KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
Coimbatore - 641021.
(For the candidates admitted from 2017 onwards)
DEPARTMENT OF BIOCHEMISTRY

SUBJECT : **DRUG BIOCHEMISTRY**

SEMESTER : III
SUBJECT CODE: 17BCP304   **CLASS**: **II M.Sc., BIOCHEMISTRY**

Course objectives
- This paper gives insight knowledge about the emerging themes of drug biochemistry.
- Provides an in depth analysis of specific drug classes, its metabolism and therapeutic approaches.

Course outcome

- Ensure the widespread visibility and high impact of Drugs, thereby promoting on emerging research, pointing the way for the establishment of new medicines – from the identification of targets, through to the synthesis and evaluation of putative therapeutic entities.
- Able to understand the adverse effect of drugs in various organs.

UNIT I
Drugs – Introduction, sources and routes of administration, Structural features and pharmacological activity, prodrug concept, Adsorption – factors modifying drug absorption. Distribution, metabolism - phase I, II reactions, action of cytochrome P450 and excretion of drugs.
Drug receptors – Localization, types and subtypes, models and theories. G-protein coupled receptor and ion-channel linked receptors. Examples of drug-receptor interactions. Agonists and antagonists. Bioavailability of drug

UNIT II
Drug tolerance and drug dependence. Principles of basic pharmacokinetics. Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, vaccination against infection, factors modifying drug action and effect. Assay of drug potency: chemical, bioassay and immunoassay.

UNIT III
Genetically engineered protein and peptide agents as drugs, Novel drug delivery systems, anti-AIDS drug development, oncogenes as targets for drugs, multidrug resistance phenotypes, production of secondary metabolites by plant tissue culture. Genome based medicine.

UNIT IV

Mechanism of action of drugs used in therapy of Respiratory system – cough, bronchial asthma, pulmonary tuberculosis. Antimicrobial drugs – sulphonamides, trimethoprim, penicillins, aminoglycosides and bacterial resistance, Cancer chemotherapy. Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, antifertility and ovulation inducing drugs. Pharmacotherapy of gout and rheumatoid arthritis, Immuno therapy – Immunosuppressants and immunostimulants, Enzymes in therapy.

UNIT V

Brain – Neurotransmitters, encephalins and endorphins; general function of autonomic and somatic nervous system; cholinergic transmission and receptors; adrenergic transmission and receptors; muscarinic receptors. Non steroidal and anti inflammatory drugs; adrenergic blocking drugs; cholinergic blocking drugs; muscatrinic blocking drugs; parkinson's disease; Alzhiemier's disease. Neurodegenerative disorders – Amylotropic, lateral sclerosis, senile dementia, schizophrenia, Huntington's disease.

TEXTBOOKS

Satoskar, R.S., Bhandarkar, S.D., and Ainapare, S.S., (2003). Pharmacology and Pharmacotherapeutics, Popular Prakasham, Mumbai.

Patrick, G., (2002). Medicinal Chemistry Instant notes, Viva books private limited, New Delhi.

Chauduri, S.K., (2001). Quintessence of Medical Pharmacology, New central book agency limited, Calcutta.

REFERENCES

Glick, B.R., Pasternak, J.J., and Patten, C.L., (2009). Molecular Biotechnology, 4th edition, Panima Publishing Corporation, Delhi.

Grahame-Smith, D.G., and Aronson, J. K., (2002). Oxford textbook of Clinical Pharmacology and Drug Therapy: 3rd edition. Oxford University Press.

Foye, W.O., Lemke, T.L., Williams, D.A., (2012). Principles of Medicinal Chemistry, 7th edition, B.I. Wanerly Pvt. Ltd, New Delhi.

Wolf, E.,(1995). Burgers Medicinal Chemistry and Drug Discovery. Principles and Practice, John Wiley and Sons, Manfred.

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Pollachi Main Road, Eachanari Post, Coimbatore - 641 021. INDIA

Phone : 0422-6471113-5, 6453777 Fax No : 0422 -2980022-3

Email : info@karpagam.com Web : www.kahedu.edu.in

DEPARTMENT OF BIOCHEMISTRY

LESSON PLAN

STAFF NAME: Mr. A. RAMAKRISHNAN

SUBJECT NAME: DRUG BIOCHEMISTRY

SUB.CODE: 17BCP304

SEMESTER: III   **CLASS: II M.Sc., BIOCHEMISTRY**

S.No	Duration of Period	Topics to be Covered	Books referred with Page No.	Web page refer red
UNIT I				
1	1	Introduction, sources and routes of administration, structural features and pharmacological activity	T1: 23-27	
2	1	Pro drug concept, excretion of drugs.		
3	1	Adsorption – factors modifying drug absorption and distribution	T2: 4-6	
4	1	Metabolism - phase I, II reactions, action of cytochrome P450	T1: 16-18	
5	1	Excretion of drugs	T1: 18-20	
6	1	Drug receptors – Localization, types and subtypes, models and theories	T1: 29-31	
7	1	G-protein coupled receptor and ion-channel linked receptors	T1: 31-32	
8	1	Examples of drug-receptor interactions		
9	1	Agonists and antagonists. Bioavailability of drug	T1: 29-30	
Total No. of Hours planned for Unit I : 9 hours				
UNIT II				
1	1	Drug tolerance and drug dependence, principles of basic pharmacokinetics	T1: 29-31	

2	1	Adverse response to drugs, drug intolerance, pharmacogenetics,	T1: 36-37	
3	1	Drug allergy, tachyphylaxis, drug abuse, vaccination against infection,	T1: 37-43, T1: 54-56	
4	1	Factors modifying drug action and effect	T2: 376-378	
5	1	Assay of drug potency:		
6		Chemical assay		
7	1	Bioassay	T1: 56-60	
8	1	Immunoassay		
9	1	Revision and Possible QP discussion		

Total No. of Hours planned for Unit II : 9 hours

UNIT III				
1	1	Genetically engineered protein	T1: 3-5	
2	1	Peptide agents as drugs, Novel drug delivery systems	T1: 23-24	W1
3	1	Anti-AIDS drug development	T2: 367-371	
4	1	Oncogenes as targets for drugs	T1: 722-724	
5	1	Multidrug resistance phenotypes	T2: 376-378	
6	1	Production of secondary metabolites		
7	1	Production of secondary metabolites by plant tissue culture		W3
8	1	Genome, Genome based medicine.		
9	1	Revision and Possible QP discussion		

Total No. of Hours planned for Unit III : 9 hours

UNIT IV				
1	1	Mechanism of action of drugs used in therapy of Respiratory system	T1: 340-342	
2	1	Cough, bronchial asthma, pulmonary tuberculosis	T1: 346-350 T1: 735-741	
3	1	Antimicrobial drugs – sulphonamides, Trimethoprim, penicillins	R1: 684-688	
4	1	Aminoglycosides and bacterial resistance		
5	1	Cancer chemotherapy, thyroid and antithyroid drugs	T1: 802-804	
6	1	Insulin and oral antidiabetic drugs	T1: 935-937 T1: 949-952	
7	1	Antifertility and ovulation inducing drugs.	T1: 935-937 T1: 949-952	
8	1	Pharmacotherapy of gout and rheumatoid arthritis	T1: 1016-1019 T1: 1022-1027	
9	1	Immuno therapy – Immunosuppressants and immunostimulants, Enzymes in therapy	T1: 1077-1080 T1: 1048-1050	

Total No. of Hours planned for Unit IV : 9 hours				
UNIT V				
1	1	Brain – Neurotransmitters, encephalins and endorphins; general function of autonomic and somatic nervous system		W3
2	1	Cholinergic transmission and receptors, adrenergic transmission and receptors; muscarinic receptors		
3	1	Non-steroidal and anti-inflammatory drugs, adrenergic blocking drugs	T2: 403-411	
4	1	Cholinergic blocking drugs; muscatrinic blocking drugs	T2: 71-78 T2: 45-48	
5	1	Parkinson's disease		W2
6	1	Alzhiemier's disease		
7	1	Neurodegenerative disorders – Amylotropic, lateral sclerosis		W2
8	1	Senile dementia, schizophrenia, Huntington's disease		
9	1	Revision and Possible QP discussion		
Total No. of Hours planned for Unit V : 9 hours				
Previous year ESE Question Paper Discussion				
1	1	Previous year ESE question paper discussion		
2	1	Objective questions discussion		
3	1	Revision		
Total Hours Planned: 45 + 3 : 48				

REFERENCES

R1: Glick, B.R., Pasternak, J.J., and Patten, C.L., (2009). Molecular Biotechnology, 4th edition, Panima Publishing Corporation, Delhi.

R2: Grahame-Smith, D.G., and Aronson, J. K., (2002). Oxford textbook of Clinical Pharmacology and Drug Therapy: 3rd edition. Oxford University Press.

R3: Foye, W.O., Lemke, T.L., Williams, D.A., (2012). Principles of Medicinal Chemistry, 7th edition, B.I. Wanerly Pvt. Ltd, New Delhi.

R4: Wolf, E.,(1995). Burgers Medicinal Chemistry and Drug Discovery. Principles and Practice, John Wiley and Sons, Manfred.

TEXTBOOKS

T1: Satoskar, R.S., Bhandarkar, S.D., and Ainapare, S.S., (2003). Pharmacology and Pharmacotherapeutics, Popular Prakasham, Mumbai.

T2: Mycek. M.J., R.A. Harvey and P.C. Champe, 2000. Pharmacology 2nd edition, Publishing Lippincott Williams and Wilkins.

R1: Tripathi, K.D, 2008. Essentials of Medical Pharmacology, 6th Edicine, Jaypee brothers medical publisher (P) Ltd, New Delhi.

W1: http://qjmed.oxfordjournals.org/content/92/1/1

W2: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4058009

W3: http://www.wikipida.com/

UNIT-I

SYLLABUS

Drugs – Introduction, sources and routes of administration, Structural features and pharmacological activity, prodrug concept, Adsorption – factors modifying drug absorption. Distribution, metabolism - phase I, II reactions, action of cytochrome P450 and excretion of drugs. Drug receptors – Localization, types and subtypes, models and theories. G-protein coupled receptor and ion-channel linked receptors. Examples of drug-receptor interactions. Agonists and antagonists. Bioavailability of drug

Route of drug administration

Classification

Routes of administration are usually classified by application location (or exposition). The route or course the active substance takes from application location to the location where it has its target effect is usually rather a matter of pharmacokinetics (concerning the processes of uptake, distribution, and elimination of drugs).

Gastrointestinal/enteral

Administration through the gastrointestinal tract is sometimes termed *enteral or enteric administration* (strictly meaning 'through the intestines'). *Enteral/enteric administration* usually includes *oral* (through the mouth) and *rectal* (into the rectum) administration, in the sense that these are taken up by the intestines. Furthermore, some application locations often classified as *enteral*, such as sublingual (under the tongue) and sublabial or buccal (between the cheek and gums/gingiva), are taken up in the proximal part of the gastrointestinal tract without reaching the intestines.

Many drugs as tablets, capsules, or drops are taken orally. Administration methods directly into the stomach include those by gastric feeding tube or gastrostomy.

Central nervous system

epidural (synonym: peridural) (injection or infusion into the epidural space), e.g. epidural anesthesia

intracerebral (into the cerebrum) direct injection into the brain. Used in experimental research of chemicals and as a treatment for malignancies of the brain.

The intracerebral route can also interrupt the blood brain barrier from holding up against

subsequent routes.

intracerebroventricular (into the cerebral ventricles) administration into the ventricular system of the brain.

Other locations

Epicutaneous (application onto the skin). It can be used both for local effect as in allergy testing and typical local anesthesia, as well as systemic effects when the active substance diffuses through skin in a transdermal route.

Intradermal, (into the skin itself) is used for skin testing some allergens, and also for mantoux test for Tuberculosis

Subcutaneous (under the skin), e.g. insulin. Skin popping is a slang term that includes this method of administration, and is usually used in association with recreational drugs.

Nasal administration (through the nose) can be used for topically acting substances, as well as for insufflation of e.g. decongestant nasal sprays to be taken up along the respiratory tract. Such substances are also called *inhalational*, e.g. inhalational anesthetics.

Intravenous (into a vein), e.g. many drugs, total parenteral nutrition

intraarterial (into an artery), e.g. vasodilator drugs in the treatment of vasospasm and thrombolytic drugs for treatment of embolism

Intramuscular (into a muscle), e.g. many vaccines, antibiotics, and long-term psychoactive agents. Recreationally the colloquial term 'muscling' is used.[8]

intracardiac (into the heart), e.g. adrenaline during cardiopulmonary resuscitation (no longer commonly performed)

intraosseous infusion (into the bone marrow) is, in effect, an indirect intravenous access because the bone marrow drains directly into the venous system. This route is occasionally used for drugs and fluids in emergency medicine and pediatrics when intravenous access is difficult.

intrathecal (into the spinal canal) is most commonly used for spinal anesthesia and chemotherapy

intraperitoneal, (infusion or injection into the peritoneum) e.g. peritoneal dialysis

Intravesical infusion is into the urinary bladder.

intravitreal, through the eye

Intracavernous injection, an injection into the base of the penis

Intravaginal, e.g. topical estrogens, antibacterials

Intrauterine

Extra-amniotic administration, between the endometrium and fetal membranes

Route from application to target

The route or course the active substance takes from application location to the location where it has its target effect is usually rather a matter of pharmacokinetics (concerning the processes of uptake, distribution, and elimination of drugs).

1. Transdermal (diffusion through the intact skin for systemic rather than topical distribution), e.g. transdermal patches such as fentanyl in pain therapy, nicotine patches for treatment of addiction and nitroglycerine for treatment of angina pectoris.

2. Transmucosal (diffusion through a mucous membrane), e.g. insufflation (snorting) of cocaine, sublingual, i.e. under the tongue, sublabial, i.e. between the lips and gingiva, nitroglycerine, vaginal suppositories

Local or systemic effect

Routes of administration can also basically be classified whether the effect is local (in topical administration) or systemic (in enteral or parenteral administration):

1. Topical: local effect, substance is applied directly where its action is desired. Sometimes, however, the term *topical* is defined as applied to a localized area of the body or to the surface of a body part, without necessarily involving target effect of the substance, making the classification rather a variant of the classification based on application location.

Topical

Epicutaneous (application onto the skin), e.g. allergy testing, typical local anesthesia

Inhalational, e.g. asthma medications

E, e.g. contrast media for imaging of the bowel

Eye drops (onto the conjunctiva), e.g. antibiotics for conjunctivitis

Ear drops - such as antibiotics and corticosteroids for otitis externa

Through mucous membranes in the body

Enteral

In this classification system, enteral administration is administration that involves any part of the gastrointestinal tract and has systemic effects:

by mouth (orally), many drugs as tablets, capsules, or drops

by gastric feeding tube, duodenal feeding tube, or gastrostomy, many drugs and enteral nutrition

rectally, various drugs in suppository

Parenteral

Intravenous (into a vein), e.g. many drugs, total parenteral nutrition

Intra-arterial (into an artery), e.g. vasodilator drugs in the treatment of vasospasm and thrombolytic drugs for treatment of embolism

intraosseous infusion (into the bone marrow) is, in effect, an indirect intravenous access because the bone marrow drains directly into the venous system. This route is occasionally used for drugs and fluids in emergency medicine and pediatrics when intravenous access is difficult.

Intra-muscular

Advantages and disadvantages

There are advantages and disadvantages to each route of administration

   Inhalation

Advantages

Fastest method, 7–10 seconds for the drug to reach the brain

User can titrate (regulate the amount of drug they are receiving

Disadvantages

Typically a more addictive route of administration because it is the fastest, leading to instant gratification. In addition, drugs taken by inhalation do not stay in the bloodstream for as long, causing the user to redose more quickly and intensifying the

Injection

Injection encompasses intravenous (IV), intramuscular (IM), and subcutaneous (subcut)

Disadvantages

Onset of action is quick, hence more risk of addiction when it comes to injecting drugs of abuse

Patients are not typically able to self-administer. Belonephobia, the fear of needles and injection.

If needles are shared, there is risk of HIV and other infectious diseases

It is the most dangerous route of administration because it bypasses most of the body's natural defenses, exposing the user to health problems such as hepatitis, abscesses, infections, and undissolved particles or additives/contaminants

Absorption (pharmacokinetics)

In pharmacology (and more specifically pharmacokinetics), absorption is the movement of a drug into the bloodstream.

Absorption involves several phases. First, the drug needs to be introduced via some route of administration (oral, via the skin, *etc*.) and in a specific dosage form such as a tablet, capsule, and so on.

In other situations, such as intravenous therapy, intramuscular injection, enteral nutrition and others, absorption is even more straight-forward and there is less variability in absorption and bioavailability is often near 100%.

Dissolution

In the most common situation, a tablet is ingested and passes through the esophagus to the stomach. Because the stomach is an aqueous environment, this is the first place where a tablet may dissolve.

The rate of dissolution is a key target for controlling the duration of a drug's effect, and as such, several dosage forms that contain the same active ingredient may be available, differing only in the rate of dissolution. If a drug is supplied in a form that is not readily dissolved, the drug may be released more gradually over time with a longer duration of action. Having a longer duration of action may improve compliance since the medication will not have to be taken as often. Additionally, slow-release dosage forms may maintain concentrations within an acceptable therapeutic range over a long period of time, as opposed to quick-release dosage forms which may result in sharper peaks and troughs in serum concentrations.

The rate of dissolution is described by the Noyes-Whitney equation as shown below:

$$\frac{dW}{dt} = \frac{DA(C_s - C)}{L}$$

Where:

$$\frac{dW}{dt}$$ is the rate of dissolution.

A is the surface area of the solid.

C is the concentration of the solid in the bulk dissolution medium.

C_s is the concentration of the solid in the diffusion layer surrounding the solid.

D is the diffusion coefficient.

L is the diffusion layer thickness.

Also, coatings on a tablet or a pellet may act as a barrier to reduce the rate of dissolution. Coating may also be used to modify where dissolution takes place. For example, enteric coatings may be applied to a drug, so that the coating only dissolves in the basic environment of the intestines. This will prevent release of the drug before reaching the intestines.

Since solutions are already dissolved, they do not need to undergo dissolution before being absorbed. Lipid-soluble drugs are less absorbed than water-soluble drugs,specially when they are enteral.

Ionization

The gastrointestinal tract is lined with epithelial cells. Drugs must pass or permeate through these cells in order to be absorbed into the circulatory system. One particular cellular barrier that may prevent absorption of a given drug is the cell membrane. Cell membranes are essentially lipid bilayers which form a semipermeable membrane. Pure lipid bilayers are generally permeable only to small, uncharged solutes.

The Henderson-Hasselbalch equation offers a way to determine the proportion of a substance that is ionized at a given pH. In the stomach, drugs that are weak acids (such as aspirin) will be present mainly in their non-ionic form, and weak bases will be in their ionic form. .

Other factors

Other facts that affect absorption include, but are not limited to, bioactivity, resonance, the inductive effect, isosterism, bio-isosterism, and consideration. of physico chemical factors biological factors patient related factors

Distribution (pharmacology)

Distribution in pharmacology is a branch of pharmacokinetics which describes the reversible transfer of drug from one location to another within the body.

The distribution of a drug between tissues is dependent on permeability between tissues (between blood and tissues in particular), blood flow and perfusion rate of the tissue and the ability of the drug to bind plasma proteins and tissue. pH parturition plays a major role as well.

Once a drug enters into systemic circulation by absorption or direct administration, A drug has to be distributed into interstitial and intracellular fluids. The lipid solubility, pH of compartment, extent of binding with plasma protein and tissue proteins, cardiac output, regional blood flow, capillary permeability are associated for distribution of the drug through tissues. The drug is easily distributed in highly perfused organs like liver, heart, kidney etc in large quantities & in small quantities it is distributed in low perfused organs like muscle, fat, peripheral organs etc. The volume of distribution (V_D) of a drug is a property that quantifies the extent of distribution.

