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Introduction

Pharmacology is the science of drugs and their effects on biological systems. A drug can be defined as a chemical that can cause a change in a biological system; the important biological system to be considered in this book is the human body. A drug is the active ingredient in a medicine; a medicine is the formulation of a drug into a tablet, capsule or other delivery system. The Medicines Act 1968 refers to drugs as medicinal products.

Drugs can be naturally occurring substances, for example hormones; everyday substances, for example caffeine and alcohol; synthetic chemicals marketed for therapeutic activity, for example aspirin; or substances used for recreation.

Pharmacology as a science encompasses the following:

- the action of natural chemicals in the body;
- the origins and sources of drugs;
- their chemical structure and physical characteristics;
- their mechanisms of action;
- their metabolism and excretion;
- studies of their action on whole animals, isolated organs, tissues and cells, enzymes, DNA and other components of cells;
- ultimately studies of their actions in humans and their therapeutic uses.

Pharmacology is also the study of the toxic effects of drugs and chemicals in the environment. All drugs are capable of being toxic and all drugs can produce unwanted effects at high doses, or if used incorrectly. The difference between a medicine and a poison is often merely a matter of concentration. In therapeutics, the treatment of disease is intended to have a beneficial effect with adverse effects kept to an acceptable minimum. The science of modern pharmacology is a relatively recent development. Prior to the 1930s, there were very few medicines available, and those that were available came from natural sources. Examples of drugs originally from natural sources and still in use today are quinine (from the bark of the cinchona tree and used to treat malaria), digitalis (from the foxglove and used for heart failure) and aspirin (extracted from the bark of willow tree and originally used to treat fever).

Development of new drugs can happen in many ways. Drugs have been developed following observation of side effects when being used for other purposes. It is now known

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that the site of action of many drugs is a cellular receptor. As knowledge of receptor structures has developed, this has allowed drugs to be designed to fit with receptors. The human genome project and mapping of genes has led to work on the development of drugs to alter genes.

1.1 Pharmacology and health care professionals

The importance of pharmacology to health care professionals cannot be overestimated. Members of the three professions, physiotherapy, podiatry and radiography, encounter patients on a daily basis, many of whom will be on drug therapy. Patients are increasingly likely to be receiving at least one drug; many older patients are likely to be on more than one drug, and prescription of eight or nine drugs at the same time is not uncommon. This is known as *polypharmacy* and it increases the chance of patients experiencing adverse effects or the effects of drug–drug interactions.

Depending on the nature of their work, health care professionals may spend some considerable time with individual patients who might have questions about their drug therapy. Some health care professionals may be treating mainly older patients, or younger patients or high-risk patients, and will become experienced and familiar with drugs in their areas of expertise.

Health care professionals can be ideally placed to spot adverse drug reactions and to play an important role in the long-term monitoring of commonly prescribed drugs. As professionals, they should be able to advise patients or know when to refer them to other experts in the health care team. Drug therapy of disease is ever expanding; new drugs exist for effective treatment or cure of more diseases than ever before. Correct use of drugs is paramount. It is therefore important for health care professionals to have an understanding of therapeutic uses of medicines, normal doses, adverse effects, interactions with other drugs, precautions and contraindications. It is equally important to be able to judge whether a change in a patient's condition is caused by drug therapy, or a change in the disease process. Medication can lead to symptoms such as dizziness, fatigue, dry mouth, constipation and patients may or may not associate new symptoms with drug use.

Health care professionals are increasingly involved in the administration of drugs to patients, either as an exemption to the Medicines Act 1968, under patient group directions, or as supplementary prescribers. The Medicines Act 1968, and additional secondary legislation since then, provides a legal framework for the manufacture, licensing, prescription, dispensing and administration of medicines. An exemption to the Medicines Act allows certain professionals, including podiatrists, access to specified prescription-only medicines, providing they are appropriately registered with the Health Professions Council. The use of patient group directions allows many health care professionals to administer prescription-only medicines to specific groups of patients without a normal prescription. Podiatrists, radiographers and physiotherapists are now included in the list of health care professionals who can train to prescribe medicines alongside doctors (and dentists) as supplementary prescribers.

Prior to 1994, only doctors, dentists and veterinary practitioners were allowed to prescribe medicinal products in the United Kingdom. That year the law was changed to enable district nurses, midwives and health visitors to prescribe from a limited formulary of dressings, appliances and some medicines. This formulary of medicines was extended in 2002.

A review of prescribing, supply and administration of medicines for the Department of Health (1999) (Crown Report 2) recommended two types of prescriber: independent and supplementary.

