretion of water and sodium, while decreasing the excretion of potassium

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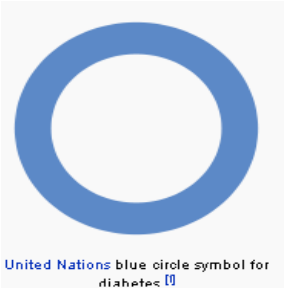
ANTIDIABETIC DRUGS



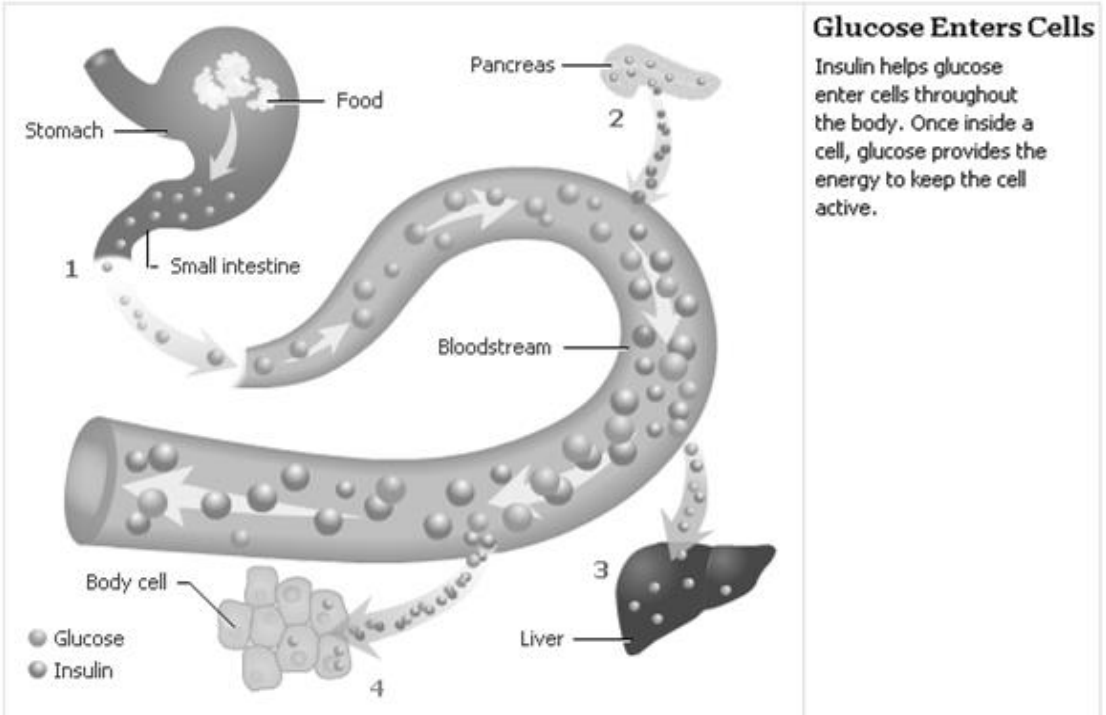
United Nations blue circle symbol for diabetes [1]

Anti-diabetic drugs; (Antihyperglycemic agents) or (oral hypoglycemic agents):

Drugs that treat diabetes mellitus by lowering glucose levels in the blood.

With the exceptions of insulin all are administered orally and are thus also called oral hypoglycemic agents or oral antihyperglycemic agents.

There are different classes of anti-diabetic drugs, and their selection depends on the nature of the diabetes, age and situation of the person, as well as other factors.



Diabetes mellitus (DM):

(large amounts of urine with high sugar)

is a chronic metabolic disorder caused by an absolute or relative deficiency of insulin, an anabolic hormone. Insulin is produced by the beta cells of pancreas, and the absence, destruction, or other loss of these cells results in

Type1 diabetes (insulin-dependent diabetes mellitus [IDDM]):

Most children with diabetes have type1 diabetes IDDM and a lifetime dependence on exogenous insulin.

Treatments include:

exogenous insulin.

Type2 diabetes (non–insulin-dependent diabetes mellitus [NIDDM]):

Is a heterogeneous disorder, most often develops in people over age 45, but more and more children, teens, and young adults are also developing it.

Cells don't respond normally to insulin; this is called insulin resistance. Your pancreas makes more insulin to try to get cells to respond. Eventually your pancreas can't keep up, and your blood sugar rises, setting the stage for prediabetes and type 2 diabetes. High blood sugar is damaging to the body and can cause other serious health problems, such as heart disease, vision loss, and kidney disease.

