

Major Concept



9.1 INTRODUCTION

Pharmacology is the branch of biomedical science which is concerned to the uses, effects, and modes of action of drugs. This branch is studied under the discipline of pharmacy.

Pharmacology as we know it today became a scientific discipline in the early 19th century, when a number of physiologists began to perform pharmacologic studies.

One who studies pharmacy responsible for dispensing prescription medications to patients and advising them are called pharmacists.

Oswald Schmiedeberg (1838–1921) is generally recognized as the founder of modern pharmacology. He studied the pharmacology of chloroform and chloral hydrate.

Patients are treated with drugs; drug is a chemical substance used to treat, cure, prevent a disease or to promote well-being or artificial pleasure.

Drugs can be derived from plants and animals. There are two categories of drugs:

1. Pharmaceutical drugs or medicinal drugs are used to treat the diseases and makes the patient physically normal.
2. Addictive drugs which makes the person relaxed by feeling pleasure, acting on the CNS of the person, finally the person become dependent on it.

9.2 MEDICINAL DRUGS

Medicinal drugs are beneficial for the patients as these drugs treat the disease to prevent them so many of the diseases can easily be cured. These beneficial drugs are obtained from various sources:

i. Drugs from plants

Many plants produce special substances in their roots, leaves, flowers, or seeds that help to form drugs in laboratory or can be used directly as herbs. For example **cinchona tree** contains Quinine in its



bark which is used in the prevention and treatment of malaria and Opium is used as pain-killer drug extracted from the unripe seed pods of the **opium poppy**.

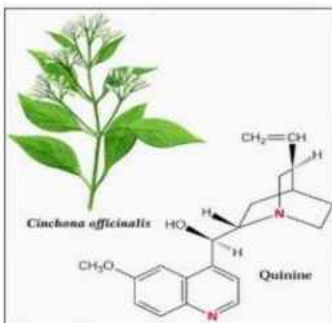


Fig 9.1 (a) Cinchona tree



Fig 9.1 (b) Opium poppy

ii. Drugs from microorganisms

Microorganisms such as Bacteria and fungi not only produce many primary metabolites, they are also capable of making secondary metabolites, which constitute half of the pharmaceuticals on the market as antibiotics and antifungal drugs.

Example: Tetracycline are produced by bacteria and Lovastatin produced by fungi.

iii. Drugs from animals

Certain animal parts and animal products are used as drug in therapeutics. The major group of animal products used in medicine is hormone, enzymes, animal extractives, organs and bile acids.

For example **Gonadotropin** hormone are prepared commercially from either horse serum or from the urine of pregnant woman.

Today, scientists are most excited about drugs derived from the sun anemone.

They control the production of sex hormones in the body.

Hyaluronidase enzyme is produced by some microorganisms, found in the heads of leeches, in snake venom and in mammalian testes.

iv. Drugs from minerals

Some of the drugs are synthesized from minerals or can be given with mineral as supplement, such as iron is used in treatment of iron deficiency (anemia). Zinc is used to make zinc oxide paste which is used in wounds and in eczema. Gold salts are used in the treatment of rheumatoid arthritis etc.

v. Synthetic drugs

Synthetic drugs are synthesized in labs by using man-made chemicals rather than natural ingredients. A number of synthetic drugs in the market are available.

Example: Synthetic marijuana goes by many names: K2, Spice, fake pot, potpourri, legal weed, and more.

There are more than 200 identified synthetic drug compounds and more than 90 different synthetic drug marijuana compounds.

9.2.1 Principle usage of important medicinal drugs

a. Pain killers

Painkillers (analgesic) reduces the pain by acting on CNS.

Example: Paracetamol, Aspirin and Panadol etc.

