Unit-5

Pharmacognosy-I

B.Pharma 4 Semester Notes

UNIT-V

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

- Fibers – Cotton, Jute, Hemp
- Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

- General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs: Novel medicinal agents from marine sources

Plant Products:

Fibers:

- Fibers can be natural or artificial substances that are longer than they are wide.
- They are often used to make other materials, including strong engineering materials like carbon fiber and ultra-high-molecular-weight polyethylene.

Some examples of natural fibers:

- Cotton, Jute, Hemp

1. Cotton:

Biological Source: Cotton is derived from the fibers surrounding the seeds of plants in the genus *Gossypium*, belonging to the Malvaceae family. The primary species used for cotton production are *Gossypium hirsutum*, *Gossypium barbadense*, *Gossypium arboreum*, and *Gossypium herbaceum*.

Chemical Nature:

- Cotton is mainly contains cellulose, moisture, protein, ash, pectin, oil fat and some pigments.
- The whole cotton fibre contains 88 to 96.5% of cellulose, the rest are non-cellulosic polysaccharides constituting upto 10% of the total fibre weight.

Uses:

- **Textiles:** Cotton fibers are extensively used in the textile industry to produce a wide range of fabrics and garments due to their softness, breathability, and moisture-wicking properties.
- **Medical Supplies:** Cotton is used in the manufacture of bandages, dressings, and cotton wool due to its absorbent and hypoallergenic properties.
- **Industrial Applications:** Cotton fibers are used in the production of high-quality paper, gunpowder (cellulose nitrate), and in the reinforcement of composite materials.

Jute:

Biological Source: Jute fibers are obtained from the bark of plants in the genus *Corchorus*, primarily *Corchorus capsularis* and *Corchorus olitorius*, belonging to the family Malvaceae (previously Tiliaceae).

Chemical Nature:

- **Cellulose:** Makes up about 60-70% of jute fiber, contributing to its strength and durability.
- **Hemicellulose:** Constitutes about 20-25%, aiding in the binding of cellulose fibers and providing additional structural integrity.

- **Lignin:** Comprises 10-15% of jute, giving the fibers rigidity and resistance to microbial attack.
- **Pectin and Waxes:** Present in smaller amounts, these substances contribute to the flexibility and smoothness of the fibers.

Uses:

- **Textiles:** Jute is used to manufacture hessian cloth, gunny bags, ropes, and carpet backing due to its coarse and strong nature.
- **Agriculture:** Jute fibers are used in making agricultural twines and sacks for storage and transport of agricultural products.
- **Eco-friendly Products:** Increasingly used in making biodegradable and sustainable products like shopping bags, geotextiles, and handicrafts.
- **Paper Industry:** Utilized in the production of high-strength paper and pulp.

3. Hemp

Biological Source: Hemp fibers are obtained from the stems of *Cannabis sativa* plants, belonging to the Cannabaceae family. The plants are specifically cultivated for fiber production, distinct from those grown for medicinal or recreational cannabis.

Chemical Nature:

- **Cellulose:** The primary component, making up about 70-75% of hemp fibers, providing high tensile strength and durability.
- **Hemicellulose:** Constitutes approximately 15-20%, contributing to the flexibility and elasticity of the fibers.
- **Lignin:** Comprises about 3-4%, giving the fibers rigidity and resistance to decay.
- **Pectin and Waxes:** These minor components help bind the cellulose fibers and provide smoothness.

Uses:

- **Textiles:** Hemp is used in producing durable and eco-friendly fabrics for clothing, home textiles, and industrial applications.
- **Paper Production:** Hemp fibers are used to produce high-quality, long-lasting paper products.
- **Construction Materials:** Hemp is used in the creation of biocomposites, insulation materials, and hempcrete, a sustainable building material.
- **Automotive Industry:** Utilized in making biodegradable and lightweight composite materials for vehicle interiors.

- **Bioplastics:** Hemp fibers are increasingly used in the development of biodegradable plastics and other sustainable materials.

Hallucinogens:

- Hallucinogen are the substance that produces psychological effects that tend to be associated with phenomena such as dreams or religious exaltation or with mental disorders such as schizophrenia.
- Hallucinogens produce changes in perception, thought, and feeling, ranging from distortions of what is sensed (illusions) to sensing objects where none exist (hallucinations).
- Hallucinogens heighten sensory signals, but this is often accompanied by loss of control over what is experienced.

Biological Source:

- It consists of dried leaves and flowering tops of ***Hyoscyamus niger*** family Solanaceae.

Chemical Nature:

- Hallucinogenic Agents also called psychominetic agents are capable of producing hallucinations, sensory illusions and bizarre thoughts.

Uses:

They have been used for a variety of purposes:

1. **Medical Research**: There is growing research interest in the potential of hallucinogens to treat medical conditions, including mental health disorders. The U.S. Food and Drug Administration (FDA) has released a statement on clinical trial guidelines for them.
2. **Recreational Use**: Some people use hallucinogens for recreational purposes, to improve well-being, or for spiritual or self-exploration. They can produce strong emotions ranging from bliss to fear and vast changes in how reality is perceived.
3. **Religious and Spiritual Practices**: Numerous indigenous cultures around the world have used hallucinogenic plants to induce states of detachment from reality, to precipitate "visions" or mystical insight, as medicines, or as adjuncts to social and religious rituals.
4. **Stress Relief**: Some people report using hallucinogens to reduce pain and stress levels.

Teratogens

- A teratogen is a substance known to cause birth defects following exposure during pregnancy. Some teratogens can be drugs (e.g., prescription drugs such as lithium or epilepsy medication or recreational drugs).
- Certain infections, such as rubella (German Measles) or chicken pox can also be teratogens.
- The mother can also unknowingly introduce the fetus to teratogens in the womb.
- Alcohol is a common teratogen. Alcohol use during pregnancy can adversely affect the unborn baby. There are many factors that influence this effect, including the amount of alcohol ingested over time and differences in the way the mother metabolizes alcohol.
- There is also evidence that variations in a person's genetic makeup can affect the baby's susceptibility to alcohol while in utero

Biological Source:

- Thalidomide is a synthetic drug, initially synthesized in the 1950s. While not of natural origin, its development was inspired by naturally occurring compounds, and it has had significant historical impact as a teratogen.

Chemical Nature:

- **Thalidomide:** Chemically known as alpha-phthalimidoglutarimide, thalidomide is a synthetic compound with the molecular formula $C_{13}H_{10}N_2O_4$.

