

Medications may be given for various reasons. In many instances, the goal of drug therapy is to lessen disease processes rather than cure them. To meet this goal, drugs may be given for local or systemic effects. Drugs with local effects, such as sunscreen lotions and local anesthetics, act mainly at the site of application. Those with systemic effects are taken into the body, circulated through the bloodstream to their sites of action in various body tissues, and eventually eliminated from the body. *Most drugs are given for their systemic effects.* Drugs may also be given for relatively immediate effects (eg, in acute problems such as pain or infection) or long-term effects (eg, to relieve signs and symptoms of chronic disorders). Many drugs are given for their long-term effects.

SOURCES OF DRUGS

Where do medications come from? Historically, drugs were mainly derived from plants (eg, morphine), animals (eg, insulin), and minerals (eg, iron). Now, most drugs are synthetic chemical compounds manufactured in laboratories. Chemists, for example, can often create a useful new drug by altering the chemical structure of an existing drug (eg, adding, deleting, or altering a side-chain). Such techniques and other technological advances have enabled the production of new drugs as well as synthetic versions of many drugs originally derived from plants and animals. Synthetic drugs are more standardized in their chemical characteristics, more consistent in their effects, and less likely to produce allergic reactions. Semisynthetic drugs (eg, many antibiotics) are naturally occurring substances that have been chemically modified.

Biotechnology is also an important source of drugs. This process involves manipulating deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) and recombining genes into hybrid molecules that can be inserted into living organisms (*Escherichia coli* bacteria are often used) and repeatedly reproduced. Each hybrid molecule produces a genetically identical molecule, called a clone. Cloning makes it possible to identify the DNA sequence in a gene and produce the protein product encoded by a gene, including insulin and several other body proteins. Cloning also allows production of adequate amounts of the drug for therapeutic or research purposes.

DRUG CLASSIFICATIONS AND PROTOTYPES

Drugs are classified according to their effects on particular body systems, their therapeutic uses, and their chemical characteristics. For example, morphine can be classified as a central nervous system depressant, a narcotic or opioid analgesic, and as an opiate (derived from opium). The names of therapeutic classifications usually reflect the conditions for which the drugs are used (eg, antidepressants, antihypertensives, antidiabetic drugs). However, the names of many drug

groups reflect their chemical characteristics rather than therapeutic uses (eg, adrenergics, antiadrenergics, benzodiazepines). Many commonly used drugs fit into multiple groups because they have wide-ranging effects on the human body.

Individual drugs that represent groups of drugs are called **prototypes**. Prototypes, which are often the first drug of a particular group to be developed, are usually the standards with which newer, similar drugs are compared. For example, morphine is the prototype of opioid analgesics; penicillin is the prototype of antibacterial drugs.

Drug classifications and prototypes are quite stable, and most new drugs can be assigned to a group and compared with an established prototype. However, some groups lack a universally accepted prototype and some prototypes are replaced over time by newer, more commonly used drugs.

DRUG NAMES

Individual drugs may have several different names, but the two most commonly used are the generic name and the trade name (also called the brand or proprietary name). The *generic name* (eg, amoxicillin) is related to the chemical or official name and is independent of the manufacturer. *The generic name often indicates the drug group (eg, drugs with generic names ending in “cillin” are penicillins).* The *trade name* is designated and patented by the manufacturer. For example, amoxicillin is manufactured by several pharmaceutical companies, some of which assign a specific trade name (eg, Amoxil, Trimox) and several of which use only the generic name. In drug literature, trade names are capitalized and generic names are lowercase unless in a list or at the beginning of a sentence. Drugs may be prescribed and dispensed by generic or trade name.

DRUG MARKETING

A new drug is protected by patent for 14 years, during which it can be marketed only by the pharmaceutical manufacturer that developed it. This is seen as a return on the company's investment in developing a drug, which may require years of work and millions of dollars, and an incentive for developing other drugs. Other pharmaceutical companies cannot manufacture and market the drug. However, for new drugs that are popular and widely used, other companies often produce similar drugs, with different generic and trade names. For example, the marketing of fluoxetine (Prozac) led to the introduction of similar drugs from different companies, such as citalopram (Celexa), fluvoxamine (Luvox), paroxetine (Paxil), and sertraline (Zoloft). Prozac was approved in 1987 and went off patent in 2001, meaning that any pharmaceutical company could then manufacture and market the generic formulation of fluoxetine. Generic drugs are required to be therapeutically equivalent and are much less expensive than trade name drugs.