



Figure 6-10 Cell-mediated immunity. Dendritic cells (DCs) capture microbial antigens from epithelia and tissues and transport the antigens to lymph nodes. During this process, the DCs mature, and express high levels of MHC molecules and costimulators. Naive T cells recognize MHC-associated peptide antigens displayed on DCs. The T cells are activated to proliferate and to differentiate into effector and memory cells, which migrate to sites of infection and serve various functions in cell-mediated immunity. CD4+ effector T cells of the T_H1 subset recognize the antigens of microbes ingested by phagocytes, and activate the phagocytes to kill the microbes; other subsets of effector cells enhance leukocyte recruitment and stimulate different types of immune responses. CD8+ cytotoxic T lymphocytes (CTLs) kill infected cells harboring microbes in the cytoplasm. Some activated T cells remain in the lymphoid organs and help B cells to produce antibodies, and some T cells differentiate into long-lived memory cells (not shown). APC, Antigen-presenting cell.

released from necrotic cells (the “damage-associated molecular patterns” mentioned earlier).

The reactions and functions of T and B lymphocytes differ in important ways and are best considered separately.

Cell-Mediated Immunity: Activation of T Lymphocytes and Elimination of Intracellular Microbes

Naive T lymphocytes are activated by antigen and costimulators in peripheral lymphoid organs, and proliferate and differentiate into effector cells that migrate to any site where the antigen (microbe) is present (Fig. 6-10). One of

the earliest responses of CD4+ helper T cells is secretion of the cytokine IL-2 and expression of high-affinity receptors for IL-2. IL-2 is a growth factor that acts on these T lymphocytes and stimulates their proliferation, leading to an increase in the number of antigen-specific lymphocytes. The functions of helper T cells are mediated by the combined actions of CD40-ligand (CD40L) and cytokines. When CD4+ helper T cells recognize antigens being displayed by macrophages or B lymphocytes, the T cells express CD40L, which engages CD40 on the macrophages or B cells and activates these cells.

Some of the activated CD4+ T cells differentiate into effector cells that secrete different sets of cytokines and