Uses:

- **Medical Use:**
  - **Historical:** Initially marketed as a sedative and anti-nausea medication for pregnant women.
  - **Current:** Used in the treatment of erythema nodosum leprosum, a complication of leprosy, and multiple myeloma, a type of blood cancer.
- **Teratogenic Effects:**
  - **Birth Defects:** Causes severe congenital deformities, including phocomelia (limb malformations), cardiac defects, and ear and eye abnormalities, when taken during pregnancy.

2. Retinoic Acid (Vitamin A Derivatives)

Biological Source: Retinoic acid is derived from vitamin A, which is found in both animal sources (such as liver and fish oils) and plant sources (such as carrots and spinach).

Chemical Nature:

- **Retinoic Acid:** Chemically known as all-trans retinoic acid, it is a metabolite of vitamin A (retinol) with the molecular formula $C_{20}H_{28}O_2$.

Uses:

- **Medical Use:**
  - **Dermatology:** Used in the treatment of severe acne and psoriasis.
  - **Oncology:** Employed in the treatment of acute promyelocytic leukemia (APL).
- **Teratogenic Effects:**
  - **Birth Defects:** High doses of retinoic acid during pregnancy can lead to a spectrum of malformations known as retinoic acid embryopathy, which includes craniofacial abnormalities, heart defects, and central nervous system malformations.

3. Alcohol (Ethanol)

Biological Source: Ethanol, commonly known as alcohol, is a natural product of fermentation of sugars by yeast, particularly *Saccharomyces cerevisiae*.

Chemical Nature:

- **Ethanol:** A simple alcohol with the chemical formula C_2H_5OH.

Uses:

- **Recreational Use:** Consumed in beverages like beer, wine, and spirits.
- **Medical Use:** Used as a disinfectant and antiseptic. Also used in certain pharmaceutical preparations.
- **Teratogenic Effects:**
  - **Fetal Alcohol Spectrum Disorders (FASD):** Chronic alcohol consumption during pregnancy can lead to a range of effects including fetal alcohol syndrome (FAS), which is characterized by growth deficiencies, facial abnormalities, and neurodevelopmental disorders.

4. Nicotine

Biological Source: Nicotine is an alkaloid found in the nightshade family of plants (Solanaceae), predominantly in tobacco plants (*Nicotiana tabacum* and *Nicotiana rustica*).

Chemical Nature:

- **Nicotine:** Chemically known as (S)-3-(1-Methyl-2-pyrrolidinyl)pyridine, with the molecular formula $C_{10}H_{14}N_2$.

Uses:

- **Recreational Use:** Found in tobacco products like cigarettes, cigars, and chewing tobacco.
- **Medical Use:** Used in nicotine replacement therapies (NRT) such as patches and gum to aid in smoking cessation.
- **Teratogenic Effects:**
    - **Developmental Issues:** Prenatal exposure to nicotine can result in low birth weight, preterm delivery, and long-term developmental and behavioral problems in children.

5. Mycotoxins (Aflatoxins)

Biological Source: Aflatoxins are produced by certain species of *Aspergillus* fungi, particularly *Aspergillus flavus* and *Aspergillus parasiticus*, which can contaminate crops like peanuts, corn, and tree nuts.

Chemical Nature:

- **Aflatoxins:** A group of structurally related mycotoxins, with aflatoxin B_1 being the most potent and prevalent, having the molecular formula $C_{17}H_{12}O_6$.

Uses:

- **Natural Occurrence:** Found as contaminants in improperly stored food products, particularly in warm and humid climates.
- **Teratogenic Effects:**
    - **Birth Defects and Cancer:** Exposure to high levels of aflatoxins during pregnancy can result in fetal growth retardation and teratogenic effects, including liver damage and increased risk of liver cancer later in life.

Natural allergens:

1. Pollen

Biological Source: Pollen is produced by the male gametophytes of seed plants, including a variety of trees (e.g., oak, birch), grasses (e.g., timothy, Bermuda), and weeds (e.g., ragweed).

Chemical Nature:

- **Pollen Allergens:** Pollen contains complex proteins and glycoproteins that can trigger allergic reactions. Common allergenic proteins include Bet v 1 from birch pollen, Amb a 1 from ragweed pollen, and Phl p 5 from grass pollen.

Uses:

- **Pollination:** Pollen is essential for the fertilization process in plants, leading to the production of seeds and fruits.
- **Allergic Reactions:** Pollen is a major cause of seasonal allergic rhinitis (hay fever), causing symptoms such as sneezing, itching, nasal congestion, and watery eyes in sensitized individuals.

2. Latex

Biological Source: Latex is a milky fluid produced by the rubber tree (*Hevea brasiliensis*) and several other plants. It is harvested by tapping the tree to collect the latex sap.

Chemical Nature:

- **Latex Allergens:** The latex from rubber trees contains proteins such as Hev b 1, Hev b 3, and Hev b 6, which can cause allergic reactions in sensitive individuals.

Uses:

- **Medical Supplies:** Latex is used in the production of gloves, catheters, and other medical devices.
- **Consumer Products:** Commonly used in items such as balloons, rubber bands, and household gloves.
- **Allergic Reactions:** Exposure to latex can cause symptoms ranging from mild skin irritation (contact dermatitis) to severe anaphylactic reactions in individuals with latex allergy.

3. Dust Mites

Biological Source: Dust mites are microscopic organisms belonging to the genus *Dermatophagoides*, including species like *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*. They thrive in warm, humid environments and are commonly found in household dust.

Chemical Nature:

- **Dust Mite Allergens:** Proteins such as Der p 1 and Der f 1 are major allergens found in dust mite feces and body fragments.

Uses:

- **Natural Occurrence:** Dust mites play a role in breaking down and recycling organic material in the environment.
- **Allergic Reactions:** Exposure to dust mite allergens can cause allergic rhinitis, asthma, and atopic dermatitis in sensitized individuals.

4. Animal Dander

Biological Source: Animal dander consists of tiny, even microscopic, flecks of skin shed by cats, dogs, rodents, birds, and other animals with fur or feathers. It also includes proteins found in the animal's saliva, urine, and feces.

Chemical Nature:

- **Dander Allergens:** Proteins such as Fel d 1 from cats and Can f 1 from dogs are potent allergens that can trigger immune responses in susceptible individuals.

Uses:

- **Natural Occurrence:** Animal dander is naturally produced by pets and other animals as part of their normal skin and bodily functions.
- **Allergic Reactions:** Exposure to animal dander can lead to symptoms of allergic rhinitis, asthma, and allergic conjunctivitis in individuals with pet allergies.

