MARUDHAR KESARI JAIN COLLEGE FOR WOMEN, VANIYAMBADI

MATERIALS (e-notes collection)

I B.Sc BIOCHEMISTRY

SUBJECT NAME: ALLIED CHEMISTRY-II

SUBJECT CODE: FACH15C

UNIT – V

5.1 Drugs - Sulpha Drugs – Preparation and Uses of Sulphapyridine and

Sulphadiazine - Mode of Action of Sulpha Drugs - Antibiotics - Uses of Penicillin, Chloramphenicol and Streptomycin - Drug Abuse and Their Implication - Alcohol – LSD.

5.2 Anaesthetics - General and Local Anaesthetics - Antiseptics - Examples and their Applications - Definition and One Example each for Analgesics, Antipyretics, Tranquilizers, Sedatives - Causes, Symptoms and Treatment of Diabetes, Cancer and AIDS.

5.3 Electrochemical Corrosion and its Prevention – Electroplating – Applications.

5.1-DRUGS:

Drugs are **Compounds which exert various physiological effects of therapeutic value. A drug is an** organic compound,natural or synthetic.It creates physiological effects on body functions.

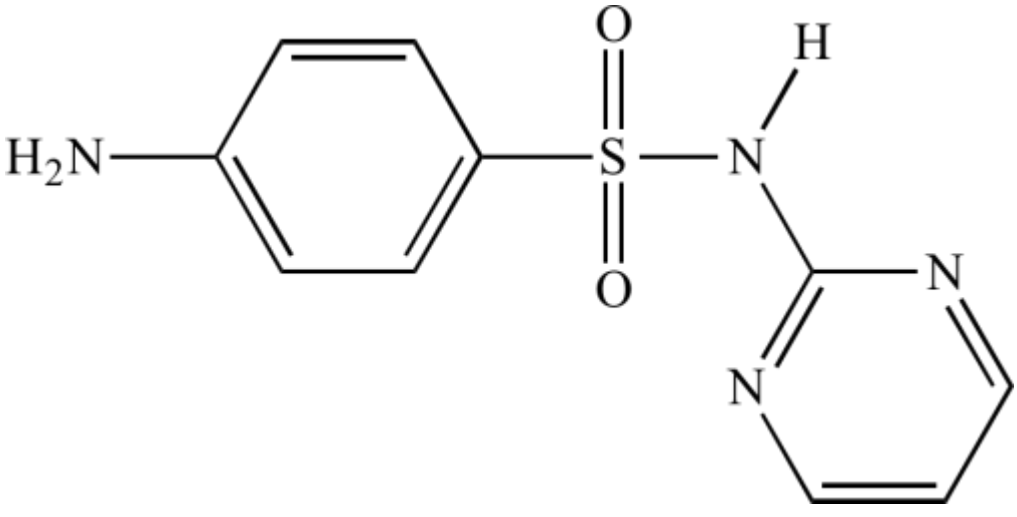
It **Selectively destroys the microorganism without affecting the normal functioning in the body of the person or animal taking it.**

A Drug is defined as a "Chemical Which is used for modifying physiological systems".

SULPHA DRUGS:

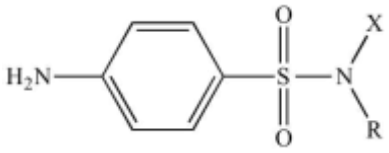
The first sulfa drug was prontosil. It was discovered by the German physician and chemist Gerhard Domagk in 1935.

Sulfa drugs kill bacteria and fungi by interfering with their metabolism. They were the "wonder drugs" before penicillin and are still used today. Because sulfa drugs concentrate in the urine before being excreted, treating urinary tract infections is one of their most common uses. Sulfa drugs can have a number of interactions with prescription and over-the-counter drugs (including PABA sunscreens), and are not appropriate for people with some health conditions.



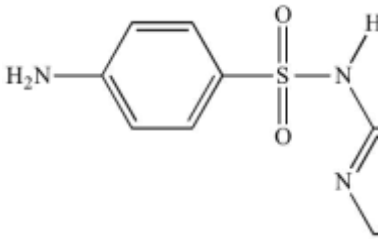
SULPHA DRUGS:

OTHER EXAMPLE OF SULPHA DRUGS:

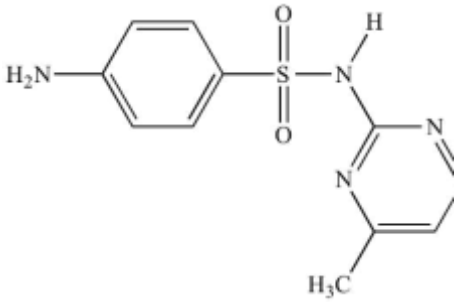


General sulfa drug molecular structure. R is usually an aromatic heterocycle. X = H or Na.

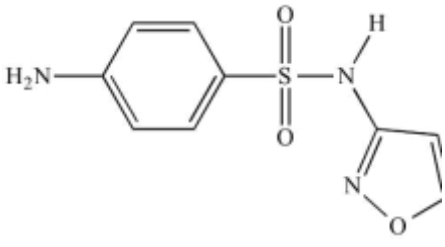
Example Sulfa Drugs



Sulfadiazine



Sulfamethazine



Sulfamethoxazole

Sulphonilamide,Sulphonamides or P-Amino benzene Sulphonamide and its derivatives have great "anti-bacterial powers" and commonly known as sulpha drugs.

The original antibacterial sulfonamides are synthetic (nonantibiotic) antimicrobial agents that contain the sulfonamide group. Some sulfonamides are also devoid of antibacterial activity, e.g., the anticonvulsant sultiame. The sulfonylureas and thiazide diuretics are newer drug groups based upon the antibacterial sulphonamides.

It had a strong protective action against infections caused by streptococci, including blood infections, childbed fever, and erysipelas, and a lesser effect on infections caused by other cocci. However, it had no effect at all in the test tube, exerting its antibacterial action only in live animals. Later, it was discovered by Bovet,[10] Federico Nitti and J. and Th. Jacques Tréfouël, a French research team led by Ernest Fourneau at the Pasteur Institute, that the drug was metabolized into two pieces inside the body, releasing from the inactive dye portion a smaller, colorless, active compound called sulfanilamide.[11] The discovery helped establish the concept of "bioactivation"

MODE OF ACTION OF SULPHA DRUGS:

Sulfonamides or Sulfa Drugs as Antimetabolites:

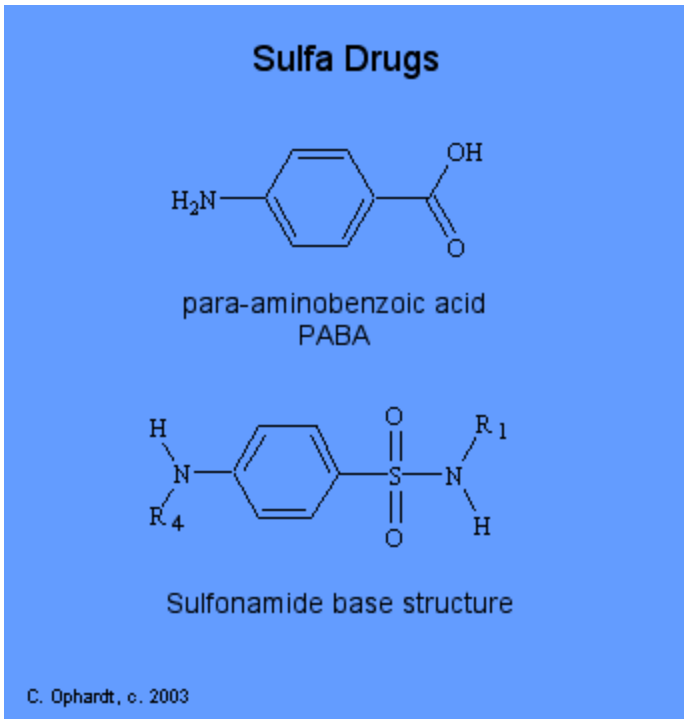
The sulfonamides are synthetic antimicrobial agents with a wide spectrum encompassing most gram-positive and many gram-negative organisms. These drugs were the first efficient treatment to be employed systematically for the prevention and cure of bacterial infections.

Their use introduced and substantiated the concept of metabolic antagonism. Sulfonamides, as antimetabolites, compete with para-aminobenzoic acid (PABA) for incorporation into folic acid. The action of sulfonamides illustrates the principle of selective toxicity where some difference between mammal cells and bacterial cells is exploited. All cells require folic acid for growth. Folic acid (as a vitamin is in food) diffuses or is transported into human cells. However, folic acid cannot cross bacterial cell walls by diffusion or active transport. For this reason bacteria must synthesize folic acid from p-aminobenzoic acid.

Sulfonamides or sulfa drugs have the following general structures as shown in the graphic on the left.

Sulfanilamide which was the first compound used of this type has H's at R1 and R4. To date about 15,000 sulfonamide derivatives, analogues, and related compounds have been synthesized.

This has lead to the discovery of many useful drugs which are effective for diuretics, antimalerial and leprosy agents, and antithyroid agents. The basic structure of sulfonamide cannot be modified if it is to be an effective competitive "mimic" for p-aminobenzoic acid. Essential structural features are the benzene ring with two substituents para to each other; an amino group in the fourth position; and the singly substituted 1-sulfonamido group.



Sulfa Drugs - Mechanism for Action:

Normally folic acid is synthesized in two steps in bacteria by the top reaction on the left. If A sulfa drug is used, the first enzyme is not to specific and can use the sulfonamide in the first reaction. This reaction produces the product containing pteridine and the sulfa drug.

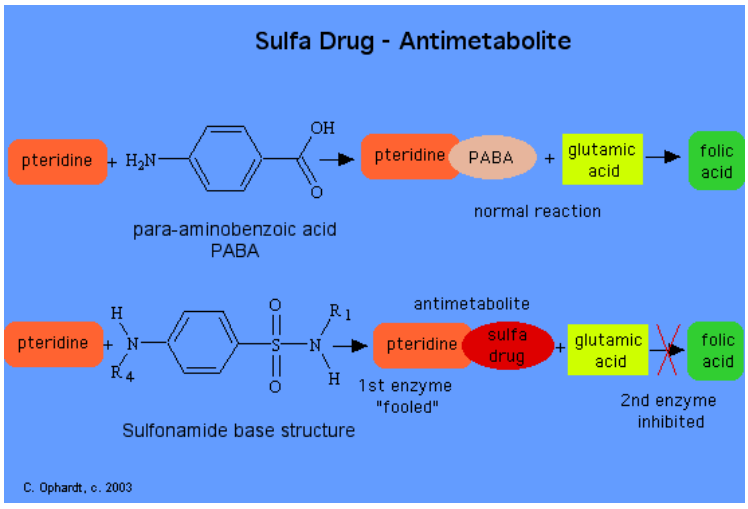
The next and final step is the reaction PABA + with glutamic acid to make folic acid. If the sulfa drug has been substituted for the PABA, then the final enzyme is inhibited and no folic acid is produced.

