Unit title: Pharmacological Principles of Drug Actions

Unit code: **K/601/0227**

QCF level: **5**

Credit value: **15**

Aim

This unit enables learners to analyse clinical data and understand the pharmacokinetic processes of diseases affecting the nervous system and the subsequent effects of drug treatments.

Unit abstract

This unit covers key areas of pharmacology enabling learners to gain an understanding of the principles of drug action and the interactions that occur between chemical substances and living organisms. Prior knowledge and understanding of human physiology are essential.

The unit introduces learners to pharmacokinetic principles allowing them to practically analyse and calculate clinical data including rates of absorption and excretion. Learners will then explore factors which affect pharmacokinetic processes and the drug/food and drug/drug interactions which arise from pharmacokinetic mechanisms.

Learners will gain an understanding of the transmission of nerve impulses and the effects of drugs on transmission. Finally, they will study the function of the immune system, gaining an appreciation of the drugs that stimulate and suppress it.

Learning outcomes

On successful completion of this unit a learner will:

1 Be able to analyse and calculate clinical data

2 Understand factors that affect pharmacokinetic processes

3 Understand the transmission of nerve impulses, diseases that affect transmission and their modification by drugs

4 Understand the function of the immune system and how drugs may affect it.

Unit content

1 **Be able to analyse and calculate clinical data**

Pharmaceutical data: graphical representations of plasma concentration against time for a drug administered by iv bolus, single oral dose, multiple oral dose, continuous iv infusion

Rates of absorption and excretion: the use of semi-log plots; calculation of rates of absorption and excretion, half-life, fraction absorbed and total amount absorbed

2 **Understand factors that affect pharmacokinetic processes**

Absorption, *distribution*, *metabolism and excretion*: factors eg food, diseases, age, other drugs, blood flow, lipid content, renal and hepatic impairment

Dosage regime: terminology; effect of factors eg food, disease, age, other drugs, blood flow, lipid content; recommendations used in the British National Formulary (BNF)

Interactions: drug/food and drug/drug interactions arising from pharmacokinetic mechanisms

3 **Understand the transmission of nerve impulses, diseases that affect transmission and their modification by drugs**

Transmission of nerve impulses: the structure and function of nerves of the central nervous system, the autonomic nervous system and voluntary nerves; movement of ions in the transmission process; the synapse; receptors; role of transmitter substances; enzymic breakdown; re-uptake

Effects of drugs: on transmission and treatment of disease; central nervous system eg Parkinson's disease, depression; voluntary nervous system eg myasthenia gravis; other disease states or treatments which involve transmitter substances or their modification eg use of beta-blockers, beta-receptor agonists, anticholinergics

4 **Understand the function of the immune system and how drugs may affect it**

Defence mechanism: non-specific and specific mode of action of antigens; vaccines and immunosuppressant drugs in relation to specific and non-specific defence mechanisms

Use of drugs: immune system stimulation and suppression antigens; corticosteroids; cyclosporin; use in autoimmune diseases; organ transplants and immunocompromised patients

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:		**Assessment criteria for pass** The learner can:	
LO1	Be able to analyse and calculate clinical data	1.1	plot pharmacokinetic data for given drug doses
		1.2	calculate rates of absorption and excretion, half-life, total amount absorbed and fraction absorbed
LO2	Understand factors that affect pharmacokinetic processes	2.1	discuss factors affecting absorption, distribution, metabolism and excretion of drugs
		2.2	explain how factors influence dosage regimes, including those for patients with renal and hepatic impairment
		2.3	explain types of drug interactions arising from pharmacokinetic mechanisms
LO3	Understand the transmission of nerve impulses, diseases that affect transmission and their modification by drugs	3.1	explain key stages in the transmission of nerve impulses
		3.2	explain the effects of drugs on transmission of nerve impulses and the treatment of disease
LO4	Understand the function of the immune system and how drugs may affect it	4.1	explain functions of defence mechanisms
		4.2	discuss the use of drugs that stimulate and suppress the immune system.

Guidance

Links

This unit has particular links with the following units within this qualification:

- *Unit reference number T/601/0215: Cell Biology*
- *Unit reference number L/601/0219: Laboratory Techniques in Applied Biology*
- *Unit reference number F/601/0220: Analysis of Scientific Data and Information*
- *Unit reference number F/601/0217: Biochemistry of Macromolecules and Metabolic Pathways*
- *Unit reference number Y/601/0224: Neurophysiology and Homeostatic Control of the Human Body*
- *Unit reference number M/601/0228: The Immune Response System*

Essential requirements

Delivery

The delivery of pharmacokinetic principles (learning outcome 1) could start with a review of graph plotting, and the use of semi-log paper. Derivation of equations could be illustrated practically using examples. Software could be used to illustrate trends, patterns and exceptions.

To explore the four areas of absorption, distribution, metabolism and excretion, (learning outcome 2) learners, in groups, could draw on a flipchart the processes they think happen following the ingestion of for example paracetamol tablets. Learners could then use this example as a basis for a thorough coverage of factors affecting pharmacokinetic processes.

Learners could individually research BNF dosage regimes for common drugs, for example via a group discussion of a commonly used antibiotic, and then share this information with the class.

Drug interactions can be delivered through a question and answer session, as learners should now have the understanding to deduce the reasons for many interactions. A class exercise using information sources could be carried out. Learners need to explain three types of drug interactions arising from pharmacokinetic mechanisms.

For learning outcome 3, learners could produce and present a scientific poster to illustrate the processes involved in the transmission of nerve impulses. DVDs/videos could be used to illustrate the effects drugs have on the transmission of diseases such as Parkinson's and the treatment of diseases.

DVDs/videos are available which cover the function of the immune system and autoimmune disease. Learners could prepare and deliver a presentation to highlight the use of drugs that stimulate and suppress the immune system, supported by a group question and answer session.

Assessment

Evidence for learning outcome 2 may be a report reviewing factors affecting absorption, distribution, metabolism and excretion of drugs, short answers to problems based on clinical data, suggested dosage regimes and written explanations for a range of drug/food and drug/drug interactions.

Evidence for learning outcome 3 may be an annotated diagram of the theory of nerve transmission and the role of transmitter substances. Evidence may also be in the form of a written account of disease states and their treatment.

Evidence for learning outcome 4 may be presentations on the use of drugs that act by modifying the immune system.

Resources

Learners will need access to library and information technology resources, tutorial and technical support, molecular models and laboratory facilities to demonstrate experiments.

Employer engagement and vocational contexts

Learners would benefit from visits to industrial laboratories to observe practical diagnostic techniques in operation.

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