5. Mold Spores

Biological Source: Molds are fungi that grow both indoors and outdoors, with common species including *Aspergillus*, *Penicillium*, *Cladosporium*, and *Alternaria*.

Chemical Nature:

- **Mold Allergens:** Mold spores contain proteins that can act as allergens, such as Alt a 1 from *Alternaria alternata* and Asp f 1 from *Aspergillus fumigatus*.

Uses:

- **Natural Occurrence:** Molds play a crucial role in decomposing organic matter and recycling nutrients in the environment.
- **Allergic Reactions:** Inhalation of mold spores can cause allergic reactions, including nasal congestion, sneezing, and asthma exacerbations in sensitized individuals.

6. Insect Venoms

Biological Source: Insect venoms are secreted by various insects, including bees (*Apis mellifera*), wasps (*Vespula species*), and fire ants (*Solenopsis invicta*).

Chemical Nature:

- **Venom Allergens:** Insect venoms contain proteins and peptides that can act as allergens, such as phospholipase A2, hyaluronidase, and melittin in bee venom.

Uses:

- **Defense Mechanism:** Venoms are used by insects as a defense mechanism against predators and threats.

- **Allergic Reactions:** Stings from these insects can cause local reactions like swelling and redness, and in some individuals, systemic allergic reactions, including anaphylaxis, which can be life-threatening.

Primary metabolites:

A primary metabolite is a kind of metabolite that is directly involved in normal growth, development, and reproduction. It usually performs a physiological function in the organism (i.e. an intrinsic function). A primary metabolite is typically present in many organisms or cells.

Example:

- Carbohydrates
- Protein
- Enzymes
- Lipids

Carbohydrates:

- Carbohydrates (CHO) are organic compounds (also called hydrated carbon) or polyhydroxy aldehydes or polyhydroxy ketones. Containing carbon, hydrogen, and oxygen.
- Carbohydrates are widely distributed in plants and animals; they have important structural and metabolic roles.
- In plants, glucose is synthesized from carbon dioxide and water by photosynthesis.

Classification of Classification:

1. **Monosaccharides** are those carbohydrates that cannot be hydrolyzed into simpler carbohydrates i.e. it composed from one unit.
2. **Disaccharides** are condensation products of two monosaccharide units.
3. **Oligosaccharides** are condensation products of two to ten monosaccharides. Example maltotriose (a trisaccharide of glucose).
4. **Polysaccharides** are condensation products of more than ten monosaccharide units; example starches.

Chemical tests:

1. ***Molisch's test*** – Given sample food + Molisch's reagent → Purple or violet ring confirms the presence of carbohydrate.

2. ***Fehling's test*** – Given sample food + Fehling's reagent → Red precipitate confirms the presence of carbohydrates
3. ***Benedict's test*** – Given sample food + Benedict's reagent → Red precipitate confirms the presence of carbohydrates.
4. ***Tollen's test*** – Given sample food + Tollen's reagent → Silver mirror confirms the presence of carbohydrates.
5. ***Iodine test*** – Given sample food + Iodine solution → Blue colour solution confirms the presence of starch.

Carbohydrates:

Acacia

Sources:

- Acacia is the dried gummy exuda-tion obtained from the stems and branches of *Acacia senegal* (L.)
- Willd or other African species of Acacia. In India, it is found as dried gummy exudation obtained from the stems and branches of *Acacia arabica* Willd, belonging to **family Leguminosae**

Preparation:

For collecting gum 6-8 year old trees and preferred

↓

Incision is made on stem at the time of winter (November)

↓

The gum exudates after 6-8 weeks

↓

The gum is collected and dried in sunlight for 3 weeks

↓

This bleaches the gum and turns in white colour

↓

Now The obtained gum is collected and packed.

Evaluation:

1. **Lead Acetate Test:** An aqueous solution of acacia when treated with lead acetate solution it yields a heavy white precipitate.

2. **Borax Test:** An aqueous solution of acacia affords a stiff translucent mass on treatment with borax.

Preservation and Storage:

- Stored in well closed containers protected from light and in cool dry place.
- It does not deteriorate due to long storage under such favorable conditions.

Therapeutic Used:

- The mucilage of acacia is employed as a demulcent.
- It is used extensively as a vital pharmaceutical aid for emulsification and to serve as a thickening agent .
- It findsits enormous application as a binding agent for tablets cough lozenges.
- It is employed as colloidalstabilizer.
- It is used extensively in making of candy and other food products.

Agar:

Sources:

- It is dried gelatinous substance obtained from ***Gelidium amansii*** family **Galidaceae.**

Preparation:

The collection of the material is done in may and October.

Sea weeds are scrapped from the bamboos (dried and bleached)

↓

To remove foreign materials like shells, sand, etc.

↓

The entire material is taken to the high altitudes where it is washed and bleached by sun.

↓

Boiled for 5 to 6 hrs with large quantity of dil. Acidified water (About 1 part of algae with 6 parts of water)

↓

This extract is then strained while hot through the cloth.

↓

Transferred to wooden thoughts

↓

On cooling jelly is produced. Rectangular solid pieces of jelly are then passed through the netting under pressure

↓

Narrow strips thus formed are allowed to melt during the day time in the sun which removes the excess of water.

↓

This operation is continued for several days

↓

Final Product

Evaluation:

1. Agar responds positively to Fehling's solution test.
2. Agar gives positive test with Molisch reagent.
3. Aqueous solution of agar (1%) is hydrolysed with con-centrated HCl by heating for 5–10 min. On addition of barium chloride solution to the reaction mixture, a white precipitate of barium sulphate is formed due to the presence of sulphate ions. This test is absent in case of starch, acacia gum and tragacanth.
4. To agar powder a solution of ruthenium red is added. Red colour is formed indicating mucilage.
5. Agar is warmed in a solution of KOH. A canary yellow colour is formed.
6. An aqueous solution of agar (1%) is prepared in boiling water. On cooling it sets into a jelly.
7. To agar solution an N/20 solution of iodine is added. A deep crimson to brown colour is obtained (distinctive from acacia gum and tragacanth).
8. To a 0.2% solution of agar an aqueous solution of tannic acid is added. No precipitation is formed indicating absence of gelatin.
9. Agar is required to comply with tests for the absence of E. coli and Salmonella, and general microbial contamination should not exceed a level of 103 microorganisms per gram as determined by a plate count. It has a swelling index of not less than 10.