Recent studies indicate that substituents on the N(1) nitrogen may play the role of competing for a site on the enzyme surface reserved for the glutamate residue in p-aminobenzoic acid-glutamate through one of the following two ways:

a) Direct competition in the linking of PABA-glutamate with the pteridine derivative.

b) Indirect interference with the coupling of glutamate to dihydropteroic acid.

QUES. 3: In your own words explain how the sulfa drug works including enzyme inhibition, folic acid, and antimetabolite.



Sulfa-containing drugs include:

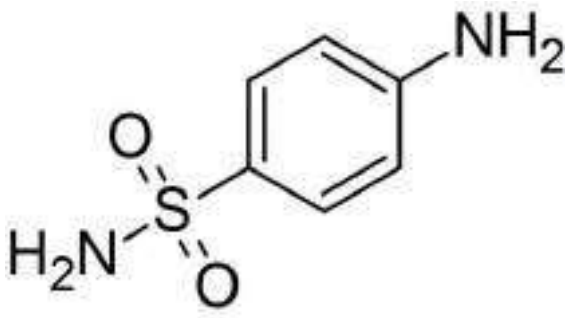
- sulfonamide antibiotics, including sulfamethoxazole-trimethoprim (Bactrim, Septra) and erythromycin-sulfisoxazole (Eryzole, Pediazole)
- some diabetes medications, such as glyburide (Diabeta, Glynase PresTabs)

IMPORTANT SULPHONAMIDE DRUGS:

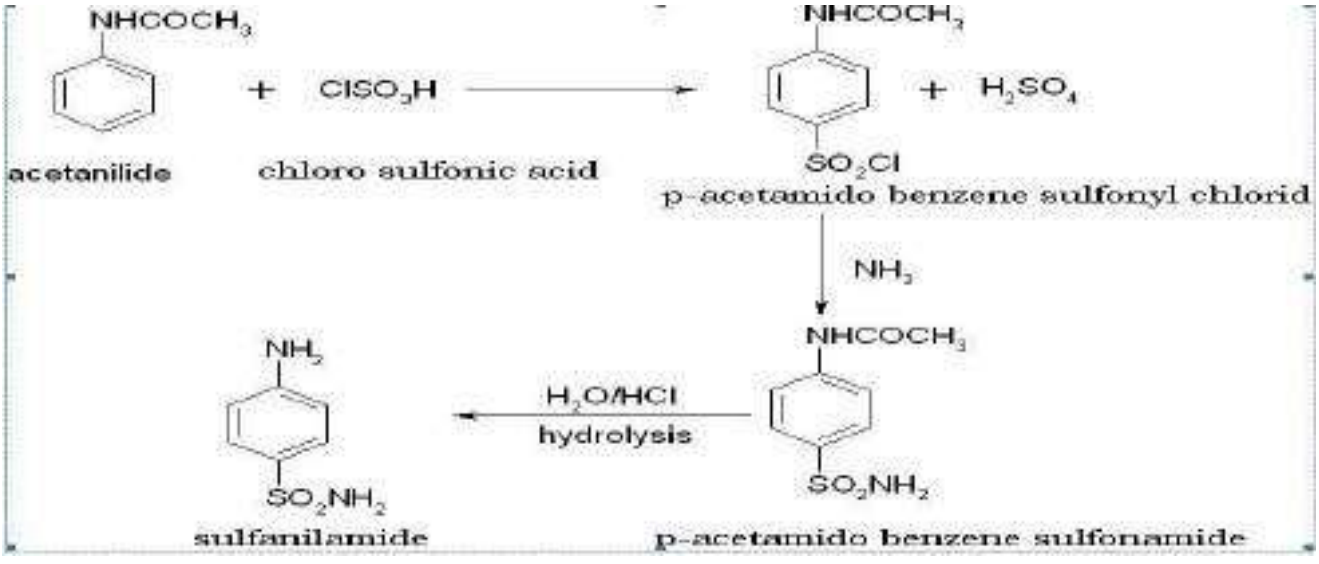
1. Sulphanilamide
2. Sulphadiazine
3. Sulphafurazole

SULPHANILAMIDE

Sulfanilamide (also spelled **sulphanilamide**) is a sulfonamide antibacterial. Chemically, it is an organic compound consisting of an aniline derivatized with a sulfonamide group.[1] Powdered sulfanilamide was used by the Allies in World War II to reduce infection rates and contributed to a dramatic reduction in mortality rates compared to previous wars.

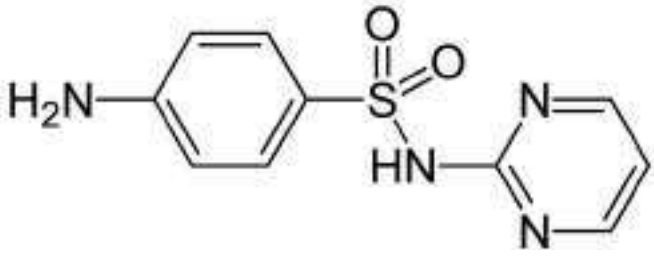


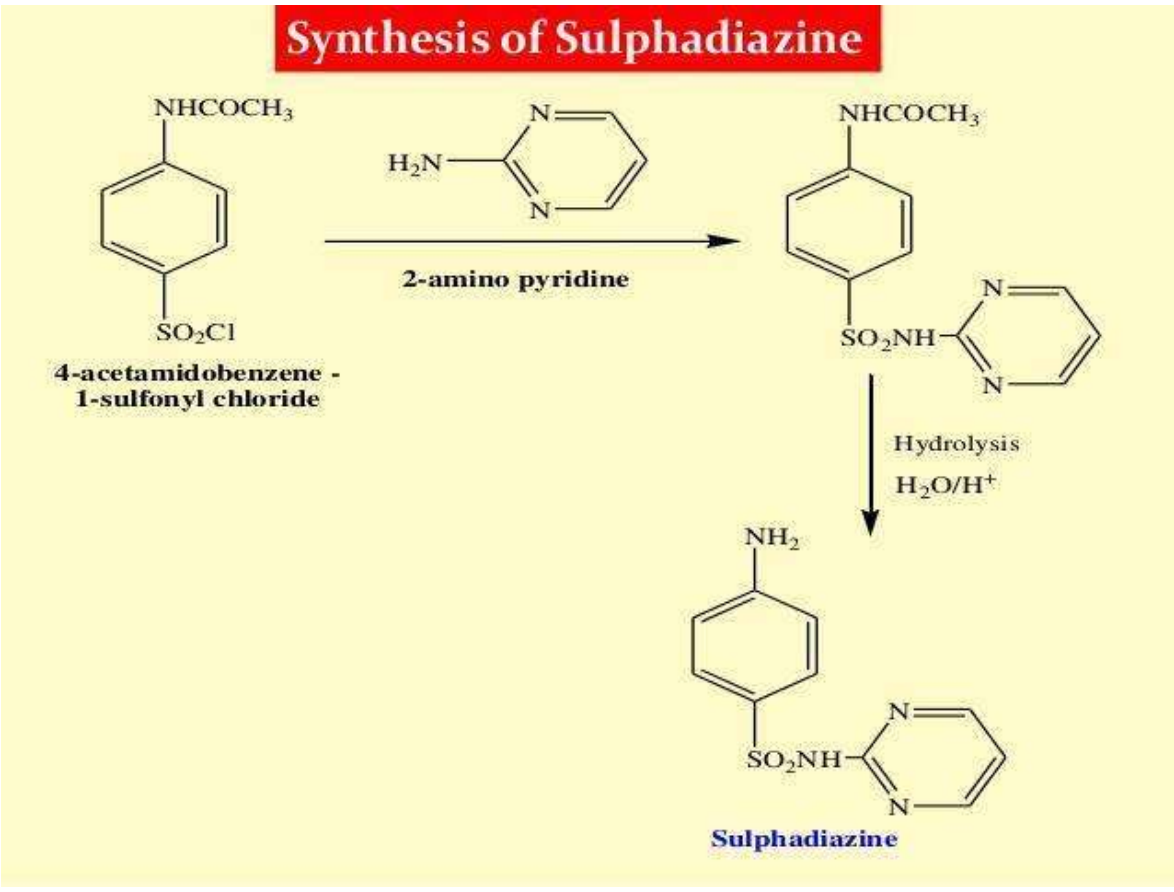
PREPARATION OF SULPHANILAMIDE:



PREPARATION AND USES OF SULPHADIAZINE

Sulfadiazine is an antibiotic.[2] Used together with pyrimethamine, it is the treatment of choice for toxoplasmosis.[4] It is a second-line treatment for otitis media, prevention of rheumatic fever, chancroid, chlamydia, and infections by *Haemophilus influenzae*.[2] It is taken by mouth.[2]



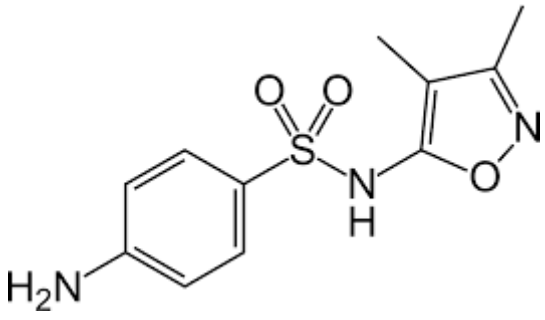


Medical uses[edit]

It eliminates bacteria that cause infections by stopping the production of folate inside the bacterial cell, and is commonly used to treat urinary tract infections and burns.

In combination, sulfadiazine and pyrimethamine can be used to treat toxoplasmosis, the disease caused by *Toxoplasma gondii*.

PREPARATION AND USES OF SULPHAFURAZOLE:

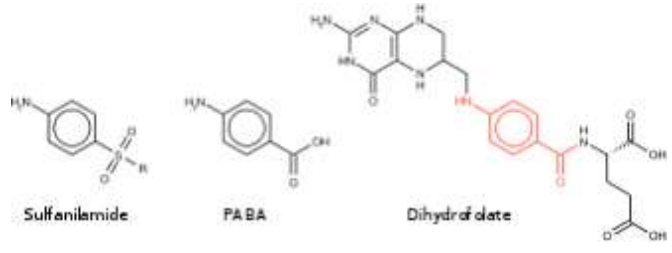


Su**lfafurazole** (INN, also known as **sulfisoxazole**) is a sulfonamide antibacterial with an dimethyl-isoxazole substituent. It has antibiotic activity against a wide range of Gram-negative and Gram-positive organisms. It is sometimes given in combination with erythromycin (see erythromycin/Sulfafurazole) or phenazopyridine. It is used locally in a 4% solution or ointment.