Most patients with NIDDM have insulin resistance, and their beta cells lack the ability to overcome this resistance.

Treatments include:

1. agents which increase the amount of insulin secreted by the pancreas.
2. agents which increase the sensitivity of target organs to insulin.
3. agents which decrease the rate at which glucose is absorbed from the gastrointestinal tract.

Antidiabetic drugs may be subdivided into six groups:

1. insulin.
2. Sulfonylureas.
3. Alpha-glucosidase inhibitors.
4. Biguanides.
5. Meglitinides.
6. Thiazolidinediones.

1. Insulin:

Insulin is usually given subcutaneously, either by injections or by an insulin pump. Research is underway of other routes of administration. In acute care settings, insulin may also be given intravenously. There are several types of insulin, characterized by the rate which they are metabolized by the body.

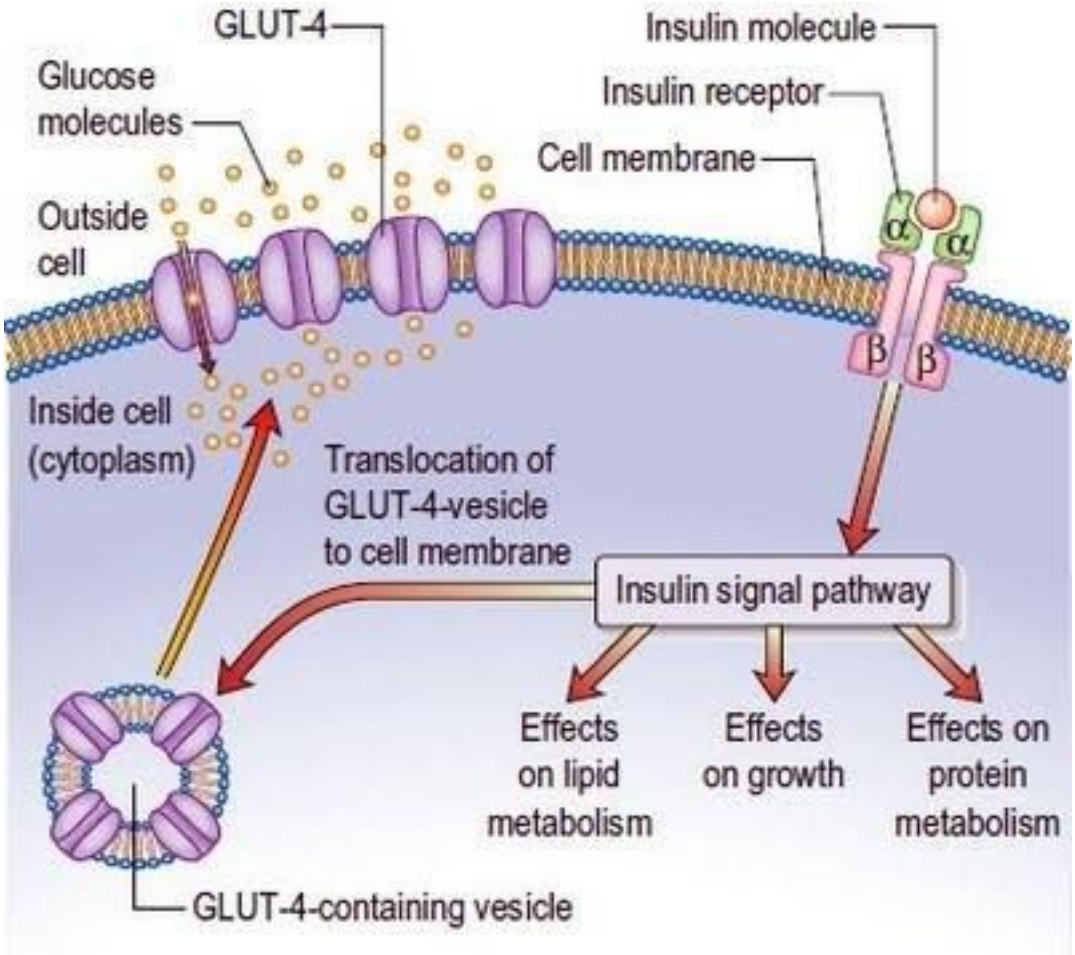
Insulin is used medically to treat some forms of diabetes mellitus. Patients with type 1 diabetes mellitus depend on external insulin (most commonly injected subcutaneously) for their survival because of the

absence of the hormone. Patients with type 2 diabetes mellitus have insulin resistance, relatively low insulin production, or both; some patients with type 2 diabetes may eventually require insulin when other medications become insufficient in controlling blood glucose levels.