Preservation and Storage:

- Stored in well closed containers protected from light and in cool dry place.

Therapeutic Used:

- It is used as an emulsifying agent, bulk laxative, and a suspending agent.
- It is used for preparing bacteriological culture medium.
- It is used in the production of ointments and medicinal encapsulations.
- It is also used as a dental impression mold base.

Tragacanth

Sources:

- It is the air dried gummy exudates, flowing naturally or obtained by incision, from the stems and branches of ***Astra-galus gummifer*** Labill and certain other species of ***Astragalus***,belonging to family **Leguminosae.**

Preparation:

Incisions are made on the stem of 2 year old plant

↓

Gum exudes out and Dried

↓

Depending on the type of incisions shape of the gum may be flat, ribbon like etc.

↓

These gums were collected and packed.

Evaluation:

- An aqueous solution of tragacanth on boiling with conc. HCl does not develop a red colour.
- It does not produce red colour with ruthenium red solution.
- When a solution of tragacanth is boiled with few drops of FeCl3 [aqueous 10% (w/v)], it produces a deep-yellow precipitate.
- It gives a heavy precipitate with lead acetate.
- When tragacanth and precipitated copper oxide are made to dissolve in conc. NH4OH, it yields a meager precipitate.

Preservation & Storage:

- Stored in well closed containers protected from light and in cool dry place.

Therapeutic Used:

- It is used as a demulcent in cough and cold preparations and to manage diarrhoea.
- It is used as an emollient in cosmetics.
- Tragacanth is used as a thickening, suspending and as an emulsifying agent.
- It is used along with acacia as a suspending agent.
- Mucilage of tragacanth is used as a binding agent in the tablets and also as an excipient in the pills.
- Tragacanth powder is used as an adhesive.
- It is also used in lotions for external use and also in spermicidal jellies.

Honey

Sources:

- It is a saccharine liquid preparation obtained from – *Apis mellifera*

  Apis Indica

Preparation:

- The nectar of the flowers is a watery solution containing 25% sucrose and 75% water. The worker bee sucks this nectar through its hollow tube of mouth (proboscis) and deposits in honey-sac located in abdomen.
- The enzyme invertase present in saliva of the bee converts nectar into invert sugar, which is partially utilized by the bee and the remaining is deposited into honey comb.
- Honey comb is smoked to remove the bees and honey is obtained by applyng the pressure to it or allowing it to drain naturally.
- The honey of commerce is heated to 80°C and allowed to stand. The impurities which float over the surface are skimmed off and the liquid is diluted with water to produce honey of 1.35 density.
- Natural honey has the density of 1.47. Many-a-time, honey is extracted from the comb by centrifugation.
- It must be free from foreign substances. Honey is liable to fermentation, unless it is suitably processed.
- Honey is heated to 80°C before it is sent to the market, so as to avoid fermentation. It should be cooled rapidly or else it darkens in colour on keeping.
- If necessary (and if not prepared by centrifugation method), honey is required to be filtered through wet cloth or funnel.

Evaluation:

1. **Fiehe's Test for Artificial Invert Sugar:** Honey (10 ml) is shaken with petroleum or solvent ether (5 ml) for 5–10 min. The upper ethereal layer is separated and evaporated in a china dish. On addition of 1% solution of resorcinol in hydrochloric acid (1 ml) a transient red colour is formed in natural honey while in artificial honey the colour persists for sometime.
2. **Reduction of Fehling's Solution:** To an aqueous solution of honey (2 ml) Fehling's solutions A and B are added and the reaction mixture is heated on a steam bath for 5–10 min. A brick red colour is produced due to the presence of reducing sugars.
3. **Limit Tests:** The limit tests of chloride, sulphate and ash (0.5%) are compared with the pharmacopoeial specifications.

Preservation & Storage:

- It is stored in room temperature in a well closed container.

Therapeutic Used:

- It used as a laxative
- It also used in treatment in cold and cough.

Proteins and Enzymes:

Proteins:

- Proteins are naturally occurring polymers made up of amino acids.
- Almost everything that occurs in the cells involves one or more Proteins.
- Proteins provide structure, cellular reaction and carried out the tasks.
- 20 amino acids are found in protein and they are called standard amino acid. These amino acids contain the carboxyl group and the amino group attached to α carbon.

Classification of Proteins:

1. **Simple Proteins:-** Simple protein contain only amino acid reduce and other intimately bound material. Ex- Albumins, globulins, glutelin etc.
2. **Conjugated Proteins:** – Conjugated proteins contain in addition to polypeptide chain others substance or groups which impart characteristics properties. . Ex- Nucleoproteins, Glycoproteins, Haemoglobin, Phosphoproteins etc.
3. **Derived Proteins:-** Derived protein are derived from partial to complete hydrolysis from the simple or conjugated proteins by the action of acids, alkalis or enzymes. Ex- Peptones, peptides, proteoses etc.

Qualitative tests of Proteins:-

1. Heat test:-

- When protein solution is heated in boiling water both the protein get co-angulated and lose their biological activity.
- This is called thermal denaturation of proteins
- e.g. – Boiling water.

2. Test with trichloroacetic acid (TCA)-

- TCA is normally used to precipitate proteins from their solution. TCA denatures the proteins.

3. Biuret Test:-

- Biuret reagents consists of copper sulphate in an alkaline medium when proteins are treated with Biuret reagent it's shows a violet colour.

4. Hydrolysis Test:-

- Proteins on hydrolysis gives free amino acids Hydrolysis can be carried out by acids like HCL, H2So4, etc. Or Alkalis like – NaOH, KoH etc.

5. Xanthoprotic test:-

- Nitration of aromatic amino acids of protein give yellow colour concentrated nitric acid is used for Nitration.

6. Millon's Test:-

- Phenolic group of tyrosine of proteins react with mercuric sulphate in the presence of sodium nitrate and sulphuric acid to give red colour.

Gelatin

Sources:

- Gelatin is a protein derivative obtained by evaporating an aqueous extract made from bones, skins, and tendons of various domestic animals. Some important sources are: **Ox, *Bos taurus, and Sheep, Ovis aries*** belonging to family Bovidae

Preparation:

Bone taken as row material

↓

Firstly grounded and then treated with organic solvent

↓

Now treated with HCL

↓

The Treated material is then heated under pressure

↓

The fluid obtained is evaporated to get gelatin

↓

The concentrated gelatin is spreaded on glass tray to form jelly

↓

Now The obtained product is dried at various temperature to get dried gelatin.

