DEFINITION OF PHARMACOLOGY

Pharmacology is the study of the therapeutic value and/or potential toxicity of chemical agents on biological

systems.

It targets every aspect of the mechanisms for the chemical actions of both traditional and novel therapeutic

agents.

Two important and interrelated areas are: pharmacodynamic and pharmacokinetics.

i. Pharmacodynamic (what drug does with the body) are the study of the molecular, biochemical, and

physiological effects of drugs on cellular systems and their mechanisms of action.

ii. Pharmacokinetics (what body does with the drug) deals with the absorption, distribution, and excretion

of drugs.

SCOPE OF PHARMACOLOGY

History

It is of intellectual interest to know how drugs are discovered and developed. Often in the past, this was

based on folklore or intelligent observation (e.g. digitalis leaf, penicillin). Nowadays, new drugs are

mostly developed by the organic chemist working with a pharmacologist, increasingly from basic

knowledge about key molecular targets. Usually some sort of biological screen is used to select among

organic molecules for optimum pharmacological activity.

1. Francois Magendie (1783-1855), a French physiologist laid down the dictum "Facts and facts alone are

the basis of science." Experimental procedures with animals are the testing grounds for determination of

drug action.

2. Claude Bernard (1813-1878), investigated the plant extract curare and proposed a site of action for this

agent.

3. Rudolph Buchheim (1820-1879). In 1847 Buchheim established the first laboratory devoted to

experimental pharmacology in the basement of his home in Dorpat which is known as the cradle of

experimental pharmacology.

4. Oswald Schmiedeberg (1838-1921). In 1872 set up an institute of pharmacology in Strasbourg, France

(Germany at that time) which became a mecca for students who were interest in pharmacological

problems.

5. J.N. Langley (1852-1925 and Sir Henry Dale (1875-1968) pioneered pharmacology in England, taking a

physiological approach.

6. John J. Abel (1857-1938) established the first chair of pharmacology in the U.S.A. (U. Michigan, 1891) after

training in Germany. Able went to Johns Hopkins in 1893, and trained many U.S. pharmacologists. He is

known as "The Father of American Pharmacology".

7. The Second World War was the impetus for accelerated research in pharmacology (the war time

antimalarial program) in the U.S., and introduced strong analytical and synthetic chemical approaches.

Pharmacodynamic

The effect of the drug on the body. Pharmaco-dynamics is the study of the relationship of drug

concentration and the biologic effect (physiological or biochemical).

For most drugs it is necessary to know the site of action and mechanism of action at the level of the

organ, functional system, or tissue. For example, the drug effect may be localized to the brain, the

neuromuscular junction, the heart, the kidney, etc. Often the mechanism of action can be described in

biochemical or molecular terms. Most drugs exert effects on several organs or tissues, and have unwanted as well as therapeutic effects. There is a dose-response relationship for wanted and unwanted (toxic) effects.

Patient factors affect drug responses - age, weight, sex, diet, race, genetic factors, disease states, trauma, concurrent drugs, etc.

Pharmacokinetics

The effect of the body on the drug. To produce its characteristic effects, a drug must be present in appropriate concentrations at its sites of action. Thus, it is important to know the interrelationship of the absorption, distribution, binding, biotransformation, and excretion of a drug and its concentration at its locus of action.

1. Absorption (oral or parenteral): A drug must be absorbed and achieve adequate concentration at its site of action in order to produce its biological effects. Thus, when a drug is applied to a body surface (e.g., G.I. tract, skin, etc.), its rate of absorption will determine the time for its maximal concentration in plasma and at the receptor to produce its peak effect.

2. Distribution: The blood, total body water, extracellular, lymphatic and cerebrospinal fluids are involved in drug movement throughout the body. Depending upon its chemical and physical properties, the drug may be bound to plasma proteins or dissolved in body fat, delaying its progress to its sites of action or excretory mechanism.

3. Metabolism: This is how certain drugs are handled by the body in preparation for their elimination and includes the fate of drugs-biotransformation (e.g., hydrolysis, conjugation, oxidation-reduction).

4. Excretion: The kidney is the most important organ for drug excretion but the liver, lung and skin are also

involved in drug elimination. Drugs excreted in feces are mostly derived from unabsorbed, orally ingested

drugs or from metabolites excreted in the bile and not reabsorbed by the intestine. The physical and

chemical properties, especially the degree of ionization of the drug, are important in the rate of excretion.

5. Biological Factors Modifying Pharmacokinetic Aspects: Normal variations occur in population

pharmacokinetic constants (absorption rates, elimination rates). Other factors include age, weight, obesity,

edema, concurrent diseases, other drugs (various interactions including effects on protein binding or

metabolic rate), diet, dose interval and route of administration, genetic variations in elimination rate.