

- *Depth of breathing:* For inhalants, the more deeply patients breathe, the more medication they inhale. For example, ask patients to inhale deeply to receive maximum benefit during treatment for asthma.



CRITICAL THINKING

Explain how to overcome the following issue to increase absorption and bioavailability of an inhaled drug.

A patient who is taking shallow breaths and who is unable to follow directions to “breathe deeply.”

Distribution

The second phase in the drug cycle is **distribution**, which is the delivery of a drug to the appropriate site after the drug has been absorbed into the bloodstream. Once the medication is in the bloodstream, it is rapidly distributed throughout the body. Initially, well-perfused organs such as the brain, heart, kidneys, and lungs receive the majority of the medication. The lesser perfused organs such as the skin, muscles, and fat receive the medication at a slower rate.

Tissues in the body are either permeable or nonpermeable, meaning that substances can or cannot pass through them. A drug’s ability to pass through tissue depends on whether it is a lipid-soluble or non-lipid-soluble drug. Lipid-soluble drugs can easily pass through the lipid layer of membranes due to their small molecular size, while non-lipid-soluble (water-soluble) drugs have a very difficult time passing through these tissues.

Certain tissues have specialized physiological “barriers,” such as densely packed cells that allow nutrients and certain chemicals, but not other substances, including medications, to pass from the blood through the tissue. Examples of these densely packed cells include the blood-brain barrier, the blood-testicular barrier, and the blood-placental barrier.

The blood-placental barrier helps to filter drugs and other substances passing from mother to fetus and thereby protects the fetus. However, alcohol, cocaine, and even some over-the-counter drugs can cross this barrier easily and cause harm. Most lipid-soluble drugs readily cross this barrier, but water-soluble drugs do not. Many drugs, such as psychotropic (mind-altering) drugs, can cross the blood-brain barrier, although some antibiotics and other drugs that are easily absorbed in the stomach cannot cross. The blood-testicular barrier protects the male reproductive organs from toxins that could damage sperm. This barrier also makes certain male reproductive diseases difficult to treat because very little is allowed through it except for substances directly involved in functioning of the testes. Many psychotropic drugs have negative sexual effects, such as decreased libido, because they cross both the blood-brain barrier and the blood-testicular barrier.



CRITICAL THINKING

Why do drugs that cross the blood-brain barrier tend to have strong negative effects?



CRITICAL THINKING

Why should a woman actively trying to become pregnant consult her physician before taking an over-the-counter medication?

Metabolism

In the phase following distribution, the drug is metabolized by the liver, kidneys, and intestines. **Metabolism** or **biotransformation** means that the medication is chemically transformed to a less active or inactive form, called a *metabolite*. A medication is a foreign substance that the body does not normally require. Metabolism is necessary to break this foreign substance down into a form that no