Evaluation:

1. ***Biuret reaction:*** To alkaline solution of a protein (2 ml), a dilute solution of copper sulphate is added. A red or violet colour is formed with peptides containing at least two peptide linkages. A dipeptide does not give this test.

2. ***Xanthoproteic reaction:*** Proteins usually form a yellow colour when warmed with concentrated nitric acid. This colour becomes orange when the solution is made alkaline.
3. ***Millon's reaction:*** Millon's reagent (mercuric nitrate in nitric acid containing a trace of nitrous acid) usually yields a white precipitate on addition to a protein solution which turns red on heating.
4. ***Ninhydrin test:*** To an aqueous solution of a protein an alcoholic solution of ninhydrin is added and then heated. Red to violet colour is formed.

Preservation & Storage:

- It is stored in room temperature in a well closed container.

Therapeutic Used:

- Gelatin is used to prepare pastilles, pastes, suppositories, capsules, pill-coatings, gelatin sponge.
- It forms glycerinated gelatin with glycerin which is used as vehicle and for manufacture of suppositories.
- Combined with zinc, it forms zinc gelatin which is employed as a topical protectant.
- As a nutrient, Gelatin is used as commercial food products and bacteriologic culture media.

Casein

Sources:

- It is a phosphoprotein found in milk at the extent of about 3%.

Preparation:

Milk is treated with acetic acid

↓

The acid treatement removes calcium cation

↓

It leaves a water insoluble phosphoprotein

↓

Dried grounded and packed

Evaluation:

Biuret test:

1-2 ml of test solution + biuret reagent

↓ (Shake well and stand for 5 mins)

Observe for any colour change

(If solution from blue to violet, means proteins are present)

Preservation & Storage:

- It is stored in room temperature in a well closed container.

Therapeutic Used:

- It is used in the manufacture of binders, adhesives, protective coatings, plastics (such as for knife handles and knitting needles), fabrics, food additives, and many other products.
- It is commonly used by bodybuilders as a slow-digesting source of amino acids.
- There is growing evidence that casein may be addictive for some individuals, particularly those on the autism spectrum or having schizophrenia.

Enzymes:

- An enzyme is a biomolecule that can be synthesized biologically (naturally occurring) or through other processes (synthetically). Its main function is to act as a catalyst to speed up a reaction without itself being changed in the process.

Classification of Enzymes:

1. Classification of Enzymes by IUB System

Enzymes are classified by complex system, suggested by commission on enzymes of International Union of Biochemistry (IUB). Based on their action they are divided into 6 major classes.

1. **Oxido-Reductases:** Enzymes in this class are involved in Oxidation-Reduction reactions. Example: Alcohol Dehydrogenase.
2. **Transferases:** Enzymes that catalyze transfer of Functional groups are called as Transferases. Example: Phosphorylases
3. **Hydrolases:** These are enzymes that bring about hydrolysis of various compounds. Example: Lipase
4. **Lyases:** Enzymes specialized in addition or removal of water. Example: Aldolase
5. **Isomerases:** The Isomerases enzymes catalyze the structural shifts present in a molecule, thus causing the change in the shape of the molecule.
    - Enzymes involved in all isomerization reactions. Example: Phosphotriose Isomerase.
6. **Ligases:** The Ligases enzymes are known to charge the catalysis of a ligation process.

2. On the basis of Site of activity on cell:

a. **Intracellular enzymes:** In this the enzyme functions within the cell.
Eg: Enzymes involved in TCA Cycle.
b. **Extracellular Enzymes:** In this enzyme functions outside the cell.
Eg. Digestive enzymes like – pepsin, amylase, etc.

Proteolytic enzymes:

- Enzymes are proteins that catalyze biochemical functions. They are required for various physiological processes.
- They are also known as protease that digest proteins, breakdown of long chain of protein molecules into shorter peptides and their components such as amino acids.
- They act as digestive aids, blood cleansers, rebalance immune system and reduce oedema in inflamed region.

Papain:

- Papain is an enzyme found in the white, latex-like fluid (also called sap) of papaya fruit .
- It is a protease, which means it breaks down proteins into smaller molecules called amino acids.
- This process is similar to what happens to proteins during digestion.

Sources:

- Papain is the dried and purified latex of the green fruits and leaves of ***Carica papaya*** L., belonging to family Caricaceae.

Preparation:

Incisions are made on the mature and green fruits

↓

Latex comes out and collected

↓

Dried and purified with water and precipitated with alcohol

↓

Creamy white product is obtained

↓

Sealed and product

Evaluation:

- Papain is reacted with a gelatin solution at 80°C in the presence of an activating cysteine chloral hydrate solution for an hour.
- The solution is cooled to 4°C for long time. The treated solution must not regel in comparison to a blank solution under identical con-ditions.

Preservation & Storage:

- They are stored at 20°C in a well closed container.

Therapeutic Used:

- It is used in digestive mixtures, liver tonics, for reducing enlarged tonsils, in prevention of postoperative adhesions, curbuncles, and eschar burns.
- It is an allergic agent causing severe paroxysmal cough, vasomotor rhinitis and dyspnea. It is a powerful poison when injected intravenously.
- In industry it is used in the manufacture of proteolytic preparations of meat, lever, and casein, with dilute alcohol and lactic acid as meat tenderizer, as a substitute for rennet in cheese manufacture.

Bromelain

Sources:

- Bromelin is a mixture of proteolytic enzymes isolated from the juice of Ananas comosus (pineapple), belonging to family Bromeliaceae.

Preparation:

- Bromelin is found in pineapple fruit juice and stem. Pine-apple is perennial, and it does not have a natural period of dormancy.
- It is propagated through suckers, slips, and crowns. In India it is planted in August, the plant generally flowers in February–March, and the fruit ripens during July–October.
- The fruits must be left on the plant to ripen for the full flavour to develop. Dark green unripe fruits gradually change to yellow and finally to deep orange.
- The fruits are cut off. The enzyme bromelin does not disappear as the fruit ripens. The enzyme from fruit and stem are known as fruit bromelin and stem bromelin, respectively.
- It is isolated from pineapple juice by precipitation with acetone and also with ammonium sulphide

Preservation & Storage:

- At pH 3-6 temprature upto 60°C.

Therapeutic Used:

- Bromelain is promoted as a dietary supplement for reducing pain and swelling, especially of the nose and sinuses, gums, and other body parts after surgery or injury.
- It is also promoted for osteoarthritis, cancer, digestive problems, and muscle soreness.