Drug metabolism

Drug metabolism is the biochemical modification of pharmaceutical substances by living organisms, usually through specialized enzymatic systems. This is a form of xenobiotic metabolism. Drug metabolism often converts lipophilic chemical compounds into more readily excreted polar products. Its rate is an important determinant of the duration and intensity of the pharmacological action of drugs.

Drug metabolism can result in toxication or detoxication - the activation or deactivation of the chemical. While both occur, the major metabolites of most drugs are detoxication products.

Drugs are almost all xenobiotics. Other commonly used organic chemicals are also xenobiotics, and are metabolized by the same enzymes as drugs. This provides the opportunity for *drug-drug* and *drug-chemical* interactions or reactions.

I reactions can lead either to activation or inactivation of the drug.

Phases

Phase I

Phase I reactions (also termed nonsynthetic reactions) may occur by oxidation, reduction, hydrolysis, cyclization, and decyclization addition of oxygen or removal of hydrogen, carried out by mixed function oxidases, often in the liver. These oxidative reactions typically involve a

cytochrome P450 monooxygenase (often abbreviated CYP), NADPH and oxygen. The classes of pharmaceutical drugs that utilize this method for their metabolism include phenothiazines, paracetamol, and steroids. If the metabolites of phase I reactions are sufficiently polar, they may be readily excreted at this point. However, many phase I products are not eliminated rapidly and undergo a subsequent reaction in which an endogenous substrate combines with the newly incorporated functional group to form a highly polar conjugate.

A common Phase I oxidation involves conversion of a C-H bond to a C-OH. This reaction sometimes converts a pharmacologically inactive compound (a prodrug) to a pharmacologically active one. By the same token, Phase I can turn a nontoxic molecule into a poisonous one ([[toxification>CN. Simple hydrolysis in the stomach transforms. Which are comparatively innocuous. But Phase I metabolism converts acetonitrile to $HOCH_2CN$, which rapidly dissociates into formaldehyde and hydrogen cyanide, both of which are toxic.

Phase I metabolism of drug candidates can be simulated in the laboratory using non-enzyme catalysts.[1] This example of a biomimetic reaction tends to give products that often contains the Phase I metabolites. As an example, the major metabolite of the pharmaceutical trimebutine, desmethyltrimebutine (nor-trimebutine), can be efficiently produced by in vitro oxidation of the commercially available drug. Hydroxylation of an N-methyl group leads to expulsion of a molecule of formaldehyde, while oxidation of the O-methyl groups takes place to a lesser extent.

Oxidation

Cytochrome P450 monooxygenase system

Flavin-containing monooxygenase system

Alcohol dehydrogenase and aldehyde dehydrogenase

Monoamine oxidase

Co-oxidation by peroxidases

Reduction

NADPH-cytochrome P450 reductase

Cytochrome P450 reductase also known as NADPH:ferrihemoprotein oxidoreductase, NADPH:hemoprotein oxidoreductase, NADPH:P450 oxidoreductase, P450 reductase, POR, CPR, CYPOR, is a membrane-bound enzyme required for electron transfer to cytochrome P450 in the

microsome of the eukaryotic cell from a FAD- and FMN-containing enzyme NADPH:cytochrome P450 reductase The general scheme of electron flow in the POR/P450 system is: NADPH → FAD → FMN → P450 → O2

Reduced (ferrous) cytochrome P450

During reduction reactions, a chemical can enter *futile cycling*, in which it gains a free-radical electron, then promptly loses it to oxygen (to form a superoxide anion).

Hydrolysis

Esterases and Amidase

Epoxide hydrolase

Phase II

Phase II reactions - usually known as conjugation reactions (e.g., with glucuronic acid, sulfonates (commonly known as sulfation) , glutathione or amino acids) — are usually detoxication in nature, and involve the interactions of the polar functional groups of phase I metabolites. Sites on drugs where conjugation reactions occur include carboxyl (-COOH), hydroxyl (-OH), amino (NH_2), and sulfhydryl (-SH) groups. Products of conjugation reactions have increased molecular weight and are usually inactive unlike Phase I reactions which often produce active metabolites.

Mechanism	Involved enzyme	Co-factor	Location
Methylation	Methyltransferase	S-adenosyl-L-methionin	Liver, kidney, lung, CNS
Sulphation	Sulfotransferases	3'-phosphoadenosine-5'-phosphosulfate	Liver, kidney, intestine
Acetylation	N-acetyltransferases Bile acid-CoA:amino acid N-acyltransferases	Acetyl coenzyme A	Liver, lung, spleen, gastric mucosa, RBCs, lymphocytes
Glucuronidation	UDP-glucuronosyltransferases	UDP-glucuronic acid	Liver, kidney, intestine, lung, skin, prostate, brain
Glutathione	Glutathione S-transferases	Glutathione	Liver, kidney

conjugation

Sites

Quantitatively, the smooth endoplasmic reticulum of the liver cell is the principal organ of drug metabolism, although every biological tissue has some ability to metabolize drugs. Factors responsible for the liver's contribution to drug metabolism include that it is a large organ, that it is the first organ perfused by chemicals absorbed in the gut, and that there are very high concentrations of most drug-metabolizing enzyme systems relative to other organs. If a drug is taken into the GI tract, where it enters hepatic circulation through the portal vein, it becomes well-metabolized and is said to show the *first pass effect*.

Other sites of drug metabolism include epithelial cells of the gastrointestinal tract, lungs, kidneys, and the skin. These sites are usually responsible for localized toxicity reactions.

Factors that affect drug metabolism

The duration and intensity of pharmacological action of most lipophilic drugs are determined by the rate they are metabolized to inactive products. The Cytochrome P450 monooxygenase system is the most important pathway in this regard. In general, anything that *increases* the rate of metabolism (*e.g.*, enzyme induction) of a pharmacologically active metabolite will *decrease* the duration and intensity of the drug action. The opposite is also true (*e.g.*, enzyme inhibition). However, in cases where an enzyme is responsible for metabolizing a pro-drug into a drug, enzyme induction can speed up this conversion and increase drug levels, potentially causing toxicity.

Various physiological and pathological factors can also affect drug metabolism. Physiological factors that can influence drug metabolism include age, individual variation (*e.g.*, pharmacogenetics), enterohepatic circulation, nutrition, intestinal flora, or sex differences.

In general, drugs are metabolized more slowly in fetal, neonatal and elderly humans and animals than in adults.

Genetic variation (polymorphism) accounts for some of the variability in the effect of drugs. With N-acetyltransferases (involved in *Phase II* reactions), individual variation creates a group of people who acetylate slowly (*slow acetylators*) and those who acetylate quickly, split roughly 50:50 in the population of Canada. This variation may have dramatic consequences, as the slow acetylators

are more prone to dose-dependent toxicity.

Cytochrome P450 monooxygenase system enzymes can also vary across individuals, with deficiencies occurring in 1 - 30% of people, depending on their ethnic background.

Pathological factors can also influence drug metabolism, including liver, kidney, or heart diseases.

In silico modelling and simulation methods allow drug metabolism to be predicted in virtual patient populations prior to performing clinical studies in human subjects.[3] This can be used to identify individuals most at risk from adverse reaction

Excretion

Excretion is the process by which waste products of metabolism and other non-useful materials are eliminated from an organism.[1] It is an essential process in all forms of life. It contrasts secretion, where the substance may have specific tasks after leaving the cell.

In single-celled organisms, waste products are discharged directly through the surface of the cell. Multicellular organisms utilize more complex excretory methods. Higher plants eliminate gases through the stomata, or pores, on the surface of leaves. Animals have special excretory organs

Clearance

In medicine, the clearance is a measurement of the renal excretion ability. Although clearance may also involve other organs than the kidney, it is almost synonymous with renal clearance or renal plasma clearance. Each substance has a specific clearance that depends on its filtration characteristics. Clearance is a function of glomerular filtration, secretion from the peritubular capillaries to the nephron, and reabsorption from the nephron back to the peritubular capillaries.

When referring to the function of the kidney, clearance is considered to be the amount of liquid filtered out of the blood that gets processed by the kidneys or the amount of blood cleaned per time because it has the units of a volumetric flow rate [volume / time].

Effect of plasma protein binding

For substances that exhibit substantial plasma protein binding, clearance is generally defined as the total concentration (free + protein-bound) and not the free concentration.

Most plasma substances have primarily their free concentrations regulated, which thus remains the same, so extensive protein binding increases total plasma concentration (free + protein-bound).

This gives a decreased clearance than what would have been the case with no protein binding. In other sites than the kidneys, however, where clearance is made by membrane transport proteins rather than filtration, extensive plasma protein binding may increase clearance by keeping concentration of free substance fairly constant throughout the capillary bed, inhibiting a decrease in clearance caused by decreased concentration of free substance through the capillary.

Pro drug

A prodrug is any compound that undergoes biotransformation before exhibiting its pharmacological effects. Prodrugs can thus be viewed as drugs containing specialized non-toxic protective groups used in a transient manner to alter or to eliminate undesirable properties in the parent molecule.

A prodrug is a pharmacological substance (drug) administered in an inactive (or significantly less active) form. Once administered, the prodrug is metabolised in vivo into an active metabolite, a process termed bioactivation. The rationale behind the use of a prodrug is generally for absorption, distribution, metabolism, and excretion (ADME) optimization. Prodrugs are usually designed to improve oral bioavailability, with poor absorption from the gastrointestinal tract usually being the limiting factor.

Additionally, the use of a prodrug strategy increases the selectivity of the drug for its intended target. An example of this can be seen in many chemotherapy treatments, in which the reduction of adverse effects is always of paramount importance. Drugs used to target hypoxic cancer cells, through the use of redox-activation, utilise the large quantities of reductase enzyme present in the hypoxic cell to bioactivate the drug into its cytotoxic form, essentially activating it. As the prodrug has low cytotoxicity prior to this activation, there is a markedly lower chance of it "attacking" healthy, non-cancerous cells which reduces the side-effects associated with these chemotherapeutic agents.

In rational drug design, the knowledge of both chemical properties likely to improve absorption and the major metabolic pathways in the body is used to modify the structure of new chemical entities for improved bioavailability. Conversely, the creation of prodrugs is sometimes unintentional, for example with serendipitous drug discoveries, where the drug is only later identified as a prodrug after extensive drug metabolism studies.

Prodrugs can be classified into two major types, based on their cellular sites of bioactivation into the final active drug form, with Type I being those that are bioactivated intracellularly (e.g., anti-viral nucleoside analogs, lipid-lowering statins,), and Type II being those that are bioactivated extracellularly, especially in digestive fluids or the systemic circulation (e.g., etoposide phosphate, valganciclovir, fosamprenavir, antibody-, gene- or virus-directed enzyme prodrugs [ADEP/GDEP/VDEP] for chemotherapy or immunotherapy). Both types can be further categorized into Subtypes, i.e. Type IA, IB and Type IIA, IIB, and IIC based on whether or not the intracellular bioactivating location is also the site of therapeutic action, or the bioactivation occurs in the gastrointestinal (GI) fluids or systemic circulation.

Type IA prodrugs include many antimicrobial and chemotherapy agents (e.g., 5-flurouracil). Type IB agents rely on metabolic enzymes, especially in hepatic cells, to bioactivate the prodrugs intracellularly to active drugs. Type II prodrugs are bioactivated extracelluarly, either in the milieu of GI fluids (Type IIA), within the systemic circulation and/or other extracellular fluid compartments (Type IIB), or near therapeutic target tissues/cells (Type IIC), relying on common enzymes such as esterases and phosphatases or target directed enzymes. Importantly, prodrugs can belong to multiple subtypes (i.e., Mixed-Type). A Mixed-Type prodrug is one that is bioactivated at multiple sites, either in parallel or sequential steps. For example, a prodrug, which is bioactivated concurrently in both target cells and metabolic tissues, could be designated as a "Type IA/IB" prodrug (e.g., HMG Co-A reductase inhibitors and some chemotherapy agents; note the symbol applied here). When a prodrug is bioactivated sequentially, for example initially in GI fluids then systemically within the target cells, it is designated as a "Type IIA-IA" prodrug (e.g., tenofovir disoproxil fumarate; note the symbol applied here). Many ADEPs, VDEPs, GDEPs and futuristic nanoparticle- or nanocarrier-linked drug moieties can understandably be Sequential Mixed-Type prodrugs. To differentiate these two Subtypes, the symbol dash is used to designate and to indicate sequential steps of bioactivation, and is meant to distinguish from the symbol slash used for the Parallel Mixed-Type prodrugs.

Monoacetylmorphine (6-MAM) is a heroin metabolite which converts into active morphine in vivo.

Carisoprodol is metabolized into meprobamate. Carisoprodol is not a controlled substance in the

United States, but meprobamate is classified as a potentially addictive controlled substance that can produce dangerous and painful withdrawal symptoms upon discontinuation of the drug.

Enalapril is bioactivated by esterase to the active enalaprilat.

Valacyclovir is bioactivated by esterase to the active acyclovir.

Fosamprenavir is hydrolysed to the active amprenavir.

Levodopa is bioactivated by DOPA decarboxylase to the active dopamine.

Chloramphenicol succinate ester is used as an intravenous prodrug of chloramphenicol, because pure chloramphenicol does not dissolve in water.

Psilocybin is dephosphorylated to the active psilocin.

Heroin is deacetylated by esterase to the active morphine.

Molsidomine is metabolized into SIN-1 which decomposes into the active compound nitric oxide.

Paliperidone is an atypical antipsychotic for schizophrenia. It is the active metabolite of risperidone.

Prednisone, a synthetic cortico-steroid drug, is bioactivated by the liver into the active drug prednisolone, which is also a steroid.

Primidone is metabolized by cytochrome P450 enzymes into phenobarbital, which is major, and phenylethylmalonamide, which is minor.

Dipivefrine, given topically as an anti-glaucoma drug, is bioactivated to epinephrine.

Lisdexamfetamine is metabolized in the small intestine to produce dextroamphetamine at a controlled (slow) rate for the treatment of attention-deficit hyperactivity disorder

Diethylpropion is a diet pill that does not become active as a monoamine releaser or reuptake inhibitor until it has been *N*-dealkylated to ethylpropion.

Fesoterodine is an antimuscarinic that is bioactivated to tolterodine.

Tenofovir disoproxil fumarate is an anti-HIV drug (NtRTI class) that is bioactivated to tenofovir (PMPA).

Drug theories

Receptor theory

Receptor theory is the application of receptor models to explain drug behaviour. John Newport Langley and Paul Ehrlich introduced the concept of a receptor that would mediate drug action at

the beginning of the 20th century. A J Clark was the first to quantify drug-induced biological responses (using an equation described firstly by A V Hill in 1909 and then in 1910) and propose a model to explain drug-mediated receptor activation.

Receptor occupancy model

The receptor occupancy model, which describes agonist and competitive antagonists, was built on the work of Langley, Hill and Clark. It is based on mass-action kinetics and attempts to link the action of a drug to the proportion of receptors occupied by that drug at equilibrium. In particular, the magnitude of the response is directly proportional to the amount of drug bound, and the maximum response would be elicited once all receptors were occupied at equilibrium. He applied mathematical approaches used in enzyme kinetics systematically to the effects of chemicals on tissues. Classic occupational models of receptor activation failed to provide evidence to directly support the idea that receptor occupancy follows a Langmuir curve as the model assumed leading to the development of alternative models to explain drug behaviour.[12]

Competitive inhibition models

The development of the classic theory of drug antagonism by Gaddum, Schild and Arunlakshana built on the work of Langley, Hill and Clark.. Gaddum described a model for the competitive binding of two ligands to the same receptor in short communication to the Physiological Society in 1937. The description referred only to binding, it was not immediately useful for the analysis of experimental measurements of the effects of antagonists on the response to agonists. In Schild regression, the change in the dose ratio, the ratio of the EC_{50} of an agonist alone compared to the EC_{50} in the presence of a competitive antagonist as determined on a dose response curve used to determine the affinity of an antagonist for its receptor.

Agonist models

The flaw in Clark's receptor-occupancy model was that it was insufficient to explain the concept of partial agonist lead to the development of agonist models of drug action by Ariens in

1954 and by Stephenson in 1956 to account for the intrinsic activity (efficacy) of a drug (that is, its ability to induce an effect after binding).[12][13]

Two-state receptor theory

The two-state model is a simple linear model to describe the interaction between a ligand and its receptor, but also the active receptor (R^*). The model uses an equilibrium dissociation constant to describe the interaction between ligand and receptor. It proposes that ligand binding results in a change in receptor state from an inactive to an active state based on the receptor's conformation. A receptor in its active state will ultimately elicit its biological response.

Ternary complex model

The original Ternary complex model was used to describe ligand, receptor, and G-protein interactions. It uses equilibrium dissociation constants for the interactions between the receptor and each ligand (K_a for ligand A; K_b for ligand B), as well as a cooperativity factor (α) that denotes the mutual effect of the two ligands on each other's affinity for the receptor.

Postulates of receptor theory

- Receptors must possess structural and steric specificity.
- Receptors are saturable and finite (limited number of binding sites)
- Receptors must possess high affinity for its endogenous ligand at physiological concentrations
- Once the endogenous ligand binds to the receptor, some early recognizable chemical event must occur
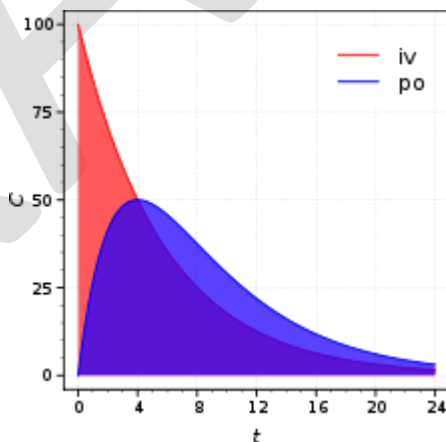
Bioavailability

- In pharmacology, bioavailability (BA) is a subcategory of absorption and is used to describe the fraction of an administered dose of unchanged drug that reaches the systemic circulation, one of the principal pharmacokinetic properties of drugs. By definition, when

a medication is administered intravenously, its bioavailability is 100 %.[1] However, when a medication is administered via other routes (such as orally), its bioavailability generally[TH[›]] decreases (due to incomplete absorption and first-pass metabolism) or may vary from patient to patient. Bioavailability is one of the essential tools in pharmacokinetics, as bioavailability must be considered when calculating dosages for non-intravenous routes of administration.

- For dietary supplements, herbs and other nutrients in which the route of administration is nearly always oral, bioavailability generally designates simply the quantity or fraction of the ingested dose that is absorbed.

- Bioavailability is defined slightly differently for drugs as opposed to dietary supplements primarily due to the method of administration and Food and Drug Administration regulations.

- Bio accessibility is a concept related to bioavailability in the context of biodegradation and environmental pollution. A molecule (often a persistent organic pollutant) is said to be bioavailable when is available to cross an organism's cellular membrane from the environment, if the organism has access to the chemical

Absolute bioavailability

-

Bioavailabilty is a ratio of areas under the curves

- Absolute bioavailability compares the bioavailability of the active drug in systemic circulation following non-intravenous administration (i.e., after oral, rectal, transdermal, subcutaneous, or sublingual administration), with the bioavailability of the same drug following intravenous administration. It is the fraction of the drug absorbed through non-intravenous administration compared with the corresponding intravenous administration of the same drug. The comparison must be dose normalized (e.g. account for different doses or varying weights of the subjects); consequently, the amount absorbed is corrected by dividing the corresponding dose administered.

