Toxins

Toxins, by definition, are poisons. Despite this fact, chemical and biological toxins are commonly used in medicine. The key is in the dosage. For instance, certain radioactive chemicals are used to diagnose and treat illnesses. Radioactive iodine, for example, in small doses can help pinpoint problems in a patient's thyroid, a small gland in the neck. In higher doses, radioactive iodine is used to shrink thyroid tumors.

Biological toxins can also be used in medicine. Botulinum toxin (Botox), which comes from a bacterium called *Clostridium botulinum,* is used in patients with torticollis (a condition in which neck muscles contract causing the head to turn to one side), strabismus (eye misalignment), and migraines. It is used in tiny doses.

CRITICAL THINKING

What are some of the dangers of using toxins as medicine?

Synthetic Medications

Synthetic drugs can be created by chemical processes, genetic engineering, or by altering animal cells. Often, drugs that are obtained from another source can be synthesized in the laboratory, thus preserving natural resources. For example, paclitaxel (Taxol), a drug for patients with cancer, was first made from the bark of the Pacific yew tree. Then a template or blueprint was developed to create a synthetic form of this drug, thus preserving the yew tree. Insulin can be obtained from pigs or cows, but a synthetic source is most commonly used. Human insulin is produced by using recombinant technology to add the insulin gene into a nonpathogenic strain of *E. coli*. This change occurred because of concern over the possible transmission of disease from animals to humans. In addition, there is a risk for immune reactions because of impurities found in the animal products. One additional advantage is that synthetic medications are usually more inexpensive because they are mass-produced.

Because scientists have been able to map the human genome, it is becoming possible to choose medications that are appropriate for individual patients, not patients as a whole. One area of uniqueness is the variation in the amount of drug-metabolizing enzymes each patient has and the effectiveness of these enzymes. The scientist can manipulate the DNA material of the medication source by changing it or combining it with DNA from another organism to target the patient's levels of the drug-metabolizing enzyme. Therefore, prescribers are able to choose drugs that work better for one population than for another. Research is also being conducted on the use of existing drugs in targeted populations. For example, BiDil is a combination of two generic drugs—hydralazine hydrochloride and isosorbide dinitrate—and is used to treat African American patients with heart failure.

CRITICAL THINKING

What are some of the ethical issues of genetically engineered drugs?

CATEGORIZING MEDICATIONS

The term **pharmacodynamics** refers to the effect of a drug on the body, or more scientifically, the negative and positive biochemical or physiological changes that a drug creates. Drugs fall into six categories of desired effects (Table 1-2).

- **Curative.** Some drugs restore normal physiological function, as in diuretics, which help the body rid itself of excess fluid.
- **Prophylactic.** These drugs prevent diseases or disorders, as in antibiotics given before surgery to prevent infection.