Serratiopeptidase

Sources:

- Serratiopeptidase is a proteolytic enzyme isolated from nonpathogenic enterobacteria *Serratia* E 15. It is also produced by the larval form of the silk moth.

Preparation:

- Serratiopeptidase is produced by fermentation technology by using nonpathogenic enterobacteria species such as *Serratia* E 15.
- The larvae of silk moth produce this enzyme in their intestine to break down cocoon walls. It can thus be obtained from the silk moth larvae.

Preservation & Storage:

- It is stored below 30˚C in a well closed container and away from sunlight.

Therapeutic Used:

- Serratiopeptidase is the most widely prescribed antiinflammatory enzyme in developed countries and also in India.
- It eliminates inflammatory oedema and swelling, accelerate liquefaction of pus and sputum, and enhance the action of antibodies.
- It is also used as a fast wound healing agent. It is proving to be a superior alternative to the nonsteroidal antiinflammatory drugs traditionally used to treat rheumatoid arthritis and osteoarthritis.
- It has wide ranging applications in trauma surgery, plastic surgery, respiratory medicine, obstetric and gynaecology.

Urokinase

Sources:

- Urokinase is serine protease enzyme isolated from human urine and from human kidney cells by tissue culture or by recombinant DNA technology.

Preparation:

- Urokinase is a fibrinolytic enzyme produced by recombinant DNA using genetically manipulated E. coli cells.

- It is produced firstly as prourokinase q.v. and then converted to active form by plasmin or kallikrein. Urokinase used medicinally is also purified directly from human urine.
- It binds to a range of adsorbents such as silica gel or kaolin which can be use to initially concentrate and purify the product.
- It can be further purified by precipitation with sodium chloride or ethanol or by chromatography.
- Human urokinase needs sterile filtration, a septic filling and freeze drying.

Preservation & Storage:

- It is stored below 30˚C in a well closed container and away from sunlight.

Therapeutic Used:

- Urokinase is used in the treatment of pulmonary embolism, coronary artery thrombosis and for restoring the potency of intravenous catheters.
- It is generally administered intra-venously in a dose of 4,400 units/kg body weight per hour for twelve hours.

Streptokinase

Sources:

- Estreptokinase, plasminokinase is a purified bacterial protein produced from the strains of group C β-haemolytic S. griseus.

Preparation:

The enzyme is present in the intestine of silkworm

↓

Isolated and purified from intestine

Preservation & Storage:

- It is stored below 30˚C in a well closed container and away from sunlight.

Therapeutic Used:

- Streptokinase is used to dissolve blood clots that have formed in the blood vessels.
- It is used immediately after symptoms of a heart attack occur to improve patient survival.
- This medicine may also be used to treat blood clots in the lungs (pulmonary embolism) and in the legs (deep venous thrombosis)

Pepsin

Sources:

- It is the enzyme prepared from the mucous membrane of the stomach of various animals like pig, sheep, or calf.
- The commonly used species of pig is ***Sus scrofa*** **Linn,** belonging to family Suidae.

Preparation:

- The mucous membrane is separated from the stomach either by the process of stripping or it is scrapped off, and it is placed in acidified water for autolysis at 37°C for 2 hours.
- The liquid obtained after autolysis consist of both pepsin and peptone.
- It is then filtered and sodium or ammonium salts are added to the liquid till it is half saturated. At this point only the pepsin separates out, and the peptone remains in the solution.
- The precipitates are collected and subjected to dialysis for the separation of salts. Remaining amount of pepsin if any in the aqueous solution is precipitated by the addition of alcohol into it.
- The pepsin is collected and dried at low temperature.

Preservation & Storage:

- It is stored below 30˚C in a well closed container and away from sunlight.

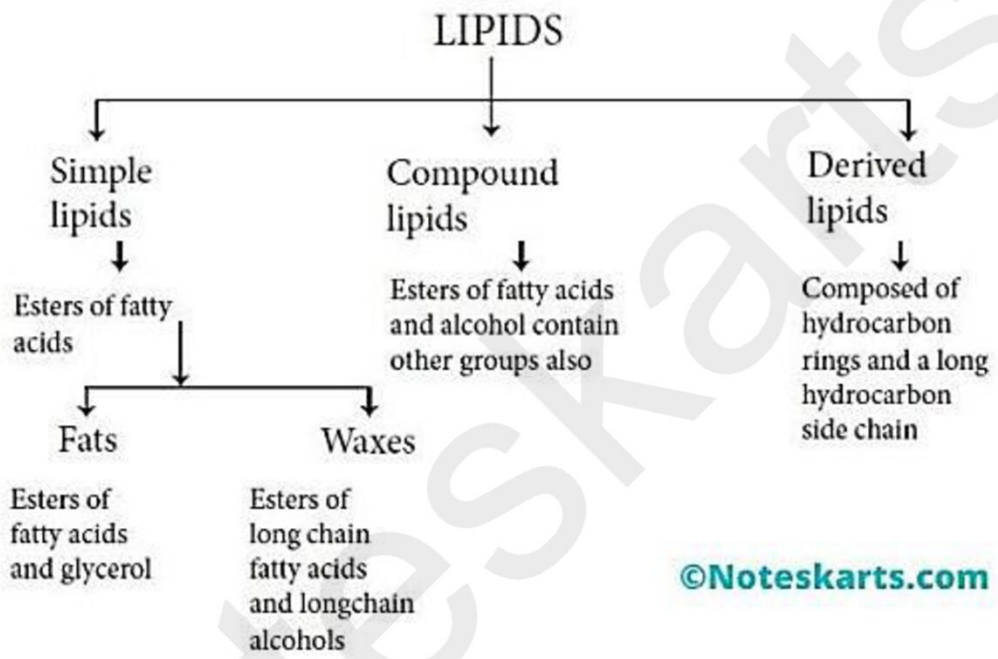
Therapeutic Used:

- It is used in the deficiency of gastric secretion.
- Pepsin is also used in the laboratory analysis of various proteins; in the preparation of cheese, and other protein-containing foods.

Lipids

- Lipids are chemically defined as a substance that changed in soluble in water and soluble in organic compound like chloroform, ether, benzene, etc.
- Lipids are the main constituents of plant and Animal cells.
- Leopard is a type of organic molecules found in a living thing. It is oily or waxy.

