



**Figure 6-4** The principal classes of lymphocytes and their functions. B and T lymphocytes are cells of adaptive immunity and natural killer (NK) cells are cells of innate immunity. Several more classes of lymphocytes have been identified, including NK-T cells and so-called innate lymphoid cells (ILCs); the functions of these cells are not established.

There are two types of adaptive immunity: *humoral immunity*, which protects against extracellular microbes and their toxins, and *cell-mediated (or cellular) immunity*, which is responsible for defense against intracellular microbes. Humoral immunity is mediated by B (bone marrow-derived) lymphocytes and their secreted products, *antibodies* (also called *immunoglobulins*, Ig), and cellular immunity is mediated by T (thymus-derived) lymphocytes. Both classes of lymphocytes express highly specific receptors for a wide variety of substances, which are called *antigens*.

### Cells of the Immune System

Although T and B lymphocytes and their subsets are morphologically unimpressive and appear quite similar to one another, they are actually remarkably heterogeneous and specialized in molecular properties and functions. The major classes of lymphocytes and their functions are

illustrated in [Figure 6-4](#). Lymphocytes and other cells involved in immune responses are not fixed in particular tissues (as are cells in most of the organs of the body) but constantly circulate among lymphoid and other tissues via the blood and the lymphatic circulation. This feature promotes immune surveillance by allowing lymphocytes to home to any site of infection. In lymphoid organs, different classes of lymphocytes are anatomically segregated in such a way that they interact with one another only when stimulated to do so by encounters with antigens and other stimuli. Mature lymphocytes that have not encountered the antigen for which they are specific are said to be *naive* (immunologically inexperienced). After they are activated by recognition of antigens and other signals described later, lymphocytes differentiate into *effector cells*, which perform the function of eliminating microbes, and *memory cells*, which live in a state of heightened awareness and are able to react rapidly and strongly to combat the microbe in case it returns. The process of lymphocyte differentiation