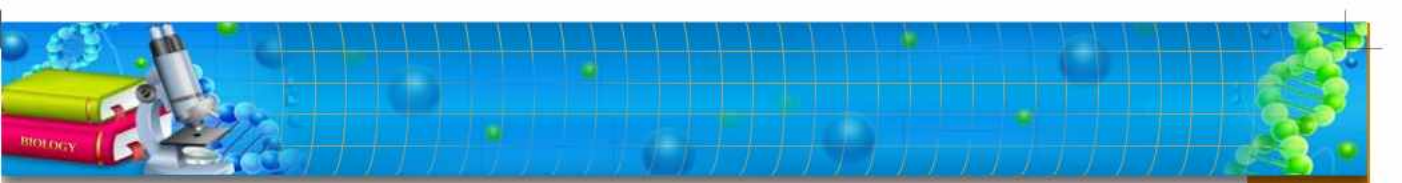
A recent study found that aspirin may be most effective when taken at night, rather than in the morning.

b. Antibiotics

Antibiotics work against bacterial infections. It either kills or inhibit the bacterial growth. For example: Penicillin, Cephalosporin and Tetracycline etc.

c. Vaccine

The vaccine is vital for One's life, vaccine prevent the living body from the microbial diseases by developing immunity in the body. For example: hepatitis vaccine, rabies vaccine, covid-19 vaccine etc.



d. Sedatives

Sedative drugs are helpful for treating **anxiety** and sleep problems. such as, Diazepam (Valium), Alprazolam (Xanax), and Clonazepam (Klonopin).

Danger Zone



1. An allergic reaction could happen with any drug. That can range from itching and rash all the way to a life-threatening anaphylactic reaction.
2. Over dose of pain killers and sedatives can make the person addictive which on leaving causes severe risk factors.
3. You cannot “catch” the disease from the vaccine. Some vaccines contain “inactive” virus, and it is impossible to get the disease from them. Others have active but weakened viruses designed to prevent the disease.
4. New study shows that children given antibiotics for routine upper respiratory infections are more susceptible to aggressive antibiotic-resistant strains of the bacteria.
5. Aggressive antibiotics, while helpful if you have a serious infection, can wipe out many useful gut bacteria.

9.2.2 Discovery of antiseptic and antibiotics

Joseph Lister is called as “Father of Antiseptic Surgery”, Joseph Lister’s contributions paved the way to safer medical procedures. His introduction of the antiseptic process dramatically decreased deaths from childbirth and surgery.

He used carbolic acid as a disinfectant, he used it for washing hands and instruments. He also designed his spray machine with carbolic acid to kill the air-borne germs.

Sir Alexander Fleming, a Scottish researcher, is credited with the discovery of penicillin in 1928. At the time, Fleming was experimenting with the influenza virus in the Laboratory of the Inoculation Department at St. Mary’s Hospital in London.



Fig. 9.2 Spray machine invented by Joseph Lister

Antiseptic

Antiseptics are antimicrobial substances that are applied to living tissue/skin to prevent the microbial infection.

Often described as a careless lab technician, Fleming returned from a two-week vacation to find that a mold had developed on an accidentally contaminated staphylococcus culture plate. Upon examination of the mold, he noticed that the culture prevented the growth of staphylococci. And this accident led the discovery of antibiotic named as Penicillin.

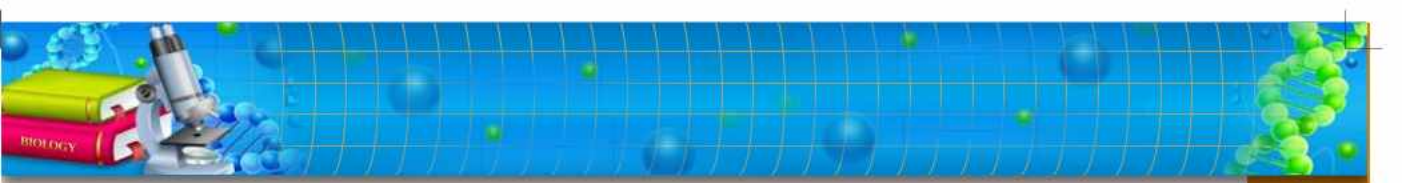
9.3 ADDICTIVE DRUGS

Addictive drugs act on the pleasure center in the brain, causing a shortcut to reward that, when repeated, can change the way a person processes information. Drugs' addictive qualities may be enhanced by how good they make a person feel when using them and how bad they may make users feel when they wear off.

