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Introduction to Pharmacology

Pharmacology

Definition, history, branches, scope and importance of pharmacology, drugs, sources of drugs, nomenclature and classification of drugs.

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CHAPTER 01 / PHARMACOLOGY 01. Introduction to Pharmacology

1. Introduction and definition

Pharmacology is the scientific study of medicines and other chemical substances that alter the functions of living organisms. It examines where medicines come from, how they act, how the body handles them, their therapeutic uses and their potential harmful effects.

A drug is a chemical or biological substance that modifies a physiological or pathological process. A medicine is a preparation containing an active substance, formulated for prevention, diagnosis or treatment of disease or relief of symptoms. An excipient is a formulation ingredient that helps stability, delivery or manufacture; excipients may occasionally cause intolerance or allergy.

2. Historical development

- Early medicine used plant, animal and mineral preparations. Traditional systems such as Ayurveda contributed to knowledge of medicinal substances.

- William Withering published his work on digitalis in 1785. Friedrich Serturner isolated morphine in the early nineteenth century.

- Rudolf Buchheim established an early experimental pharmacology institute in the nineteenth century; Oswald Schmiedeberg helped establish pharmacology as a distinct scientific discipline.

- Paul Ehrlich developed concepts of selective toxicity and chemotherapy. Alexander Fleming observed the antibacterial activity of penicillin in 1928; its later therapeutic development involved Florey, Chain and colleagues.

- Modern pharmacology incorporates molecular receptors, biotechnology, clinical trials, pharmacogenomics and post-marketing safety surveillance.

3. Branches of pharmacology

Branch	Meaning and example
Pharmacokinetics	Movement of a drug through the body: absorption, distribution, metabolism and excretion.
Pharmacodynamics	Biological effects and mechanisms of drug action, such as beta-blockade.
Pharmacotherapeutics	Selection and use of medicines to treat disease.
Toxicology	Harmful effects, poisoning and their management.
Clinical pharmacology	Study of medicines in humans, including efficacy and safety.

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Chemotherapy	Use of chemicals against infectious agents or malignant cells.
Pharmacognosy	Study of medicines and bioactive substances from natural sources.
Pharmaceutics	Design and preparation of medicinal dosage forms.
Pharmacogenetics / pharmacogenomics	Influence of genetic variation on drug response.
Pharmacovigilance	Detection, assessment and prevention of medicine-related harm.

4. Sources of drugs

Source	Representative example	Significance
Plant	Digoxin, atropine, morphine	Natural substances may be purified or chemically modified.
Microbial	Penicillin	Products of microorganisms or their derivatives.
Animal	Some heparin preparations	Biological origin requires appropriate quality control.
Mineral	Ferrous salts, magnesium salts	Used for replacement or specific therapeutic effects.
Synthetic	Paracetamol, lidocaine	Produced by chemical synthesis.
Semisynthetic	Amoxicillin	Natural compounds modified to improve properties.
Recombinant / biological	Human insulin, monoclonal antibodies	Manufactured using biotechnology.

5. Drug nomenclature

- Chemical name describes molecular structure; it is often complex.

- Generic or nonproprietary name identifies the active substance, for example paracetamol. International Nonproprietary Names support consistent communication.

- Trade or brand name identifies a marketed product. Different brands may contain the same active substance.

- Pharmacopoeial standards describe identity, strength, purity and quality. The Indian Pharmacopoeia is an important official reference in India.

Clinical example: Two cold and fever preparations may both contain paracetamol. Checking only the brand name can lead to accidental duplication. Verify every active ingredient, strength and dosage form.

6. Classification of drugs

Basis	Examples
Therapeutic use	Antihypertensives, analgesics, antidiabetics.

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Pharmacological action	Beta-blockers, calcium channel blockers.
Chemical structure	Benzodiazepines, beta-lactam antibiotics.
Organ system	CNS, respiratory, cardiovascular drugs.
Source	Natural, synthetic, biological.
Legal supply category	Prescription, non-prescription or specially controlled medicines under applicable local rules.

The WHO Anatomical Therapeutic Chemical (ATC) classification organizes medicines by the organ or system and by therapeutic, pharmacological and chemical characteristics. The same medicine can have several clinical uses; classification depends on context.

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7. Dosage forms and essential medicines

Tablets, capsules, solutions, suspensions, injections, creams, ointments, patches, inhalers and suppositories are common dosage forms. Immediate-release and modified-release formulations have different release characteristics and must not be substituted without verification. Medicines are selected according to clinical evidence, patient factors, quality, availability and cost. Essential medicines are those intended to meet priority healthcare needs; consult the applicable national list and formulary.

8. Scope and nursing importance

- Understand the prescribed indication and mechanism before administration.
- Identify allergies, contraindications, interactions and high-risk situations.
- Calculate doses accurately, verify the route and formulation, and monitor therapeutic and adverse responses.
- Educate patients about purpose, technique, adherence and warning symptoms.
- Document administration and any omissions or adverse reactions; participate in pharmacovigilance.
- Work with pharmacists and prescribers to clarify doubtful orders. Nursing competence does not imply independent prescribing authority.

9. Important examination questions

Long answer questions

1. 1. Define pharmacology and describe its history, branches and scope.
2. 2. Explain the sources, nomenclature and classification of drugs with examples.
3. 3. Discuss the importance of pharmacology in safe nursing practice.

Short answer questions

- Pharmacokinetics versus pharmacodynamics; pharmacognosy; pharmacovigilance; essential medicines; generic and trade names.

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Very short answer questions

- Who observed penicillin activity in 1928? - Alexander Fleming.
- What is toxicology? - Study of harmful effects of substances.
- Give one recombinant drug. - Human insulin.

10. Quick revision

Pharmacology links the drug, body and clinical outcome. Generic name identifies the active substance; formulation and strength remain essential. Therapeutic classes group medicines by clinical purpose. Safe drug use requires assessment, verification, administration, monitoring and education.

Conclusion

Knowledge of drug origins, classification and scientific principles allows the nurse to identify medication risks and provide informed, evidence-based care.

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Practice questions

Choose one best answer. The answer key and explanations follow the questions.

1. Which branch studies biological effects and mechanisms of drug action?

A. Pharmaceutics
B. Pharmacognosy
C. Pharmacodynamics
D. Pharmacokinetics

2. Which branch focuses on detecting, assessing and preventing medicine-related harm?

A. Pharmaceutics
B. Pharmacognosy
C. Pharmacogenetics
D. Pharmacovigilance

3. What does a medicine's generic or nonproprietary name identify?

A. Its active substance
B. Only its manufacturer
C. Its commercial packaging
D. Only its molecular structure

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Answer key and explanations

1. C - Pharmacodynamics

Pharmacodynamics addresses drug effects and mechanisms, such as receptor blockade.

2. D - Pharmacovigilance

Pharmacovigilance monitors and prevents medicine-related harm.

3. A - Its active substance

The generic name identifies the active substance and supports consistent communication.

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