Composition:

Insulin is a peptide hormone composed of 51 amino acid residues and has a molecular weight of 5808 Da. It is produced in the Islets of Langerhans in the pancreas. The name comes from the Latin insula for "island".

Mode of actions:



2. Sulfonylureas:

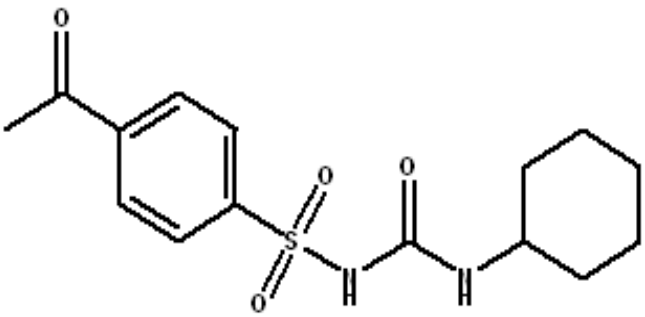
Sulfonylureas were the first widely used oral hypoglycemic medications. They are insulin secretagogues, They are only useful in Type II diabetes, as they work by stimulating endogenous release of insulin. They work best with patients over 40 years old, who have had diabetes mellitus for under ten years. They cannot be used with type I diabetes, or diabetes of pregnancy.

Mod of action:

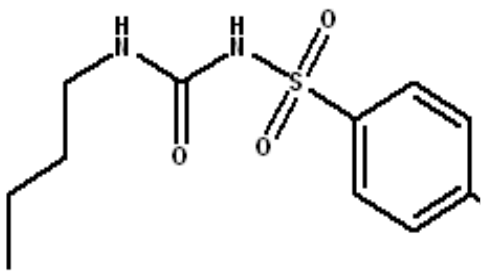
triggering insulin release by direct action on the pancreatic beta cells.

Examples:

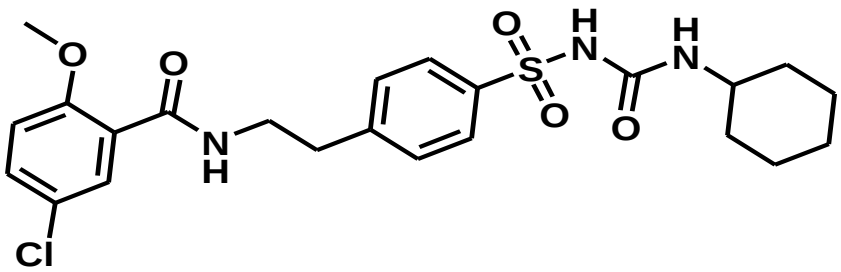
a) tolbutamide (Orinase)
b) glimepiride (Amaryl)
c) Glibenclamide (Daonil)
d) Acetohexamide



1-(4-acetylphenyl)sulfonyl-3-cyclohexyl-urea
Acetohexamide



3-butyl-1-(4-methylphenyl)sulfonyl-ure
Tolbutamide



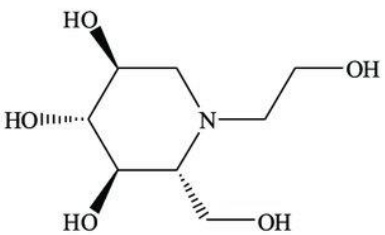
5-chloro-N-[2-[4-(cyclohexylcarbamoylsulfamoyl) phenyl]ethyl]-2-methoxy-benzamide
Daonil

3. Alpha-glucosidase inhibitors:

Are oral anti-diabetic drugs used for diabetes mellitus type 2 that work by preventing the digestion of carbohydrates (such as starch and table sugar). Carbohydrates are normally converted into simple sugars (monosaccharides) which can be absorbed through the intestine. Hence, alpha-glucosidase inhibitors reduce the impact of carbohydrates on blood sugar.

Examples:

Miglitol - Glyset®

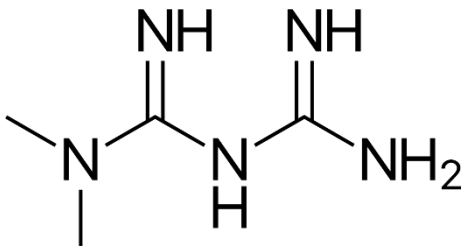


4. Biguanide:

Biguanides can function as oral antihyperglycemic drugs used for diabetes mellitus or prediabetes treatment. They are also used as antimalarial drugs.