Following are the major categories of addictive drugs:

a. Sedatives

Sedatives are central nervous system (CNS) depressants, a category of drugs that slow normal brain function. One of the most marked effects of sedatives is their potential for abuse and addiction. It can cause drowsiness and sleepiness and are used to reduce anxiety. They also reduce heart rate and breathing, and can reduce them to the point that death occurs, if there is an overdose.



b. Narcotics

Narcotics are also called painkiller. These drugs bind with the pain receptor present in CNS and reduces the pain. They are used to treat moderate to severe pain that may not respond well to other pain medications. The short-term effects of opiate use can include feelings of euphoria, pain relief, drowsiness and sedation. Narcotics can be dangerous not only because of their potential for abuse and addiction, but also because they can sometimes lead to overdose and death.

i. Heroin

Heroin is considered highly addictive. Heroin and other opioid drugs interact with dopamine levels in the brain, which is what causes the burst of pleasure associated with their use. Abuse of heroin can quickly lead to drug tolerance, dependence, and addiction.

ii. Morphine

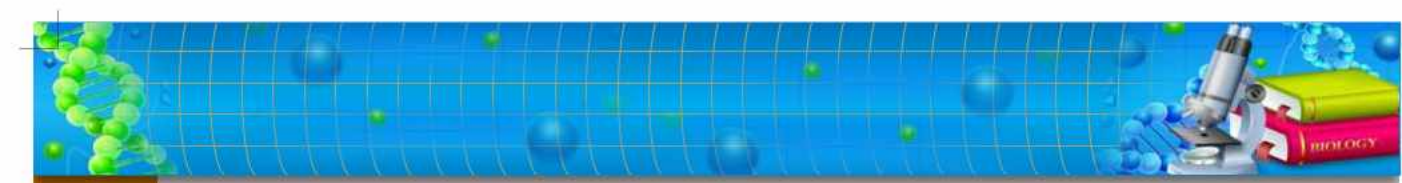
Being narcotic drug, morphine is used to relieve moderate to severe pain. It remains active in blood stream upto 6 Hrs. It acts on the CNS and causes relief from pain but overdose can cause many side effects including nausea, vomiting, constipation, lightheadedness, dizziness, drowsiness, or sweating.

c. Hallucinogen

Hallucinogens are a class of drugs that cause hallucinations—profound distortions in a person's perceptions of reality. Some of the typical effects of hallucinogens are: increased breathing rate, increased heart rate and blood pressure, irregular heartbeat, palpitations and blurred vision etc.

i. Marijuana

Marijuana is the most commonly used illicit drug in the United States. It can be obtained from the flower, stem and leaves of the *Cannabis indica* plant. People smoke marijuana in hand-rolled cigarettes or in pipes or water pipes. The intake of this drug produces



immediate sensations—increased heart rate, reduce coordination and balance, and a “dreamy,” unreal state of mind. Marijuana also affects brain development. When people begin using marijuana as teenagers, the drug may impair thinking, memory, and learning functions and affect how the brain builds connections between the areas necessary for these functions.

9.3.1 Symptoms of addiction

1. When a person is addicted to a substance, such as a drug, alcohol or nicotine, they are not able to control the use of that substance.
2. When body levels of that substance go below a certain level the patient has physical and mood-related symptoms. There are cravings for drugs, bouts of moodiness, bad temper, poor focus, a feeling of being depressed and empty, frustration, anger, bitterness and resentment.
3. While under the influence of some substances the addict may engage in risky activities, such as driving fast.

9.3.2 Problems associated to drug addiction

The problems associated with drug abuse extend beyond immediate personal impact. People being an addictive, suffer in health issues which increases other illness. Addiction can damage the one's social life. Research reveals that, addictive people can easily involve in crimes such as robbery, stealing/ snatching, law violator and a criminal. Addiction can damage the one's social life. It can also affect their family, when the addict does not get its need he become, angry, aggressive, harsh, short temper and does not behave well, ultimately lose relations.



Salvia divinorum



Datura



Opium poppy



Willow Bark (Salix)



Cannabis



Psilocybin mushroom

Fig. 9.3 Hallucinogen and narcotics obtaining plants found in Pakistan

9.4 ANTIBIOTICS AND VACCINE

Antibiotics are chemical substances mostly used to fight infections caused by bacteria. They treat infections by killing or decreasing the growth of bacteria. These can be produced naturally by microorganisms (bacteria or fungi) or can be derived by microorganisms in laboratory or can be synthesized in labs.

Antibiotics are used to treat only bacterial infections.