PREPARATION AND USES OF SULPHAFURAZOLE:

Preparation:

It is prepared by condensing 5-amino isoxazole(or highly substituted isoxazole)with **P-N-Acetyl Sulphanilyl chloride(P-ASC).**



USAGE & PROPERTIES OF SULPHA DRUGS:

In the treatment of infections the sulphonamides have been largely replaced by antibiotics. They are of interest in the **treatment of patients intolerant to antibiotics & they continue to be widely used.** The individual sulphonamides do not differ much in their activity against specific microorganisms.

There is a difference however in their extent of absorption, their diffusion to the body tissues & their rate of elimination from the body. Most of them are readily absorbed from the GI tract.

ANTIBIOTICS:

The term **antibiotic** is defined **as a drug derived from living matter or microorganism, which either prevents the growth of other microorganism or destroy them.**

Antibiotics are obtained from microorganism such as fungi, actinomycetes, bacteria etc. The first well authenticated report on an antibiotic was made by **Pasteur** who found that certain aerobic non-pathogenic bacteria inhibited the growth of ***Anthrax bacilli.***

All the chemical substances obtained from living cells cannot be considered as antibiotics as the antibiotics have to satisfy certain conditions such as...

1. It should be **effective at low concentration.**
2. It should **antagonize the growth or kill one or more species of the microorganism.**
3. **It should not have significant side effects.**
4. **It must be effective against a pathogen.**
5. It should be **stored for a long time without appreciable loss of the activity.**
6. The **antibiotic should be completely removed from the body after its administration has been stopped.**
7. It should be **highly stable so that it can be isolated & processed into suitable forms of dosages, which are readily absorbed.**

Penicillins are of two classes:

- Biosynthetic
- Semi synthetic

Biosynthetic types are formed during fermentation.

E.g. **Penicillin G, V.**

Semi synthetic types are made by adding certain compounds to **6-Amino Penicillanic acid.**

USES OF PENICILLIN:

Penicillin is very effective against

i) Pneumococcal infections like pneumonia, meningitis etc

ii) Streptococcal infection like scarlet fever, pharyngitis etc.,

iii) Staphylococcal infection like acute osteomyelitis etc., in these infections generally Benzyl penicillin is used

iv) Meningococcal infections

v) Veneral diseases such as gonorrhoea, syphilis etc.

vi) Actinomycosis

vii) Rheumatic fever, in these infections mainly Benzyl penicillin is given. It is also used in the treatment of diphtheria, tetanus & gangrene.

The antibiotic can be used **orally or parenterally.**

Antibiotics are very important therapeutic agent & have been formed to be clinically effective in many protozoans, bacterial & fungal infections.

The antibiotics are very specific in their action i.e. a given antibiotic is effective against certain types of microorganisms only.

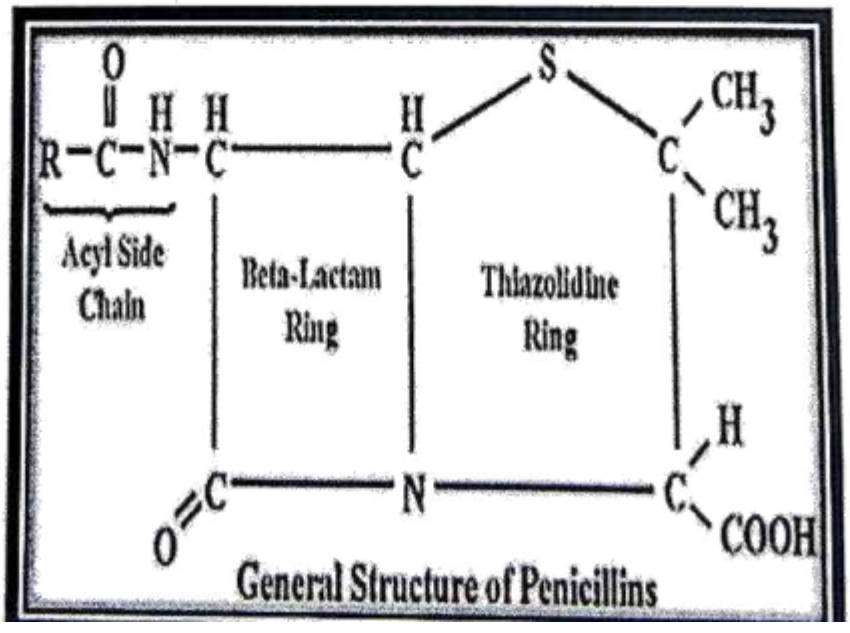
The organisms susceptible to the inhibitory or lethal of an antibiotic are known as **"Spectrum".**

PENICILLINS:

Penicillins are the **most potent antibacterial drugs.**

Fleming in 1929 discovered it from the **mold Penicillium species.** Penicillin is the name given to the mixture of natural compounds having the general molecular formula $C_9H_{11}O_4N_2SR$ & differing only in the nature of R.

Penicillin G is the most widely used one among the natural penicillin.

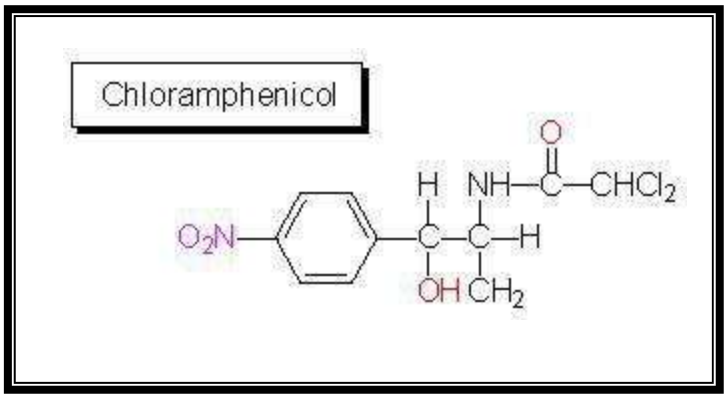


General Structure of Penicillins

CHLORAMPHENICAL:

Chloramphenical was the first **effective broad spectrum antibiotic to be discovered.**

The Chlorine containing antibiotic chloramphenicol was isolated in 1948 by carter etal from a microorganism called streptomyces Venezuela.



USES OF CHLORAMPHENICOL:

It is effective against both gram positive and gram negative and also against rickettsia.

It inhibits the growth of Staphylococcus,Streptococcus,Bacillus,Vibrios..etc.,

It is used in the treatment of typhoid fever(Gram negative bacteria),pneumonia(gram negative bacteria),rickettstic (epidemic typhus),dysentery,urinary tract infections,entereic fever,whooping cough..etc.,

It also finds its use in the treatment of Haemophilus influenza,meaningitis,plague,syphilis,gonorrhoea.

This antibiotic is effectively absorbed from the intestinal tract and is diffused into the tissues.Being poorly water soluble its absorption depends to a greater extent on its particle size.

STREPTOMYCIN:

Streptomycin was isolated by **Waksman et al from cultures of *Streptomyces griseus* in 1944.**

It is composed of three units **Streptose, Streptidine & N-Methyl glucosamine.**

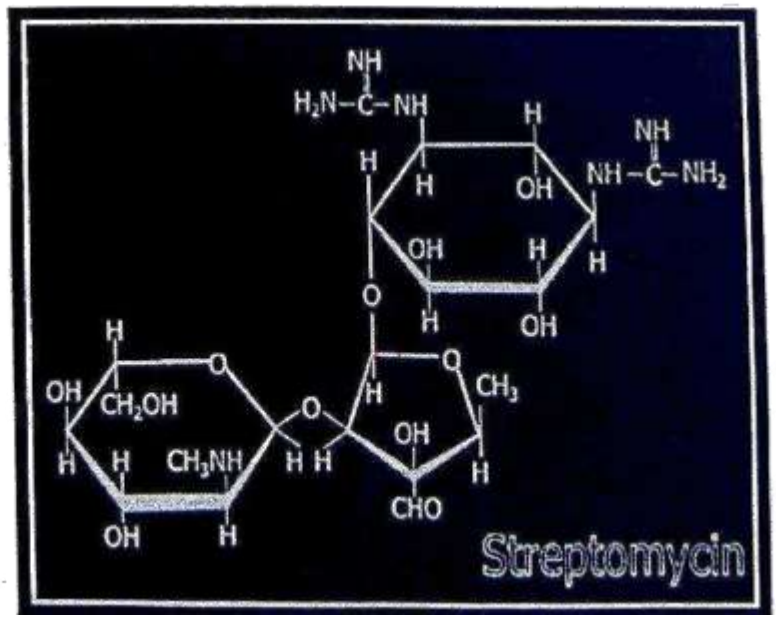
USES OF STREPTOMYCIN:

The most important use of streptomycin is in the **treatment of Tuberculosis.**

It is also useful in treating infection of ***E.Coli*, *Haemophilus influenzae*, Plague, respiratory tract infections, meningitis, bacteremia, peritonitis.**

It is also used to treat other common infections like **throat, lungs, ears & kidneys.**

Prolonged use of this drug may lead to deafness.



DRUG ABUSE & THEIR IMPLICATION:

Drug use & dependence are viewed with concern by the world community.

It is being viewed as an **infectious disease** which is fast spreading causing considerable damage to the individual family & the society as a whole.

Drugs should be used with caution. This is because the drugs like antibiotics are toxic & they also kill the host tissues besides the microorganisms which cause the disease.

Another limitation of the **drug abuse is the side effects of the drugs.** The patient is required to follow the instructions of the physician while taking a drug.

The drugs which are commonly abused are **Marijuana, Heroin, Cocaine, and Morphine**...etc.

The problem of drugs is universal affecting every sector of the society. The patterns of use are highly varied. Chronic consumption of drugs leads to changes in the behavior.

A drug abusing individual experiences physical, emotional or social complications which threaten or impair his/her wellbeing. The need to consume becomes a priority over everything else, and it also leads to health & social problems.

The individual may even **steal to generate additional income to support this habit.**

DRUG ADDICTION:

When a **drug is frequently used it brings about habit formation among patients. This is known as Addiction.**

For example, people are addicted towards alcohol & other narcotic drugs, although these are useful in small doses.

Once a person becomes addict to a particular drug it is not advisable to **stop it suddenly as it may cause adverse side effects. This is known as Withdrawal effects.**

ALCOHOL:

Alcoholism is a **killer disease.** It is a **chronic & progressive disease that leads to severe physical & social problems.** Alcohol provides a **lot of empty calories without any nutritive value.** Many people think that **alcohol is a stimulant which is not true. Alcohol is a depressant & it slows down the activity of the nervous system.**

The body becomes accustomed to the use of alcohol over a period of time, that when one stops drinking **"Withdrawal symptoms", such as sleeplessness, anxiety, nervousness, tremors, convulsions, hallucinations etc occur.** This state is called **Physical dependence.**

This slowly leads to an **irresistible craving to drink.** This stage is called **Psychological dependence.**

Repeated excessive drinking over a period of time affects heart, lungs, liver, stomach, intestine, nervous system.