Example:

Metformin (Glucophage) widely used in treatment of diabetes mellitus type2



N, N-Dimethylimidodicarbonimidic diamide

Mechanism of action:

The mechanism of action of biguanides (metformin) is not fully understood, and many mechanisms have been proposed for metformin.

Biguanides do not affect the output of insulin, unlike other hypoglycemic agents such as sulfonylureas and meglitinides. Therefore, they are effective in Type 2 diabetics; and in Type 1 diabetes when used in conjunction with insulin therapy.

Mainly used in Type II diabetes, metformin is considered to increase insulin sensitivity, resulting in reduced plasma glucose concentrations, increased glucose uptake, and decreased gluconeogenesis.

However, in hyperinsulinemia, biguanides can lower fasting levels of insulin in plasma. Their therapeutic uses derive from their tendency to reduce gluconeogenesis in the liver, and, as a result, reduce the level of glucose in the blood. Biguanides also tend to make the cells of the body

more willing to absorb glucose already present in the bloodstream, and there again reducing the level of glucose in the plasma

5. Meglitinides:

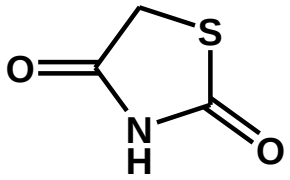
Meglitinides or glinides are a class of drugs used to treat type 2 diabetes.

Examples:

Repaglinide (trade name Prandin); Nateglinide (Starlix)

MOD of action: Same as Sulfonylureas.

6. Thiazolidinediones:



Thiazolidinedione

also known as glitazones after the prototypical drug ciglitazone.

The only approved use of the thiazolidinediones is in diabetes mellitus type2

Mod of action:

These drugs will increase the storage of fatty acids in adipocytes, thereby decreasing the amount of fatty acids present in circulation. As

a result, cells become more dependent on the oxidation of carbohydrates, more specifically glucose, in order to yield energy for other cellular processes

Enzymes, hormones and vitamins

A-Enzymes

Organic substances, composed of polymers of amino acids, that act as catalysts عامل محفز to regulate the speed of the many chemical reactions involved in the metabolism of living organisms, such as digestion.

Individual enzyme are named by adding ase to the name of the substrate with which they react. The enzyme that controls urea decomposition is called urease; those that control protein hydrolyses are known as proteinases. Some enzymes, such as the trypsin and pepsin, retain the names used before this nomenclature was adopted.

Classifications:

1. Hydrolytic enzymes: accelerate reactions in which a substance is broken down into simpler compounds through reaction with water molecules.
2. Oxidizing enzymes: accelerate oxidation reactions.
3. Reducing enzymes: speed up reduction اختزال reactions, in which oxygen is removed.

Functions:

1. Digestive aid هاضمة: Bring about the digestion of meat, control many different reactions e.g., pepsin and trypsin
2. proteolytic action محللة: the breakdown of proteins or peptides into amino acids

3. Energy release: Release energy to make the heart beat and the lungs expand and contract.
4. Building: Facilitate the conversion of sugar and foods into the various substances the body requires for tissue-building
5. Blood forming: The replacement of blood cells
6. Moving: The release of chemical energy to move muscles.

Examples:

Pepsin: an enzyme produced in the stomach that breaks down proteins into simpler compounds.

Trypsin: a pancreatic enzyme that digests proteins

Protease: a pancreatic enzyme that breaks down proteins and peptides by catalyzing the hydrolysis of peptide bonds

Lipase: a pancreatic enzyme that breaks down fats

Streptokinase: enzyme produced by streptococcus bacteria that is capable of digesting fibrin, the protein making up blood clots. It is used to treat pulmonary embolism and heart attacks, reducing mortality.

Urokinase: an enzyme, produced by the kidneys, that catalyzes the conversion of plasminogen {the inactive precursor of plasmin} to plasmin {a plasma enzyme that helps break down fibrin}

Urease: breaks down urea to produce carbon dioxide and ammonia

$$H_2NCONH_2 \longrightarrow 2NH_3 + CO_2$$

DRUGS EXAMPLES:

1. Pancreatin usp: from fresh pancreas of hog خنزير or ox ثور, contains amylase ,protease and lipase, used for digestive aid.
2. Trypsin usp: from fresh pancreas of cow بقرة or ox, contains trypsin, used for proteolytic action, it's also employed in removing foreign matter and dead tissue from wounds and burns.
3. Pancrelipase usp (Cotazyem): contains lipase, use for lipolytic action {help in control steatorrhea الاسهال الدهني and insufficient pancreas (impairs the digestion of fats)}
4. Urokinase: Use medicinally to dissolve blood clots.