They can treat viral or fungal infections. Some of the Antibiotics are **Bacteriostatic** which means they inhibit the growth of bacteria whereas some antibiotics are **Bactericidal** which means these can kill the bacterial cell.

The first beta-lactam antibiotic, penicillin, was discovered by Alexander Fleming accidentally by mold..

9.4.1 Misuse of antibiotics

Antibiotics can cause side effects based on how they work. Antibiotics are prescribed for a particular infection, but can harm to your normal flora which is beneficial for your body. Apart from it, side effects can also occur which are:

- Antibiotic resistance
- Diarrhea
- Upset stomach
- Thrush, which is a fungal infection that can affect the mouth or digestive tract
- Vaginal yeast infection caused by *Candida albican* (discharge, burning, pain, itchiness)
- Can cause yellowing of teeth.

9.4.2 Antibiotic resistance

Over use of antibiotics can cause antibiotic resistance in which bacteria become habitual for that antibiotics or alter strategy to hinder the effect of antibiotics. The change either protects the bacterium from the action of the medication or neutralizes the medication. They can acquire resistance by getting a resistance gene encoded to its chromosomes.

9.4.3 Vaccine

A vaccine is a biological preparation that improves immunity to a particular disease. A vaccine typically contains an agent that resembles a disease-causing microorganism, and is often made from weakened or killed form of the microbe, its toxins or one of its surface proteins. A vaccine can confer active immunity against a specific harmful agent by stimulating the immune system to attack the



Fig. 9.4
Edward Jenner ; vaccination

agent. The first vaccine was introduced by British physician Edward Jenner, who in 1796 used the cowpox virus (vaccinia) to confer protection against smallpox, a related virus, in humans.

Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a **vaccine**.

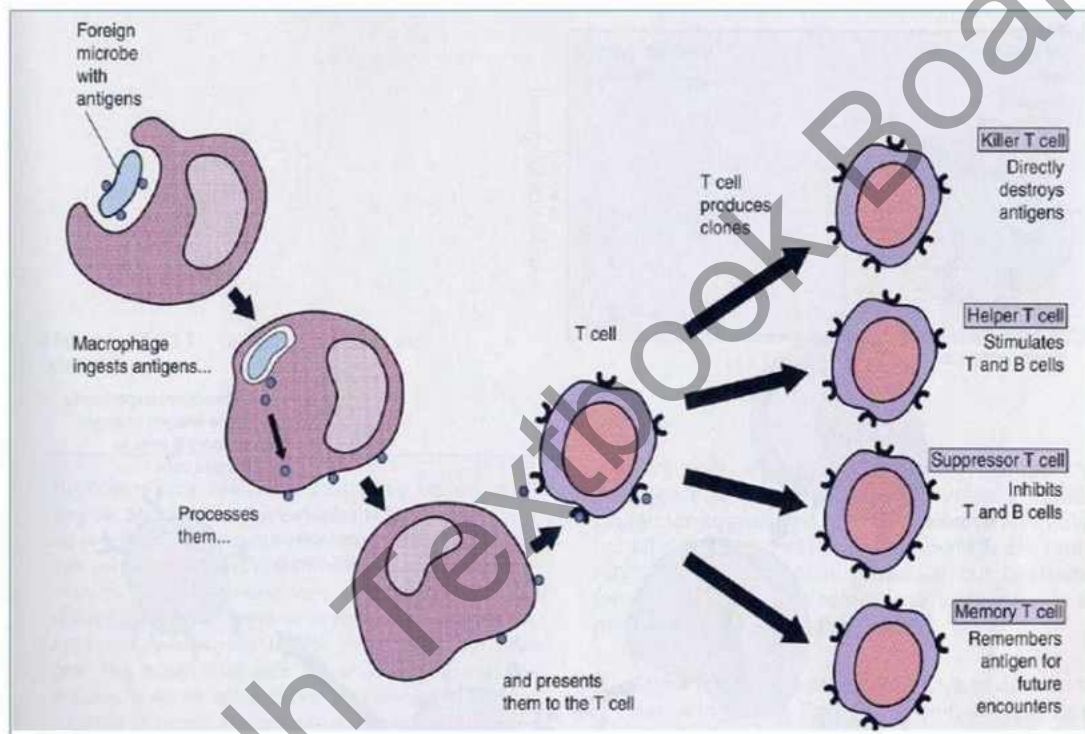
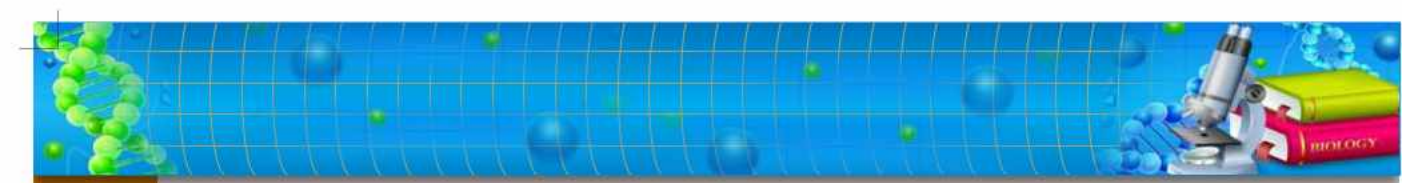


