Chapter 1
Print ISBN: 978-93-89246-86-5, eBook ISBN: 978-93-89246-87-2

History & Development of Pharmacology

Subhash Chandra Kothiyal[1*], Sarla Saklani[1], Shrivatsa Kothiyal[2] and Sarvesh Kumar[3]

DOI: 10.9734/bpi/mono/978-93-89246-87-2

1.1 Drug History & Development

The world's oldest known pharmacological or therapeutic writings come from India and China. The earliest Indian records are the Vedas. Although there are medical descriptions in Rigveda (3000 B.C). It was Charaka, a renowned ancient Indian physician, and later Sushruta and Vagbhata, who described various medicinal preparations included in Ayurveda, Charaka described about 300 herbal drugs and classified them according to their effects,

The Chinese material medica 'Pan Tsao' was probably written in (2735 B.C) and contained many plant and metallic preparations and a few animal products. Modern medicine is considered to date from Hippocrates, a Greek physician (450 B.C), who for the first time introduced the concept of disease as a pathologic process and tried to organize the science of medicine on the basis of observation, analysis and deduction.

Herbs:-

(The word herb comes from the Latin word '*herba'* meaning grass, green stalks or blades).

In general use, herbs are plants with savory or aromatic properties that are used for in medicine, flavoring food or as fragrances. Herbs have a variety of uses including medicinal and in some cases, spiritual. The term "herb" differs between culinary herbs and medicinal herbs; in medicinal or spiritual use, any parts of the plant might be considered as "herbs", including leaves, roots, flowers, seeds, root bark, inner bark (and cambium), resin and pericarp. Herbs have long been used as the basis of traditional Chinese herbal medicine, with usage dating as far back as the first century CE and far before. In India, the Ayurveda medicinal system is based on herbs. Which plant parts (flower, fruit, root, leaves stem, bark and seed) contain medicinal properties that are called herbs.

Medicine:-

(Medicine is the science and practice of the diagnosis, treatment, and prevention of disease or a drug or other preparation for the treatment or prevention of disease). Medicine encompasses a variety of health care practices evolved to maintain and restore health by the prevention and treatment of illness. Contemporary medicine applies biomedical sciences, biomedical research, genetics and medical technology to diagnose, treat and prevent injury and disease.

Ayurvedic medicine:-

The word "ayurveda" is Sanskrit, A*yurveda*, meaning knowledge of life and longevity. Ayurvedic medicine is one of the world's oldest holistic healing systems. It was developed more than 3,000 years ago in India. It's based on the belief that health and wellness depend on a delicate balance between the mind, body, and spirit. Ayurveda names seven basic tissues, which are plasma, blood,

[1]Department of Pharmaceutical Chemistry, School of Sciences, H. N. B. Garhwal (Central) University, Srinagar (Garhwal), Uttarakhand, India.
[2]D. B. S. Public School, Muni Ki Reti, Lal Tappar, Rishikesh, Dehradun, Uttarakhand, India.
[3]Government Polytechnic, Srinagar Garhwal, Uttarakhand, India.
**Corresponding author: E-mail: subhashkothiyal@gmail.com;*

muscles, fat, bone, marrow and semen. Ayurveda has historically divided bodily substances into five classical elements (Sanskrit *panchabhuta*, viz. earth, water, fire, air and ether. Ayurveda also names three elemental substances (called Vata, Pitta and Kapha). Ayurveda has eight ways to diagnose illness, called pulse, urine, stool, tongue, speech, touch, vision and appearance. After all it is a type of traditional Hindu medicine system that treats illness/disease using a combination of food, herbs and breathing exercise.

Homeopathy:-

The term "homeopathy" was coined by Hahnemann (respected doctor in Germany) and derived from two Greek words that mean “like disease”. Homeopathy is a system of alternative medicine created in 1796 by Samuel Hahnemann, based on his doctrine of *like cures like.* Homeopathy is an alternative medical practice in which extremely dilute amounts of certain natural substances are used to treat various ailments. It is a medical system based on the belief that the body can cure itself. Those who practice it use tiny amounts of natural substances, like plants and minerals. It is a system of treating disease or disease like condition, where we have using a very small amount of the drug/ chemical substance/compound in high amount, which cause the disease or disease like condition.

Allopathy:-

(A western system of medicine, Western-American culture).

The term "allopathy" was coined in 1842 by C.F. Samuel Hahnemann. The system of medical practice which treats disease by the use of remedies which produce effects different from those produced by the disease under treatment. Allopathic medicine refers to the practice of traditional or conventional Western medicine.The term allopathic medicine is most often used to contrast conventional medicine with alternative medicine or homeopathy.

Drugs:-

(French term –Drogue, which means –A dry herb).

It is the single active chemical entity/compound/substance in a medicine that is used for diagnosis/treatment/cure/prevention of a disease (allergy, cancer, tuberculosis, analgesic & AIDS etc). This disease oriented definition of drug does not including contraceptives or improvement of health. The WHO (1966) has given a more comprehensive definition-“Drug is any substance or product that is used or is intended/consumption/intake to be used to modify/change or explore physiological system or pathological states for the benefit of the recipients.”

1.2 The Nature and Sources of Drugs

The various sources of drugs are:

I. Natural source
II. Synthetic source
III. Other sources

I. Natural source:-

a) Plant (Morphine, digoxin, quinine, atropine, nicotine, reserpine and caffeine etc)
b) Animal (Insulin, thyroid extract, heparin, antivenom, gonadotropins and antitoxic etc)
c) Mineral (Liquid paraffin, magnesium sulfate, magnesium trisilicate, kaolin, Ca, I and Cl etc)
d) Microorganism (Bacteria and fungi, isolated from soil are important sources of antibacterial substances, e.g., penicillin)

II. Synthetic source:-

a) Laboratory sources (e. g Analgesics, hypnotics, anticancer drugs, e.g. Paracetamol, Aspirin etc).