PREVENTION OF ALCOHOLISM & DRUG ABUSE:

Alcoholism & drug abuse can be prevented by promoting broad public awareness of the problem of drug abuse & alcoholism. By **educating parents, teachers & others on ways to assist individuals at risk of drug abuse.**

TREATMENT:

Identifying the **alcoholic & drug dependence on the basis of sufficient symptoms.**

Establish an **understanding with him in friendly manner without making judgments.**

Make him to **realize that alcoholism is a disgrace.**

Act immediately & take him to the treatment centre without delay.

Rehabilitation.

LSD-LYSERGIC ACID DIETHYLAMIDE:

Drugs which stimulate the CNS to afford alterations in mood & perception, illusions or hallucinations, which resemble natural psychosis, are called PSYCHEDELIC DRUGS.

Lysergic acid Diethylamide abbreviated LSD also known as Lysegide or as acid, is a semi synthetic psychedelic drug of the **ergoline family,** well known for its psychological effects which can include altered thinking processes.

LSD was first synthesized by Albert Hofmann in 1938.

EFFECTS OF ADMINISTERING LSD:

LSD stimulates CNS, sleeplessness, dilation of the pupil & feelings of tightness of jaws result.

Moderate increase in blood pressure occurs.

Nausea & vomiting accompany LSD administration.

Hunger & inability to eat is produced.

Distribution of perception is caused.

Hallucinations characterized by distortion of senses (distortion of sizes & distances, feeling of separation from the parts of the body & distorted vision. Vivid patterns of colour, excitation, euphoria & loss of personal identity are produced

LSD possesses unique property of flashbacks even after a single exposure to LSD.

Feelings of anxiety & tension are produced, suicidal attitude may be caused.

An expectant mother exposed to LSD delivers a child with clubbed feet.

Prolonged psychic disturbances may occur. (E.g. flashes of colour, psychotic episodes, schizophrenia even months & years after the discontinuation of LSD.

LSD is quickly bound to plasma proteins & concentrates in liver, spleen, & kidneys.

It does not reach brain.

A person with schizophrenia can suffer from hallucinations that involve seeing, hearing and smelling imaginary things, and experience the paranoia of being targeted.

CLINICAL USES OF LSD:

1. LSD is used in **psychotherapy.**

A patient is relieved from self-centered fixation by psychotherapeutic treatment.

2. Psychoanalysis:

Repressed memories can be activated. **E.g. Childhood experience.**

3. LSD can cure neurosis, alcoholism

But treatment should be very carefully done, with skill.

An alcoholic stops drinking.

Euphoric & detachment producing effects help patients to endure chronic pain.

5.2 - ANAESTHETICS:

Anaesthetics are drugs which produce **loss of sensation.** The term anaesthesia means **loss of sensation.** It is derived from a Greek word **"anaestheisa" which means insensibility.**

Anaesthetics produce **insensibility to the vital function of all types of cells & especially those of nervous system.**

The most important aspect of anaesthetics is that the **loss of consciousness is reversible, i.e. as soon as the concentration of the anaesthetic is decreased the affected organs return to the normal state.**

Priestly discovered the first inhalation anaesthetic, Nitrous Oxide in 1776.

Nitrous oxide is a **colourless, inorganic, non-irritating gas.**

It is the safest of the anaesthetic agents.

Later in 1846, Marton showed the use of anaesthetics in surgical operations.

The discovery of **anaesthetics proved to be a great boon to mankind as the patient has no agony during the operation.**

CLASSIFICATION OF ANAESTHETICS:

The anaesthetics could be classified as follows according to their mode of action.

1) General anaesthetics

2) Local anaesthetics

1) GENERAL ANAESTHETICS:

General anaesthetics are the agents which produce **unconsciousness all over the body, by depressing the CNS to such an extent that the sensitivity to pain or feeling is reduced.**

The general anaesthetics are further classified as

i) Volatile general anaesthetics

ii) Non-volatile general anaesthetics

i) VOLATILE GENERAL ANAESTHETICS:

This group includes the drugs which are **volatile gases or liquids.** Example:

a) Ether, C_2H_5-O-C_2H_5:

It is a volatile liquid. This is mixed with stabilizer 0.002% Propyl halide.

After absorption by tissues, it attacks the CNS & makes unconscious.

b) Chloroform, $CHCl_3$:

It is a volatile liquid. It has **pleasant smell & sweet taste.**

c) Halothane, $CF_3CHBrcl$

d) Trichloroethylene, $CHCl=CCl_2$

e) Ethyl chloride, C_2H_5Cl

f) Nitrous oxide, N_2O

g) Cyclopropane,

ii) NON VOLATILE GENERAL ANAESTHETICS:

These **anaesthetics produce unconsciousness when they are administered parenterally or intravenously.**

They **induce anaesthesia rapidly.**

Examples:

a) Thiopental Sodium

b) Methohexitone

c) Propanidiol

d) Ketamine

e) Etomidate

f) Althesin

2) LOCAL ANAESTHETICS:

These **substances are applied topically or by injection & abolish sensation in the localized area, i.e. the whole body is not affected; only a part of the body becomes insensitive to any pain or feeling.**

These **drugs affect the peripheral nervous tissues & block the nerve conduction & thus abolish all sensation in the part supplied by the nerve.**

Thus **local anaesthetics prevent the pain sensation in the localized areas without affecting the degree of consciousness.**

Examples:

Cocaine, Benzocaine, Procaine, Amethocaine, Proxymetacaine, Lignocaine, Cinchocaine

ANTISEPTICS:

The term **'Septic' is derived from the Greek word Septikos, which means Putrefy or rot.**

In medicine, it indicates the state of being infected with pus forming organisms.

Anti infective agents, which are applied locally, i.e. applied directly to the skin wound etc, are known as antiseptics as well as disinfectants.

Generally the term 'antiseptic' includes those anti-infective agents, which are applied to living tissues. Thus, **antiseptics are bacteriostatic & do not necessarily sterilize the surface under treatment.**

On the other hand, **disinfectants are bactericides, which are applied to non living surfaces or inanimate objects. They rapidly produce irreversible lethal effects.**

An antiseptic is a substance, which **prevents the growth of microorganisms as long as it remains in contact with them, whereas a disinfectant is one, which kills the organism outright.**

Thus, an antiseptic action is milder but more prolonged; while a disinfectant action is immediate & is of short duration.

Examples:

1. Alcohols & Aldehydes:

a) Ethyl alcohol & Isopropyl alcohol:

These are widely used as antiseptics.

The concentration over 70 percent can be used for preoperative treatment of the skin. Absolute alcohol has been injected for the relief in carcinoma & in other conditions where pain is local.

Isopropyl alcohol is used to remove Creosote from the skin & as a disinfectant for the skin & surgical instrument.

b) Carboxide:

Carboxide is a **commercially available product, which is 10 percent ethylene oxide & 90 percent Carbon dioxide.** It is mainly used to sterilize temperature sensitive medical instrument.

Recently it is used for the **sterilization of certain thermo labile pharmaceuticals.**

c) Formaldehyde:

Formaldehyde either as **a gas or in solution is an excellent germicide probably equal to phenol or mercury & its volatility renders it more penetrating.** Formaldehyde gas has been employed to disinfect rooms, excreta, instruments & clothing but is little used.

d) Para formaldehyde:

Para formaldehyde is obtained by evaporating a formaldehyde solution.

It is a **white powder & has been used as the active ingredient of contraceptive creams.**

e) Glutaraldehyde:

Glutaraldehyde **(Cidex)** is used as a **sterilizing solution for equipment & surgical instruments, which cannot be heat sterilized.**

APPLICATION:

Antiseptics are the substance that helps in rendering microorganisms innocuous by killing them or preventing their growth.

The **ideal antiseptic would destroy bacteria, spores, fungi, viruses, & other infective agents without harming the tissues of the host.**

LIMITATIONS:

The use of an antiseptic in medicine is always local because of systemic toxicity which these agents may produce. This prevents other routes of administration, which depend on absorption by the body.

Most of the antiseptics have a limited spectrum of activity & may show an adverse side effect on tissues.

Hence, the **value of antiseptic is greatly affected by their toxicity.**

ANALGESICS:

Analgesics are drugs which relieve pain by acting on the Central Nervous System & they reduce the pain without the loss of consciousness.

CLASSIFICATION OF ANALGESICS:

Analgesics can be divided into 2 main groups based namely:

1. **Narcotic analgesics**
2. **Non-Narcotic analgesics**

1. Narcotic analgesics:

These drugs produce depression of the CNS & are mainly of 2 types

Natural analgesics e.g. Morphine, Codeine

Synthetic analgesics e.g. Pethidine, Methadone.

2. Non-Narcotic analgesics:

These drugs do not produce significant depression on the CNS, unlike narcotic analgesics, the **non-narcotic analgesics possess anti-inflammatory & anti pyretic effects.**

E.g. Salicylates & related compounds such as aspirin, methyl Salicylates, sodium Salicylates.

ANTIPYRETICS:

Antipyretic agents **reduce the elevated body temperature.**

An antipyretic drug is thus responsible for lowering the temperature of a feverish organism to normal, but has no effect on normal temperature states.

The hypothalamus situated at the base of the brain, plays an important role in regulating the body temperature.

In fever, **the thermostatic mechanism is set at higher level & these antipyretic agents induce changes in the region of the anterior of the hypothalamus** & help to bring the thermostatic mechanism at the normal level.

EXAMPLES:

Salicylic acid derivatives:

The derivatives of salicylic acid are well known for their **analgesic & antipyretication.**

The most important drugs are Aspirin (Acetyl salicylic acid), Sodium Salicylates, Methyl Salicylates (Oil of winter green), Salicin.

Para Amino Phenol Derivatives:

These compounds have **very pronounced analgesic & anti pyretic effects.**

They are **not useful anti inflammatory drugs.**

E.g. Phenacetin (Acetophenacitin) & Paracetamol (Acetaminophen).

TRANQUILIZERS:

Tranquilizers are drugs which give 'Peace of mind' or which have the ability to calm without causing hypnosis or anaesthesia. Thus, tranquilizers are substances which are used for the cure of mental disease. The tranquilizers are also called as **Psycho therapeutic drugs.** They have the ability to calm a patient suffering from psychotic disorders.

They give strong sedation without sleep & produce a state of indifference & disinterest. They reduce excitation, agitation & aggressiveness.

The administration of these drugs make the patient passive & help to control the emotional distress which otherwise is likely to interfere with their normal function.

Barbituric acid & its derivatives serve as good tranquilizers.

CHARACTERISTICS OF TRANQUILIZERS:

An ideal tranquilizer must possess the following characteristics:

It should not produce toxic effects

It should not produce undesirable side effects

It should not impair consciousness

It should be effective.

CLASSIFICATION OF TRANQUILIZERS:

The tranquilizers are classified as

1. Antipsychotics or Neuroleptics

2. Antianxiety agents.

1. Antipsychotics or Neuroleptics:

These are of the following types:

a) Rauwolfia alkaloids

b) Phenothiazine derivatives

c) Butyrophenone derivatives.