- Relative bioavailability and bioequivalence

- In pharmacology, relative bioavailability measures the bioavailability (estimated as the AUC) of a formulation (*A*) of a certain drug when compared with another formulation (*B*) of the same drug, usually an established standard, or through administration via a different route. When the standard consists of intravenously administered drug, this is known as absolute bioavailability (see above).

$$F_{rel} = 100 \cdot \frac{AUC_A \cdot D_B}{AUC_B \cdot D_A}$$

- Relative bioavailability is one of the measures used to assess bioequivalence (BE) between two drug products.

Factors influencing bioavailability

- The absolute bioavailability of a drug, when administered by an extravascular route, is usually less than one (i.e. *F* <100 %). Various physiological factors reduce the availability of drugs prior to their entry into the systemic circulation. Whether a drug is taken with or without food will also affect absorption, other drugs taken concurrently may alter absorption and first-pass metabolism, intestinal motility alters the dissolution of the drug and may affect the degree of chemical degradation of the drug by intestinal microflora. Disease states affecting liver metabolism or gastrointestinal function will also have an effect.

- Other factors may include, but are not limited to:

- Physical properties of the drug (hydrophobicity, pKa, solubility)

- The drug formulation (immediate release, excipients used, manufacturing methods, modified release – delayed release, extended release, sustained release, etc.)

- Whether the formulation is administered in a fed or fasted state

- Gastric emptying rate

- Circadian differences

- Interactions with other drugs/foods:

- Interactions with other drugs (e.g. antacids, alcohol, nicotine)

- Interactions with other foods (e.g. grapefruit juice, pomello, cranberry juice, brassica vegetables)

- Transporters: Substrate of efflux transporters (e.g. P-glycoprotein)

- Health of the GI tract

- Enzyme induction/inhibition by other drugs/foods:

- Enzyme induction (increased rate of metabolism), e.g. Phenytoin induces CYP1A2, CYP2C9, CYP2C19, and CYP3A4

- Enzyme inhibition (decreased rate of metabolism), e.g. grapefruit juice inhibits CYP3A → higher nifedipine concentrations

- Individual variation in metabolic differences

- Age: In general, drugs are metabolized more slowly in fetal, neonatal, and geriatric populations

- Phenotypic differences, enterohepatic circulation, diet, gender

Disease state

- e.g. hepatic insufficiency, poor renal function

- Each of these factors may vary from patient to patient (inter-individual variation), and indeed in the same patient over time (intra-individual variation). In clinical trials, inter-individual variation is a critical measurement used to assess the bioavailability differences from patient to patient in order to ensure predictable dosing.

POSSIBLE QUESTIONS

UNIT-I

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Write the pharmacological activity of drug?

2. Briefly describe the pro drug and its concept

3. Given account of Agonist and antagonist

PART-C (8 MARKS)

Explain the Distribution of drug

2. What is Receptor? Explain its types

3. Write account of absorption and first pass effect of drugs

4. Given account of elimination of drug in body

5. Briefly explains the G – protein coupled receptor and ion- Channel linked receptors

6. Discuss about Phase I reactions in Metabolism of drug

7. Describe Phase II reactions in metabolism of drug

Karpagam academy of higher education
Department of biochemistry
Drug Biochemistry (17BCP304) MCQ
UNIT I

S.No	Unit	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	I	Pharmacokinetics is:	The study of biological and therapeutic effects	The study of absorption, distribution, metabolism	The study of mechanisms of drug	The study of methods of new drug	**The study of absorption,**
2	I	The main mechanism of drugs absorption in GI tract :	Active transport (carrier-mediated diffusion)	Filtration (aqueous diffusion)	Endocytosis and exocytosis	Passive diffusion (lipid diffusion)	**Passive diffusion (lipid diffusion)**
3	I	What does the term "bioavailability" mean?	Plasma protein binding degree of substance	Permeability through the brain-blood barrier	Fraction of an uncharged drug reaching the systemic	Amount of a substance in urine relative to the initial dose	**Fraction of an uncharged drug reaching the systemic**
4	I	Which route of drug	Sublingual	Oral	Intravenous	Intramuscular	**Oral**
5	I	The volume of distribution (Vd) relates:	Single to a daily dose of an administrated drug	An administrated dose to a body weight	An uncharged drug reaching the systemic	The amount of a drug in the body to the	**The amount of a drug in the body to the**
6	I	Metabolic transformation (phase 1) is:	Acetylation and methylation of	Transformation of substances due to	Glucuronide formation	Binding to plasma proteins	**Transformation of substances due to**
7	I	Which organ involved in first	Heart	Kidney	Brain	Liver	**Liver**
8	I	Which one of the following is not a route of administration?	Intravenous	Oral	Topical	Dissolution	**Dissolution**
9	I						
10	I	Which of the following processes proceeds in the second	Acetylation	Reduction	Oxidation	Hydrolysis	**Acetylation**
11	I	Which enzyme is involved in	Catalase	Polyphenol oxidase	Cytochorome p450 MO	Oxygenase	**Cytochorome p450**
12	I	Cytochorome p450 MO is found	Heart	Liver	Brain	Kidney	**Liver**
13	I	Dichloroisopropylarterenol	Alpha adrenergic	Beta adrenergic receptors	Both alpha and beta	Gamma adrenergic	**Beta adrenergic**
14	I	Half life (t ½) is the time required to:	Change the amount of a drug in plasma by half	Metabolize a half of an introduced drug into the	Absorb a half of an introduced drug	Bind a half of an introduced drug to	**Change the amount of a drug in plasma by**
15	I	Irreversible interaction of an	Ionic bonds	Hydrogen bonds	Covalent bonds	Sulphur bond	**Covalent bonds**
16	I	The second messenger of G-	Adenylyl cyclase	Sodium ions	Phospholipase C	cAMP	**cAMP**

#		Question					Answer
17	I	Give the definition for a therapeutical dose:	The amount of a substance to produce the cAMP	The amount of a substance to produce effects cGMP	The amount of a substance to produce G–protein	The amount of a substance to accelerate Calcium ions	**The amount of a substance to produce G–protein**
18	I	The substance which changes the activity of an effector					
19	I	An agonist can produce	Partial agonist	Antagonist	Agonist-antagonist	Full agonist	**Partial agonist**
20	I	Conjugation is:	Process of drug reduction by special	Process of drug oxidation by special oxidases	Coupling of a drug with an endogenous	Solubilization in lipids	**Coupling of a drug with an endogenous**
21	I	What is implied by "active transport"?	Transport of drugs trough a membrane by	Transport without energy consumption	Engulf of drug by a cell membrane with a new	Transport against concentration gradient	**Transport against concentration gradient**
22	I	What kind of substances can't	Lipid-soluble	Non-ionized substances	Hydrophobic	Hydrophilic	**Hydrophilic**
23	I	The reasons determining bioavailability are:	Rheological parameters of blood	Amount of a substance obtained orally and	Extent of absorption and hepatic first-pass	Glomerular filtration rate	**Extent of absorption and hepatic first-pass**
24	I	For the calculation of the	Concentration of a	Concentration of substance	Therapeutical width of	A daily dose of drug	**Concentration of a**
25	I	Biotransformation of a	Faster urinary excretion	Slower urinary excretion	Easier distribution in	Higher binding to	**Faster urinary**
26	I	The organelle that carry	Endoplasmic reticulam	Golgi complex	Mitochondria	Mitochondria	**Endoplasmic**
27	I	Conjugation of a drug includes	Glucoronidation	Sulfate formation	Hydrolysis	Methylation	**Hydrolysis**
28	I	The phase II reaction which produce a compound with	Glucoronic acid conjugation	Conjugation with amino acid	Methylation	Glutathione conjugation	**Methylation**
29	I	Elimination is expressed as follows:	Rate of renal tubular reabsorption	Clearance speed of some volume of blood from	Time required to decrease the amount of	Clearance of an organism from a	**Clearance of an organism from a**
30	I	Acidic drug rapidly absorbed at	Stomach	GI tract	Large intestine	Mouth	**Stomach**
31	I	Coenzyme required by	NADH	NADPH	Lipoic acid	TPP	**NADPH**
32	I	Basic drugs are absorbed in	small intestine	stomach	Large intestine	Pancreas	**small intestine**
33	I	Which effect may lead to toxic reactions when a drug is taken	Refractoriness	Cumulative effect	Tolerance	Tachyphylaxis	**Cumulative effect**
34	I	What term is used to describe a more gradual decrease in	Refractoriness	Cumulative effect	Tolerance	Tachyphylaxis	**Tolerance**
35	I	What term is used to describe a decrease in responsiveness to a	Refractoriness	Cumulative effect	Tolerance	Tachyphylaxis	**Tachyphylaxis**
36	I	Which drug that cross the lipid	Water soluble drug	lipid soluble drug	ionsoluble drug	Non ionsoluble drug	**lipid soluble drug**
37	I	Science that deals with drug	Pharmacy	pharmacognosy	pharmacodynamics	pharmacology	**pharmacology**
38	I	Inhibition of MAO causses an	decrease in the deamination of	increasse in the deamination of dopamine	increase in the deamination of	decrease in the deamination of	**decrease in the deamination of**

#		Question	A	B	C	D	Answer
39	I	Systemic clearance (CLs) is related with:	Only the concentration of substances in plasma	Only the elimination rate constant	Volume of distribution, half life and elimination	Bioavailability and half life	**Volume of distribution, half life**
40	I	Elimination rate constant (Kelim) is defined by the	Rate of absorption	Maximal concentration of a substance in plasma	Highest single dose	Half life (t ½)	**Half life (t ½)**
41	I	Half life (t ½) is the time required to:	Change the amount of a drug in plasma by half	Metabolize a half of an introduced drug into the	Absorb a half of an introduced drug	Bind a half of an introduced drug to	**Change the amount of a drug in plasma by**
42	I	Aspirin is chemically	Sodium salicylate	Acetylsalicylic acid	Salicylamide	Sodium salicylamide	**Acetylsalicylic acid**
43	I	Which is the most appropriate to the term "receptor"	All types of ion channels modulated by a drug	Enzymes of oxidizing-reducing reactions activated by a drug	Active macromolecular components of a cell or an organism which a	Carriers activated by a drug	**Active macromolecular components of a cell or**
44	I	What does "affinity" mean?	A measure of how tightly a drug binds to	A measure of how tightly a drug binds to a receptor	A measure of inhibiting potency of a drug	A measure of bioavailability of a	**A measure of how tightly a drug binds to**
45	I	A measure of bioavailability of a drug	A measure of how tightly a drug binds to a	An agonist is a substance that:	Interacts with the receptor without	Interacts with the receptor and initiates	**Increases concentration of**
46	I	An agonist is a substance that:	Interacts with the receptor without producing any effect	Interacts with the receptor and initiates changes in cell function, producing	Increases concentration of another substance to produce effect	Interacts with plasma proteins and doesn't produce any effect	**Interacts with the receptor and initiates changes in cell**
47	I	An antagonist is a substance that:	Binds to the receptors and initiates changes in cell function, producing	Binds to the receptors and initiates changes in cell function, producing	Interacts with plasma proteins and doesn't produce any effect	Binds to the receptors without directly altering their functions	**Binds to the receptors without directly altering their functions**
48	I	A competitive antagonist is a substance that:	Interacts with receptors and produces sub maximal effect	Binds to the same receptor site and progressively inhibits the agonist	Binds to the nonspecific sites of tissue	Binds to one receptor subtype as an agonist and to another as an	**Binds to the same receptor site and progressively inhibits**
49	I	The substance binding to one receptor subtype as an agonist	Competitive antagonist	Irreversible antagonist	Agonist-antagonist	Partial agonist	**Agonist-antagonist**
50	I	Irreversible interaction of an	Ionic bonds	Hydrogen bonds	Covalent bonds	Weak bonds	**Covalent bonds**
51	I	Tick the second messenger of G-	Adenylyl cyclase	Sodium ions	Phospholipase C	cAMP	**cAMP**
52	I	What is the type of drug-to-drug interaction which is connected	Pharmacodynamic interaction	Physical and chemical interaction	Pharmaceutical interaction	Pharmacokinetic interaction	**Pharmacokinetic interaction**
53	I	Chloramphenicol is derived	Streptomyces venezulae	Streptomyces griseus	Streptomyces	Pencillin	**Streptomyces griseus**
54	I	A hydrophilic medicinal agent has the following property:	Low ability to penetrate through the cell	Penetrate through membranes by means of	Easy permeation through the blood-brain	High reabsorption in renal tubules	**Low ability to penetrate through the**

55	I	The feature of the sublingual route:	Pretty fast absorption	A drug is exposed to gastric secretion	A drug is exposed more prominent liver	A drug can be administrated in a	**Pretty fast absorption**
56	I	Pick out the parenteral route of	Rectal	Oral	Sublingual	Inhalation	**Inhalation**
57	I	Parenteral administration:	Cannot be used with unconsciousness patients	Generally results in a less accurate dosage than oral	Usually produces a more rapid response	Is too slow for emergency use	**Usually produces a more rapid response**
58	I	Volume of distribution (Vd) one	Concentration of a	Concentration of substance	Therapeutical width of	A daily dose of drug	**Concentration of a**
59	I	Biotransformation of the drugs	Less ionized	More pharmacologically	More lipid soluble	Less lipid soluble	**Less lipid soluble**
60	I	Tick the drug type for which	Lipid soluble	Water soluble	Low molecular weight	High molecular weight	**Lipid soluble**

KARPAGAM UNIVERSITY
DEPARTMENT OF BIOCHEMISTRY
II M.Sc., BIOCHEMISTRY
MULTIPLE CHOICE QUESTIONS
Drug **Biochemistry**-17BCP304

UNIT-II

SYLLABUS

Drug tolerance and drug dependence. Principles of basic pharmacokinetics. Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, vaccination against infection, factors modifying drug action and effect. Assay of drug potency: chemical, bioassay and immunoassay.

Adverse Drug Reactions

Drug hypersensitivity results from interactions between a pharmacologic agent and the human immune system. These types of reactions constitute only a small subset of all adverse drug reactions. Allergic reactions to medications represent a specific class of drug hypersensitivity reactions mediated by IgE. Immune-mediated drug reactions may be discussed generally in the Gell and Coombs classification system, a widely accepted conceptual framework for understanding complex immune reactions. However, some reactions involve additional, poorly understood mechanisms that are not easily classified. Identifiable risk factors for drug hypersensitivity reactions include age, female gender, concurrent illnesses, and previous hypersensitivity to related drugs. Drug hypersensitivity is a clinical diagnosis based on available data. Laboratory testing may be useful, with skin testing providing the greatest specificity. Treatment is largely supportive and includes discontinuation of the offending medication, symptomatic treatment, and patient education. Patients with penicillin allergy should avoid carbapenems, and caution should be used in prescribing cephalosporins in these patients. Reactions to radiocontrast media can be limited by pretreatment with prednisone, diphenhydramine, and either ephedrine or a histamine H_2-receptor antagonist.

Adverse drug reactions are common. Identifying true drug allergy, however, can be challenging. Complicating factors of drug reactions include the myriad clinical symptoms and multiple mechanisms of drug-host interaction, many of which are poorly understood. In addition, the relative paucity of laboratory testing that is available for drug allergy makes the diagnosis dependent on clinical findings.

TABLE 1

Immunologic and Non immunologic Drug Reactions

Type	*Example*
Immunologic	
Type I reaction (IgE-mediated)	Anaphylaxis from β-lactam antibiotic
Type II reaction (cytotoxic)	Hemolytic anemia from penicillin
Type III reaction (immune complex)	Serum sickness from anti-thymocyte globulin
Type IV reaction (delayed, cell-mediated)	Contact dermatitis from topical antihistamine
Specific T-cell activation	Morbilliform rash from sulfonamides
Fas/Fas ligand-induced apoptosis	Stevens-Johnson syndrome
	Toxic epidermal necrolysis
Other	Drug-induced, lupus-like syndrome
	Anticonvulsant hypersensitivity syndrome
Nonimmunologic	
Predictable	
Pharmacologic side effect	Dry mouth from antihistamines
Secondary pharmacologic side effect	Thrush while taking antibiotics
Drug toxicity	Hepatotoxicity from methotrexate
Drug-drug interactions	Seizure from theophylline while taking erythromycin
Drug overdose	Seizure from excessive lidocaine (Xylocaine)
Unpredictable	
Pseudoallergic	Anaphylactoid reaction after radiocontrast media
Idiosyncratic	Hemolytic anemia in a patient with G6PD deficiency after primaquine therapy

Type	Example
Intolerance	Tinnitus after a single, small dose of aspirin

Drug Interactions

The effect a drug has on a person may be different than expected because that drug interacts with

- Another drug the person is taking (drug-drug interaction)

- Food, beverages, or supplements the person is consuming (drug-nutrient interaction)

- Another disease the person has (drug-disease interaction).

The effects of drug interactions are usually unwanted and sometimes harmful. Interactions may increase or decrease the actions of one or more drugs, resulting in side effects or failed treatment.

DRUG-DRUG INTERACTIONS

Drug-drug interactions can involve prescription or nonprescription (over-the-counter) drugs. Types of drug-drug interactions include duplication, opposition (antagonism), and alteration of what the body does to one or both drugs.

Drug intolerance

Drug intolerance or drug sensitivity is a lower threshold to the normal pharmacologic action of a drug. It is not to be confused with drug allergy. Drug intolerance is uncommon and idiopathic, thus extremely difficult to predict except in persons with a prior history or a family history of intolerance to that specific drug. Some drug intolerances are known to result from genetic variants of drug metabolism.

Examples

• Tinnitus after a normal dose of aspirin

• Liver failure (possibly also kidney failure) after a normal dose of acetaminophen

• Fatal poisoning in a breastfed newborn baby due to normal use of codeine by the mother.

Analgesic intolerance

Intolerance to analgesics, particularly NSAIDs, is relatively common. Its cause is believed to be variation in the metabolism of arachidonic acid. Symptoms include chronic rhinosinusitis with nasal polyps, asthma, gastrointestinal ulcers, angioedema, and urticaria.

Idiosyncratic drug reaction

Idiosyncratic drug reactions, also known as type B reactions, are drug reactions which occur rarely and unpredictably amongst the population. This is not to be mistaken with idiopathic which implies that the cause is not known. They frequently occur with exposure to new drugs, as they have not been fully tested and the full range of possible side effects have not been discovered; they may also be listed as an adverse drug reaction with a drug, but be extremely rare.

Some patients have multiple-drug intolerance. Patients who have multiple idiopathic effects that are nonspecific are more likely to have anxiety and depression. Idiosyncratic drug reactions appear to not be concentration dependent. A minimal amount of drug will cause an immune response, but it is suspected that at a low enough concentration, a drug will be less likely to initiate an immune response.

Mechanism

In adverse drug reactions involving overdoses, the toxic effect is simply an extension of the pharmacological effect (Type A adverse drug reactions). On the other hand, clinical symptoms of idiosyncratic drug reactions (Type B adverse drug reactions) are different than the pharmacological effect of the drug. The proposed mechanism of most idiosyncratic drug reactions is immune mediated toxicity. To create an immune response, you must have a foreign molecule that antibodies can bind to (ie. the antigen) and you must have cellular damage. Very often, drugs will not be immunogenic because they are too small to bind antibodies. However, a drug can cause an immune response if the drug binds a larger molecule. Some unaltered drugs such as penicillin will bind avidly to proteins. Others must be bioactivated into a toxic compound that will in turn bind to proteins. The second criteria of cellular damage can come either from a toxic drug/drug metabolite or it may come from an injury or infection. These will sensitize the immune system to the drug and cause a response. Idiosyncratic reactions fall conventionally under toxicology

Drug allergy

A drug allergy is an allergy to a drug, most commonly a medication. Medical attention should be

sought immediately if an allergic reaction is suspected. An allergic reaction will not occur on the first exposure to a substance. The first exposure allows the body to create antibodies and memory lymphocyte cells for the antigen. However, drugs often contain many different substances, including dyes, which could cause allergic reactions. This can cause an allergic reaction on the first administration of a drug. For example, a person who developed an allergy to a red dye will be allergic to any new drug which contains that red dye. A drug allergy is different from an intolerance. A drug intolerance, which is often a milder, non-immune-mediated reaction, does not depend on prior exposure. Most people who believe they are allergic to aspirin are actually suffering from a drug intolerance. Risk factors a drug allergy is more likely to develop with large doses and extended exposure. Common drug allergens when a medication causes an allergic reaction, it is called an allergen. The following is a short list of the most common drug allergens:

• Antibiotics

• Penicillin

• Sulfa drugs

• Tetracycline

• Analgesics

• Codeine

• Non-steroidal anti-inflammatory drugs (NSAIDs)

• Antiseizure

• Phenytoin

• Carbamazepine.