B-Hormones

Is a chemical messenger that carries a signal from one cell (or group of cells) to another via the blood.

Hormones Functions:

1. Regulate growth, metabolism and development the biological function, either directly by acting on target organs or indirectly by controlling the secretion and synthesis of secondary or tertiary hormone systems.
2. Control the function of various tissues
3. Support reproductive functions

The majority of hormones are produced by:

1. The glands of the endocrine system غدد صماء which produce and secrete hormones directly into the bloodstream
2. The mucous membranes of the small intestine secrete hormones that stimulate secretion of digestive juices from the pancreas
3. The placenta, an organ formed during pregnancy, to regulate some aspects of fetal development.

Classification:

Hormones are classified into two basic types based on their chemical makeup (sources).

1. Peptides, or amino acid derivatives (The majority of hormones) which produced by the anterior pituitary, thyroid, parathyroid, placenta, and pancreas.
2. Steroid hormones, which include those hormones secreted by the adrenal glands الكظرية and ovaries المبيضين or testes الخصيتين.

Most hormones are released directly into the bloodstream, where they circulate throughout the body in very low concentrations. Some hormones travel intact in the bloodstream. Others require a carrier substance {reservoir} to dissolved in the blood. These carriers also serve as a hormone reservoir خزان, keeping hormone.

Reservoir:

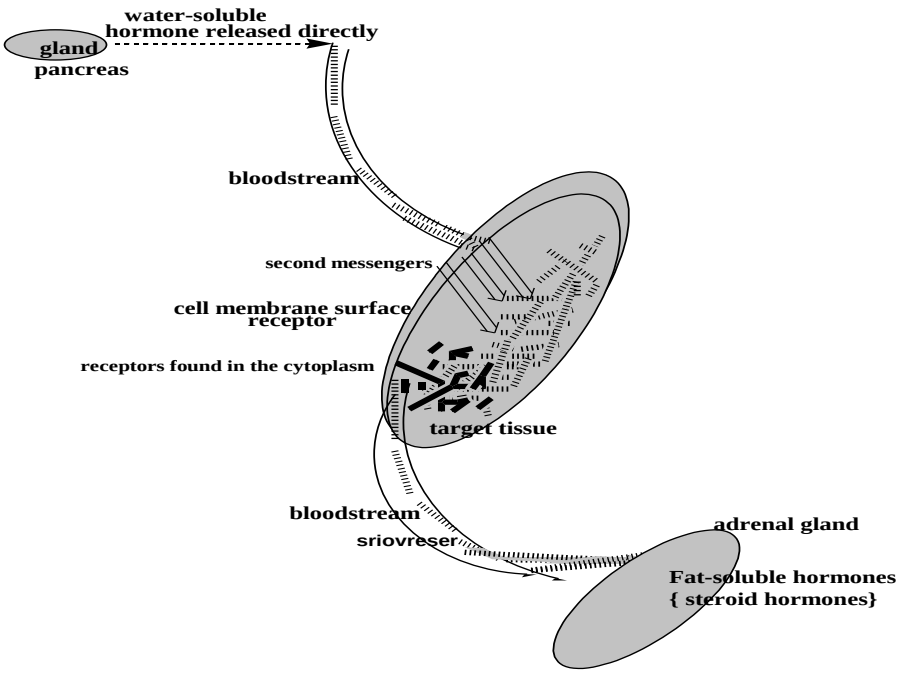
A carrier substance such as protein molecule that keep hormones concentrations constant in the bloodstream and protecting the bound hormone from chemical breakdown over time

Mechanisms of Hormones Travel:

Hormones travel in the bloodstream until they reach their target tissue, where they activate a series of chemical changes. To achieve its intended result, a hormone must be recognized by a specialized protein in the cells of the target tissue called a receptor.

1. water-soluble hormones are used a receptor located on the cell membrane surface of the target tissues. A series of special molecules within the cell, known as second messengers, transport the hormone's information into the cell.

2. Fat-soluble hormones, such as steroid hormones, pass through the cell membrane and bind to receptors found in the cytoplasm. When a receptor and a hormone bind together, both the receptor and hormone molecules undergo structural changes that activate mechanisms within the cell. These mechanisms produce the special effects induced by the hormone.