2. Antianxiety agents (Minor tranquilizers):

They possess a calming effect in the anxiety state which is associated with neurotic personality, situation crisis or some physical disease.

These are further divided as follows:

a) Muscle relaxants:

i) Mepabromate,

ii) Benzodiazepines

b) Ataractics: (Gk- cool, calm, collected)

i) Diphenylmethanes (anti histaminic & anti cholinergic).

SEDATIVES:

Sedatives are **substances or a drug that reduces nervousness & excitement & induce relaxation, whereas hypnotics are the substances that induce sleep like state wherein mind responds to external suggestions.** The patient cannot be awakened easily until the effect of the hypnotic wears out.

But there is no definite line of demarcation among the various groups of sedatives & hypnotics.

Their action varies with dosage. For,ucn87 e.g., Phenobarbital when administered in dosages of **25-30 mg is a mild sedative, whereas in a 100mg dose it is a hypnotic.**

When Phenobarbital is taken in large doses it leads to anaesthetic state & in some cases even death may result.

Sedation↔Hypnosis↔Anaesthesia↔Coma↔Death.

There are some compounds exerting only one effect, **e.g. Simple bromides are good sedatives having little or no hypnotic effect, whereas Thiopentone is a powerful hypnotic but cannot be used as a sedative.**

The most commonly used sedatives; hypnotics have been divided into the following chemical classes:

Alcohols, Aldehydes, Ketones & Sulphones, Amides, ureas, urethanes & biuret Barbiturates, Hydantoin derivatives & Heterocyclic compounds.

CAUSES FOR DIABETES, CANCER AND AIDS:

DIABETES:

Diabetes is of two types:

1.Diabetes Insipidus

2.Diabetes Mellitus

1. Diabetes Insipidus:

This diabetes arises due to lesser secretion of **vasopressin (an anti diuretic hormone)** by posterior pituitary gland.

Symptoms:

- Patient **passes larger quantity of urine,** mainly water
- **Excessive thirst**
- It can be cured by injecting **Pituitrin** secreted by posterior pituitary.

2. Diabetes Mellitus:

Diabetes is characterized by an **excess of blood glucose**, or blood sugar, that builds up in the bloodstream because the body is not able to adequately process the sugar taken in through food. **High blood sugar is an abnormal state for the body and creates specific symptoms and possible long-term health problems if blood sugar is not managed well.**

There are three main types of diabetes:

Type 1 diabetes occurs **when the pancreas stops or nearly stops producing the hormone insulin.** Insulin is needed to enable blood glucose to be used for energy by the body. People with type 1 diabetes must take daily insulin injections. Type 1 diabetes has also been referred to as **insulin-dependent diabetes and juvenile diabetes.**

Juvenile Diabetes Mellitus is hereditary and is treated by giving insulin.

Type 2 diabetes occurs when the **body is unable to make effective use of the insulin the pancreas does make.** This is often referred to as **insulin resistance.** Obesity is a major cause of insulin resistance in both adults and children. Type 2 diabetes has also been called **non-insulin dependent diabetes and adult-onset diabetes.**

Adult type occurs in elderly people and it is treated by **controlling the diet and oral anti-diabetic drug.**

Gestational diabetes occurs in women who have **high blood sugar during pregnancy** but have not been diagnosed with diabetes previously. After delivery of the baby, many women see their blood sugar return to normal. Some women will go on to develop type 2 diabetes.

DIABETES MELLITUS – CHARACTERISTICS:

- Diabetes Mellitus is a disease of metabolism due to **deficiency of insulin.**
- Blood sugar level is maintained constant at a value of **70-120 mg of glucose/100ml.**
- Though several hormones are involved in the maintenance of diabetes, **the most important ones are insulin and glucagon.**
- It is caused as a result of:
- **loss of the balanced effect of these hormones,**
- Due to less insulin production, **sugar starts accumulating in the blood and blood sugar level increases and sugar passes in urine along with other minerals.**
- High blood sugar level is known as **hyperglycemia.**
- Presence of sugar in urine is known as **glycosuria.**
- Insulin is secreted by the **beta cells of islets of langerhans of pancreas.**
- Insulin is necessary for the **burning of sugar in the tissues with the help of oxygen.**

SYMPTOMS:

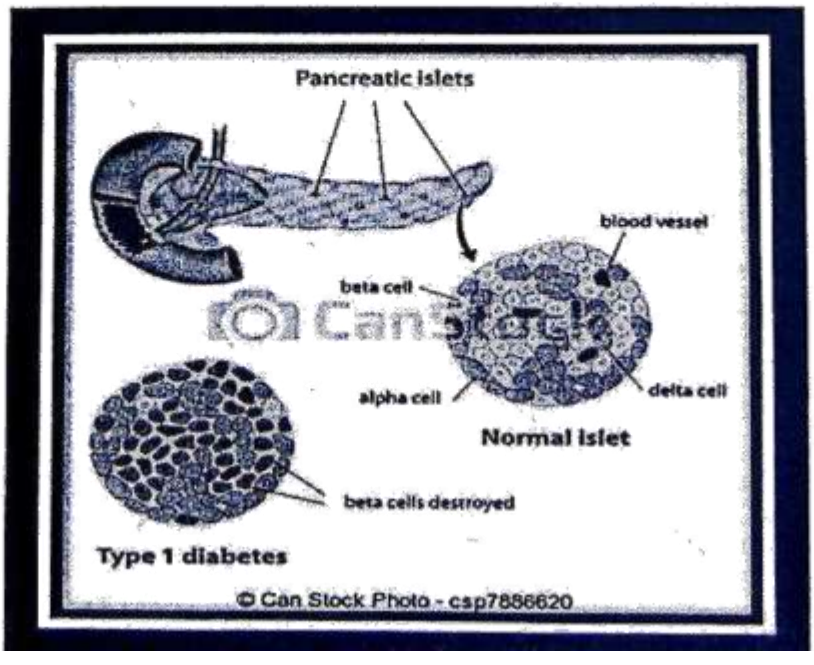
- Increased thirst **(Poly dipsia)**
- Increased urinary output **(Poly uria)**
- Excessive eating **(Poly phagia)**
- Ketonaemia **(Ketone bodies in blood)**
- Ketouria **(Ketone bodies in urine)**

Diabetes should be suspected when any of the following symptoms are present.

If there is any history of diabetes in one's family then an individual should check for diabetes.

DETECTION:

- DM can be detected by **GTT, Glucose Tolerance Test,** which divides diabetes according to the sugar level of the patient as **normal, mild, moderately severe diabetes.**
- If diabetes is properly controlled a **diabetic patient can live a normal long life.**

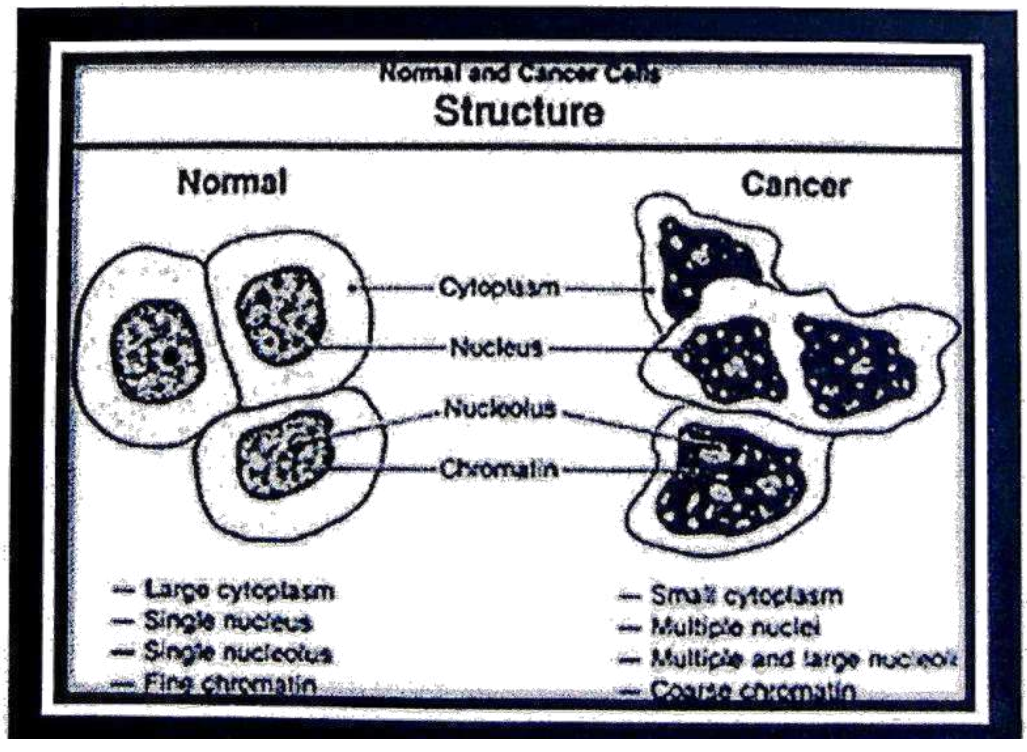


CANCER

Cancer also known as a **malignant tumor or malignant neoplasm** is a group of diseases involving **abnormal cell growth with the potential to invade or spread to other parts of the body.**

Not all tumors are cancerous; benign tumors do not spread to other parts of the body. Possible signs and symptoms include: **a new lump, abnormal bleeding, a prolonged cough, unexplained weight loss, and a change in bowel movements,** among others. While these symptoms may indicate cancer they may also occur due to other issues. There are over 100 different known cancers that affect humans.

- It is a disease, which can affect any individual at any age & it can develop in organ of the body.
- **Cancer is actually an abnormal development that changes normal cells into cancerous cells.**
- The most obvious feature of many cancers is the development of a new growth, a nodule or a tumor in the tissues of their origin.