Tachyphylaxis

Tachyphylaxis is a medical term describing a decrease in the response to a drug due to previous exposure to that drug. Increasing the dose of the drug may be able to restore the original response. In this context tachyphylaxis is a synonym for drug tolerance. This can sometimes be caused by depletion or marked reduction of the amount of neurotransmitter responsible for creating the drug's effect, or by the depletion of receptors available for the drug or neurotransmitter to bind to. This depletion is caused by the cell's reducing the number of receptors in response to their saturation. Examples: Amphetamine, ephedrine, MDMA (indirectly acting drugs) Tachyphylaxis is

characterized by the rate sensitivity: The response of the system depends on the rate with which a stimulus is presented. To be specific, a high-intensity prolonged stimulus or often-repeated stimulus may bring about a diminished response also known as desensitization. In biological sciences, molecular interactions are the physical bases of the operation of the system. The control of the operation, in general, involves interaction of a stimulus molecule with a receptor/enzyme subsystem by, typically, binding to the macromolecule A and causing an activation or an inhibition of the subsystem by forming an activated form of the macromolecule B. The following schematic represents the activity:

A --------> B

Where p is the activation rate coefficient. It is customary that p is called a rate constant, but, since the p stands for

measure of the intensity of the stimulus causing the activation, p may be variable (non-constant). The above scheme is only the necessary condition for the rate sensitivity phenomenon, and other pathways of deactivation of B may be considered, with the subsequent return to the inactive form of the receptor/enzyme A. Examples offer particular use of such (mathematical) models in endocrinology, physiology and pharmacology.

Examples

Examples of tachyphylaxes are the following:

• Calcitonin demonstrates tachyphylaxis in 2–3 days when being used to treat hypercalcemia of malignancy. This

reaction is anticipated and calcitonin is given along with biphosphonates, which have their maximum effect in 2–3 days.

• Nitroglycerine demonstrates tachyphylaxis, requiring drug-free intervals when administered transdermally

• Repeated doses of ephedrine may display tachyphylaxis, since it is an indirectly acting sympathomimetic amine, which will deplete noradrenaline from the nerve terminal. Thus, repeated doses result in less noradrenaline released than the initial dose.

• Nicotine may also show tachyphylaxis over the course of a day, although the mechanism of this action is unclear.

• Hydralazine displays tachyphylaxis if given as a monotherapy for antihypertensive treatment. It is administered with a beta-blocker with or without a diuretic.

• Metoclopramide is another example.

• Dobutamine, a direct-acting beta agonist used in congestive heart failure, also demonstrates tachyphylaxis.

• Desmopressin used in the treatment of type 1 von Willebrand disease is, in general, given every 12–24 hours in limited numbers due to its tachyphylactic properties.

• Hormone replacement when used in menopausal women in the form of estrogen and progesterone implants is cited as having potential to lead to tachyphylaxis, but that citation is based on a single study done in 1990 and no followup research is available to support this interpretation. Tachyphylaxis 2

• Psychedelics such as LSD-25 and psilocybin-containing mushrooms demonstrate very rapid tachyphylaxis. In other words, one may be unable to 'trip' two days in a row. Some people are able to 'trip' by taking up to three times the dosage, yet some users may not be able to negate tachyphylaxis at all until a period of days has gone by In a patient fully withdrawn from centrally-acting analgesics, viz. opioids, going back to an intermittent schedule or maintenance dosing protocol, a fraction of the old tolerance level will rapidly develop, usually starting two days after opioid therapy is resumed and, in general, leveling off after day 7. Whether this is caused directly by opioid receptors modified in the past or effecting a change in some metabolic set-point is unclear. Increasing the dose will usually restore efficacy; relatively rapid opioid rotation may also be of use if the increase in tolerance continues.

Drug abuse

Drug abuse also known as drug abuse, refers to a maladaptive pattern of use of a substance that is not considered dependent. The term "drug abuse" does not exclude dependency, but is otherwise used in a similar manner in nonmedical contexts. The terms have a huge range of definitions related to taking a psychoactive drug or performance enhancing drug for a non-therapeutic or non-medical effect. All of these definitions imply a negative judgment of the drug use in question (compare with the term responsible drug use for alternative views). Some of the drugs most often associated with this term include alcohol, amphetamines, barbiturates,

benzodiazepines (particularly temazepam, nimetazepam, and flunitrazepam), cocaine, methaqualone, and opioids. Use of these drugs may lead to criminal penalty in addition to possible physical, social, and psychological harm, both strongly depending on local jurisdiction Other definitions of drug abuse fall into four main categories: public health definitions, mass communication and vernacular usage, medical definitions, and political and criminal justice definitions. Substance abuse is a form of substance-related disorder.

Drug misuse

Drug misuse is a term used commonly for prescription medications with clinical efficacy but abuse potential and known adverse effects linked to improper use, such as psychiatric medications with sedative, anxiolytic, analgesic, or stimulant properties. Prescription misuse has been variably and inconsistently defined based on drug prescription status, the uses that occur without a prescription, intentional use to achieve intoxicating effects, route of administration, co-ingestion with alcohol, and the presence or absence of abuse or dependence symptoms.

Multiple drug resistance

Multiple drug resistance or Multidrug resistance is a condition enabling a disease-causing organism to resist distinct drugs or chemicals of a wide variety of structure and function targeted at eradicating the organism. Organisms that display multidrug resistance can be pathologic cells, including bacterial and neoplastic (tumor) cells.

Common MultiDrug-Resistant Organisms (MDROs)

• Vancomycin Resistant Enterococci (VRE)

• Methicillin Resistant *Staphylococcus aureus* (MRSA)

• Extended spectrum ß-lactamse (ESBLs) producing Gram-negative bacteria

• *Klebsiella pneumoniae* carbapenemase (KPC) producing Gram-negatives

• Imipenem resistant or MultiDrug Resistant Organisms *Acinetobacter baumannii*

• Imipenem resistant or MultiDrug Resistant Organisms *Pseudomonas aerginosa*

Bacterial resistance to antibiotics

Various microorganisms have survived for thousands of years by their being able to adapt to antimicrobial agents. They do so via spontaneous mutation or by DNA transfer. This process enables some bacteria to oppose the assault of certain antibiotics, rendering the antibiotics

ineffective. These microorganisms employ several mechanisms in attaining multidrug resistance:

• No longer relying on a glycoprotein cell wall

• Enzymatic deactivation of antibiotics

• Decreased cell wall permeability to antibiotics

• Altered target sites of antibiotic

• Efflux mechanisms to remove antibiotics

• Increased mutation rate as a stress response

Neoplastic resistance

Cancer cells also have the ability to become resistant to multiple different drugs, and share many of the same mechanisms:

• **Increased efflux of drug** (as by P-glycoprotein, multidrug resistance-associated protein, lung resistance-related protein, and breast cancer resistance protein & reproductive cancer resistance protein)

• Enzymatic deactivation (i.e., glutathione conjugation)

• Decreased permeability (drugs cannot enter the cell)

• Altered binding-sites

• Alternate metabolic pathways (the cancer compensates for the effect of the drug).

 Dose-response relationship

Semi-log plots of two agonists with different Kd. The **dose-response relationship**, or **exposure-response relationship**, describes the change in effect on an organism caused by differing levels of exposure (or doses) to a stressor (usually a chemical) after a certain exposure time. This may apply to individuals (e.g.: a small amount has no significant effect, a large amount is fatal), or to populations (e.g.: how many people or organisms are affected at different levels of exposure). Studying dose response, and developing

Dose response models, is central to determining "safe" and "hazardous" levels and dosages for drugs, potential pollutants, and other substances to which humans or other organisms are exposed. These conclusions are often the basis for public policy. The U.S.Environmental Protection Agency has developed extensive guidance and reports on dose-response modeling and assessment, as well as software it should be realized that dose-response relationships will generally depend on the

exposure time and exposure route

(e.g., inhalation, dietary intake); quantifying the response after a different exposure time or for a different route leads to a different relationship and possibly different conclusions on the effects of the stressor under consideration. This limitation is caused by the complexity of biological systems and the often unknown biological processes operating between the external exposure and the adverse cellular or tissue response.

Assay of Drug

Bioassay (commonly used shorthand for biological assay), or biological standardization is a type of scientific experiment. Bioassays are typically conducted to measure the effects of a substance on a living organism and are essential in the development of new drugs and in monitoring environmental pollutants. Both are procedures by which the potency (pharmacology) or the nature of a substance is estimated by studying its effects on living matter. Response that it produces. Quantitative bioassays are typically analyzed using the methods of biostatistics.

Types

- Chemicl assay
- Bio assay
- Immuno assay

POSSIBLE QUESTIONS

UNIT-II

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Write account of receptor interaction

2. Given account on drug allergy

3. Explain the adverse response of drugs

4. Write short notes on tachyphylaxis

5. Briefly discuss the drug tolerance

PART-C (8 MARKS)

1. Explain the drug abuse

2. Discuss about drug-intolerance

3. Describe the multidrug resistance phenotypes

4. What are the different factors that modify the effect of drug?

5. Write the assay of drug potency

Karpagam academy of higher education
Department of biochemistry
Drug Biochemistry (17BCP304) MCQ
UNIT II

S.No	Unit	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	II	Cell surface receptors are	C protein	G-protein coupled	Protein A tyrosine	Protein A B tyrosine	**G-protein coupled receptors**
2	II	The receptor serves as	Recognition	Non recognition	Target sites	Active sites	**Recognition molecule**
3	II	Which one of the following not	Tyrosine	Steroid receptors	ion channel linked	G- protein coupled	**steroid receptors**
4	II	When the person remains well only when he is taking the drug is termed	psychic dependence	physical dependence	withdrawal syndrome	Non Psychic dependence	**physical dependence**
5	II	If the abusing drug is withdrawn the	Abstinence	physical dependence	Tolerance	psychic dependence	**Abstinence**
6	II	If a greater dose of the drug is required to elicit the normal	dependence	abstinence	tolerance	intolerance	**tolerance**
7	II	Th 1 cells	enhance CMI	enhance humoral	inhibit CMI	inhibit humoral	**enhance CMI**
8	II	If the drug is disposed more speedily		pharmacodynamic	psychic tolerance	drug intolerance	**pharmacokinetic tolerance**
9	II	A repeated injection of egg albumin in such an animalcauses a violent	cytotoxic type reaction	cell mediated reaction	immune complex mediated reaction	anaphylaxis	**anaphylaxis**
10	II	A state where some changes develop in the tissue leading to less	pharmacokinet	pharmacodynamic tolerance	psychic tolerance	drug intolerance	**pharmacodynamic tolerance**
11	II	Best example of psychic	cigarette	barbiturates	sulphonamides	salicylates	**cigarette smoking**
12	II	The state when the person seeks	drug	physical dependence	psychic	pathological	**psychic dependence**
13	II	bstances like lead can remain deposited in bones without	passive immunization	additive effect	antagonism	synergism	**passive immunization**
14	II	Inflammatory reactions initiated by mononuclear lymphocytes and not	type I hypersensitivit	type II hypersensitivity	delayed hypersensitivity	type III hypersensitivity	**delayed hypersensitivity**
15	II	Methadone is	agonist of	antagonist of opioid	agonist of μ	antagonist of μ	**agonist of opioid receptors**
16	II	Opioids used for abusing are by	CNS	CNS depressants	CVS stimulants	CVS depressants	**CNS depressants**
17	II	The drug naltrexone is	agonist of	antagonist of opioid	agonist of μ	antagonist of μ	**antagonist of opioid receptors**
18	II	The drugs used to treat abusing of	Ibu brufen	methadone	Diclofenac	Analgesic	**methadone**

No.	Sec	Question	A	B	C	D	Answer
19	II	If the opioid abusers are doctors,nurses and other health	methadone	methadyl acetate	naltrexone	pethidine	**pethidine**
20	II	Amphetamine is an	antifatigue	fatigue agent	nausea inducer	heroin	**antifatigue agent**
21	II	Polydrug abuse common in USA is	cocaine and	heroin and	amphetamine and	nicotine	**cocaine and heroin**
22	II	The half life of cocaine is	2 hrs	3 hrs	15 hrs	1hr	**1hr**
23	II	Drug used for the treatment of	Naproxen	amphetamine	diazepam	Ibu brufen	**diazepam**
24	II	The mechanism of action of	blocking of	blocking of α and β	blocking of K^+	blocking of P^+	**blocking of α and β receptor**
25	II	The mechanism of action of	blocking of	blocking of α and β	blocking of K^+	blocking of P^+	**blocking of Ca^{2+} channel**
26	II	The drug of choice for CNS	labetalol	nifedipine	diazepam	sulphonamides	**diazepam**
27	II	The craving of cocaine is reduced	labetalol	nifedipine	desipramine	diazepam	**desipramine**
28	II	LSD causes -------------- of	hyper activity	hypo activity	normal activity	less activity	**hypo activity**
29	II	The half life of LSD is	1 hr	2 hrs	3 hrs	4 hrs	**3 hrs**
30	II	The active principle of cannabis is	diazepam	nifedipine	cannabinol	Ibu brufen	**cannabinol**
31	II	A repeated injection of egg albumin in such an animal causes a violent	Cytotoxic type reaction	Cell mediated reaction	Immune complex mediated reaction	Anaphylaxis	**Anaphylaxis**
32	II	The drug naltrexone is	Agonist of	Antagonist of opioid	Agonist of morphine	Antagonist of	**Antagonist of opioid receptors**
33	II	The average dose of drug is	mg per kg	µg per kg body weight	kg per kg body	Cal per kg body	**mg per kg body weight**
34	II	The pharmacokinetics of drug	sex	height	weight	age	**age**
35	II	The body surface area is calculated	height and	height and weight	weight and age	weight alone	**height and weight**
36	II	What type of drugs should be avoided during menstruation	drugs likely to produce pelvic	drugs which may stimulate uterine smooth	nephrotoxic drugs	neurotoxic drugs	**drugs likely to produce pelvic congestion**
37	II	Consumption of alcohol enhances	CNS	CNS stimulants	PNS depressants	PNS stimulants	**CNS depressants**
38	II	The chances of drug toxicity is	IV route	orally	IM route	Rectal route	**IV route**
39	II	Aspirin reduces body temperature	pyrexia	angina pectoris	bronchial asthma	congestive cardiac	**pyrexia**
40	II	The vasoconstrictor effect of	metabolic	metabolic acidosis	myxedema	pyrexia	**metabolic acidosis**
41	II	In myxedema, morphine acts for a	acylation	reduction	oxidation	hydration	**oxidation**
42	II	Both tobacco smoke and alcohol	renal enzymes	cardiac enzymes	liver enzymes	Kidney enzymes	**liver enzymes**
43	II	The phenomenon of the total pharmacological action of two or more drugs Administered together is	an synergism	an antagonism	a drug intolerance	an addictive effect	**an addictive effect**
44	II	Facilitation of a pharmacological response by the concomitant use of	antagonism	synergism	additive effect	drug intolerance	**synergism**

No.		Question	a	b	c	d	Answer
45	II	The phenomenon of opposing actions of two drugs on the same	drug antagonism	synergism	additive effect	drug intolerance	**drug antagonism**
46	II	The phenomenon of an unusually large dose of a drug is required to	tolerance	drug tolerance	antagonism	synergism	**drug tolerance**
47	II	The development of tolerance is confined to certain effects or to	cross tolerance	racial tolerance	tissue tolerance	species tolerance	**tissue tolerance**
48	II	Functional tolerance is otherwise		pharmacogenetic	acquired tolerance	tachyphylaxis	**pharmacodynamic tolerance**
49	II	If drugs like ephedrine, tyramine etc are administered repeatedly as very short Intervals, the pharmacological	true tolerance	functional tolerance	antagonism	tachyphylaxis	**tachyphylaxis**
50	II	chyphylaxis is otherwise known as	acquired	acute tolerance	tissue tolerance	true tolerance	**acute tolerance**
51	II	Determination of the amount of biological activity in a unit quantity	chemical assay	immunological assay	bioassay	Radioassay	**bioassay**
52	II	Radio immuno assay is	physico-	chemical assay	biological assay	Radioassay	**physico-chemical assay**
53	II	ELISA	Enzyme	Enzyme linked innate	Enzyme linked	Enzyme linked idiosyncracy	**Enzyme linked immunosorbent assay**
54	II	Any response to a drug that is noxious and unintended and that	adverse drug reactions	drug intolerance	drug allergy		**adverse drug reactions**
55	II	Inability of the individuals to	Idiosyncracy	drug intolerance	adverse drug	drug allergy	**drug intolerance**
56	II	Qualitative intolerance due to other	tachyphylaxis	drug intolerance	adverse effects	idiosyncracy	**idiosyncracy**
57	II	The innate immune system are	macrophages	lymphocytes	macrophages and	NKcells and mast	**macrophages and NKcells**
58	II	Origin of T-lymphocytes is	bursa of	thymus	thyroid	T cells	**Thymus**
59	II	What type of T-cells are mainly	T-cells bearing	T-cells bearing on CD_8	B cells	K cells	**T-cells bearing on CD_4 antigen**
60	II	When does tachyphylaxis occur	When there is a decreased	When there is an increased risk of side	When smaller doses cause an increased	When the drug causes a faster heart	**When there is a decreased receptor mediated response to a drug**
61	II	What term is used to describe a decrease in responsiveness to a drug	Refractoriness	Cumulative effect	Tolerance	Tachyphylaxis	**Tachyphylaxis**
62	II	If two drugs with the same effect, taken together, produce an effect	Antagonism	Potentiation	Additive effect	Agonism	**Additive effect**
63	II	What phenomenon can occur in case	Tolerance	Tachyphylaxis	Accumulation	Synergism	**Synergism**
64	II	Inflammatory reactions initiated by mononuclear lymphocytes and not	Type I hypersensitivit	Type II hypersensitivity	Delayed hypersensitivity	Type III hypersensitivity	**Delayed hypersensitivity**

No.		Question	A	B	C	D	Answer
65	II	What type of drugs should be avoided during menstruation?	Drugs likely to produce pelvic	Drugs which may stimulate uterine smooth	Nephrotoxic drugs	Neurotoxic drugs	**Drugs likely to produce pelvic congestion**
66	II	The development of tolerance is confined to certain effects or to	Cross tolerance	Racial tolerance	Tissue tolerance	Species tolerance	**Tissue tolerance**
67	II	Enzymes used in ELISA are	Acid	Acid phosphatase and	Alkaline	Zinc phosphate	**Alkaline phosphatase and penicillinase**
68	II	Cells of the innate immune system	Macrophages	Lymphocytes	Macrophages and	NK cells and mast	**Macrophages and NK cells**
69	II	Origin of T-lymphocytes is	Bursa of	Thymus	Thyroid	T cells	**Thymus**
70	II	Idiosyncratic reaction of a drug is:	A type of hypersensitivit	A type of drug antagonism	Unpredictable, inherent,	Quantitatively exaggerated response	**Unpredictable, inherent, qualitatively abnormal reaction to a drug**
71	II	Tachyphylaxis is:	A drug interaction	Very rapidly developing tolerance	A decrease in responsiveness to a	A drug interaction between similar	**Very rapidly developing tolerance**
72	II	What type of T-cells is mainly	T-cells bearing	T-cells bearing on CD_8	B cells bearing on	NK cells	**T-cells bearing on CD_4 antigen**
73	II	Radio immuno assay is	Physico-	Chemical assay	Biological assay	Radioassay	**Physico-chemical assay**
74	II	The drugs used to treat abusing of	Ibu brufen	Methadone	Diclofenac	Analgesic	**Methadone**
75	II	The average dose of drug is	mg per kg	µg per kg body weight	kg per kg body	cal per kg body	**mg per kg body weight**
76	II	Consumption of alcohol enhances	CNS	CNS stimulants	CSF depressants	CSF stimulants	**CNS depressants**
77	II	The phenomenon of an unusually large dose of a drug is required to	Tolerance	Drug tolerance	Antagonism	Synergism	**Drug tolerance**

KARPAGAM UNIVERSITY
DEPARTMENT OF BIOCHEMISTRY
II M.Sc., BIOCHEMISTRY
MULTIPLE CHOICE QUESTIONS
Drug **Biochemistry**-17BCP304

UNIT-III

SYLLABUS

Genetically engineered protein and peptide agents as drugs, Novel drug delivery systems, anti-AIDS drug development, oncogenes as targets for drugs, multidrug resistance phenotypes, production of secondary metabolites by plant tissue culture. Genome based medicine.