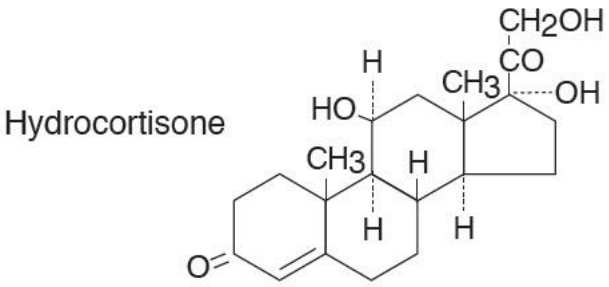


Mechanisms of Hormones Travel

Major Hormones :

1. Hydrocortisone,

C21H30O5



Also named cortisol, the principal hormone secreted by the outer layer, or cortex القشرة, of the adrenal gland.

Hydrocortisone affects:

- the metabolism of carbohydrate, protein, and fat;
- the maturation نضوج of white blood cells;
- the retention of salt and water in the body;
- the activity of the nervous system;
- and the regulation of blood pressure.

Secretion of hydrocortisone from the adrenal cortex is stimulated by the pituitary hormone ACTH (Adrenocorticotropic hormone).

Because of their widespread effects, hydrocortisone and related compounds, called corticosteroids, or corticoids, are employed for many medical purposes.

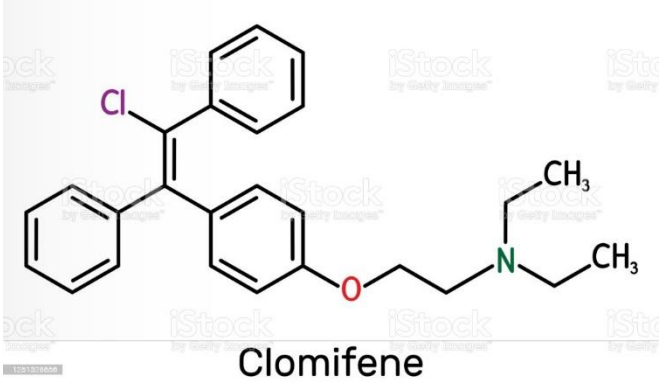
- They are used to treat a deficiency of adrenal cortical hormones, a condition called congenital adrenal hyperplasia تضخم,

- rheumatoid تورم الانسجة disease that is not helped by milder drugs,
- and to counter severe non-infectious inflammations التهابات.
- Corticosteroids suppress the immune response, so they are used to increase acceptance of transplantsزراعة الأعضاء,
- Other conditions for which they are helpful as asthma,

Because corticosteroids affect so many body processes, they must be used carefully. Corticosteroids dispose تعرض persons to infection and can lead to swelling of the face and limbs, muscle weakness, weight gain, high blood pressure, and diabetes.

2. Clomiphene,

C26H28ClNO



{CLOMIDE}Fertility-stimulating Drug.

Another drug of gynecological تخصص الامراض الجنسية and general endocrinological تخصص الغدد الصماء interest is clomiphene, a potent estrogenic substance. The drug is capable of stimulation of ovulation الاباضة in the female and spermatogenesis تكوين النطف in the male, The clomiphene effect seems to be mediated via stimulation of the anterior lobe of the pituitary gland الغدة النخامية.

C-Vitamins

Vitamins are essential organic compounds which are either not synthesized in the human and animal organism or formed only in insufficient amounts. Therefore, they must be regularly consumed with the diet either as such or as a precursor (pro vitamin) that can be converted to the vitamin in the body.

Benefits of vitamin:

1. Metabolism.
2. protect health.
3. for proper growth in children.
4. assist in the formation of:
    a. hormones.
    b. blood cells.
    c. nervous system.
    d. chemicals, and genetic material.

Actions:

They generally act as catalysts, combining with proteins to create metabolically active enzymes that in turn produce hundreds of important chemical reactions throughout the body. Without vitamins, many of these reactions would slow down or cease. The ways in which vitamins act on the body, however, are still far from clear.

Sources:

The body can manufacture only vitamin D, all others must be derived from the diet. Lack of them causes a wide range of metabolic and other dysfunctions

Classification:

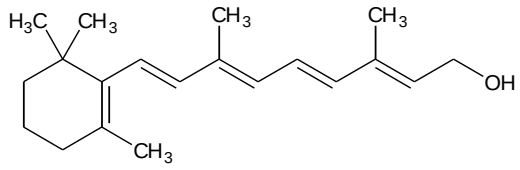
The 13 well-identified vitamins are classified according to their ability to be absorbed in fat or water:

a) Fat-soluble vitamins:

Vitamin A, D, E and K

Examples:

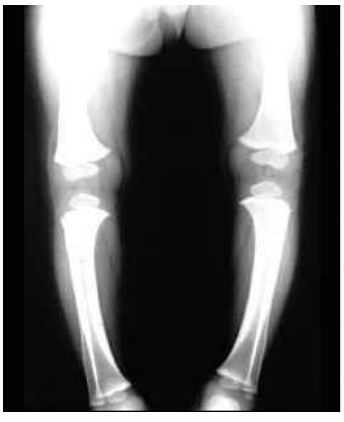
Vitamin A:



The body obtains vitamin A in two ways:

a) by manufacturing it from carotene, a vitamin precursor found in such vegetables as carrotsجزر, broccoli, squashقرع, spinach, kaleكرنب, and sweet potatoes.
b) by absorbing ready-made vitamin A from plant-eating organisms. In animal form, vitamin A is found in milk, butter, cheese, egg yolk, liver, and fish-liver oil.

VITAMIN D:



Bone Deformation Rickets can result from insufficient vitamin D in the diet or from insufficient amounts of ultraviolet radiation from the sun.

Rickets can lead to skeletal deformation, such as vertebral or leg curvature.

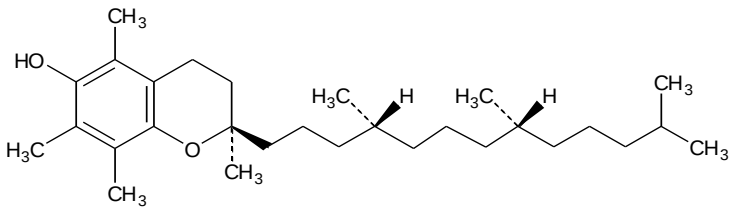
This vitamin is necessary for normal bone formation and for retention of calcium and phosphorus in the body. It also protects the teeth and bones against the effects of low calcium intake by making more effective use of calcium and phosphorus. Also called the sunshine vitamin,

Vitamin D is obtained from egg yolk, liver, tuna, and vitamin-D fortified milkالحليب المدعم.

Vitamin D deficiency, or rickets, occurs only rarely in tropical climates where sunlight is strong, but it was once common among children of northern cities before the use of vitamin D-fortified milk. Rickets is characterized by deformities of the rib cage and skull and by bowlegsتقوس القدم, due to failure of the body to absorb calcium and phosphorus.

Because vitamin D is fat-soluble and stored in the body, excessive consumption can cause vitamin poisoning, kidney damage, lethargyخمول, and loss of appetite.

VITAMIN E:



The role of vitamin E in the human body is not clearly established, but it is known to be an essential nutrient in more than 20 vertebrate speciesالفقريات.

The vitamin plays some role in forming red blood cells and muscle and other tissues and in preventing the oxidation of vitamin A and fats. It is found in vegetable oils, wheatالقمح, liver, and leafy green vegetables.

Although vitamin E is stored in the body, overdoses appear to have lower toxic effects than do overdoses of other fat-soluble vitamins.

VITAMIN K:

This vitamin is necessary mainly for the coagulation of blood. It aids in forming prothrombin, an enzyme needed to produce fibrin for blood clotting. The richest sources of vitamin K are alfalfa البرسيم and fish livers, which are used in making concentrated preparations of this vitamin. Dietary sources include all leafy green vegetables, egg yolks, soybean oil, and liver.

b) Water-soluble vitamins:

Vitamin B1(thiamin), B2(riboflavin), B6(pyridoxal group), B12(cobalamins), C(ascorbic acid). Folic acid.

Example:

VITAMINS B:

Known also as vitamin B complex, these are fragile, water-soluble substances, several of which are particularly important to carbohydrate metabolism.

- B1:

Thiamine, or vitamin B1, a colorless, crystalline substance, acts as a catalyst in carbohydrate metabolism, enabling pyruvic acid to be absorbed and carbohydrates to release their energy. Thiamine also plays a role in the synthesis of nerve-regulating substances. Deficiency in thiamine causes beriberi, which is characterized by muscular weakness, swelling of the heart, and leg cramps and may, in severe cases, lead to heart failure and death. Many foods contain thiamine, but

few supplies it in concentrated amounts. Foods richest in thiamine are pork الخنزير, organ meats (liver, heart, and kidney), brewer's yeast خميرة البيرة, lean meats اللحوم الطرية, eggs, leafy green vegetables, cereals, wheat القمح, berries التوت, nuts الجوز, and legumes البقوليات.

Milling طحن of cereal removes those portions of the grain richest in thiamine; consequently, white flour الطحين and polished white rice الرز الابيض may be lacking in the vitamin.

- B2

Riboflavin, or vitamin B2, like thiamine, serves as a coenzyme—one that must combine with a portion of another enzyme to be effective—in the metabolism of carbohydrates, fats. It also serves in the maintenance of mucous membranes.

