

the original or natural source serves as a template for creating a synthetic equivalent, which is especially useful if the natural source is a rare plant. Scientists are constantly researching natural sources (plants, animals, marine animals, and microbes) in the hope of finding new sources of medications. Some drugs are made by combining chemicals with natural products, such as hydrocodone, which combines natural opium in the form of codeine combined with acetaminophen (a man-made medication), whereas other drugs are synthesized in a laboratory. Barbiturates are an example of synthetic drugs because they are chemically derived from barbituric acid (itself an artificial compound of urea and malonic acid).

## Plants

Today plants are rarely used as medications; instead the active component of the plant is extracted and utilized in the manufacturing of the drug. Digoxin (Lanoxin), a drug used to treat heart failure, is made from the foxglove plant and has been used for healing since the 1500s. Most estrogen hormone replacements come from yams. Procaine (Novocain), used as an anesthetic, is derived from the coca plant. Rose hips are a rich source of vitamin C and are sold as an ingredient in vitamin C supplements. Aspirin (acetylsalicylic acid) is a compound based on salicin, which is found in the bark of a white willow tree, and is used to relieve pain and to treat inflammation.

Unfortunately, as less land becomes available for growing plants, fewer plants will exist for making medications. For example, as the rain forest diminishes, the rare plants that are located only in this environment may become extinct. In this instance, these rare plants are used as a template to manufacture a medication instead of using the plants and depleting them.



### CRITICAL THINKING

If people rely on plants for medication, what effect does the increasing human population have on the potential supply of medications?

## Animals

Domesticated animals are also a source of drugs. To ensure the purity of the drugs, donor animals are generally well cared for. Some examples include sheep, which provide lanolin, a topical skin medication that comes from the wool. Cows (**bovine**) and pigs (**porcine**) are good sources of hormone replacements. If a patient's body cannot manufacture a hormone, animal hormones can serve as a substitute. Horses provide humans with the replacement hormone conjugated estrogen (Premarin), which comes from a pregnant mare's urine. In addition, insulin is collected from the pancreases of cows or pigs. We obtain IGG (Immunoglobulin G) by injecting an antigen into animals (most commonly cows) and collecting the antibody that is formed. The drug heparin is extracted from porcine intestinal mucosa and bovine lungs.



### CRITICAL THINKING

Cows and pigs are good sources of hormones. Do you think animals may be a better hormone source than humans? Why or why not?

## Minerals

When foods grown from rich soil are unavailable, calcium, iron, zinc, magnesium, copper, and selenium are some of the minerals that are offered as necessary supplements.

For patients taking certain medications, mineral replacement is critical. Diuretic drugs such as furosemide (Lasix) cause the body to lose excess water through the kidneys, and potassium, a vital mineral, is also excreted with the water. Potassium is needed for the heart to function normally, so supplemental potassium chloride is frequently prescribed in addition to the medication. Potassium is also contained in sweet potatoes, bananas, and oranges.

Minerals are also used to treat certain conditions. For example, gold is used in the treatment of arthritis, iodine is used to treat goiter, and magnesium sulfate is used for constipation and eclampsia.