Classification of Lipids:



Chemical Test:

1. Acrolein Test:

- In the acrolein test, we take the given food sample, prepare the extract of the given food sample. Then add potassium bisulphite to the above extract.
- A Pungent irritating odour evolves to form the solution confirms the presence of Fats in the food.

2. Baudouin Test:

- This test is used to identify the adulterant (vanaspati ghee) in the desi ghee.
- The food sample is treated with the mixture, containing 5 ml hydrochloric acid, 2% fufral solution in the alcohol.
- A rose-red colour appears after some time (around 5-10 minutes) in the solution confirms the presence of vanaspati in the desi ghee.

3. Solubility Test:

- Take the given food sample, prepare the extract of the given food sample.

- Then add the above extract to the chloroform solution or alcohol solution.
- If the extract gets dissolved into the solution, it confirms the presence of Fats in the food.
- By using the above methods, the analysis of fats and oils can be done.

Castor oil:

Sources:

- Castor oil is a vegetable oil derived from the seeds of the ***Ricinus communis*** plant, native to tropical areas of Africa and Asia

Family : Euphorbiaceae

Preparation:

- Castor seeds are used to make castor oil. There are two methods to get the oil: either with the seed coat still on, or after it has been removed.
- The process of removing seed coverings involves smashing the seeds beneath the grooved rollers and then blowing the testas out with an air current. When the kernels are put into oil expellers, they are expressed with one to two tons of pressure per square inch at room temperature, until around thirty percent of the oil is extracted.
- To aid with the coagulation and precipitation of the oil's proteins, the lipase enzyme, and the toxic ingredient ricin, it is filtered and heated to 80–100°C. After filtering, 1% acidity oil is utilized for medicinal purposes.
- The remaining oil cake is composed of around 20% oil, lipase, and ricin.
- The cake is crushed, steam-cooked between 40 and 80 degrees Celsius, and subjected to three tons of pressure per square inch. This produces oil of the second quality, which has an acidity of 5% and is utilized in industry.
  After the second quality oil is expressed, there is still 8–10% oil left in the leftover cake.
- This oil is prepared by extracting it using lipid solvents in a soxhlet. Additionally, industry uses this acquired oil. Because it contains ricin, the leftover cake is utilized as manure rather than being given to animals. The cake is also employed in the lipase synthesis process.

Evaluation:

- About 5 ml of light petroleum (50° to 60°) when mixed with 10 ml of castor oil at 15.5° shows a clear solution, but if the amount of light petroleum is increased to 15 ml, the mixture becomes turbid. This test is not shown by other oils.

Preservation & Storage:

- It is stored below 30°C in a well closed container and away from sunlight.

Therapeutic Used:

- It is used as lubricant.

- It is also used in cosmetics industry.
- They are used in the preparation of soap.

Chaulmoogra oil:

Sources:

- Chaulmoogra oil is the fixed oil obtained by cold expression from ripe seeds of *Taraktogenos kurzii* King, (syn. *Hydnocarpus kurzii* (King) Warb.), *Hydnocarpus wightiana* Blume, *H. anthelminticta* Pierre, *H. heterophylla*, and other species of Hydnocarpus, belonging to family Flacourtiaceae.

Preparation:

1. **Harvesting the Seeds**: The trees bear fruit usually in August and September. The fruits are brown berries containing 10-16 seeds within the pulp.
2. **Seed Preparation**: The seeds are cleaned, washed, and dried. The testa (seed coat) is cracked and removed.
3. **Oil Extraction**: The kernels are then turned into a paste, often kept in jute bags. This paste is then subjected to a hydraulic press, expressing the oil. The fixed oil content of ripe seeds ranges from 40 to 45 percent.

Preservation & Storage:

- It is stored below 30°C in a well closed container and away from sunlight.

Therapeutic Used:

- The oil is useful in leprosy and many other skin diseases.
- The cyclopentenyl fatty acids of the oil exhibit specific toxicity for Mycobaeterium leprae and M. tuberculosis.
- The oil has now been replaced by the ethyl esters and salts of hydnocarpic and chlumoogric acids.
- At present organic sulphones have replaced Chaulmoogra oil in therapeutic use.

Wool Fat (Lanolin)

Sources:

- Lanolin is the fat-like purified secretion of the sebaceous glands which is deposited into the wool fibres of sheep, *Ovis aries* Linn., belonging to family Bovidae.

Preparation:

- Wool is cut and washed with a soap or alkali. An emulsion of wool fat, called as wool grease, takes place in water.

- Raw lanolin is separated by cracking the emulsion with sulphuric acid. Wool grease floats on the upper layer and fatty acids are dissolved in the lower layer.
- Lanolin is purified by treating with sodium peroxide and bleaching with reagents.

Evaluation:

- Dissolve 0.5 g of lanolin in chloroform, and to it add 1 ml of acetic anhydride and two drops of sulphuric acid.
- A deep green colour is produced, indicating the presence of cholesterol.

Preservation & Storage:

- It is stored in a well closed container and away from sunlight

Therapeutic Used:

- Lanolin is used as an emollient, as water absorbable ointment base in many skin creams and cosmetic and for hoof dressing.
- Wool fat is readily absorbed through skin and helps in increasing the absorption of active ingredients incorporated in the ointment.

Bees Wax

Sources:

- It is a purified wax obtained from the honey comb of bees (***Apis mellifera***)

Preparation:

Honey comb is melted in boiling water

↓

Wax is melted

↓

Cooled to solified

↓

Wax is removed and bleached with H_2O_2 or $KMnO_4$

↓

Beeswax Obtained

Evaluation:

Wax + Caustic soda solution

↓

For 10 minutes cool it

↓

No turbidity is produced

Preservation & Storage:

- It is stored in a well closed container and away from sunlight

Therapeutic Used:

- Preparation of ointments
- Used in cosmetics for the preparation of lipstick and face creams.

Marine Drugs:

- It is a branch of Pharmacognosy which deals with the isolation and identification of bioactive molecules from marine organism. That means study of chemicals that derived from marine sources.
- Sources are Bioactive molecules obtained from microbes, sponges, seaweeds and other marine organisms.

Novel medicinal agents from marine sources:

- The novel medicinal agents which are obtained from marine source are as follows:-

Class	Examples
Antibiotic compounds	Cycloeudesmol, variabilin, Ircinin-1
Anti inflammatory & anti spasmodic	Manoalide, Tetrado toxin
Antimicrobial compounds	Holotoxin ABC, Tholepin, eunicin acanthelin
Cardiovascular active compounds	Anthopleurins, Laminine, Eptatretin, saxitoxin, spongosine, eledosin, ATX-II, Autonomium
Anti cancer (cytotoxic)	Ara-c, crassin acetate simularin.
Marine toxins compounds	Ciguatoxin, Palytoxin, Saxitoxin, Brevetoxin
Miscellaneous compounds	Kainic acid, Domoic acid, Aplysinopsin.