Fig. 9.5 Mechanism of vaccine



SUMMARY

- ◆ Pharmacology is the branch of biomedical science which is concerned with the use, effect and mode of actions of drugs.
- ◆ Drug is a chemical substance which is used to treat, cure, prevent a disease and used for artificial pleasure.
- ◆ Drugs can be derived from plants and animals.
- ◆ There are two categories of drugs
 - i. Pharmaceutical or medicinal drug
 - ii. Addictive drugs or narcotics
- ◆ Medicinal drugs are derived from micro organisms, mineral, plants, animal or synthetic.
- ◆ Medicinal drugs may be pain killer, antibiotics, vaccine, sedative, antiseptics.
- ◆ Addictive drugs may be sedative, narcotics (Heroin, Morphine, Marijuana).
- ◆ Antibiotics are bacteriostatic or bactericidal.
- ◆ Bacteriostatic means inhibit growth of bacteria.
- ◆ Bactericidal means kill the bacteria.
- ◆ Antibiotics work against wide range of Gram+ve and Gram-ve bacteria called broad spectrum antibiotics.
- ◆ A vaccine is a biological preparation that improves immunity to a particular disease.
- ◆ Immunization is the process whereby a person is made resistant to an infectious disease.

EXERCISE

A. MULTIPLE CHOICE QUESTIONS

Choose the correct answer:

- i) Who is called father of antiseptic?
- | | |
|-----------------------|-------------------------|
| (a) Alexander Fleming | (b) Edward Jenner |
| (c) Lister | (d) Oswald Schmiedeburg |



- ii)** Drugs for treatment of rheumatoid arthritis can be obtained from:
- (a) Animals (b) Minerals
(c) Plants (d) Microorganisms
- iii)** Drugs that slow normal brain functioning are categorized as:
- (a) Narcotics (b) Hallucinogen
(c) Marijuana (d) Sedatives
- iv)** Vaccination can be administered :
- (a) After infection (b) Before infection
(c) During infection (d) All are Correct
- v)** The substance which inhibit the growth of bacteria can be considered as:
- (a) Vaccine (b) Bactericidal
(c) Bacteriostatic (d) Antibiotics
- vi)** Haris is addicted to a drug , which left the following effect on Haris :
- i. Blurred vision
ii. Making unseen faces in imagination
iii. Euphoria
- Identify the drug, to which Haris is addicted?
- (a) Narcotics (b) Hallucinogen
(c) Antibiotics (d) Antiseptic
- vii)** Which one is not the effect of misuse of antibiotics?
- (a) Diarrhea (b) Immunization
(c) Stomach upset (d) Antibiotic resistance

B. SHORT QUESTIONS:

- i)** Why antibiotics are not effective against viral infection?
ii) Why the sedative is used for?
iii) Why addiction is considered as harmful condition?
iv) How drugs (medicine) can be taken from natural source?
v) Is it possible to get drugs from animals name some of them?
vi) Do we have any harm of antibiotics? If, so mention them.
vii) How vaccine work against pathogen? Explain the process with the help of diagram.

C. EXTENSIVE RESPONSE QUESTIONS:

- i)** How bacteria produces antibiotic resistance?
ii) Describe the mode of vaccination.