

Pharmacodynamics: Principles of drug action, concept of drug receptor, nature, chemistry, classification.

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Introduction

- Pharmacodynamics (PD) is the study of the biochemical and physiologic effects of drugs (especially pharmaceutical drugs). The effects can include those manifested within animals (including humans), microorganisms, or combinations of organisms (for example, infection).
- Pharmacodynamics and pharmacokinetics are the main branches of pharmacology, being itself a topic of biology interested in the study of the interactions between both endogenous and exogenous chemical substances with living organisms.

- In particular, pharmacodynamics is the study of how a drug affects an organism, whereas pharmacokinetics is the study of how the organism affects the drug.
- Both together influence dosing, benefit, and adverse effects. Pharmacodynamics is sometimes abbreviated as PD and pharmacokinetics as PK, especially in combined reference (for example, when speaking of PK/PD models).

- Pharmacodynamics places particular emphasis on dose–response relationships, that is, the relationships between drug concentration and effect. One dominant example is drug-receptor interactions as modeled by
- $$\{L + R \rightleftharpoons LR\}$$
- where L, R, and LR represent ligand (drug), receptor, and ligand-receptor complex concentrations, respectively. This equation represents a simplified model of reaction dynamics that can be studied mathematically through tools such as free energy maps.

Drug action

- The majority of drugs either
- mimic or inhibit normal physiological/biochemical processes or inhibit pathological processes in animals or
- inhibit vital processes of endo- or ectoparasites and microbial organisms.

- There are 7 main drug actions[citation needed]:
- stimulating action through direct receptor agonism and downstream effects
- depressing action through direct receptor agonism and downstream effects (ex.: inverse agonist)
- blocking/antagonizing action (as with silent antagonists), the drug binds the receptor but does not activate it
- stabilizing action, the drug seems to act neither as a stimulant or as a depressant (ex.: some drugs possess receptor activity that allows them to stabilize general receptor activation, like buprenorphine in opioid dependent individuals or aripiprazole in schizophrenia, all depending on the dose and the recipient)

- exchanging/replacing substances or accumulating them to form a reserve (ex.: glycogen storage)
- direct beneficial chemical reaction as in free radical scavenging
- direct harmful chemical reaction which might result in damage or destruction of the cells, through induced toxic or lethal damage (cytotoxicity or irritation)