Riboflavin deficiency may be complicated by a deficiency of other B vitamins; its symptoms, which are not as definite as those of a lack of thiamine, are skin lesions, especially around the nose and lips, and sensitivity to light. The best sources of riboflavin are liver, milk, meat, dark green vegetables, and mushrooms.

- B3

Niacin, also known as nicotinic acid and vitamin B3, also works as a coenzyme in the release of energy from nutrients. A deficiency of niacin causes pellagra, the first symptom of which is a sunburn like eruption ثوران او طفح جلدي that breaks out تنتشر where the skin is exposed to sunlight. Later symptoms are a red and swollen tongue, diarrhea, mental confusion, irritability, and, when the central nervous system is affected, depression and mental disturbances.

The best sources of niacin are liver, poultryدواجن, meat, canned tuna and salmon, whole grain and cereals, dried beansالفاصوليا and peasبازلاء, and nutsالجوز.

The body also makes niacin from the amino acid tryptophan. Mega doses of niacin have been used experimentally in the treatment of schizophrenia, although no experimental proof has been produced to show its efficacy. In large amounts it reduces levels of cholesterol in the blood, and it has been used extensively in preventing and treating arteriosclerosis. Large doses over long periods cause liver damage.

- B6

Pyridoxine, or vitamin B6, is necessary for the absorption and metabolism of amino acids. It also plays roles in the use of fats in the body and in the formation of red blood cells.

Pyridoxine deficiency is characterized by skin disorders, cracksتشققات at the mouth corners, smooth tongue, convulsions, dizziness, nausea, anemia, and kidney stones.

The best sources of pyridoxine are whole grainsبقوليات, cerealsحبوب, bread, liver, avocadoes, spinach, green beansالفاصوليا الخضراء, and bananas.

- B12

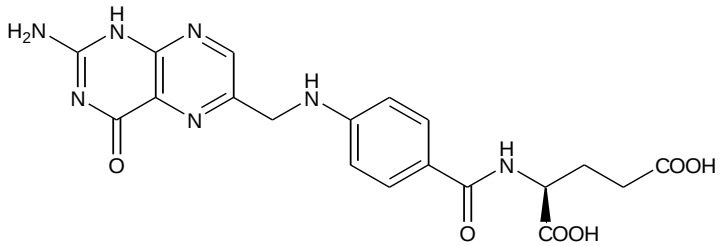
Cobalamin, or vitamin B12, one of the most recently isolated vitamins, is necessary in minute amounts for the formation of nucleoproteins, proteins, and red blood cells, and for the functioning of the nervous system.

Cobalamin deficiency is often due to the inability of the stomach to produce glycoprotein, which aids in the absorption of this vitamin.

Pernicious anemiaفقر الدم الخبيث results, with its characteristic symptoms of ineffective production of red blood cells, faulty myelin (nerve sheathغمد) synthesis, and loss of epithelium (membrane lining) of the intestinal tract.

Cobalamin is obtained only from animal sources, liver, kidneys, meat, fish, eggs, and milk. Vegetarians are advised to take vitamin B12 supplements.

Folic acid, or folacin:



is a coenzyme needed for forming body protein and hemoglobin. Recent investigations show that folic acid deficiency may be responsible for neural tube defects, a type of birth defect that results in severe brain or neurological disorders. The U.S. Public Health Service recommends that women of child-bearing age should take 0.4 mg of folic acid daily. Women should continue to take that dose through the first three months of pregnancy. Folic acid is effective in the treatment of certain anemias. Dietary sources are organ meats, leafy green vegetables, legumesالبقوليات, nutsمكسرات, and brewer's yeastخميرة البيرة.

VITAMIN C, OR ASCORBIC ACID:

This well-known vitamin is important in the formation and maintenance of collagen, the protein that supports many body structures and plays a major role in the formation of bones and teeth. It also enhances the absorption of iron from foods of vegetable origin.

Scurvyالاسقربوط is the classic manifestation of severe ascorbic acid deficiency. Its symptoms are due to loss of the cementing actionالوظيفةالتدعيمية of collagen and include hemorrhages, loosening of teeth, and cellular changes in the long bones of children.

Although unused ascorbic acid is quickly excreted in the urine, large and prolonged doses can result in the formation of bladder and kidney stones, interference with the effects of blood-thinning drugs, destruction of B12, and the loss of calcium from bones.

Sources of vitamin C include citrus fruitsالحمضيات, fresh strawberriesفراولة, cantaloupeالشمام, pineappleاناناس, and guavaجوافة.