Antibiotic Compounds

Antibiotic compounds from marine sources have been found to inhibit the growth of bacteria, fungi, and other microorganisms.

1. **Cycloeudesmol:**
    - **Source:** Marine sponges.
    - **Activity:** Exhibits antibacterial properties by interfering with bacterial cell wall synthesis or protein synthesis.
2. **Variabilin:**
    - **Source:** Marine sponges, specifically *Ircinia* species.

- **Activity:** Shows broad-spectrum antibiotic activity, potentially disrupting bacterial cell membranes or inhibiting bacterial enzymes.

3. **Ircinin-1:**
    - **Source:** Marine sponges.
    - **Activity:** Possesses antibacterial and antifungal properties, inhibiting the growth of various pathogenic microorganisms.

Anti-inflammatory & Antispasmodic Compounds

These compounds help reduce inflammation and muscle spasms, providing therapeutic benefits for inflammatory diseases and conditions involving muscle spasms.

1. **Manoalide:**
    - **Source:** Marine sponge *Luffariella variabilis*.
    - **Activity:** Inhibits phospholipase A2, reducing the production of inflammatory mediators and showing significant anti-inflammatory effects.
2. **Tetrodotoxin:**
    - **Source:** Pufferfish and other marine animals.
    - **Activity:** Acts as a potent neurotoxin that blocks sodium channels, reducing neuronal excitability and having potential antispasmodic effects.

Antimicrobial Compounds

These compounds exhibit broad-spectrum activity against various microorganisms, including bacteria, fungi, and viruses.

1. **Holotoxin ABC:**
    - **Source:** Sea cucumbers.
    - **Activity:** Exhibits strong antimicrobial activity by disrupting microbial cell membranes or interfering with their metabolic processes.
2. **Tholepin:**
    - **Source:** Marine sponges.
    - **Activity:** Shows potent antimicrobial effects against a range of pathogens, possibly by inhibiting critical enzymes or pathways in microorganisms.
3. **Eunicin and Acanthelin:**
    - **Source:** Marine polychaetes (bristle worms).
    - **Activity:** These compounds demonstrate antimicrobial properties, likely through disruption of microbial cell structures or inhibition of vital microbial functions.

Cardiovascular Active Compounds

These compounds affect the cardiovascular system, potentially offering benefits for treating heart-related conditions.

1. **Anthopleurins:**
    - **Source:** Sea anemones.
    - **Activity:** Act as potent cardiotoxins that modify ion channel function, specifically sodium channels, influencing heart muscle contraction.
2. **Laminine:**
    - **Source:** Marine algae.
    - **Activity:** Exhibits cardiovascular activity by potentially influencing blood pressure regulation and heart function.
3. **Eptatretin:**
    - **Source:** Hagfish.
    - **Activity:** Shows potential in modulating cardiovascular functions, though its exact mechanisms are still under investigation.
4. **Saxitoxin:**
    - **Source:** Marine dinoflagellates and cyanobacteria.
    - **Activity:** A potent neurotoxin that blocks sodium channels, affecting nerve transmission and potentially influencing heart rhythm.
5. **Spongosine:**
    - **Source:** Marine sponges.
    - **Activity:** Exhibits cardiovascular effects, potentially through modulation of heart muscle contractility.
6. **Eledoisin:**
    - **Source:** Octopus.
    - **Activity:** Acts on smooth muscles and blood vessels, causing vasodilation and influencing cardiovascular functions.
7. **ATX-II:**
    - **Source:** Sea anemones.
    - **Activity:** Modulates sodium channels, affecting heart muscle contraction and potentially offering therapeutic benefits for heart conditions.
8. **Autonomium:**
    - **Source:** Marine organisms.

- **Activity:** Potentially influences the autonomic nervous system, which regulates cardiovascular functions.

Anticancer (Cytotoxic) Compounds

These compounds exhibit cytotoxic properties, making them potential candidates for cancer treatment.

1. **Ara-C (Cytarabine):**
   - **Source:** Marine sponge *Tethya crypta*.
   - **Activity:** A chemotherapy agent used to treat leukemia, it inhibits DNA synthesis in rapidly dividing cancer cells.
2. **Crassin Acetate:**
   - **Source:** Marine gorgonian corals.
   - **Activity:** Shows cytotoxic activity against cancer cells, potentially inducing apoptosis or inhibiting cell proliferation.
3. **Simularin:**
   - **Source:** Marine organisms.
   - **Activity:** Exhibits potent anticancer effects, possibly through mechanisms like DNA intercalation or inhibition of key enzymes in cancer cells.

Marine Toxin Compounds

These compounds are highly toxic but provide insights into neurological and physiological processes, and some have therapeutic potential in controlled doses.

1. **Ciguatoxin:**
   - **Source:** Marine dinoflagellates and fish.
   - **Activity:** A potent neurotoxin that affects ion channels, causing neurological and gastrointestinal symptoms.
2. **Palytoxin:**
   - **Source:** Zoanthid corals.
   - **Activity:** One of the most potent toxins known, it affects the sodium-potassium pump in cells, leading to severe physiological effects.
3. **Saxitoxin:**
   - **Source:** Marine dinoflagellates and cyanobacteria.
   - **Activity:** A neurotoxin that blocks sodium channels, leading to paralysis and other severe symptoms.
4. **Brevetoxin:**

- **Source:** Marine dinoflagellates.
- **Activity:** A neurotoxin that affects sodium channels, causing neurological and respiratory symptoms.

Miscellaneous Compounds

These compounds have various therapeutic and biological activities.

1. **Kainic Acid:**
   - **Source:** Red algae *Digenea simplex*.
   - **Activity:** An excitatory neurotransmitter analog used in neurological research to study excitotoxicity.
2. **Domoic Acid:**
   - **Source:** Marine diatoms.
   - **Activity:** A neurotoxin that causes amnesic shellfish poisoning, providing insights into glutamate receptor function.
3. **Aplysinopsin:**
   - **Source:** Marine sponges and mollusks.
   - **Activity:** Exhibits neuroprotective and antitumor activities, potentially through modulation of neurotransmitter systems or inhibition of tumor growth.