COMMON CAUSES OF CANCER:

- The exact cause of the cancer **is not known** but there are several factors which cause cancer and these are known as cancer producing or carcinogens, few of them are
- Constant physical irritation of any tissue of the body can cause cancer. E.g.: **heavy smoking causes constant irritation of the lung tissues, which may produce cancer.**
- **Chewing pan or tobacco cause continuous irritation in mouth,** which may cause mouth cancer.
- Any type of injury continued over a long time often initiate cancer. E.g.: **jagged edge of a broken tooth rubbing against the tongue can cause cancer**
- **Ionizing radiations, X-rays, UV rays are carcinogenic in nature.**
- **Contact with intense sunlight results in cancer of the skin**
- Some Aromatic amines used in the **manufacture of synthetic dyes cause cancer of urinary bladder.**
- **Caused due to certain habits and some customs**
- E.g.: In Andhra Pradesh a particular tribal people are in **habit of smoking a local cigar with burning end inside the mouth. Some of these people develop an ulcer on the palate, which often turns into cancer after some years.**

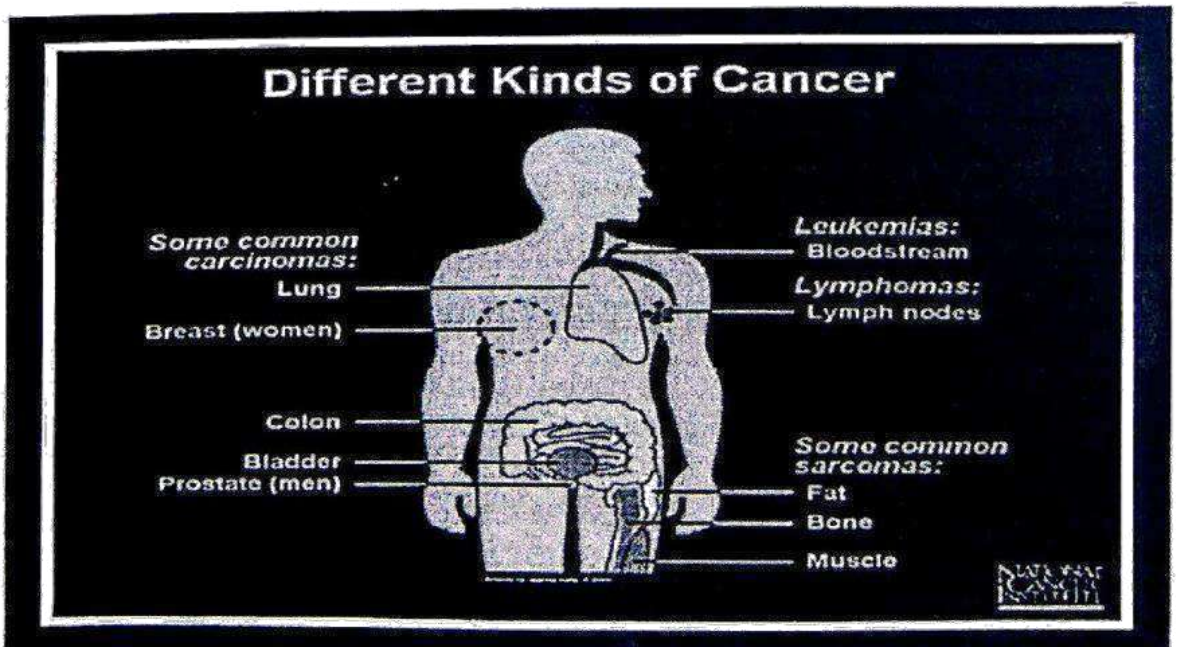
SPREAD OF CANCER:

- **Cancer is a dreadful disease & once it is developed it spreads in different ways.**
- The **Cancer cells multiply at the site of their origin and form a tumor.** These cells move to surrounding tissue & get fixed to them & make these cells malignant.

- The **cancer cells, which multiply rapidly, are loosely attached to one another & some of them are detached & are carried by the lymph stream to the different organs.**
- Where ever these cells are deposited they **continue to grow independently and also invade the adjacent tissues.**
- This development is known as **secondary growth and their eradication is extremely difficult.**
- Some cancer cells spread **through the blood stream and get scattered much rapidly.** The tumors of the connective tissue & bone marrow etc show this type of tendency.

BENIGN VS MALIGNANT TUMORS:

- There are two main classifications of tumors.
- One is known as benign and the other as malignant.
- A **benign tumor** is a tumor that **does not invade its surrounding tissue or spread around the body.**
- A **malignant tumor** is a tumor that **may invade its surrounding tissue or spread around the body.**



AIDS

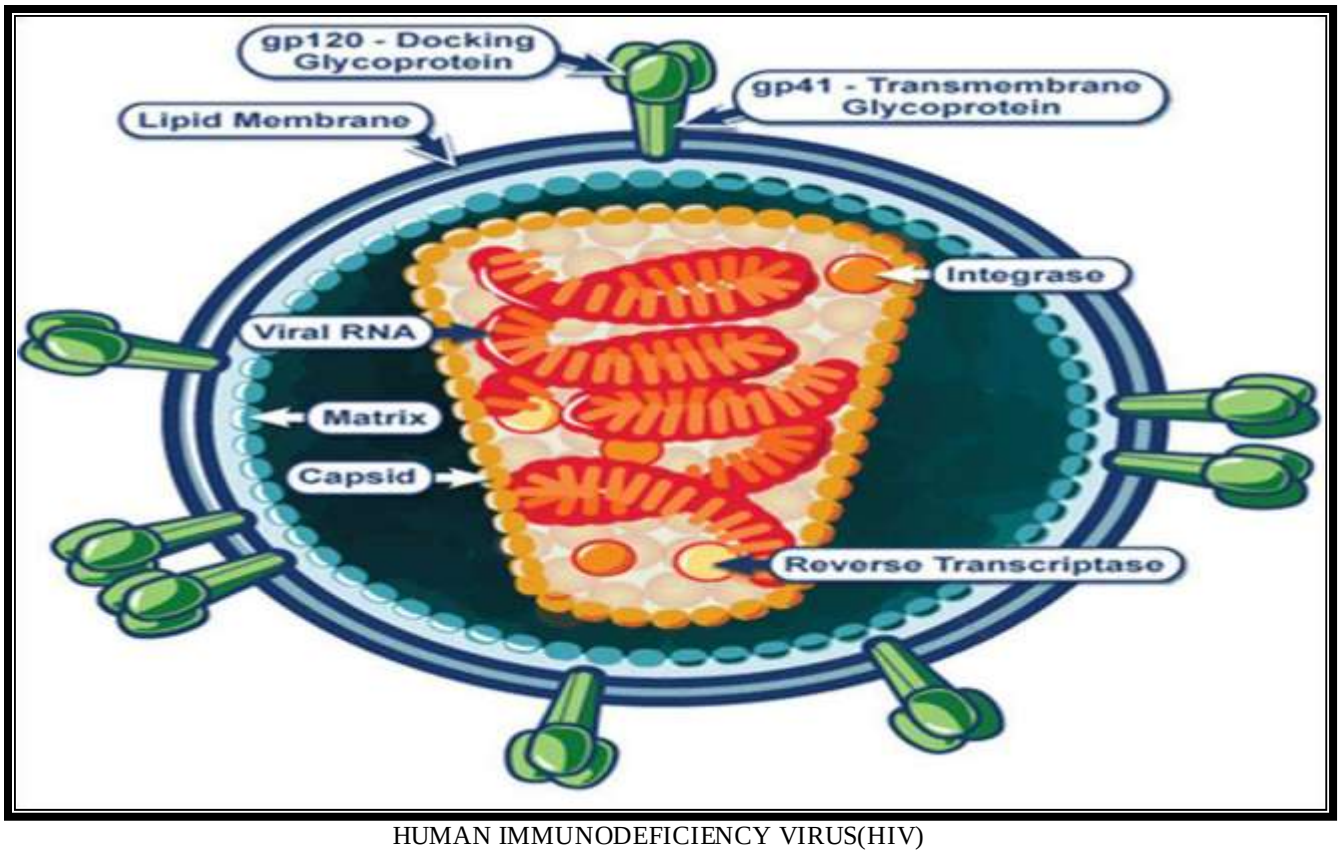
- ACQUIRED IMMUNO DEFICIENCY SYNDROME, A deadlier & more virulent infection is caused by Human Immunodeficiency Virus (HIV).
- **First identified in 1981 in USA**
- AIDS is caused by HIV; it is an RNA retro virus, which produces the enzyme **Reverse transcriptase** inside the cell of the infected person.
- This enzyme transforms Viral RNA to DNA & this new DNA is known as Provirus, which is incorporated into the host cell DNA.

  The host cell then produces new copies of the virus that pass out into tissue fluid and blood and infect other host cells.
- When infected host cells divide, **copies of the provirus are integrated into the DNA of daughter cells** & thus spread the disease within the body.
- The HIV invades the T-lymphocyte **cells** & possibly **neuroglial cells** in the brain.
- When these cells are infected their number is reduced & this causes suppression of T-cell immunity & consequently there is wide spread infection often by microbes of relatively low pathogenecity.
- **The immunity of the infected individual decreases due to HIV.**
- HIV has been isolated from **semen, cervical secretions, lymphocytes, plasma, cerebrospinal fluid, tears, saliva, and urine & breast milk.**
- The secretions known to be especially infectious are **semen, cervical secretions, blood & blood products.**
- **The infections generally spreads through the following sources:**
- By **sexual intercourse**

- By infected blood,blood products,donated semen and organs.
- By Contaminates needles used.
- From an infected mother to her child,infection can spread possible by breast milk or through the placenta before birth or while the baby is passing through the brth canal.
- The presence of antibodies to **HIV indicates that the individual has been exposed to the virus but not that a naturally acquired immunity has developed.**
- All those who have antibodies in their blood **do not develop AIDS although they may spread the infection to others.**

DETECTION:

- One of the methods to detect AIDS is **ELISA(ENZYME LINKED IMMUNOSORBANT ASSAY),** Which was developed by **Engvall and Perlmann in 1971.**
- This method employs the **antigen-antibody reaction** to estimate minute quantities of hormones and other substances in biological fluids.

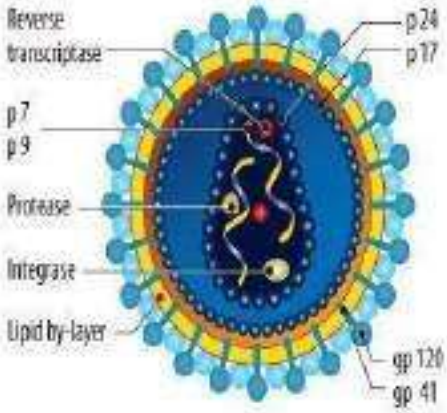


HUMAN IMMUNODEFICIENCY VIRUS(HIV)

Symptoms and spread of HIV and AIDS

Human immunodeficiency virus (HIV) causes Acquired Immune Deficiency Syndrome (AIDS)

The AIDS virus



Human immunodeficiency virus (HIV) penetrates the human body ▸ weakens the immune system ▸ affects cells that fight infection (T-lymphocytes or CD4) ▸ The body is unable to fight infection ▸ This results in one or several serious diseases

Symptoms

- Fever lasting over a month
- Diarrhea lasting over a month
- Unexplainable weight loss of 10 percent of body mass or more
- Protracted pneumonia
- Constant cough
- Protracted and relapsing virus, bacterial and parasitic diseases
- Sepsis
- Lymph nodes remain swollen for over a month
- Sub-acute encephalitis

AIDS is the final stage of the disease

- Cancerous AIDS (Kaposi's sarcoma and brain lymphoma)
- Neuro-AIDS (various diseases of the central nervous system and peripheral nerves)
- Numerous AIDS-related infections

The virus can remain inert inside the human body for 10-12 years

How the infection spreads

Unprotected sex

Joint use of syringes, needles and other injection systems

The use of non-sterile tattooing and skin piercing instruments

The use of other people's razors and tooth brushes with blood residue

HIV-positive mothers can infect their babies during pregnancy, birth and while breast-feeding

Treatment and diagnostic methods, including surgery, blood transfusion, injections, etc.