Over the next few years, supplementary prescribing by nurses and pharmacists was introduced and legislation to allow this was changed in April 2003.

A similar process occurred with podiatry, physiotherapy and radiography and led to extension of supplementary prescribing to these professions in April 2005. In a further development in 2006, nurses and pharmacists became eligible to train as independent prescribers.

Non-medical prescribing is now the term applied to prescribing by members of the health care professions who are not 'medically' qualified.

Prescribing can be described in the following three ways:

1. to order in writing the supply of prescription-only medicine for a named patient;
2. to authorize by means of an NHS (National Health Service) prescription the supply of any medicine (prescription-only, pharmacy or general sales list item) at public expense;
3. to advise a patient on suitable care or medication, including over-the-counter drugs, and therefore with no written prescription.

All health care professionals who are involved in prescribing, and/or administration of medicines have to abide by standards set out by their respective professional bodies. For podiatrists, radiographers and physiotherapists, this is the Health Professions Council. Health care professionals have a responsibility to consult documentation produced by the professional bodies and be accountable for prescribing and administering drugs. All members of health care professions have a responsibility to reduce the risk of errors in prescribing, must assess and appraise their own practice and show a commitment to continuing professional development. This is essential not least because information about drugs and associated legislation is constantly changing. New drugs come on the market, and others are withdrawn or reclassified. Reliable sources of information are the *British National Formulary* (*BNF*), the *Monthly Index of Medical Specialities* (*MIMS*), the *British Pharmacopoeia* (*BP*), patient information leaflets (PILs) and summaries of product characteristics (SPCs) supplied by medicines manufacturers. Official bodies concerned with the use, quality and safety of medicines are the Commission on Human Medicines (CHS, formerly the Committee on the Safety of Medicines), the Medicines and Healthcare Products Regulatory Agency (MHRA) and the National Institute for Health and Clinical Excellence (NICE).

1.2 Patient compliance

Patient compliance is important for successful drug therapy. Compliance in this context is defined as the extent to which the patient follows the clinical prescription. Non-compliance and reasons why patients do not always take drugs as prescribed should be appreciated. Some common reasons for non-compliance are that the patient has doubts about a drug's effectiveness, they believe they are cured, they misunderstand instructions, dosage regimes are too complicated, or they experience unacceptable side effects.

Health care professionals play an important role in improving compliance. This is particularly important if a drug is for serious conditions like epilepsy, glaucoma or hypertension, or is for infection because of the problem of drug resistance.

Well-informed patients are more likely to be compliant.

It is worth spending time explaining what the medication is, how it is taken and why, how long it is to be used for, what adverse effects to look out for and any alternatives if appropriate. The importance of the drug therapy can be explained and what might happen if the patient did not comply. Aids to help compliance can be suggested, for example packaging of daily doses can be arranged with pharmacists, special containers can be obtained, the help of relatives can be sought, suitable time of day for administration can be chosen and provision of written information can all help. Patient information leaflets must be included in packaging of medicines.

1.3 Drug names

All drugs have at least three names: the chemical name, the generic name and the proprietary name. Chemical names can be complicated and difficult to remember and are not used in this book. A generic name is a drug's official name and the majority of drugs in this book are referred to by their generic names. The proprietary name is the name given to a drug by the manufacturing company. As the same drug can be manufactured by several different companies, a drug can have multiple proprietary names and this can be confusing. Hence, proprietary names have been avoided in this book except where the proprietary name is in common usage. In the United Kingdom, the generic name is known as the *British approved name* (*BAN*). Following European Directive 92/27/EEC, European Law requires the use of the recommended International Non-proprietary Name (rINN). This ensures that all countries, in Europe at least, recognize the same drug. In most cases, the BAN and the rINN were the same, but some British names have been changed. For example, amphetamine is now spelt amfetamine and lignocaine is now lidocaine. Where this has happened, both names are listed in the BNF. Wherever possible, drugs should be prescribed by their generic name; this allows any suitable product to be dispensed and in many cases, it saves the health service money. The only exception to this rule is when a patient must always receive the same brand of a drug because different preparations can result in different blood levels of the drug. No details of dosages are given in this book (except in some of the case studies), because these are subject to change and often have to be varied to suit individual patients. In practice, the *BNF* or *MIMS* should be used as a guide to dosages.

Examples of individual drugs have been kept to a minimum in the text, with usually just one or two examples given in each section. It would be impractical to try to remember the names of all drugs available. In practice, health care professionals quickly become familiar with drugs commonly used in their area.

Nevertheless, the examples used in this book amount to over 300 drug names, which are listed for easy reference in Appendix I.