

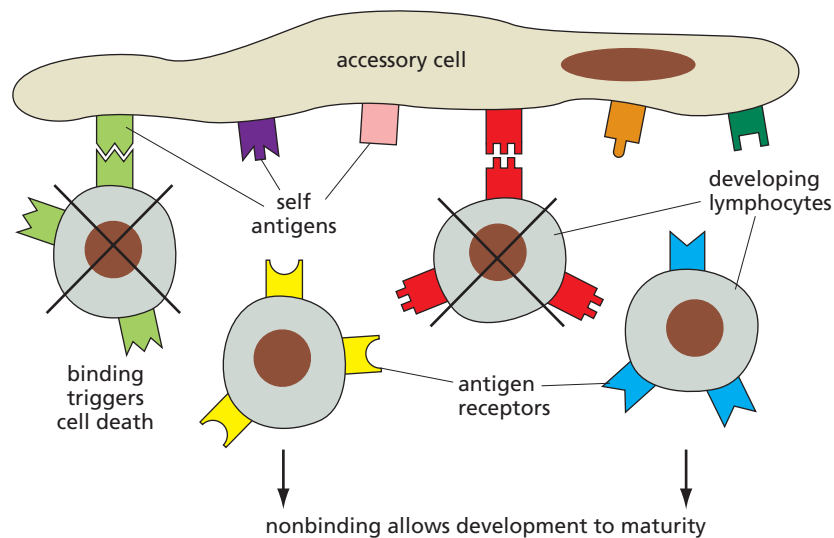
## TEXT SUPPLEMENT (Ch 15): Immune Selection

How can the body's population of lymphocytes recognize over 100,000,000,000 different antigens, if each B or T lymphocyte recognizes only a single antigen? The secret lies in the development of these lymphocytes. As they differentiate, portions of their DNA are cut out and rearranged at random. As a result, each mature B cell or T cell has a DNA sequence that makes a unique protein that functions as a receptor for only one specific antigen shape. These variations are generated independently of one another, even before exposure to any antigen, resulting in many billions of different lymphocytes, each with receptors for a different antigen. If you are now exposed to some virus or other threat, you probably have a few lymphocytes with receptors that can bind to that virus.

Immature T lymphocytes develop in the bone marrow, then travel through the blood to an organ called the **thymus** (see Figure 15.2), where they receive the cytokine signals that stimulate their final differentiation into T lymphocytes. The developing T lymphocytes are tested and sorted on the basis of matching their antigen receptors with self antigens on the surfaces of the accessory cells of the thymus. Those T lymphocytes whose receptors match an accessory cell antigen would be capable of reacting

against self. In a process called **population selection**, these cells are eliminated, an important process that usually protects you from reacting against the tissues of your own body. Cells with receptors that do not match self antigens go on to become fully mature T lymphocytes. Thus, although any one lymphocyte can match only one antigen, the total population of mature lymphocytes has the potential of reacting with any nonself antigen encountered later, but no lymphocytes react with self (see the Figure below). The immune system's capability of discriminating self from nonself thus results from the selection of a population of responding cells from those that arose randomly. This capability is a characteristic of the *population* of cells, not a characteristic of any single cell.

The B lymphocytes likewise undergo population selection, a process that eliminates any B lymphocyte whose antigen receptors could bind to self molecules. The B lymphocytes that mature secrete surface-bound proteins called antibodies. When a B lymphocyte encounters its specific antigen, it divides and makes more antibodies to that antigen. Some of the B cells also develop into memory cells that can trigger a faster and stronger immune response upon a later encounter with the same antigen.



**Lymphocyte population selection.** Developing lymphocytes encounter characteristic self antigens on accessory cells. Any developing lymphocyte whose antigen receptor binds to an antigen on an accessory cell dies. Lymphocytes whose receptors do not bind develop to maturity.