Diagnostics

AIDS centers offer free tests to detect virus antibodies using immune-ferment analysis

Treatment

No cure for AIDS has been found. Some treatments make it possible to seriously extend the lifespan of HIV-positive individuals and to improve their quality of life

After the virus enters the bloodstream, it takes the human body between 25 days and three months to create the required number of antibodies necessary for detection in blood tests. Patients may test negative during this "window period."

5.3-ELECTROCHEMICAL CORROSION AND ITS PREVENTION:

CORROSION:

CORROSION:

Corrosion is a natural process that converts a refined metal into a more chemically-stable form such as oxide, hydroxide, or sulfide. It is the gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment. Corrosion engineering is the field dedicated to controlling and preventing corrosion.

In the most common use of the word, this means electrochemical oxidation of metal in reaction with an oxidant such as oxygen or sulfates. Rusting, the formation of iron oxides, is a well-known example of electrochemical corrosion. This type of damage typically produces oxide(s) or salt(s) of the original metal and results in a distinctive orange colouration.

TYPES OF CORROSION

1. **Chemical or Dry corrosion**
2. **Electrochemical or wet corrosion.**

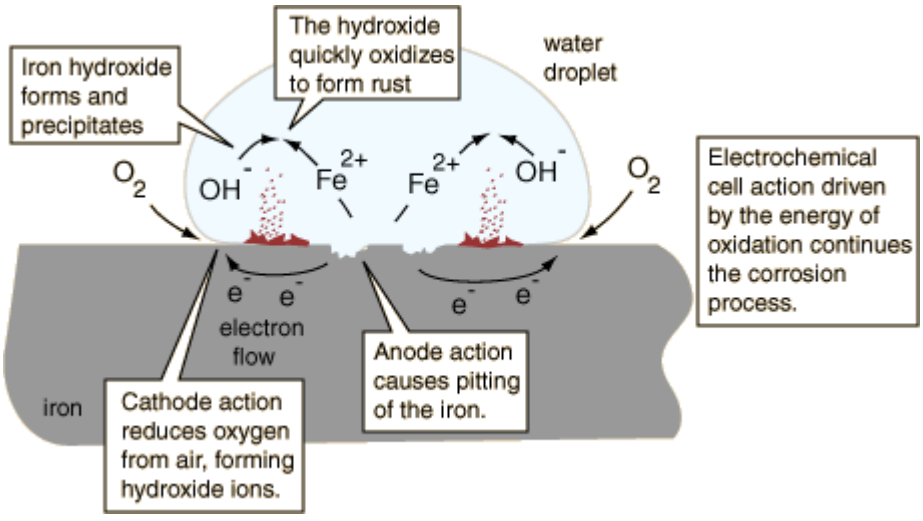
CHEMICAL CORROSION:

Chemical corrosion refers to the gradual destruction of a metal's surface due to the reaction of the surface with substances in its external environment. It is often characterized by the oxidation of a metal with an acid to form oxides.

ELECTOCHEMICAL CORROSION:

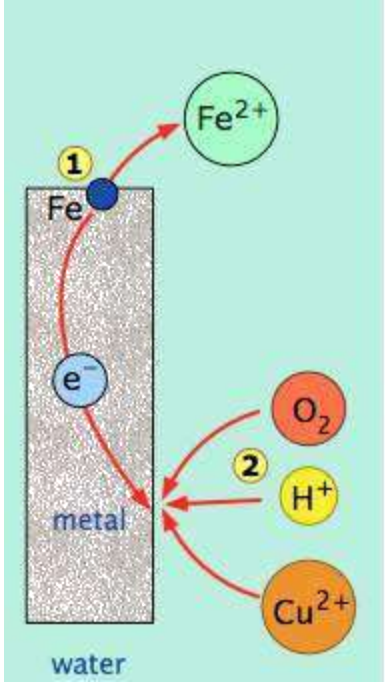
Electrochemical corrosion of metals occurs when electrons from atoms at the surface of the metal are transferred to a suitable electron acceptor or depolarizer . Water must be present to serve as a medium for the transport of ions. The most common depolarizers are oxygen, acids, and the cations of less active metals.

PROCESS OF AN ELECTROCHEMICAL CORROSION



Corrosion Cells and Reactions

The special characteristic of most corrosion processes is that the oxidation and reduction steps occur at separate locations on the metal. This is possible because metals are conductive, so the electrons can flow through the metal from the anodic to the cathodic regions (Figure 16.8.116.8.1). The presence of water is necessary in order to transport ions to and from the metal, but a thin film of adsorbed moisture can be sufficient.



1 $Fe \rightarrow Fe^{2+} + 2e^-$

Fe atom at metal surface dissolves into moisture film, leaving negative charge in metal.

2 Corrosion continues as a *depolarizer* removes electrons from metal. Common depolarizers are:

oxygen:
$O_2 + 4H_2O \rightarrow 4e^- + 4OH^-$

acid: $2H^+ + 2e^- \rightarrow H_2$

cation of more-noble metal:
$Cu^{2+} + 2e^- \rightarrow Cu$

Figure 16.8.116.8.1 : Corrosion is a two-step process. Figure 16.8.116.8.1 : Electrochemical corrosion of iron. Corrosion often begins at a location (**1**) where the metal is under stress (at a bend or weld) or is isolated from the air (where two pieces of metal are joined or under a loosely-adhering paint film.) The metal ions dissolve in the moisture film and the electrons migrate to another location (**2**) where they are taken up by a *depolarizer*. Oxygen is the most common depolarizer; the resulting hydroxide ions react with the

Fe^{2+} to form the mixture of hydrous iron oxides known as *rust*. (CC BY 3.0 Unported; Stephen Lower)

A corrosion system can be regarded as a short-circuited electrochemical cell in which the anodic process is something like

Fe(s)→Fe2+(aq)+2e−(16.8.1)(16.8.1)Fe(s)→Fe2+(aq)+2e−

and the cathodic steps may invove the reduction of oxygen gas

O2+2H2O+4e−→4OH−(16.8.2)(16.8.2)O2+2H2O+4e−→4OH−

or the reduction of protons

H++e−→12H2(g)(16.8.3)(16.8.3)H++e−→12H2(g)

or the reduction of a metal ion M2++2e–→M(s)(16.8.4)(16.8.4)M2++2e–

→M(s)

where MM is a metal.

Which parts of the metal serve as anodes and cathodes can depend on many factors, as can be seen from the irregular corrosion patterns that are commonly observed. Atoms in regions that have undergone stress, as might be produced by forming or machining, often tend to have higher free energies, and thus tend to become anodic.

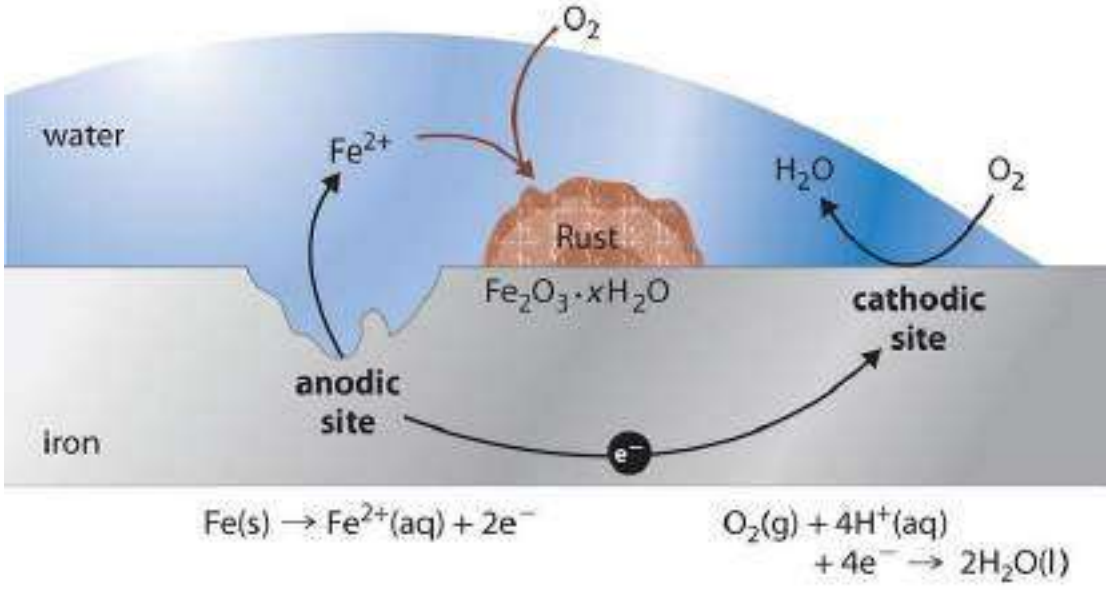


Figure 16.8.216.8.2 : Schematic diagram of corrosion cells on iron. (CC BY-NSA-NC; Anonymous by request)

If one part of a metallic object is protected from the atmosphere so that there is insufficient O2O2 to build or maintain the oxide film, this "protected" region will often be the site at which corrosion is most active. The fact that such sites are usually hidden from view accounts for much of the difficulty in detecting and controlling corrosion.

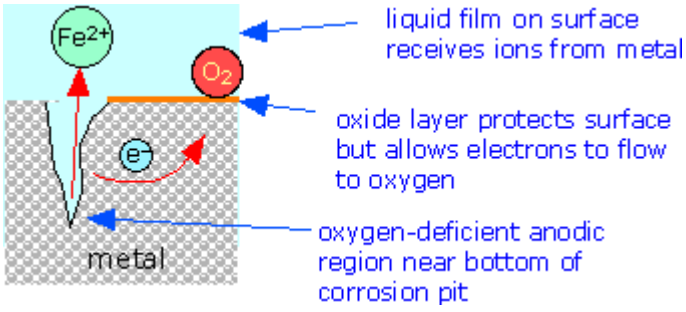


Figure 16.8.316.8.3 : Pitting corrosion

Most metals are covered with a thin oxide film which inhibits anodic dissolution. When corrosion does occur, it sometimes hollows out a narrow hole or pit in the metal. The bottoms of these pits tend to be deprived of oxygen, thus promoting further growth of the pit into the metal. (CC BY 3.0 Unported; Stephen Lower)

In contrast to anodic sites, which tend to be localized to specific regions of the surface, the cathodic part of the process can occur almost anywhere. Because metallic oxides are usually semiconductors, most oxide coatings do not inhibit the flow of electrons to the surface, so almost any region that is exposed to O2O2 or to some other electron acceptor can act as a cathode. The tendency of oxygen-deprived locations to become anodic is the cause of many commonly-observed patterns of corrosion.