Genetically engineered drugs and their application

Over the past two decades, many genetically engineered drugs have been developed and approved for the treatment of patients. Typically, these drugs are characterized by a high and specific activity in the presence of optimal safety. They include hormones, enzymes, growth and coagulation factors, antibodies as well as vaccines. All these proteins are generated using recombinant DNA technology. An expression vector with the gene encoding for the protein of interest is introduced into an appropriate microorganism or cell line. The biochemical machinery of the host cell then translates the genetic information into the corresponding protein. Large scale production of the recombinant drugs uses biotechnological processes. The genetically modified organisms are grown in bioreactors from which the desired protein is finally isolated and purified. This review focuses on the production and clinical application of recombinant erythropoietin in the areas of nephrology, hemato-oncology and elective surgery.

Novel drug delivery system

Drug Delivery System

Nanobots are robots that carry out a very specific function and are just several nanometers wide. They can be used very effectively for drug delivery. Normally, drugs work through the entire body before they reach the diseaseaffected area. Using nanotechnology, the drug can be targeted to a precise location which would make the drug much more effective and reduce the chances of possible side-effects.
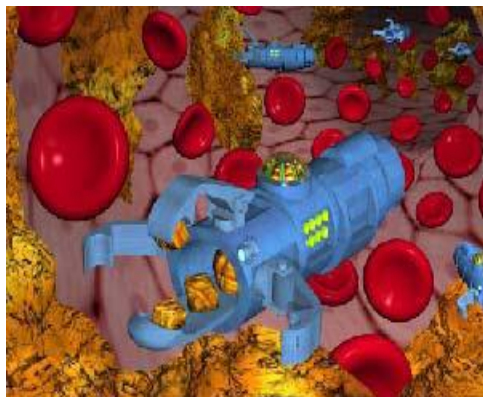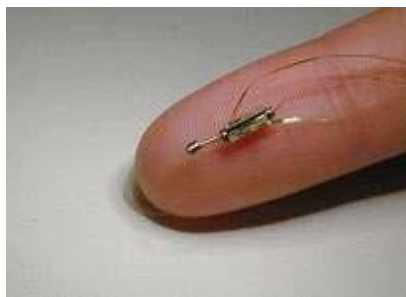
Nanobots

Miniature Cameras Inside
Blood Vessels

Non conventional routes of administration

The enhancement of oral bioavailability of poorly water-soluble drugs remains one of the most challenging aspects of drug development. The solid dispersions have attracted considerable interest as an efficient means of improving the dissolution rate and thereby the bioavailability of poorly soluble therapeutic substances which were otherwise to be formulated through nanomiling or prodrug formation. This review compiles historical background, definitions as well as rationale and scope of the various solid dispersion systems, the formulation aspects along with different carriers and preparation methods, drug release mechanisms, characterization, advantages and limitations. The present article also addresses some alternative approaches to overcome certain limitations of solid dispersion technology which are responsible for its little commercialization.

Novel Approach for anti AIDS drug development.

Novel Approach for anti AIDS drug development. A peptide that kills HIV infected cells before they produce HIV virus.

HIV infection and AIDS is one of the major causes of worry in front of every nation today as this disease is spreading very fast, and so far there is no lifesaving treatment available for this disease. The anti-retroviral drugs available today do extended the life and do enhance quality of life, but there are causes of worry when the virus develops a drug resistance and the drugs in the regimen do not lower the viral load to the required level. So far the anti-retroviral drugs available work by inhibiting multiplication of HIV virus. HIV virus infect and integrates its own DNA in to Human T–Lymphocytic cells there cells Even if we are successful in killing all the HIV viruses in the body of a HIV virus infected person, later on the T-Lymphocytic cells which are part of our body, automatically starts producing HIV viruses as and when these cells undergo a metabolic process and protein synthesis. Serves as factories of HIV virus. When these T-Cells are producing required proteins for our body, the DNA in them is also producing HIV virus genetic material as well as proteins and enzymes which after words come together and to form a new HIV virus. Thus a new HIV virus is always arising from Human cells itself, and not directly from HIV virus, unlike bacteria's and other viruses.

Our body cells themselves are now working for HIV virus multiplication. And the drugs available so far till today's date are not able to destroy these infected T-cells.

To make a person free from HIV virus will thus requires that, the whole T cells are required to be replaced with one which do not contain the HIV virus genetic material incorporated in them (Provirus).

This makes it very difficult but it is not impossible we can do this by engineering infected T-Lymphocytes genetically.

Oncogenes as targets for drugs

The universal deregulation of c-*myc* gene expression in tumor cells suggests that this oncogene represents an attractive target for cancer therapeutic purposes. The same applies to the N-*myc* gene, which has a more restricted tissue specificity.

Translocation (e.g., c-*myc* in Burkitt's lymphoma), or amplification (e.g., N-*myc* in neuroblastoma) of *myc* genes has been causally linked to tumor formation. Furthermore, the c-*myc* promoter integrates diverse mitogenic signalling cascades, which are constitutively activated in tumor cells, and translates them into expression of the c-MYC transcription factor, which promotes cell proliferation by regulating the expression of numerous target genes. Recent experimental data suggest, that even a brief inhibition of c-*myc* expression may be sufficient to permanently stop tumor growth and induce regression of tumors. Attempts to identify specific inhibitors of c-MYC/MAX dimerization have yielded promising results. In addition, downstreamtarget genes of c-MYC represent attractive targets for tumor therapy. Tumor cells expressing c-MYC at elevated levels are sensitized to treatment with DNA-damaging drugs. In mice and presumably also in human patients, the successful treatment of c-*myc*-induced tumors with conventional chemotherapy depends on the presence of functional p53. Therefore, restoration of this pathway, which is commonly lost in cancer cells, may enhance therapy of c-*myc*-induced tumors. These and other recent developments, which address the use of *myc* genes as therapeutic targets for cancer treatment.

Cancer chemotherapy

Chemotherapy (sometimes cancer chemotherapy) is the treatment of cancer with an antineoplastic drug or with a combination of such drugs into a standardized treatment regimen. Most commonly, chemotherapy acts by killing cells that divide rapidly, one of the main properties of most cancer

cells. This means that it also harms cells that divide rapidly under normal circumstances: cells in the bone marrow, digestive tract and hair follicles; this results in the most common side effects of chemotherapy: myelosuppression (decreased production of blood cells, hence also immunosuppression), mucositis (inflammation of the lining of the digestive tract), and alopecia (hair loss).

Newer anticancer drugs act directly against abnormal proteins in cancer cells; this is termed targeted therapy and is technically not chemotherapy.

Cancer is the uncontrolled growth of cells coupled with malignant behavior: invasion and metastasis. Cancer is thought to be caused by the interaction between genetic susceptibility and environmental toxins.

In the broad sense, most chemotherapeutic drugs work by impairing mitosis (cell division), effectively targeting fast-dividing cells. As these drugs cause damage to cells they are termed *cytotoxic*. Some drugs cause cells to undergo apoptosis (so-called "self-programmed cell death").

POSSIBLE QUESTIONS

UNIT-III

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Explain genetically engineered protein
2. Write any peptide agents used as drugs

PART-C (8 MARKS)

1. 1. Discuss novel drug delivery systems
2. What are the non-conventional routes of drug administration
3. Describe the anti-AIDS drug
4. Write notes on Oncogenes as targets for drugs?
5. Discuss about cancer chemotherapy?

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UNIT III

S.No	Unit	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	III	Colloidal drug carrier systems are	micellar solutions	vacuoles	solid crystal	Mobile vesicles	**micellar solutions**
2	III	A three-dimensional, hydrophilic, polymeric networks capable of imbibing	Hydrogels	Vaccum gels	Non vaccum gels	Polymeric gels	**Hydrogels**
3	III	Controlled release (CR) drugs are called	Tinature	Spansules	tamuare	chisuare	**Spansules**
4	III	_____ is the first genetically engineered	Growth hormone	Insulin	HBsAg	HIB	**Insulin**
5	III	Genes for insulin peptides is incorporated	beta galactosidase	Synthetic vectors	pBr322	TMV	**beta galactosidase**
6	III	Genetically engineered growth hormone is	Dwarfism	Gigantism	malignancies	Renal failure	**Dwarfism**
7	III	Insulin injection for the treatment of	intramuscularly	intradermally	subcutaneously	intravenously	**subcutaneously**
8	III	Which of the following method has slower	intradermal injection	IM injection	IV injection	Intrathecal injection	**intradermal**
9	III	Which of the following method is rapid in	intradermal injection	IM injection	IV injection	subcutaneous injection	**IV injection**
10	III	Diagnostic studies such as angiogram is	ntravenously	intra arterially	intramuscularly	intradermally	**intra arterially**
11	III	For rhematoid arthritis drug is given	Intra articularly	Intramedullary	Intraperitoneally	Intrathecally	**Intra articularly**
12	III	Using galvanic current penetration of drugs	Transmucosal	Iontophoresis	Trans nasal	Transrectal method	**Iontophoresis**
13	III	BCG vaccine is administred	intradermally	intramuscularly	intravenously	subcutaneously	**intradermally**
14	III	Sublingually taken drugs are absorbed into	pulmonary	hepatic circulation	systemic	renal circulation	**systemic**
15	III	The initial antibody secreted after immune	IgG	IgM	IgA	IgE	**IgM**
16	III	Toxoids are produced by adding _____to	Acetic acid	Formic acid	Formalin	Saline	**Formalin**
17	III	BCG vaccine is used against	Typhoid	Tuberculosis	Tetanus	chicken pox	**Tuberculosis**
18	III	Salk vaccine is a part of	BCG vaccine	Poliomyelitus vaccine	MMR vaccine	Hepatitis vaccine	**Poliomyelitus**
19	III	Sabin vaccine for polimyelitus is	subcutaneously	orally	intramuscularly	intravenously	**orally**
20	III	OPV provides systemic immunity &	IgG	IgM	IgA	IgE	**IgA**
21	III	The usual incubation period of rabies virus	4-6 weeks	1-2 weeks	7-8 weeks	8-10 weeks	**4-6 weeks**
22	III	Which vaccine is given subcutaneously on	rubella vaccine	Poliomyelitus vaccine	Anthrax vaccine	rabies vaccine	**rabies vaccine**
23	III	Nerve tissue vaccine is used for	Hepatitis B	Rabies	Mumps	Cholera	**Rabies**
24	III	The first vaccine prepared by rDNA	Hepatitis B vaccine	DPT vaccine	Hib vaccine	MMR vaccine	**Hepatitis B vaccine**

#		Question	A	B	C	D	Answer
25	III	To prevent neonatal tetanus____is given	DPT	OPV	MMR	TT	**TT**
26	III	Anti-D (Rho) immunoglobulin is used to	yellow fever	Encephalitis	Erythroblastosis	Plague	**Erythroblastosis**
27	III	Which of the following is not a bacterial	Rabies vaccine	Plague vaccine	BCG vaccine	Anthrax vaccine	**Rabies vaccine**
28	III	Which of the following is not a viral	MMR vaccine	Diptheria vaccine	Varicella vaccine	poliomyelitis vaccine	**Diptheria vaccine**
29	III	Glycosylated erythropoietin is a	Anemia	Skin disorders	Muscular	Brain disorders	**Anemia**
30	III	The mean incubation period of HIV is	7 years	4.5 years	6.5 years	2 years	**4.5 years**
31	III	Antibodies to HIV develops in_eafter	2-8 weeks	1-2 weeks	7-8 weeks	8-10 weeks	**2-8 weeks**
32	III	In AIDS patients opportunistic infections	Renal failure	Anti Candidiasis	Pneumonia	NSAID	**Pneumonia**
33	III	Drugs for AIDS is still in infancy stage	HIV infects T cells	available drugs are toxic	virus develops	antiviruses	**available drugs are**
34	III	Which of the following is a drug used for	Abacavir	Saquinavir	diazepam	Ibubrufen	**Abacavir**
35	III	Azidothymidine is a_____used for AIDS	NRTI	NNRTI	Protease inhibitor	Fusion inhibitor	**NRTI**
36	III	Advantages of anticancer drugs	Low selectivity to	Depression of bone	Depression of	Depression of immune	**Depression of**
37	III	Rational combination of anticancer drugs is used to	Provide synergism resulting from the use of anticancer drugs	Provide synergism resulting from the use of anticancer drugs with the	Provide stimulation of immune system	Provide stimulation of cell proliferation	**Provide synergism resulting from the use of anticancer**
38	III	Anticancer alkylating drug, a derivative of	Methotrexate	Cisplatin	Cyclophosphamid	Carmustine	**Cyclophosphamide**
39	III	Tick the anticancer alkylating drug, a	Mercaptopurine	Thiotepa	Chlorambucil	Procarbazine	**Thiotepa**
40	III	The group of hormonal drugs used for	Mineralocorticoids	Glucocorticoids and	Gonadal hormones	Insulin	**Glucocorticoids**
41	III	The anticancer drug of plant origin:	Dactinomycin	Vincristine	Methotrexate	Procarbazine	**Vincristine**
42	III	Action mechanism of alkylating agents is:	Producing carbonium ions altering protein	Producing carbonium ions altering DNA	Structural antagonism	Inhibition of DNA-dependent RNA synthesis	**Producing carbonium ions**
43	III	Methotrexate is	A purine antagonist	A folic acid antagonist	An antibiotic	An alkylating agent	**A folic acid**
44	III	The antibiotic for cancer chemotherapy	Cytarabine	Doxorubicin	Gentamycin	Etoposide	**Doxorubicin**
45	III	Fluorouracil belongs to	Antibiotics	Antimetabolites	Plant alkaloids	Bone marrow growth	**Antimetabolites**
46	III	The action mechanism of anticancer drugs belonging to plant alkaloids	Inhibition of DNA-dependent RNA	Cross-linking of DNA	Mitotic arrest at a metaphase	Nonselective inhibition of aromatases	**Mitotic arrest at a metaphase**
47	III	Action mechanism of methotrexate is	Inhibition of	Activation of cell	Catabolic	Activation of cell	**Inhibition of**
48	III	The anticancer drug belonging to inorganic	Dacarbazine	Cisplatin	Methotrexate	Vincristine	**Cisplatin**
49	III	The indication for estrogens in oncological	Leukemia	Cancer of prostate	Endometrial	Brain tumors	**Cancer of prostate**
50	III	Enzyme drug used for acute leukemia	Dihydrofolate	Asparaginase	Aromatase	DNA gyrase	**Dihydrofolate**
51	III	Which one of the following drug is not the	Carmustine	Vincristine	Lomustine	Semustine	**Vincristine**
52	III	Estrogen inhibitor:	Leuprolide	Tamoxifen	Flutamide	Anastrozole	**Tamoxifen**
53	III	The antiandrogen drug:	Flutamide	Aminoglutethimide	Tamoxifen	Testosterone	**Flutamide**

#		Question	A	B	C	D	Answer
54	III	The drug belonging to aromatase inhibitors	Octreotide	Anastrozole	Flutamide	Tamoxifen	**Anastrozole**
55	III	The drug belonging to gonadotropin-	Leuprolide	Tamoxifen	Flutamide	Anastrozole	**Leuprolide**
56	III	Which of the following chemotherapy drug	Adriamycin	Vinblastine	Paclitaxel	Procarbazine	**Procarbazine**
57	III	High dose chemotherapy given prior to stem cell transplant may be associated with	Busulfan + cyclophosphamide	Cyclophosphamide + TBI	Ifosfamide +carboplatin+	Fludarabine + ATG	**Fludarabine + ATG**
58	III	Incidence of Gallbladder cancer is highest	Chile	India	United Kingdom	South Africa	**Chile**
59	III	Which of the following is least to occur as	Adenocarcinoma	Squamous cell	Lymphoma	Carcinoid tumour	**Lymphoma**
60	III	Which of the following is less likely to be	Obesity	Use of tobacco and	Aflotoxins	Past history of enteric	**Aflotoxins**
						Tachyphylaxis	**Tachyphylaxis**
						Agonism	**Additive effect**
						Synergism	**Synergism**
						Type III hypersensitivity	**Delayed**
						Neurotoxic drugs	**Drugs likely to produce pelvic**
						Species tolerance	**Tissue tolerance**
						Zinc phosphate	**Alkaline**
						NK cells and mast cells	**Macrophages and NK cells**
						T cells	**Thymus**
						Quantitatively exaggerated response	**Unpredictable, inherent,**
						A drug interaction	**very rapidly**
						NK cells	**T-cells bearing on CD antigen**
						Radioassay	**Physico-chemical assay**
						Analgesic	**Methadone**
						cal per kg body weight	**mg per kg body weight**
						CSF stimulants	**CNS depressants**
						Synergism	**Drug tolerance**

KARPAGAM UNIVERSITY
DEPARTMENT OF BIOCHEMISTRY
II M.Sc., BIOCHEMISTRY
MULTIPLE CHOICE QUESTIONS
Drug **Biochemistry**-17BCP304

UNIT-IV

SYLLABUS

Mechanism of action of drugs used in therapy of Respiratory system – cough, bronchial asthma, pulmonary tuberculosis. Antimicrobial drugs – sulphonamides, trimethoprim, penicillins, aminoglycosides and bacterial resistance, Cancer chemotherapy. Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, antifertility and ovulation inducing drugs. Pharmacotherapy of gout and rheumatoid arthritis, Immuno therapy – Immunosuppressants and immunostimulants, Enzymes in therapy.

Therapy of respiratory system

Cough

A cough medicine (or linctus, when in syrup form) is a medicinal drug used in an attempt to treat coughing and related conditions. For dry coughs, treatment with cough suppressants (antitussives) may be attempted to suppress the body's urge to cough, while in productive coughs (coughs that produce phlegm), treatment is attempted with expectorants (typically guaifenesin, in most commercial medications) in an attempt to loosen mucus from the respiratory tract. There however is no good evidence for or against the use of these medications in those with a cough. Even though they are used by 10% of American children weekly, they are not recommended in children 6 years of age or younger due to lack of evidence showing effect, and concerns of harm.