III. Other sources:-

a) Genetic engineering (DNA recombinant technology) e.g insulin and growth hormones, genes.
b) Hybridoma technique (e. g monoclonal antibodies).

1.3 Drug Nomenclature

A drug generally has three categories of names.

1) **Chemical name (IUPAC Name).**
2) **Non-proprietary name (Govt. authority name e.g IP, BP & USP).**
3) **Proprietary/Brand name (Owner or manufacturer name).**

1) **Chemical name:-** It describes the substance chemically through International union of pure and applied chemistry (IUPAC) e. g. butenol-1, isopropyl amino and propan-2-ol etc.

2) **Non-proprietary name:-** It is the name accepted by a competent/Government scientific body/authority/committee e.g the United States Adopted Name (USAN) by the USAN council. Similarly there is the British Approved name (BAN) of a drug. The non-proprietary names of newer drugs are kept uniform by an agreement to use the recommended International Nonproprietary Name (rINN) in all member countries of the WHO.

3) **Proprietary/Owner (Brand) name:-** It is the name assigned/designed by the manufacturer/owner and is his/her property or trade mark. One drug may have multiple/different proprietary names, e.g ALTOL, ATCARDIL, ATECOR, ATEN, BETACARD, LONOL, TENOLOL, TENORMIN for atenolo from different manufacturers. Brand names are deigned to be catchy/short/easy to remember and often suggestive e.g LOPRESOR suggesting drug for lowering blood pressure. Brand names generally differ in different countries, e.g timolol maleate eye drops are marketed as TIMOPTIC in USA but as GLUCOMOL in India.

Composition of Drugs:- Inorganic drugs have simple formula, whereas organic drugs have a complex one. The most active amongst drugs are those containing alkaloids and glycosides.

1) Inorganic drugs (Acids, Bases and Salts).
2) Organic drugs (Alkaloids, glycosides, tannins, saponins etc).

1.4 Pharmacological Introduction

The 'father of pharmacology'- Oswald Schmiedeberg.

Pharmacology is the science of drugs (Greek: *Pharmacon*—drug; *logos*—discourse in). In a broad sense, it deals with interaction of exogenously (outer side of body) administered chemical molecules with living systems, or any single chemical substance which can produce a biological response is a 'drug'. It encompasses all aspects of knowledge about drugs, but most importantly those that are relevant to effective and safe use for medicinal purposes. For thousands of years most drugs were crude natural products of unknown composition and limited efficacy. Rudolf Buchheim, who founded the first institute of pharmacology in 1847 in Germany.

1.5 Types of Pharmacology

The two main divisions of pharmacology are pharmacodynamics and pharmacokinetics.

1) **Pharmacodynamics**
2) **Pharmacokinetic**

Pharmacodynamics:-

(Greek: *Dynamis*—power) What the drug does to the body.

This includes physiological and biochemical effects of drugs and their mechanism of action at organ system/subcellular/macromolecular levels, e.g.—Adrenaline → interaction with adrenoceptors → G-

protein mediated stimulation of cell membrane bound adenylyl cyclase → increased intracellular cyclic 3´,5´AMP → cardiac stimulation, hepatic glycogenolysis and hyperglycaemia, etc.

Pharmacokinetics:-

(Greek: *Kinesis*—movement) What the body does to the drug.

This refers to movement of the drug in and alteration of the drug by the body; includes absorption, distribution, binding/localization/storage, biotransformation and excretion of the drug, e.g. paracetamol is rapidly and almost completely absorbed orally attaining peak blood levels at 30–60 min; 25% bound to plasma proteins, widely and almost uniformly distributed in the body (volume of distribution ~ 1L/kg); extensively metabolized in the liver, primarily by Glucuronide and sulfate conjugation into inactive metabolites which are excreted in urine; has a plasma half life (t½) of 2–3 hours and a clearance value of 5 ml/kg/min.

1.6 Branches of Pharmacology

Some other important aspects of pharmacology are:

Pharmacotherapeutics:-

It is the scientific study of drugs together with knowledge of the disease for its prevention, mitigation or cure. Selection of the most appropriate drug, dosage and duration of treatment taking into account the specific features of a patient are a part of pharmacotherapeutics.

Clinical pharmacology:-

It is the scientific study of drugs (both old and new) in man. It includes pharmacodynamic and pharmacokinetic investigation in healthy volunteers and in patients. The aim of clinical pharmacology is to generate data for optimum use of drugs and the practice of 'evidence based medicine'.

Chemotherapy:-

It is the treatment of systemic infection/malignancy with specific drugs that have selective toxicity for the infecting organism/malignant cell with no/minimal effects on the host cells. Drugs in general, can thus be divided into:

Pharmacodynamic agents:- These are designed to have pharmacodynamic effects in the recipient.

Chemotherapeutic agents:- These are designed to inhibit/kill invading parasite/malignant cell and have no/minimal pharmacodynamic effects in the recipient.

Pharmacy:-

It is the art and science of compounding and dispensing drugs or preparing suitable dosage forms for administration of drugs to man or animals. It includes collection, identification, purification, isolation, synthesis, standardization and quality control of medicinal substances. The large scale manufacture of drugs is called *Pharmaceutics*. It is primarily a technological science.

Toxicology:-

It is the scientific study of drugs poisonous effect and other chemicals (household, environmental pollutant, industrial, agricultural, homicidal) with emphasis on detection, prevention and treatment of poisonings. It also includes the study of adverse effects of drugs, since the same substance can be a drug or a poison, depending on the dose.