HOW DRUGS WORK

Before the discovery of the sulpha drugs in 1935, medical knowledge of drugs was limited to possibly only a dozen or so drugs that had a clear medical value. Most of these were the extracts of plants (such as digitalis, from foxgloves), while others, such as aspirin, were chemically closely related to plant extracts (in this case, salicylic acid, from the willow tree). It was soon realized, however, that crude plant extracts had two disadvantages: they were of variable potency, and the same plant could contain a number of different substances with different actions. These might even oppose each other, or cause serious adverse effects. Now, thousands of effective drugs are available and scientific knowledge regarding drugs and their actions has virtually exploded.

Today's doctor understands the complexity of drug actions in the body, both beneficial and adverse. As a result of extensive research and clinical experience, the doctor can now also recognize that some drugs interact harmfully with others, or with certain foods and alcohol.

DRUG ACTIONS

While the exact workings of some drugs are not fully understood, medical science provides clear knowledge as to what most of them do once they enter or are applied to the human body. Drugs serve different purposes: sometimes they cure a disease, sometimes they only alleviate symptoms. Their impact occurs in various parts of the anatomy. Although different drugs act in different ways, their actions generally fall into one of three categories.

Replacing chemicals that are deficient

To function normally, the body requires sufficient levels of certain chemical substances. These include vitamins and minerals, which the body obtains from food. A balanced diet usually supplies what is needed. But when deficiencies occur, various deficiency diseases result. Lack of vitamin C causes scurvy, iron deficiency causes anaemia, and lack of vitamin D leads to rickets in children and osteomalacia in adults.

Other deficiency diseases arise from a lack of various hormones which are the chemical substances produced by glands. Hormones act as internal messengers. Diabetes mellitus, hypothyroidism, and Addison's disease all result from deficiencies of different hormones.

Deficiency diseases are treated with drugs that replace the substances that are missing or, in the case of some hormone deficiencies, with animal or synthetic replacements.

Interfering with cell function

Many drugs can change the way cells work by increasing or reducing the normal level of activity. Inflammation, for example, is due to the action of certain natural hormones and other chemicals on blood vessels and blood cells. Anti-inflammatory drugs block the action of the hormones or slow their production. Drugs that act in a similar way are used in the treatment of a variety of conditions: hormone disorders, blood clotting problems, and heart and kidney diseases.

Many such drugs do their work by altering the transmission system by which messages are sent from one part of the body to another.

A message – to contract a muscle, say – originates in the brain and enters a nerve cell through its receiving end. The message, in the form of an electrical impulse, travels the nerve cell to the sending end. Here a chemical substance called a neurotransmitter is released, conducting the message across the tiny gap (synapse) separating it from an adjacent nerve cell. That process is repeated until the message reaches the appropriate muscle.

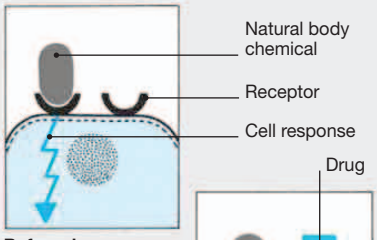
Many drugs can alter this process, often by their effect on receptor sites on cells (see left). Some drugs (agonists) intensify the response to cell receptor activation while other drugs (antagonists) reduce it.

Acting against invading organisms or abnormal cells

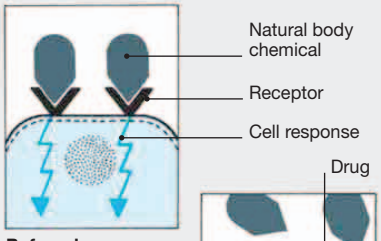
Infectious diseases are caused by viruses, bacteria, protozoa, and fungi invading the body. We now have a wide choice of drugs that destroy these microorganisms, either by halting their multiplication or by killing them directly. Other drugs treat disease by killing abnormal cells produced by the human body – cancer cells, for example.

RECEPTOR SITES

Many drugs produce their effects through their action on special sites called receptors, which may be on the surface of cells or inside them. Natural body chemicals such as neurotransmitters bind to these sites, initiating a response in the cell. A cell may have many types of receptors, each with an affinity for a different chemical. Drugs may also bind to receptors, either adding to the effect of the body's natural chemicals and enhancing cell response (agonists) or preventing such a chemical from binding to its receptor, and thereby blocking a particular cell response (antagonists).



Agonist drugs
These drugs bind to receptors and enhance normal cell response to receptor activation.



Antagonist drugs
These drugs bind to receptors and block cell response to receptor activation.