Asthma

Asthma is the common chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction, and bronchospasm Symptoms include wheezing, coughing, chest tightness, and shortness of breath. Asthma is clinically classified according to the frequency of symptoms, forced expiratory volume in 1 second (FEV1), and peak expiratory flow rate. Asthma may also be classified as atopic (extrinsic) or non-atopic (intrinsic). It is thought to be caused by a combination of genetic and environmental factors.[12] Treatment of acute symptoms is usually with an inhaled short-acting beta-2 agonist (such as salbutamol). Symptoms can be prevented by avoiding triggers, such as allergens and irritants, and by inhaling corticosteroids. Leukotriene antagonists are less effective than corticosteroids and thus less preferred. Its diagnosis is usually made based on the pattern of symptoms and/or response to therapy over time. The prevalence of asthma has increased significantly since the 1970s. As of

2010, 300 million people were affected worldwide. In 2009 asthma caused 250,000 deaths globally. Despite this, with proper control of asthma with step down therapy, prognosis is generally good.

Pulmonary tuberculosis

Isoniazid (Laniazid, Nydrazid), also known as isonicotinylhydrazine (INH), is an organic compound that is the first-line antituberculosis medication in prevention and treatment. It was first discovered in 1912, and later in 1951 it was found to be effective against tuberculosis. Isoniazid is never used on its own to treat active tuberculosis because resistance quickly develops. Isoniazid also has an antidepressant effect, and it was one of the first antidepressants discovered. Isoniazid can also be used in the treatment of a BCG-oma. The compound was first synthesised in the early 20th century but its activity against tuberculosis was first reported in the early 1950s and three pharmaceutical companies attempted unsuccessfully to simultaneously patent the drug (the most prominent one being Roche, who launched their version, Rimifon, in 1952). With the introduction of isoniazid, a cure for tuberculosis was first considered reasonable. Isoniazid is available in tablet, syrup, and injectable forms (given intramuscularly or intravenously). Isoniazid is available worldwide, is inexpensive and is generally well tolerated. It is manufactured from isonicotinic acid, which is produced from 4-methylpyridine.

Antimicrobial

An anti-microbial is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi, or protozoans. Antimicrobial drugs either kill microbes (microbiocidal) or prevent the growth of microbes (microbiostatic). Disinfectants are antimicrobial substances used on non-living objects or outside the body.

The history of antimicrobials begins with the observations of Pasteur and Joubert, who discovered that one type of bacteria could prevent the growth of another. They did not know at that time that the reason one bacterium failed to grow was that the other bacterium was producing an antibiotic. Technically, antibiotics are only those substances that are produced by one microorganism that kill, or prevent the growth, of another microorganism. Of course, in today's common usage, the term antibiotic is used to refer to almost any drug that attempts to rid your body of a bacterial

infection. Antimicrobials include not just antibiotics, but synthetically formed compounds as well. The discovery of antimicrobials like penicillin and tetracycline paved the way for better health for millions around the world. Before penicillin became a viable medical treatment in the early 1940s, no true cure for gonorrhea, strep throat, or pneumonia existed. Patients with infected wounds often had to have a wounded limb removed, or face death from infection. Now, most of these infections can be cured easily with a short course of antimicrobials. However, with the development of antimicrobials, microorganisms have adapted and become resistant to previous antimicrobial agents. The old antimicrobial technology was based either on poisons or heavy metals, which may not have killed the microbe completely, allowing the microbe to survive, change, and become resistant to the poisons and/or heavy metals.

Antithyroid agent

An antithyroid agent is a hormone antagonist acting upon thyroid hormones.

The main antithyroid drugs are carbimazole (in the UK), methimazole (in the US), and propylthiouracil/PTU. A less common antithyrioid agent is potassium perchlorate.

Mechanism of action

Carbimazole, methimazole and propylthiouracil inhibit the enzyme thyroperoxidase, and thereby block the binding of iodine and coupling of iodotyrosines, in turn causing reduced synthesiis of thyroid hormones.

Adverse effects

The most dangerous side-effect is agranulocytosis (1/250, more in PTU); this is an idiosyncratic reaction which generally resolves on cessation of drug. It occurs in about 0.2 to 0.3% of cases treated with antithyroid drugs. Others include granulocytopenia (dose dependent, which improves on cessation of the drug) and aplastic anemia, and for propylthiouracil severe, fulminant liver failure. Patients on these medications should see a doctor if they develop sore throat or fever. The most common side effects are rash and peripheral neuritis. These drugs also Methimazole

Indications

Methimazole is a drug used to treat hyperthyroidism, a condition that usually occurs when the thyroid gland is producing too much thyroid hormone. It may also be taken before thyroid surgery to lower thyroid hormone levels and minimize the effects of thyroid manipulation.

Mechanism of action

Methimazole inhibits the addition of iodine to thyroglobulin by the enzyme thyroperoxidase, a necessary step in the synthesis of triiodothyronine (T3) and thyroxine (T4).

It does not inhibit the action of the sodium-dependent iodide transporter located on follicular cells' basolateral membranes. Inhibition of this step requires competitive inhibitors such as perchlorate and thiocyanate. It acts at CXCL10.

Adverse effects

The chance of side effects from methimazole is about 5%. It is important to monitor any symptoms of fever or sore throat while taking methimazole; this could indicate the development of agranulocytosis, an uncommon but severe side effect resulting from a drop in the white blood cell count (to be specific, neutropenia, a deficiency of neutrophils). A complete blood count (CBC) with differential is performed to confirm the suspicion, in which case the drug is discontinued. Administration of recombinant human granulocyte colony-stimulating factor (rhG-CSF) may increase recovery.

Other side effects include

• Skin rash

• Itching

• Abnormal hair loss

• Upset stomach

• Vomiting

• Loss of taste

• Abnormal sensations (tingling, prickling, burning, tightness, and pulling)

• Swelling

• Joint and muscle pain

• Drowsiness

• Dizziness

• Decreased white blood cells

• Decreased platelet

• Aplasia cutis congenita (prenatal exposure)

Methimazole 3

Drug interactions

Adverse effects may occur for individuals who:

• Take anticoagulants ('blood thinners') such as warfarin (Coumadin), beta blockers such as propranolol (Inderal), diabetes medications, digoxin (Lanoxin), theophylline (Theobid, Theo-Dur), and vitamins

• Have ever had any blood disease, such as decreased white blood cells (leukopenia), decreased platelets (thrombocytopenia), or aplastic anemia, or liver disease (hepatitis, jaundice)

• Are pregnant, or going to become pregnant, or are breast-feeding. An alternative anti-thyroid drug, propylthiouracil, is often substituted during pregnancy or breast-feeding. If pregnancy occurs while taking methimazole, switching to propylthiouracil may be an alternative. Early studies suggested that methimazole may harm the fetus; however, more recent studies suggest this may not be the case.

• Are going to have surgery, including dental surgery.

Anti-diabetic medication

Anti-diabetic medications treat diabetes mellitus by lowering glucose levels in the blood. With the exceptions of insulin, exenatide, and pramlintide, all are administered orally and are thus also called oral hypoglycemic agents or oral antihyperglycemic agents. There are different classes of anti-diabetic drugs, and their selection depends on the nature of the diabetes, age and situation of the person, as well as other factors. Diabetes mellitus type 1 is a disease caused by the lack of insulin. Insulin must be used in Type I, which must be injected.

Diabetes mellitus type 2 is a disease of insulin resistance by cells. Treatments include (1) agents which increase the amount of insulin secreted by the pancreas, agents which increase the sensitivity of target organs to insulin, and agents which decrease the rate at which glucose is absorbed from the gastrointestinal tract. Several groups of drugs, mostly given by mouth, are effective in Type II, often in combination. The therapeutic combination in Type II may include insulin, not necessarily because oral agents have failed completely, but in search of a desired combination of effects. The great advantage of injected insulin in Type II is that a well-educated patient can adjust the dose, or even take additional doses, when blood glucose levels measured by the patient, usually with a

simple meter, as needed by the measured amount of sugar in the blood.

Insulin

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

Sulfonylurea

- General formula of a sulfonylurea, showing the sulfonylurea backbone itself in red and the side chains that distinguish each compound in blue-Chlorpropamide - Tolazamide -Gliclazide - Glimepiride Sulfonylurea (UK: Sulphonylurea) derivatives are a class of antidiabetic drugs that are used in the management of diabetes mellitus type 2. They act by increasing insulin release from the beta cells in the pancreas.
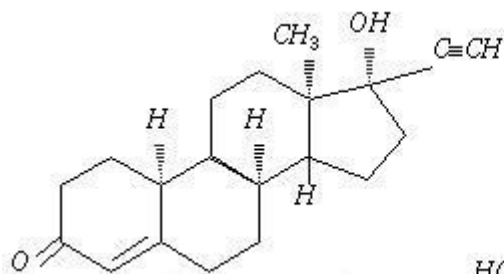
ANTIFERTILITY DRUGS

These are the chemical substances used to control the pregnancy. These are also called *oral contraceptives*. The basic aim of antifertility drugs is to prevent conception or fertilization. Oral contraceptives belong to the class of natural products known as steroids.

These control the female menstrual cycle and ovulation. The birth control pills are essentially a mixture of esterogen and *progesterone derivatives* which are more potent than the natural hormones.

These common pills are used for a combination of progesterone, norethindrone and estrogen ethynylestradiol.
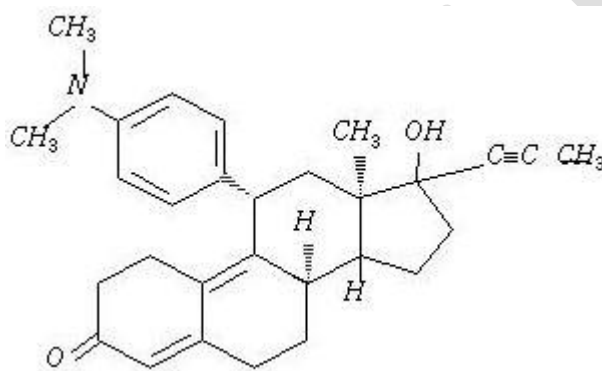
   Mifepristone is a synthetic steroid which blocks the effects of progesterone and is used as a "morning after pill" in many countries.
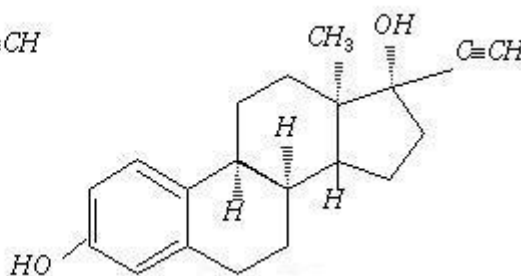
Norethindrone   Ethynylestradiol

Mifepristone

Ormeloxifene (*Centchroman, Saheli*) has also been developed and tested at the Central Drug Research Institute, Lucknow as an effective antifertility drug to acceptable degree. The oral contraceptives are commonly known as *pills* or *oral pills* and have been used worldwide for birth control.

Anti-fertility Drugs

With global population growing by the day, birth control has become essential. There are drugs that control ovulation and if regularly consumed, function as effective contraceptives. Some examples of birth control pills are orthonovum and Enovid. Orthonovum is a mixture of norethindrone (17a - ethynyl - 19 - nortestosterone) and mestranol (17a - ethynyl - 3 - methoxy -

1,3,5(10), estratriene - 17 b - ol). Envoid is a mixture of norethynodrel (17 a - ethynyl - 17 - b - hydroxy - 5 (10)-estern - 3-one) and mestranol.

Mestranol

Norethindrone

Norethynodrel
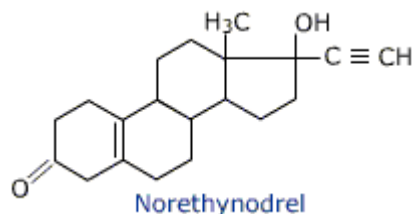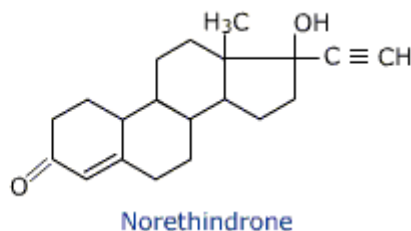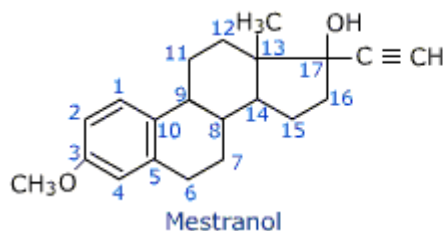
Ovulation Drugs

Ovulation inducing agents are used in two different ways. First they are used for patients with irregular cycles to normalize ovulation. Secondly, they are used for normally ovulating women as an adjunct to intrauterine insemination. This is because insemination in the natural cycle has poor pregnancy rates. There are two categories of ovulation drugs: oral and injectable. The oral medications are simple to take, inexpensive and have modest results. The injectable drugs are more complex to administer but give far superior results.

CLOMID AND SEROPHENE (ORAL MEDICATIONS)

The first line therapy is oral medication such as Clomid or Serophene. These are identical drugs made by two different companies. They are both oral mild medications with modest results. These drugs work by stimulating the release of FSH and LH, which are the crucial hormones that stimulate egg production. The total pregnancy rate with these agents is 35 - 40% after 4 - 6 cycles of use. It is important to know that the lowest effective dose is best. Also most individuals will get pregnant with lower doses within the first few months of use. A typical dose is one to three 50 mg

tablets daily for 5 days. We typically begin on day 3 of the menstrual cycle. We typically monitor by ultrasound around day 12 to judge the response to the drug dose. Treatment with Clomid for more than 6 cycles is not useful in most cases. While the drug is administered, response can most accurately judged with ultrasound or progesterone levels. The reason some individuals will not get pregnant with this medication is that it thickens the cervical mucus and thins the lining of the uterus. Approximately 90% of all births are single with this medication. One such example is the young lady who appears below: Side effects include hot flushes and mood disturbance. Occasionally ovarian enlargement requiring a rest cycle may be encountered. The multiple pregnancy rate with this medication should be no more than 7-10%. Most multiples seen here will be twins. The incidence of birth defects with Clomid and Serophene is estimated to be 4.7% which is similar to the 3-4% rate expected in the general population.

POSSIBLE QUESTIONS

UNIT-IV

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Discuss used in therapy for bronchial asthma

2. Discuss mechanism of action, adverse reactions and therapeutic uses of antithyroid drugs

3. Explain (i) emitics (ii) Antiemitics drugs

PART-C (8 MARKS)

1. Describe the management of pulmonary tuberulosis

2. Describe the pharmacotherapy of diabetes mellitus

3. How sulfonamides act as antimicrobial drug? Explain the mechanism of action.

4. Discuss pharmacotherapy of peptic ulcer disease.

5. What are all the drugs which can act as digestants?

6. Discuss about anti-fertility drugs.

7. Write pharmacological actions and adverse reactions of ovulation inducing drugs.

Karpagam academy of higher education
Department of biochemistry
Drug Biochemistry (17BCP304) MCQ
UNIT IV

S.No	Unit	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	IV	The main mechanism of most drugs absorption in GI tract is:	Active transport (carrier-mediated diffusion)	Filtration (aqueous diffusion)	Endocytosis and exocytosis	Passive diffusion (lipid diffusion)	**Passive diffusion**
2	IV	The mechanism of Cytiton action is	Direct activation of the	The reflex	The mixed mechanism	Active transport	**The reflex**
3	IV	What kind of substances can't permeate	Lipid-soluble	Non-ionized	Hydrophobic substances	Hydrophilic substances	**Hydrophilic**
4	IV	Choose the unwanted effects of clonidine:	Parkinson's syndrome	Sedative and	Agranulocytosis and	Dry cough and respiratory	**Sedative and**
5	IV	The tissues most sensitive to atropine are:	The salivary, bronchial	The gastric parietal	Smooth muscle and	The heart	**The salivary,**
6	IV	Compared with atropine, scopolamine has all of the following properties EXCEPT:	More marked central effect	Less potent in decreasing	More potent in producing mydriasis and cycloplegia	Lower effects on the heart, bronchial muscle and	**Less potent in decreasing**
7	IV	Contraindications to the use of	Glaucoma	Myasthenia	Bronchial asthma	Paralytic ileus and atony of	**Bronchial**
8	IV	A bronchial smooth muscle contains:	Alfa$_1$ receptor	Alfa$_2$ receptor	Beta $_1$ receptor	Beta $_2$ receptor	**Beta** $_2$
9	IV	Which of the following sympathomimetics is used in the therapy of bronchial asthma?	Formoterol	Norepinephrine	Methoxamine	Dobutamine	**Formoterol**
10	IV	Pick out the bronchodilator drug related to	Atropine	Orciprenaline	Adrenaline	Theophylline.	**Theophylline**
11	IV	Pick out the bronchodilator drug belonging	Isoprenaline	Ephedrine	Atropine	Salbutamol	**Ephedrine**
12	IV	Propranolol is used in the treatment all of	Cardiovascular diseases	Hyperthyroidism	Migraine headache	Bronchial asthma	**Bronchial**
13	IV	This drug is contraindicated in patients	Propranolol	Clonidine	Enalapril	Nifedipine	**Propranolol**
14	IV	Which of the following vitamins is given along with isoniazide in treatment of	Nicotinic acid	Riboflavin	Pyridoxine	Ascorbic acid	**Pyridoxine**
15	IV	Combined chemotherapy of tuberculosis is used to:	Decrease mycobacterium drug-	Increase mycobacterium	Decrease the antimicrobal activity	Decrease the onset of antimycobacterial drugs	**Decrease mycobacteriu**
16	IV	Which of the following enzymes improves	Pepsin	Urokinase	L-asparaginase	Lydaze	**Pepsin**
17	IV	All of the following drugs stimulate	Vitamins	Bitters	Fepranone	Insulin	**Fepranone**

No.		Question					Answer
18	IV	Serious side effects of glucocorticoids include the following, EXCEPT:	Acute peptic ulcers	Iatrogenic Cushing's syndrome (rounding,	Salicylism (vomiting, tinnitus, decreased hearing, and vertigo)	Hypomania or acute psychosis	**Salicylism (vomiting, tinnitus, decreased**
19	IV	Gastric acid secretion is under the control	Histamine	Acetylcholine	Serotonin	Gastrin	**Serotonin**
20	IV	Indicate the drug belonging to proton	Pirenzepine	Ranitidine	Omeprazole	Trimethaphan	**Omeprazole**
21	IV	All of the following agents intensify the	Pepsin	Gastrin	Histamine	Carbonate mineral waters	**Pepsin**
22	IV	Which of the following drugs is an agent	Gastrin	Hydrochloric acid	Hystamine	Carbonate mineral waters	**Hydrochloric**
23	IV	An adverse effect of oral iron therapy is:	Anemia	Thrombocytopenia	Headache	Constipation	**Constipation**
24	IV	Mental confusion and hallucinations, peripheral atropine-like toxicity (e.g. Cycloplegia, tachycardia, urinary retention,	Sinemet	Benztropine	Tolkapone	Bromocriptine	**Benztropine**
25	IV	Adverse peripheral effects, such as loss of accommodation, dry mouth, tachycardia,	Alpha adrenoreceptor blockade	Muscarinic cholinoreceptor	Supersesitivity of the dopamine receptor	Dopamine receptor blockade	**Muscarinic cholinorecepto**
26	IV	Sedation, peripheral atropine-like toxicity (e.g. Cycloplegia, tachycardia, urinary retention, and constipation), orthostatic	Sertaline	Amitriptyline	Phenelsine	Bupropion	**Amitriptyline**
27	IV	Choose the drug that causes constipation	Sodium bicarbonate	Aluminium	Calcium carbonate	Magnesium oxide	**Aluminium**
28	IV	Which of histamine H1 antagonists is	Diazoline	Loratadine	Suprastine	Dimedrol	**Diazoline**
29	IV	Combination of sulfonamides with trimethoprim	Decreases the unwanted effects of sulfonamides	Increases the antimicrobial	Decreases the antimicrobial activity	Increases the elimination of sulfonamides	**Increases the antimicrobial**
30	IV	Indicate a beta-blocker, which is	Pindolol	Sotalol	Phentolamine	Propranolol	**Propranolol**
31	IV	Which of the following hormones is	Thyroxine	Thyroid-stimulating	Thyrotropin-releasing	Thyroglobulin.	**Thyroxine**
32	IV	Thyroid hormones produce various pharmacological effects. Indicate the	Decline of the basal metabolic rate in the	Increase in the rate and force of	Increase in the blood cholestrol level	Increase in the heat production	**Decline of the basal**
33	IV	Currently used antithyroid drugs include	Propylthiouracil (PTU)	Diatrizoate sodium	Methimazole (Tapazole)	Potassium perchlorate	**Potassium**
34	IV	Secretory products of pancreatic β-cells are	Glucagon, proglucagon	Insulin, C-peptide, proinsulin, islet	Somatostatin	Pancreatic polypeptide (PP)	**Insulin, C-peptide,**
35	IV	Insulin cannot be administered by	Oral route	Intravenous route	Subcutaneous route	Intramuscular route	**Oral route**
36	IV	Diabetic coma is treated by the	Lente insulin	Glucose	Crystalline insulin	Oral anti-diabetic drugs	**Crystalline**
37	IV	Which of the following oral hypoglycaemic drugs stimulates both	Glibenclamide	Phenformin	Buformine	Metformin	**Glibenclamide**
38	IV	The action of insulin is potentiated by	Sulphonylureas	Glucagon	Biguanides	Glibenclamide	**Biguanides**

