1.7: Pharmacodynamics

Complex Interactions

So far, we have learned the importance of pharmacokinetics in describing how the body absorbs, moves, processes, and eliminates a medication. Now let’s consider a drug’s impact on the body, a series of complex interactions known as pharmacodynamics.

When considering how the cells of the body respond to medications, it is important to remember that the majority of drugs bind to specific receptors on the surface or interior of cells. However, there are many other cellular components and non-specific sites that can serve as receptor sites where drugs can bind to create a response. For example, did you know that an osmotic laxative like magnesium citrate attracts and binds with water? This medication works to pull water content into the bowel and increases the likelihood of a bowel movement.

Other medications may inhibit specific enzyme binding sites in order to impact the functionality of a cell or tissue. For example, antimicrobial and antineoplastic drugs commonly work by inhibiting enzymes that are critical to the function of the cell. With blockage of the enzyme binding site, the cell microbe or neoplastic cell is no longer viable and cell death occurs.
Agonist and Antagonist Actions

Understanding the mechanism of action or how a medication functions within the body, is essential to understanding the processes medications go through to produce the desired effect (see Figure 1.6). Drugs have agonistic or antagonistic effects. A drug agonist binds tightly to a receptor to produce a desired effect. A drug antagonist competes with other molecules and blocks a specific action or response at a receptor site. For example, the cardiac medication atenolol (Tenormin) is a beta-1 receptor antagonist used to treat patients with hypertension or heart disease. Beta-1 receptor antagonist medications like atenolol produce several effects by blocking beta-1 receptors: a negative inotropic effect occurs by weakening the contraction of the heart, thus causing less work of the heart muscle; a negative chronotropic effect occurs when the heart rate is decreased; and a negative dromotropic effect occurs when the conduction of the electrical charge in the heart is slowed. Understanding the effects of a beta-1 antagonist medication allows the nurse to anticipate expected actions of the medication and the patient response. Agonistic and antagonistic effects on receptors are further discussed in the “Autonomic Nervous System” chapter.

Critical Thinking Activity 1.7a

Atenolol (Tenormin) is a beta-1 antagonist with a negative inotropic and chronotropic effects. What should a nurse assess before administration?
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