Introduction & Background

- At the most basic level, pharmacology is the study of how organisms interact with drugs.
- The discipline of pharmacology is changing because offshoots from pharmacology have become disciplines of their own (eg. toxicology).
- **Pharmacodynamics**: study of what drugs do to the body
  - A pharmacodynamic study will try to address the effects of a drug on the body. These effects may be at the organ level, cellular level, or even molecular level. Therefore, drug-induced physiological effects, the details of how a drug interacts with a receptor, the intracellular signaling events triggered by a drug, and side effects caused by a drug are all part of pharmacodynamics.
- **Pharmacokinetics**: study of what the body does to drugs
  - A pharmacokinetic study addresses the fate of a drug starting from its entry into the body to its exit from the body. Absorption (A) of a drug into the body, its distribution (D) throughout the body organs and tissues, its breakdown or metabolism (M), and its elimination (E) are all part of the pharmacokinetic study. These four parameters are abbreviated as **ADME**.
- **Drugs**: We are used to thinking of drugs as chemicals that are either synthesized in the laboratory or natural products isolated from plants or microbes. But drugs are not always chemicals. Insulin, for example, is a hormone. It is a protein and not a small chemical molecule. In fact, recent advances in biotechnology has enabled us to produce a lot of drugs that are proteins. These are now known as **Biologicals**—also known as **Biologics**.
- **Drug Names**: Each drug has at least 3 distinct names. There is a chemical name, a generic name, and a brand or trade name.
- The **chemical name of a drug** is based on the chemical nomenclature and it describes the chemical structure of the drug.

- **Generic names** of drugs are nonproprietary. In the United States the generic name of a drug is determined by an organization known as United States Adopted Names or USAN. USAN works closely with another international naming organization known as INN to make sure that there is a consistency in naming a drug throughout the world. Nevertheless, there may be instances where a drug is named differently in the United States compared to other countries. For example, in North America, we use acetaminophen as the generic name for Tylenol but in most of the world this same drug is recognized as paracetamol. Another thing to remember about generic drugs is that the names are usually written out in all lower case letters, but in practice this convention is not always followed.

- The **brand name** of a drug is also known as a trade name. Unlike, the generic name, the brand name is decided by the company that markets the drug and is therefore proprietary, and the name is a registered trademark of the company. So it is possible that if a drug is made by more than one company then it will have different brand names. For example, in North America the major brand of acetaminophen is Tylenol marketed by McNeil but in the UK the common brand is Panadol, marketed by GSK. Unlike generic names which are written in all lower case letters, the first letter of the brand name is in upper case and sometimes the entire name is in upper case.

- **Drug Classification**: In addition to the naming system, drugs can be classified into 3 different categories. These groupings are done according to either the therapeutic class of a drug, action or effect of the drug, or by the chemical or biological class that the drug belongs to.
First, let's compare **therapeutic and action-based classifications**. Let's take an example of drugs that are considered antacids. Obviously, they would fall into the therapeutic class of antacids but drugs within this class are further divided into subgroups according to their mechanisms of action. For example, some drugs reduce acid through antagonism of the H2 histamine receptors, so we call these H2 antagonists H2 blockers. On the other hand, there are drugs that act directly at the proton pump, that's responsible for acid production, so they fall into a separate subgroup known as the proton pump inhibitors or PPIs. But both groups belong to the same therapeutic class.

The third classification approach is based on the **chemical or biological identity** of a drug. Previously, this was called chemical class only, but since we now have a growing list of drugs that are biological, we also need to consider these drugs separately. In terms of chemical classification, let's take an example of Non-Steroidal Antiinflammatory Drugs or NSAIDs. There are plenty of drugs that share this particular action but have different chemical identities. For example, Aspirin, Difflunisal, and Salsalates are considered to be salicylates because that is the chemical moiety shared by all three. On the other hand ibuprofen, Naproxen, and Ketoprofen are propionic acid derivatives because they all have a propionate group.

Drugs that are **proteins or peptides** are considered to be **biologics**. These drugs can be further sub divided according to their biological functions. The two most common groups are, (1) Hormones or growth factors, and (2) Antibodies. Examples of hormones include insulin and human growth hormone, while antibodies include drugs like Humira, which is used to treat severe inflammatory disorders.