#		Question	A	B	C	D	Answer
39	IV	Insulin causes reduction in blood sugar level by the following mechanisms, Sulphonylureas act by	Increased glucose uptake in the peripheral tissue	Reduction of breakdown	Diminished gluconeogenesis	Decreased glucose absorption from the gut	**Decreased glucose**
40	IV		Reducing the absorption of carbohydrate from the	Increasing the uptake of glucose in	Reducing the hepatic gluconeogenesis	Stimulating the beta islet cells of pancreas to produce	**Stimulating the beta islet**
41	IV	The primary reason for a physician to prescribe human insulin is that	It has a faster onset of action than other	It has a shorter duration of action	It can be given to patients who have an allergy to	It is more effective in preventing the	**It can be given to patients**
42	IV	Mechanism of sulfonamides' antibacterial	Inhibition of	Inhibition of	Inhibition of	Activation of DNA gyrase	**Inhibition of**
43	IV	Mechanism of Rifampin action is	Inhibition of mycolic acids synthesis	Inhibition of DNA dependent RNA	Inhibition of topoisomerase II	Inhibition of cAMP synthesis	**Inhibition of DNA**
44	IV	Choose the drug which is a H2-receptor	Omeprazole	Pirenzepine	Carbenoxolone	Ranitidine	**Ranitidine**
45	IV	All of the following drugs are proton pump	Pantoprozole	Omeprazole	Famotidine	Rabeprazole	**Famotidine**
46	IV	Indicate the drug belonging to M1-	Cimetidine	Ranitidine	Pirenzepin	Omeprazole	**Pirenzepin**
47	IV	Which of the following drugs may cause	Omeprazole	Pirenzepine	Cimetidine	Sucralfate	**Cimetidine**
48	IV	Select an endocrine drug which is an	Insulin	Hydrocortisone	Calcitonin	Thyroxine	**Thyroxine**
49	IV	Thiazolidinediones act by	Diminishing insulin resistance by increasing glucose uptake and metabolism in muscle	Reducing the absorption of carbohydrate from the gut	Stimulating the beta islet cells of pancreas to produce insulin	Stimulating the alpha islet cells of pancreas to produce glucagon	**Diminishing insulin resistance by increasing**
50	IV	Tamoxifen is	Antiprogestin	Antiandrogen	Antiestrogen	Androgen	**Antiestrogen**
51	IV	The major natural progestin is	Estradiol	Estron	Progesterone	Estriol	**Progesterone**
52	IV	Progesterone is secreted by	Ovarian follicles	Corpus luteum	Granulosa cells	Theca cells	**Corpus**
53	IV	Mifepristone (RU-486) is	Antiprogestin	Antiandrogen	Antiestrogen	Androgen	**Antiprogestin**
54	IV	An endogenous vasoconstrictor that can stimulate aldosterone release from	Angiotensinogen	Angiotensin I	Angiotensin II	Angiotensin-converting enzyme	**Angiotensin II**
55	IV	Choose the vasodilator which releases NO	Nifedipine	Hydralazine	Minoxidil	Sodium nitroprusside	**Sodium**
56	IV	Tick the drug belonging to non-selective	Salbutamol	Isoprenaline	Salmeterol	Terbutaline	**Isoprenaline**
57	IV	The mechanism of methylxanthines action is	Inhibition of the enzyme phosphodiesterase	Beta2 - adrenoreceptor	Inhibition of the production of inflammatory cytokines	Inhibition of M-cholinoreceptors	**Inhibition of the enzyme**
58	IV	Choose an emetic drug of central action:	Ipecacuanha derivatives	Promethazine	Tropisetron	Apomorphine hydrochloride	**Apomorphine**
59	IV	Indicate an antiemetic agent which is	Metoclopramide	Nabilone	Tropisetron	Prochlorperazine	**Prochlorperaz**
60	IV	The mechanism of stimulant purgatives is	Increasing the volume of non-absorbable solid	Increasing motility and secretion	Altering the consistency of the feces	Increasing the water content	**Increasing motility and**
						Tachyphylaxis	**Tachyphylaxis**

Agonism

Synergism

Type III hypersensitivity

Neurotoxic drugs

Species tolerance

Zinc phosphate

NK cells and mast cells

T cells

Quantitatively exaggerated response

A drug interaction between

NK cells

Radioassay

Analgesic

cal per kg body weight

CSF stimulants

Synergism

Additive effect

Synergism

Delayed

Drugs likely to

Tissue

Alkanne

Macrophages and NK cells

Thymus

Unpredictable, inherent, very rapidly

T-cells

Physico-chemical assay

Methadone

mg per kg

CNS

Drug

tolerance

KARPAGAM UNIVERSITY
DEPARTMENT OF BIOCHEMISTRY
II M.Sc., BIOCHEMISTRY
MULTIPLE CHOICE QUESTIONS
Drug **Biochemistry**-17BCP304

UNIT-IV

SYLLABUS

Brain – Neurotransmitters, encephalins and endorphins; general function of autonomic and somatic nervous system; cholinergic transmission and receptors; adrenergic transmission and receptors; muscarinic receptors. Non-steroidal and anti-inflammatory drugs; adrenergic blocking drugs; cholinergic blocking drugs; muscatrinic blocking drugs; parkinson's disease; Alzhiemier's disease. Neurodegenerative disorders – Amylotropic, lateral sclerosis, senile dementia, schizophrenia, Huntington's disease.

Non-steroidal anti-inflammatory drug

Non-steroidal anti-inflammatory drug Coated 200 mg Ibuprofen tablets, a common NSAID Nonsteroidal anti-inflammatory drugs, usually abbreviated to NSAIDs or NAIDs, but also referred to as nonsteroidal anti-inflammatory agents/analgesics (NSAIAs) or nonsteroidal Anti-inflammatory medicines (NSAIMs), are drugs with analgesic and antipyretic (fever-reducing) effects and which have, in higher doses, anti-inflammatory effects.

The term "nonsteroidal" is used to distinguish these drugs from steroids, which, among a broad range of other effects, have a similar eicosanoid-depressing, anti-inflammatory action. As analgesics, NSAIDs are unusual in that they are non-narcotic.

The most prominent members of this group of drugs are aspirin, ibuprofen, and naproxen, all of which are available over the counter in many areas.

Medical uses

NSAIDs are usually indicated for the treatment of acute or chronic conditions where pain and inflammation are present. Research continues into their potential for prevention of colorectal cancer, and treatment of other conditions, such as cancer and cardiovascular disease. NSAIDs are generally indicated for the symptomatic relief of the following conditions

• Rheumatoid arthritis

• Osteoarthritis

• Inflammatory arthropathies (e.g. ankylosing spondylitis, psoriatic arthritis, Reiter's syndrome)

• Acute gout

• Dysmenorrhoea (menstrual pain)

• Metastatic bone pain

• Headache and migraine

• Postoperative pain

• Mild-to-moderate pain due to inflammation and tissue injury

• Pyrexia (fever)

• Ileus

• Renal colic

Adverse effects

The widespread use of NSAIDs has meant that the adverse effects of these drugs have become increasingly prevalent. The two main adverse drug reactions (ADRs) associated with NSAIDs relate to gastrointestinal (GI) effects and renal effects of the agents.

NON-STEROIDAL DRUGS

Prostaglandins are a family of chemicals that are produced by the cells of the body and have several important functions. They promote inflammation, pain, and fever; support the blood clotting function of platelets; and protect the lining of the stomach from the damaging effects of acid.

Prostaglandins are produced within the body's cells by the enzyme cyclooxygenase (COX). There are two COX enzymes, COX-1 and COX-2. Both enzymes produce prostaglandins that promote inflammation, pain, and fever. However, only COX-1 produces prostaglandins that support platelets and protect the stomach. Nonsteroidal antiinflammatory drugs (NSAIDs) block the COX enzymes and reduce prostaglandins throughout the body. As a consequence, ongoing inflammation, pain, and fever are reduced. Since the prostaglandins that protect the stomach and support platelets and blood clotting also are reduced, NSAIDs can cause ulcers in the stomach and promote bleeding.

Adrenergic blocking drugs

Beta blockers (sometimes written as β-blockers) or beta-adrenergic blocking agents, beta-adrenergic antagonists, or beta antagonists, are a class of drugs used for various indications, but particularly for the management of cardiac arrhythmias, cardioprotection after myocardial infarction (heart attack), and hypertension. As beta adrenergic receptor antagonists, they diminish

the effects of epinephrine (adrenaline) and other stress hormones. In 1958 the first beta blocker, dichloroisoproterenol, was synthesised by Eli Lilly Laboratories, but it was Sir James W. Black in 1962, who found the first clinically significant use of beta blockers with propranolol and pronethalol; it revolutionized the medical management of angina pectoris and is considered by many to be one of the most important contributions to clinical medicine and pharmacology of the 20th century. Beta blockers block the action of endogenous catecholamines (epinephrine (adrenaline) and norepinephrine (noradrenaline) in particular), on β-adrenergic receptors, part of the sympathetic nervous system which mediates the "fight or flight" response. There are three known types of beta receptor, designated β1, β2 and β3 receptors. β1-adrenergic receptors are located mainly in the heart and in the kidneys. β2-adrenergic receptors are located mainly in the lungs, gastrointestinal tract, liver, uterus, vascular smooth muscle, and skeletal muscle.

Anticholinergic (Cholinergic Blocking) Agents

Typical anticholinergic (cholinergic blocking) agents include (but are not limited to) the following:

- Atropine sulfate
- Benztropine mesylate
- Biperiden hydrochloride
- Dicyclomine hydrochloride
- Ipratropium bromide
- Propantheline bromide
- Scopolamine hydrobromide
- Scopolamine transdermal therapeutic system
- Trihexyphenidyl hydrochloride

Anticholinergic (cholinergic blocking) agents prevent the neurotransmitter acetylcholine from combining with receptors on the postganglionic parasympathetic nerve terminal (muscarinic site). Effects include reduction of smooth muscle spasms, blockade of vagal impulses to the heart,

decreased secretions (e.g., gastric, salivation, bronchial mucus, sweat glands), production of mydriasis and cycloplegia, and various CNS effects. In therapeutic doses, these drugs have little effect on transmission of nerve impulses across ganglia (nicotinic sites) or at the neuromuscular junction. Several anticholinergic drugs abolish or reduce the symptoms of Parkinson's disease, such as tremors and rigidity, and result in sonic improvement in mobility, muscular coordination, and motor performance. These effects may be due to blockade of the effects of acetylcholine in the CNS.

Cardiac failure

Heart failure (HF), often called congestive heart failure (CHF) or congestive cardiac failure (CCF), is the inability of the heart to provide sufficient pump action to distribute blood flow to meet the needs of the body. Heart failure can cause a number of symptoms including shortness of breath, leg swelling, and exercise intolerance. The condition is diagnosed with echocardiography and blood tests. Treatment commonly consists of lifestyle measures (such as smoking cessation, light exercise including breathing protocols, decreased salt intake and other dietary changes) and medications. Sometimes it is treated with implanted devices (pacemakers or ventricular assist devices) and occasionally a heart transplant.

Common causes of heart failure include myocardial infarction and other forms of ischemic heart disease, hypertension, valvular heart disease, and cardiomyopathy. The term "heart failure" is sometimes incorrectly used to describe other cardiac-related illnesses, such as myocardial infarction (heart attack) or cardiac arrest, which can cause heart failure but are not equivalent to heart failure.

Antihypertensive drug

Antihypertensive therapy seeks to prevent the complications of high blood pressure, such as stroke and myocardial infarction. The antihypertensives are a class of drugs that are used to treat hypertension (high blood pressure). Evidence suggests that reduction of the blood pressure by 5 mmHg can decrease the risk of stroke by 34%, of ischaemic heart disease by 21%, and reduce the

likelihood of dementia, heart failure, and mortality from cardiovascular disease. There are many classes of antihypertensives, which lower blood pressure by different means; among the most important and most widely used are the thiazide diuretics, the ACE inhibitors, the calcium channel blockers, the beta blockers, and the angiotensin II receptor antagonists or ARBs. Which type of medication to use initially for hypertension has been the subject of several large studies and resulting national guidelines? The fundamental goal of treatment should be the prevention of the important endpoints of hypertension, such as heart attack, stroke and heart failure. Patient age, associated clinical conditions and end-organ damage also play a part in determining dosage and type of medication administered. The several classes of antihypertensives differ in side effect profiles, ability to prevent endpoints, and cost. The choice of more expensive agents, where cheaper ones would be equally effective, may have negative impacts on national healthcare budgets. As of 2009, the best available evidence favors the thiazide diuretics as the first-line treatment of choice for high blood pressure when drugs are necessary.

Diuretics

Hydrochlorothiazide, a popular thiazide diuretic

Diuretics help the kidneys eliminate excess salt and water from the body's tissues and blood.

• Loop diuretics:

• Bumetanide

• Ethacrynic acid

• Furosemide

• Torsemide

• Thiazide diuretics:

• Epitizide

• Hydrochlorothiazide and chlorothiazide

• Bendroflumethiazide

• Thiazide-like diuretics:

• Indapamide

• Chlorthalidone

• Metolazone

• Potassium-sparing diuretics:

• Amiloride

• Triamterene

• Spironolactone

Vasodilation

Vasodilation refers to the widening of blood vessels resulting from relaxation of smooth muscle cells within the vessel walls, particularly in the large arteries, smaller arterioles and large veins. The process is essentially the opposite of vasoconstriction, or the narrowing of blood vessels. When vessels dilate, the flow of blood is increased due to a decrease in vascular resistance. Therefore, dilation of arterial blood vessels (mainly arterioles) leads to a decrease in blood pressure. The response may be intrinsic (due to local processes in the surrounding tissue) or extrinsic (due to hormones or the nervous system). Additionally, the response may either be localized to a specific organ (depending on the metabolic needs of a particular tissue, as during strenuous exercise), or systemic (seen throughout the entire systemic circulation). Factors that result in vasodilation are termed vasodilators.

Diuretic

This illustration shows where some types of diuretics act, and what they do. A diuretic is any drug that elevates the rate of urination and thus provides a means of forced diuresis. There are several categories of diuretics. All diuretics increase the excretion of water from bodies, although each class does so in a distinct way.

Types

High ceiling loop diuretic High ceiling diuretics are diuretics that may cause a substantial diuresis – up to 20% of the filtered load of NaCl and water. This is huge when compared to normal renal sodium reabsorption which leaves only ~0.4% of filtered sodium in the urine.

Loop diuretics have this ability, and are therefore often synonymous with high ceiling diuretics. Loop diuretics, such as furosemide, inhibit the body's ability to reabsorb sodium at the ascending loop in the nephron which leads to a retention of water in the urine as water normally follows sodium back into the extracellular fluid (ECF). Other examples of high ceiling loop diuretics

include ethacrynic acid, torsemide and bumetanide.

Thiazides

Thiazide-type diuretics such as hydrochlorothiazide act on the distal convoluted tubule and inhibit the sodium-chloride symporter leading to a retention of water in the urine, as water normally follows penetrating solutes. Frequent urination is due to the increased loss of water that has not been retained from the body as a result of a concomitant relationship with sodium loss from the convoluted tubule. The short-term anti-hypertensive action is based on the fact that thiazides decrease preload, decreasing blood pressure. On the other hand the long-term effect is due to an unknown vasodilator effect that decreases blood pressure by decreasing resistance.

Anti-diuretic drugs

Chlorpropamide is a drug in the sulphonylurea class used to treat type 2 diabetes mellitus. It is a long-acting sulphonylurea. It has more side effects than other sulphonylureas and its use is no longer recommended.

Chlorpropamide

Mechanism of action

Like other sulfonylureas, chlorpropamide acts to increase the secretion of insulin, so it is only effective in patients who have some pancreatic beta cell function. It can cause relatively long episodes of hypoglycemia; this is one reason why shorter-acting sulfonylureas such as gliclazide or tolbutamide are used instead. The risk of hypoglycemia makes this drug a poor choice for the elderly and patients with mild to moderate hepatic and renal impairment.

Chlorpropamide is also used in Partial Central Diabetes Insipidus.

Gout (also known as podagra when it involves the big toe) is a medical condition usually characterized by recurrent attacks of acute inflammatory arthritis—a red, tender, hot, swollen joint. The metatarsal-phalangeal joint at the base of the big toe is the most commonly affected (approximately 50% of cases). However, it may also present as tophi, kidney stones, or urate

nephropathy. It is caused by elevated levels of uric acid in the blood which crystallizes and the crystals are deposited in joints, tendons, and surrounding tissues.

A clinical diagnosis is confirmed by the visualization of the characteristic crystals in joint fluid. Treatment with nonsteroidal anti-inflammatory drugs (NSAIDs), steroids, or colchicine improves symptoms. Once the acute attack has subsided, levels of uric acid are usually lowered via lifestyle changes, and in those with frequent attacks allopurinol or probenecid provide long-term prevention.

Gout has increased in frequency in recent decades affecting approximately one to two percent of the Western population at some point in their lives. The increase is believed to be due to increasing risk factors in the population, such as metabolic syndrome, longer life expectancy and changes in diet. Gout was historically known as "the disease of kings" or "rich man's disease".

Rheumatoid arthritis (RA) is a chronic, systemic inflammatory disorder that may affect many tissues and organs, but principally attacks flexible (synovial) joints. The process involves an inflammatory response of the capsule around the joints (synovium) secondary to swelling (hyperplasia) of synovial cells, excess synovial fluid, and the development of fibrous tissue (pannus) in the synovium. The pathology of the disease process often leads to the destruction of articular cartilage and ankylosis (fusion) of the joints. Rheumatoid arthritis can also produce diffuse inflammation in the lungs, membrane around the heart (pericardium), the membranes of the lung (pleura), and white of the eye (sclera), and also nodular lesions, most common in subcutaneous tissue. Although the cause of rheumatoid arthritis is unknown, autoimmunity plays a pivotal role in both its chronicity and progression, and RA is considered a systemic autoimmune disease.