Control of Corrosion

Since both the cathodic and anodic steps must take place for corrosion to occur, prevention of either one will stop corrosion. The most obvious strategy is to stop both processes by coating the object with a paint or other protective coating. Even if this is done, there are likely to be places where the coating is broken or does not penetrate, particularly if there are holes or screw threads. A more sophisticated approach is to apply a slight negative charge to the metal, thus making it more difficult for the reaction to take place:

M⟶M2++2e−.(16.8.5)(16.8.5)M⟶M2++2e−.

Protection Method 1: Sacrificial Coatings

One way of supplying this negative charge is to apply a coating of a more active metal. Thus a very common way of protecting steel from corrosion is to coat it with a thin layer of zinc; this process is known as galvanizing.The zinc coating, being less noble than iron, tends to corrode selectively.

Dissolution of this sacrificial coating leaves behind electrons which concentrate in the iron, making it cathodic and thus inhibiting its dissolution.

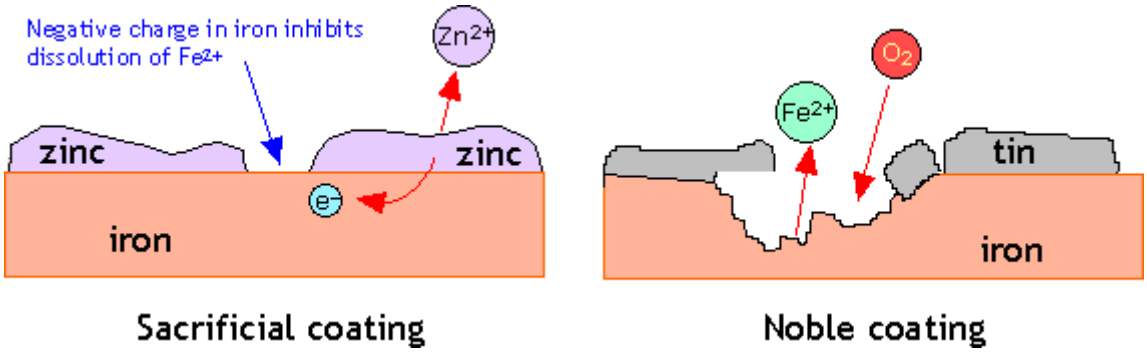


Figure 16.8.516.8.5: Sacrificial Coatings (CC BY 3.0 Unported; Stephen Lower)

The effect of plating iron with a less active metal provides an interesting contrast. The common tin-plated can (on the right) is a good example. As long as the tin coating remains intact, all is well, but exposure of even a tiny part of the underlying iron to the moist atmosphere initiates corrosion. The electrons released from the iron flow into the tin, making the iron more anodic so now the tin is actively promoting corrosion of the iron! You have probably observed how tin cans disintegrate very rapidly when left outdoors.

Protection Method 2: Cathodic Protection

A more sophisticated strategy is to maintain a continual negative electrical charge on a metal, so that its dissolution as positive ions is inhibited. Since the entire surface is forced into the cathodic condition, this method is known as *cathodic protection*. The source of electrons can be an external direct current power supply (commonly used to protect oil pipelines and other buried structures), or it can be the corrosion of another, more active metal such as a piece of zinc or aluminum buried in the ground nearby, as is shown in the illustration of the buried propane storage tank below.

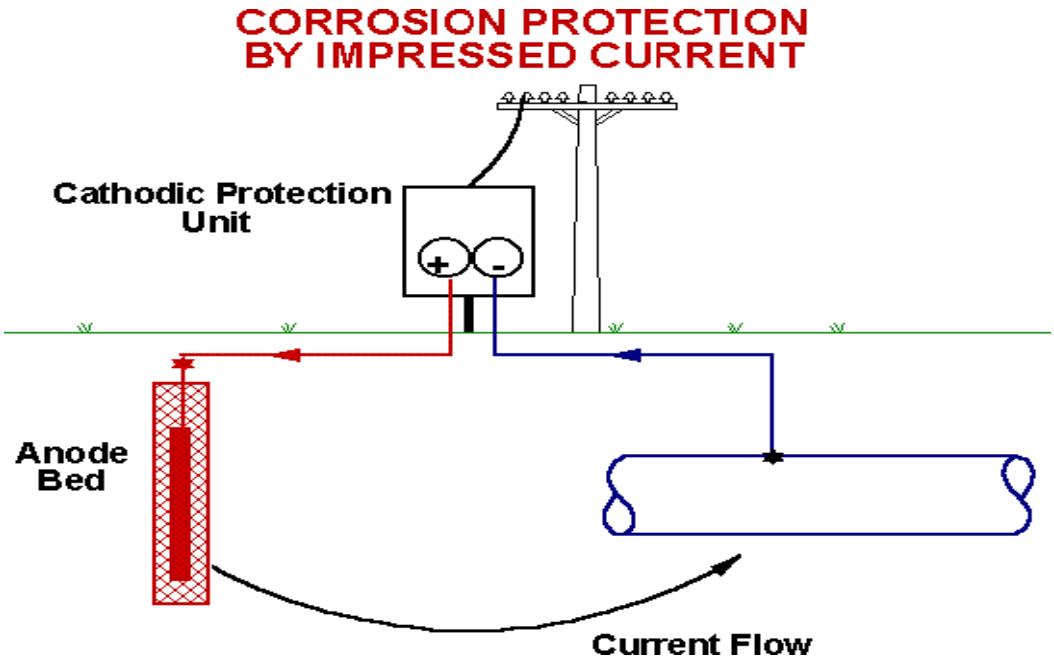


Figure 16.8.616.8.6: Cathodic Protection (CC BY 3.0 Unported; Stephen Lower)

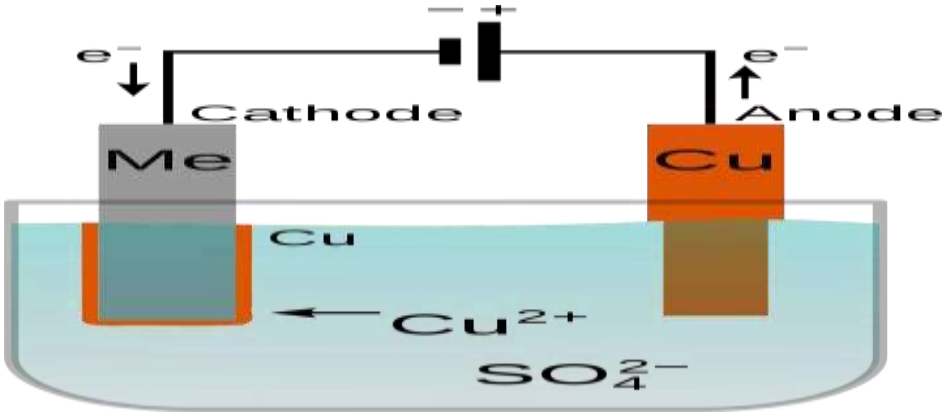
DIFFERENCE BETWEEN CHEMICAL AND ELECTRICAL CORROSION:

CHEMICAL CORROSION	*ELECTROCHEMICAL CORROSION*
It occurs in dry condition.	It occurs in the presence of moisture or electrolyte.
It is due to direct chemical attack of the metal by the environment.	It is due to formation of large number of anodic and cathodic areas.
Even a homogenous metal gets corroded.	Heterogeneous (bimetallic) surface alone get corroded.
It is a self controlled process.	It is a continuous process.
It adopts adsorption mechanism.	It follows electro chemical reaction.
Formation of mild scale on iron surface is an example.	Rusting of iron in moist atmosphere is an example.

ELECTROPLATING:

E**lectroplating** is a process that uses an electric current to reduce dissolved metal cations so that they form a thin coherent metal coating on an electrode. The term is also used for electrical oxidation of anions on to a solid substrate, as in the formation of silver chloride on silver wire to make silver/silver-chloride electrodes. Electroplating is primarily used to change the surface properties of an object (such as abrasion and wear resistance, corrosion protection, lubricity, aesthetic qualities), but may also be used to build up thickness on undersized parts or to form objects by electroforming.

The process used in electroplating is called electrodeposition. It is analogous to a concentration cell acting in reverse. The part to be plated is the cathode of the circuit. In one technique, the anode is made of the metal to be plated on the part. Both components are immersed in a solution called an electrolyte containing one or more dissolved metal salts as well as other ions that permit the flow of electricity.



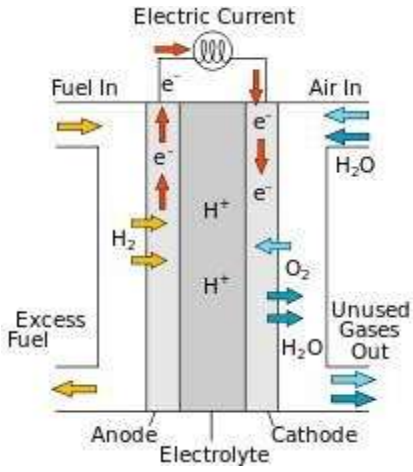
The applications of electroplating

- A good example to demonstrate the purpose of electroplating is an application in the medical devices industry.
- A lot of components for medical devices are created with nickel. Nickel, however, isn't supposed to come into direct contact with the human body.
- The same coating process applies to an ink-jetting nozzle plate, where the released chemicals would cause the nickel plates to deteriorate.
- To sum up, you can realise next-level engineering by leveraging the synergy between electroplating and electroforming, rather than seeing them as independent manufacturing methods.
- If you would like to discover the pull potential of electroforming — such as ultra-precision metal parts, high repeatability, and short lead and delivery times — we have an electroforming whitepaper available for you.

FUEL CELLS:

A **fuel cell** is an electrochemical cell that converts the chemical energy of a fuel (often hydrogen) and an oxidizing agent (often oxygen[1]) into electricity through a pair of redox reactions.[2] Fuel cells are different from most batteries in requiring a continuous source of fuel and oxygen (usually from air) to sustain the chemical reaction, whereas in a battery the chemical energy usually comes from metals and their ions or oxides[3] that are commonly already present in the battery, except in flow batteries. Fuel cells can produce electricity continuously for as long as fuel and oxygen are supplied.

The first fuel cells were invented by Sir William Grove in 1838. The first commercial use of fuel cells came more than a century later following the invention of the hydrogen–oxygen fuel cell by Francis Thomas Bacon in 1932. The alkaline fuel cell, also known as the Bacon fuel cell after its inventor, has been used in NASA space programs since the mid-1960s to generate power for satellites and space capsules. Since then, fuel cells have been used in many other applications. Fuel cells are used for primary and backup power for commercial, industrial and residential buildings and in remote or inaccessible areas. They are also used to power fuel cell vehicles, including forklifts, automobiles, buses, boats, motorcycles and submarines.


Electric Current
Fuel In
Air In
e⁻
e⁻
e⁻
e⁻
H₂O
H⁺
H₂
H⁺
O₂
Excess Fuel
Unused Gases Out
H₂O
Anode
Electrolyte
Cathode