ENZYME THERAPY

To the Right: A picture of the digestive system of the human body. Below: A chart of the numerous digestive enzymes of the body and their functions.	
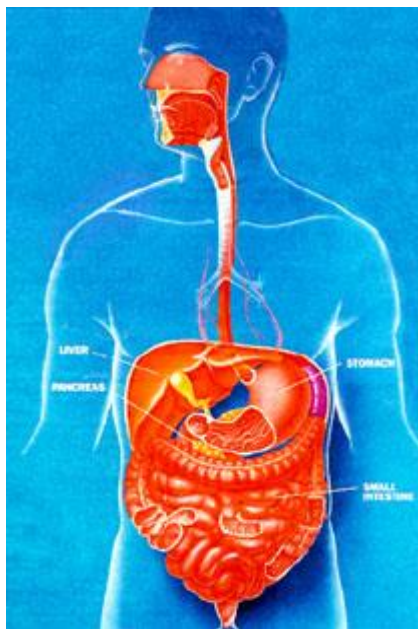
Amylase	digests starches
Bromelain	a proteolytic, anti-inflammatory food enzyme from pineapple. Aids digestion of fats
Catalase	works with SOD to reduce free radical production
Cellulase	digests cellulose, the fibrous component of most vegtable matter
Chymotrypsin	helps convert chyme
Diastase	a pontent vegtable starch digestant

Lactase	digests lactose, or milk sugar, (almost 65% of humans are deficient).
Lipase	digests fats.
Mycozyme	a single-celled plant enzyme for digestion of starches.
Pancreatin	a broad spectrum, proteolytic digestive aid, derived from secretions of animal pancreas; important in degenerative disease research.
Papin and chymopapain	proteolytic food enzymes from unripe papaya; a veegatable pepsin for digesion of proteins. These enzymes help loosen nercotic and encrusted waste material from the intestinal walls.
Pepsin	a proteolytic enzyme that breaks down proteins into peptides. Can digest 3500 times its weight in proteins.
Protease	digests proteins
Rennin	helps digest cow's milk products.
Trypsin	a proteoytic enzyme

Immunotherapy

Immunotherapy is a medical term defined as the "treatment of disease by inducing, enhancing, or suppressing an immune response". Immunotherapies designed to elicit or amplify an immune response are classified as activation immunotherapies. While immunotherapies that reduce or suppress are classified as suppression immunotherapies.

Immunomodulators

The active agents of immunotherapy are collectively called immunomodulators. They are a diverse array of recombinant, synthetic and natural preparations, often cytokines. Some of these substances, such as granulocyte colony-stimulating factor (G-CSF), interferons, imiquimod and cellular membrane fractions from bacteria are already licensed for use in patients. Others including IL-2, IL-7, IL-12, various chemokines, synthetic cytosine phosphate-guanosine (CpG), oligodeoxynucleotides and glucans are currently being investigated extensively in clinical and preclinical studies. Immunomodulatory regimens offer an attractive approach as they often have fewer side effects than existing drugs, including less potential for creating resistance in microbial diseases.

Cell based Immunotherapies are proven to be effective for some cancers. Immune effector cells such as lymphocytes, macrophages, dendritic cells, natural killer cells (NK Cell), cytotoxic T lymphocytes (CTL), etc., work together to defend the body against cancer by targeting abnormal antigens expressed on the surface of the tumor due to mutation.

Immunosuppressive drug

Immunosuppressive drugs or immunosuppressive agents are drugs that inhibit or prevent activity of the immune system. They are used in immunosuppressive therapy to:

• Prevent the rejection of transplanted organs and tissues (e.g., bone marrow, heart, kidney, liver)

• Treat autoimmune diseases or diseases that are most likely of autoimmune origin (e.g., rheumatoid arthritis, multiple sclerosis, myasthenia gravis, systemic lupus erythematosus, focal segmental glomerulosclerosis, Crohn's disease, Behcet's Disease, pemphigus, and ulcerative colitis).

• Treat some other non-autoimmune inflammatory diseases (e.g., long term allergic asthma control).

These drugs are not without side-effects and risks. Because the majority of them act non-selectively, the immune system is less able to resist infections and the spread of malignant cells. There are also other side-effects, such as hypertension, dyslipidemia, hyperglycemia, peptic ulcers, liver, and kidney injury. The immunosuppressive drugs also interact with other medicines and affect their metabolism and action. Actual or suspected immunosuppressive agents can be evaluated in terms of their effects on lymphocyte subpopulations in tissues using immunohistochemistry.

Immunosuppressive drugs can be classified into five groups:

• Glucocorticoids

• cytostatics

• Antibodies

• Drugs acting on immunophilins

Immunostimulant

Immunostimulants, also known as immunostimulators, are substances (drugs and nutrients) that stimulate the immune system by inducing activation or increasing activity of any of its components. One notable example is the granulocyte macrophage colony-stimulating factor.

Classification

There are two main categories of immunostimulants:

• Specific immunostimulants provide antigenic specificity in immune response, such as vaccines or any antigen.

• Non-specific immunostimulants act irrespective of antigenic specificity to augment immune response of other antigen or stimulate components of the immune system without antigenic specificity, such as adjuvants and non-specific immunostimulators.

Deoxycholic acid, also known as deoxycholate, cholanoic acid, and 3α,12α-dihydroxy-5β-cholanate, is a bile acid. Deoxycholic acid is one of the secondary bile acids, which are metabolic byproducts of intestinal bacteria. The two primary bile acids secreted by the liver are cholic acid and chenodeoxycholic acid. Bacteria metabolize chenodeoxycholic acid into the secondary bile acid lithocholic acid, and they metabolize cholic acid into deoxycholic acid. There are additional

secondary bile acids, such as ursodeoxycholic acid. Deoxycholic acid is soluble in alcohol and acetic acid. When pure, it comes in a white to off-white crystalline powder form.

parkinson's disease

Parkinson's disease (PD) is a long-term degenerative disorder of the central nervous system that mainly affects the motor system. The symptoms generally come on slowly over time. Early in the disease, the most obvious are shaking, rigidity, slowness of movement, and difficulty with walking. Thinking and behavioral problems may also occur. Dementia becomes common in the advanced stages of the disease. Depression and anxiety are also common, occurring in more than a third of people with PD. Other symptoms include sensory, sleep, and emotional problems. The main motor symptoms are collectively called "parkinsonism", or a "parkinsonian syndrome".

The cause of Parkinson's disease is generally unknown, but believed to involve both genetic and environmental factors. Those with a family member affected are more likely to get the disease themselves. There is also an increased risk in people exposed to certain pesticides and among those who have had prior head injuries, while there is a reduced risk in tobacco smokers and those who drink coffee or tea. The motor symptoms of the disease result from the death of cells in the substantia nigra, a region of the midbrain. This results in not enough dopamine in these areas. The reason for this cell death is poorly understood, but involves the build-up of proteins into Lewy bodies in the neurons. Diagnosis of typical cases is mainly based on symptoms, with tests such as neuroimaging being used to rule out other diseases.

There is no cure for Parkinson's disease, with treatment directed at improving symptoms. Initial treatment is typically with the antiparkinson medication levodopa (L-DOPA), with dopamine agonists being used once levodopa becomes less effective. As the disease progresses and neurons continue to be lost, these medications become less effective while at the same time they produce a complication marked by involuntary writhing movements. Diet and some forms of rehabilitation have shown some effectiveness at improving symptoms. Surgery to place microelectrodes for deep brain stimulation has been used to reduce motor symptoms in severe cases where drugs are ineffective. Evidence for treatments for the non-movement-related symptoms of PD, such as sleep disturbances and emotional problems, is less strong.

Treatment

Parkinson's disease can't be cured, but medications can help control your symptoms, often dramatically. In some later cases, surgery may be advised.

Your doctor may also recommend lifestyle changes, especially ongoing aerobic exercise. In some cases, physical therapy that focuses on balance and stretching also is important. A speech-language pathologist may help improve your speech problems.

Medications

Carbidopa-levodopa, Carbidopa-levodopa infusion, Dopamine agonists, MAO B inhibitors, Catechol O-methyltransferase (COMT) inhibitors.

Alzhiemier's disease

Alzheimer's disease (AD), also referred to simply as Alzheimer's, is a chronic neurodegenerative disease that usually starts slowly and worsens over time. It is the cause of 60–70% of cases of dementia. The most common early symptom is difficulty in remembering recent events (short-term memory loss). As the disease advances, symptoms can include problems with language, disorientation (including easily getting lost), mood swings, loss of motivation, not managing self-care, and behavioural issues. As a person's condition declines, they often withdraw from family and society. Gradually, bodily functions are lost, ultimately leading to death. Although the speed of progression can vary, the typical life expectancy following diagnosis is three to nine years.

The cause of Alzheimer's disease is poorly understood. About 70% of the risk is believed to be genetic with many genesusually involved. Other risk factors include a history of head injuries, depression, or hypertension. The disease process is associated with plaques and tangles in the brain. A probable diagnosis is based on the history of the illness and cognitive testing with medical imaging and blood tests to rule out other possible causes. Initial symptoms are often mistaken for normal ageing. Examination of brain tissue is needed for a definite diagnosis.[4] Mental and physical exercise, and avoiding obesitymay decrease the risk of AD; however, evidence to support these recommendations is not strong. There are no medications or supplements that have been shown to decrease risk.

No treatments stop or reverse its progression, though some may temporarily improve symptoms. Affected people increasingly rely on others for assistance, often placing a burden on the caregiver; the pressures can include social, psychological, physical, and economic elements. Exercise programmes may be beneficial with respect to activities of daily living and can potentially improve outcomes. Behavioural problems or psychosis due to dementia are often treated with antipsychotics, but this is not usually recommended, as there is little benefit with an increased risk of early death.

Diagnosis

There's no specific test today that confirms you have Alzheimer's disease. Your doctor will make a judgment about whether Alzheimer's is the most likely cause of your symptoms based on the information you provide and results of various tests that can help clarify the diagnosis.

Doctors can nearly always determine whether you have dementia, and they can often identify whether your dementia is due to Alzheimer's disease. Alzheimer's disease can be diagnosed with

complete accuracy only after death, when microscopic examination of the brain reveals the characteristic plaques and tangles.

To help distinguish Alzheimer's disease from other causes of memory loss, doctors now typically rely on the following types of tests.

Physical and neurological exam

Your doctor will perform a physical exam, and is likely to check your overall neurological health by testing your:

- Reflexes

- Muscle tone and strength

- Ability to get up from a chair and walk across the room

- Sense of sight and hearing

- Coordination

- Balance

POSSIBLE QUESTIONS

UNIT-IV

PART-A (20 MARKS)

(Q.NO 1 TO 20 Online Examination)

PART-B (2 MARKS)

1. Explain about anti-inflammatory drugs.

2. How to manage shock?

3. Discuss mechanism of action, adverse reactions and therapeutic uses of catecholamines

4. Explain pharmacotherapy of Gout.

PART-C (8 MARKS)

1. Write about the pharmacotherapy of cardiac failure

2. Describe diuretic and antidiuretic drugs?

3. How to manage hypertension?

4. Explain pharmacotherapy of Rhumatoid arthriris

5. How are vasodilators used as drugs for angina pectoris?

Karpagam academy of higher education
Department of biochemistry
Drug Biochemistry (17BCP304) MCQ
UNIT V

KARPAGAM
DEPARTME
II M.Sc., BIC
MULTIPLE C
Drug **Bioch**

S.No	Unit	Questions	Option 1	Option 2	Option 3	Option 4	Answer
1	V	The protein fraction with immuno	Albumin	alpha globulin	beta globulin	gamma globulin	**gamma globulin**
2	V	Human normal Ig is also called as _____	Histafine	immuneserum	hyperimmuneseru	human specific Ig	**Histafine**
3	V	_____ is used intreatment of	muromab	infliximab	daclizumab	rituximab	**infliximab**
4	V	Cyclosporin is a cyclic _____	undecapeptide	hexapeptide	octapeptide	nonapeptide	**undecapeptide**
5	V	_____is a T cell growth	IL-4	IL-2	IL-6	IL-8	**IL-2**
6	V	Tacrolimus is obtained from	Aspergillus niger	Beauveria nivea	E.coli	Streptomyces	**Beauveria nivea**
7	V	Cyclosporin is produced by	Aspergillus niger	Beauveria nivea	E.coli	Streptomyces	**Aspergillus niger**
8	V	Thalidomide is a selective	TNF-alpha	TNF-beta	TNF-gamma	TNF-delta	**TNF-alpha**
9	V	Daclizumab is a geneticall engineered	IgG	IgA	IgD	IgE	**IgG**
10	V	_____ is an immunomodulator	Interferon	glatiramer acetate	lavamisole	Sirolimus	**glatiramer acetate**
11	V	_____restore cutaneous delayed	amantadine	tilorane	levamisole	BCG	**levamisole**
12	V	____&_____ stimulate humoral immune	Amantidine&lev	tilorane&levamisole	BCG&clofazimine	amantidine&tilorane	**amantidine&tiloran**
13	V	Drugs which increase the rate of urine	Anti-diuretics	Vasopressin	osmotic diuretics	diuretics	**Anti-diuretics**
14	V	Which of the following is a osmotic	furosemide	chlorthalidone	bumetamide	mannitol & sucrose	**mannitol & sucrose**
15	V	Extravasation of mannitol may cause	intracranial	pulmonary edema	confusion	thrombophlebitis	**thrombophlebitis**
16	V	_____ present in the cilia which is improtant in the production of aqeuous	electrolytes	carbonic anhydrase	xanthine	sucrose	**carbonic anhydrase**
17	V	_____ should be avoided for fear	dexamethason	nifedipine	dexamethason and	sedative hypnotics	**sedative hypnotics**
18	V	Excessive renal loss of Na and chloride	hyponatremia	hyponatremic	hypokalemic	weak diuretics	**hypokalemic**
19	V	_____ is an anti-bacterial drug	osmotic diuretic	potassium sparing	benzothiadiazine	high ceiling diuretic	**benzothiadiazine**
20	V	Diabetes insipidus treated with _____	mannitol	furosemide	aminophylline	benzothiadiazine	**benzothiadiazine**
21	V	_____ acts as a competitive	thiazides	mannitol	spironolactone	weak diuretics	**spironolactone**
22	V	Absense of _____ may cause	Desmopressin	arginine vasopressin	high ceiling	osmotic diuretics	**arginine vasopressin**
23	V	In gout plasma level of uric acid is------------	2 to 7 mg/dl	10 to 15 mg/dl	below 7mg/dl	above 7mg/dl	**above 7mg/dl**
24	V	colichicine is used for the treatment of ------	chronic gout	acute gout	RA	Anaemia	**acute gout**

#	V	Question	A	B	C	D	Answer
25	V	Lesch-Nyhan syndrome leads to--------------	chronic gout	acute gout	chronic and acute	RA	**chronic gout**
26	V	uricosuric drugs are employed in the	chronic gout	acute gout	RA	Epilepsy	**chronic gout**
27	V	The colichicine is rapidly absorbed from ----	GI tract	duodenum	intestine	stomach	**GI tract**
28	V	Myopathy is caused by the chronic	colichicine	allopurinol	probenecid	stomach	**colichicine**
29	V	The derivative of phenylbutazone which is	probenecid	sulfinpyrazone	Azapropazone	benzbromarone	**sulfinpyrazone**
30	V	The drug used in the treatment of RA	muromab	infliximab	daclizumab	rituximab	**infliximab**
31	V	cyclophosphamide used in the treatment of	analgesic	NSAID	daclizumab	DMARD	**daclizumab**
32	V	Which of the following is used for the treatment of patients with severe RA who	methotrexate	cyclophosphamide	daclizumab	Ibuprofen	**methotrexate**
33	V	Enzyme used in the treatment of	urokinase	bibrinolysin	pepsin	hyaluronidase	**pepsin**
34	V	Cretain snake and bee venum contains	hyaluroonidase	disastase	trypsin	streptokinase	**hyaluroonidase**
35	V	_____ in highly purified form is used	potassium	sodium hyaluronidase	chymotrypsin	collagenase	**sodium**
36	V	Streptokinase is produced by certain strains	stephylococci	bacilli	pneumococci	beta hemolytic	**beta hemolytic**
37	V	Trypsin is obtained from	bovine pancreas	ox pancreas	horse pancreas	bacterial strains	**ox pancreas**
38	V	The activity of collagenase is optimal	pH 6-8	pH 5-8	pH 3-5	pH 7	**pH 6-8**
39	V	The concentrated protease enzyme	carcia papaya	pineapple	ox pancreas	bacterial strains	**pineapple**
40	V	Collagenase enzyme is derived from	cl.bromelains	cl.histolyticum	cl.papase	cl.botulinum	**cl.histolyticum**
41	V	_____ used to liquefy excessive	aerosal trypsin	bovine pancreas	chymoral	collagenase	**aerosal trypsin**
42	V	Streptokinase has its maximum activity	pH 6.0-7.0	pH 7.3-7.6	pH 2.5-6.2	pH 5-7	**pH 7.3-7.6**
43	V	Aspirin is chemically ----------------	sodium salicylate	salicylamide	acetyl salicylic acid	salicylate	**acetyl salicylic acid**
44	V	Aspirin is an example for -------------	NSAID	Adrenergic drug	Cholinergic drug	Emitic drug	**NSAID**
45	V	Aspirin inhibit ------------- activity	Cyclooxygenase	Esterase	Xanthine oxidase	Oxidase	**Cyclooxygenase**
46	V	NSAID repress the sensatoin of pain by	PGE2	PGI2	PGF2 alpha	PGF2 beta	**PGE2**
47	V	Aspirin -------------thromboxane	reversibly inhibit	irreversibly inhibit	reversibly activate	irreversibly activate	**irreversibly inhibit**
48	V	Hyperkalemia is the increase of --------------	sodium	Magnesium	Calcium	Potassium	**Potassium**
49	V	Therapeutic action of aspirin is ------- -----	Anti	anti tumour	diuretic	antiemitic	**Anti inflammation**
50	V	A cyclooxigenase inhibitor used in the long term treatment of RA, osteo arthritis and	Diclofenac	Ketorolac	Tolmetin	Ibuprofen	**Diclofenac**
51	V	The inactive prodrug closely related to indomethacin which is used as NSAID is --	Diclofenac	Sulindac	Etodolac	Fenamates	**Sulindac**
52	V	Orally administered aspirin is usually	GI tract	Intestine	Stomach	Liver	**Stomach**
53	V	--------------- is the competitive block of	Prazosin	Perazosin	Phentolamine	Propranolol	**Phentolamine**
54	V	All beta blockers are competitive -----------	Agonist	Antagonist	Agonst and	beta blocker	**Agonist**

No.		Question	A	B	C	D	Answer
55	V	Labetalol is a ---------	alpha blocker	beta blocker	alpha and beta	gamma blocker	**alpha and beta**
56	V	All of them are competitive blockers of	Prazosin	Terazosin	Daxazosin	Propranolol	**Propranolol**
57	V	---------- drug related to nitrogen mustard	Phenoxybenzami	Propramolol	Labetalol	Esmolol	**Phenoxybenzamine**
58	V	Drug used in the treatment of	Phenoxybenzami	Propramolol	Labetalol	Acebutolol	**Phenoxybenzamine**
59	V	The other name of anticholinergic drug is	anti adregenic	anti muscuranic	anti inflammatory	anti emitic	**anti muscuranic**
60	V	Which one is not anticholinergic drugs?	Atrophin	scopalamine	dicyclomine	labetalol	**labetalol**

Tachyphylaxis — **Tachyphylaxis**
Agonism — **Additive effect**
Synergism — **Synergism**
Type III — **Delayed**
Drugs likely to produce pelvic
Neurotoxic drugs
Species tolerance — **Tissue tolerance**
Zinc phosphate — Alkaline
NK cells and mast — **Macrophages and NK cells**
T cells — **Thymus**
Quantitatively exaggerated response — **Unpredictable, inherent, very rapidly**
A drug interaction — T-cells bearing on
NK cells — CD antigen
Radioassay — **Physico-chemical assay**
Analgesic — **Methadone**
cal per kg body weight — mg per kg body weight
CSF stimulants — **CNS depressants**
Synergism — **Drug tolerance**