TABLE 372e-9 CYTOKINE FAMILIES GROUPED BY STRUCTURAL SIMILARITY

Hematopoietins	IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-9, IL-11, IL-12, IL-15, IL-16, IL-17, IL-21, IL-23, EPO, LIF, GM-CSF, G-CSF, OSM, CNTF, GH, and TPO
	TNF-α, LT-α, LT-β, CD40L, CD30L, CD27L, 4-1BBL, OX40, OPG, and FasL
IL-1	IL-1α, IL-1β, IL-1ra, IL-18, bFGF, aFGF, and ECGF
PDGF	PDGF A, PDGF B, and M-CSF
TGF-β	TGF-β and BMPs (1, 2, 4, etc.)
C-X-C chemokines	IL-8, Gro-α/β/γ, NAP-2, ENA78, GCP-2, PF4, CTAP-3, MIG, and IP-10
C-C chemokines	MCP-1, MCP-2, MCP-3, MIP-1α, MIP-1β, RANTES

Abbreviations: aFGF, acidic fibroblast growth factor; 4-1BBL, 401 BB ligand; bFGF, basic fibroblast growth factor; BMP, bone marrow morphogenetic proteins; C-C, cysteine-cysteine; CD, cluster of differentiation; CNTF, ciliary neurotrophic factor; CTAP, connective tissue–activating peptide; C-X-C, cysteine-x-cysteine; ECGF, endothelial cell growth factor; EPO, erythropoietin; FasL, Fas ligand; GCP-2, granulocyte chemotactic protein 2; G-CSF, granulocyte colony-stimulating factor; GH, growth hormone; GM-CSF, granulocyte-macrophage colony-stimulating factor; Gro, growth-related gene products; IFN, interferon; IL, interleukin; IP, interferon-γ inducible protein; LIF, leukemia inhibitory factor; LT, lymphotoxin; MCP, monocyte chemoattractant; M-CSF, macrophage colony-stimulating factor; MIG, monokine induced by interferon-γ; MIP, macrophage inflammatory protein; NAP-2, neutrophil activating protein 2; OPG, osteoprotegerin; OSM, oncostatin M; PDGF, platelet-derived growth factor; PF, platelet factor; R, receptor; RANTES, regulated on activation, normal T cell–expressed and –secreted; TGF, transforming growth factor; TNF, tumor necrosis factor; TPO, thyroperoxidase.

Cytokines are involved in the regulation of the growth, development, and activation of immune system cells and in the mediation of the inflammatory response. In general, cytokines are characterized by considerable redundancy; different cytokines have similar functions. In addition, many cytokines are pleiotropic in that they are capable of acting on many different cell types. This pleiotropism results from the expression on multiple cell types of receptors for the same cytokine (see below), leading to the formation of "cytokine networks." The action of cytokines may be (1) autocrine when the target cell is the same cell that secretes the cytokine, (2) paracrine when the target cell is nearby, and (3) endocrine when the cytokine is secreted into the circulation and acts distal to the source.

Cytokines have been named based on presumed targets or based on presumed functions. Those cytokines that are thought to primarily target leukocytes have been named *interleukins* (IL-1, -2, -3, etc.). Many cytokines that were originally described as having a certain function have retained those names (e.g., granulocyte colony-stimulating factor [G-CSF]). Cytokines belong in general to three major structural families: the hematopoietin family; the TNF, IL-1, platelet-derived growth factor (PDGF), and transforming growth factor (TGF) β families; and the CXC and C-C chemokine families (Table 372e-9). Chemokines are cytokines that regulate cell movement and trafficking; they act through G protein-coupled receptors and have a distinctive three-dimensional structure. IL-8 is the only chemokine that early on was named an IL (Table 372e-7).

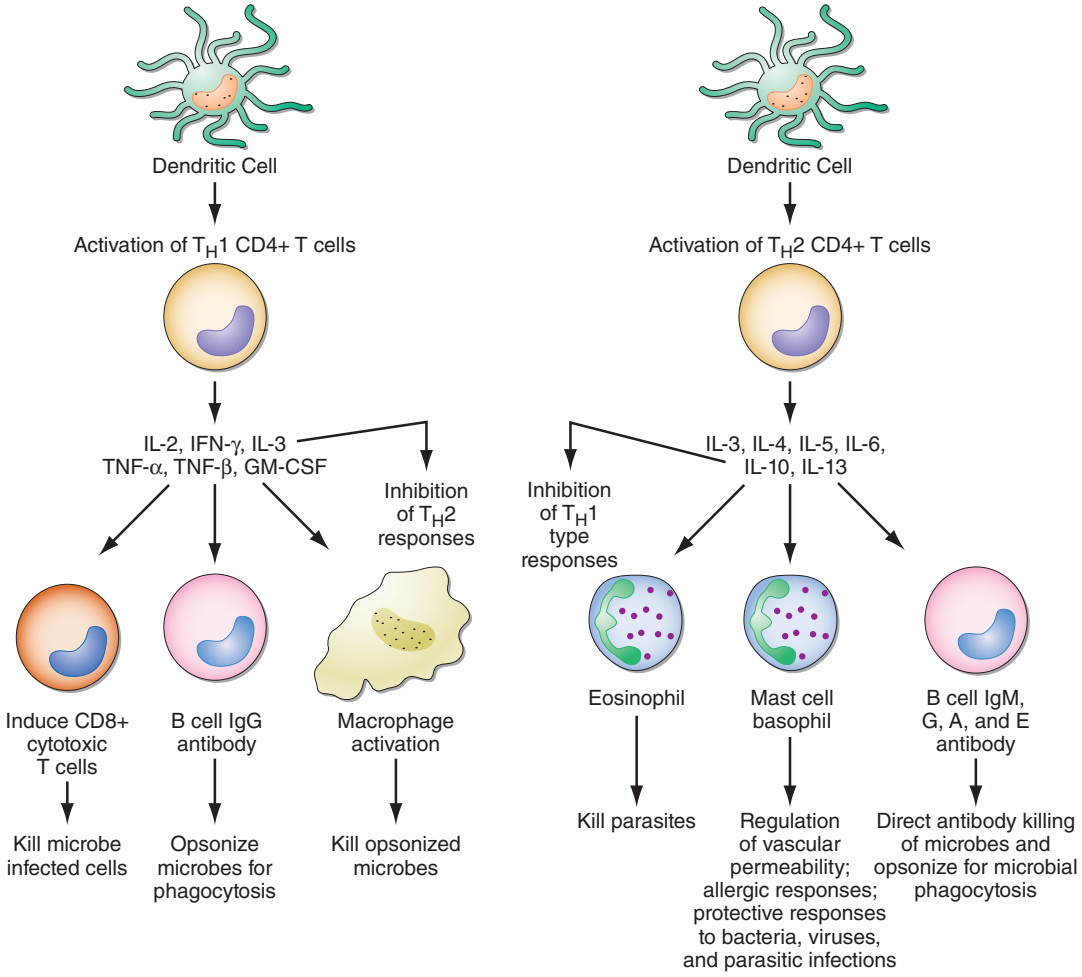

FIGURE 372e-3 CD4+ helper T1 (T_H1) cells and T_H2 T cells secrete distinct but overlapping sets of cytokines. T_H1 CD4+ cells are frequently activated in immune and inflammatory reactions against intracellular bacteria or viruses, whereas T_H2 CD4+ cells are frequently activated for certain types of antibody production against parasites and extracellular encapsulated bacteria; they are also activated in allergic diseases. GM-CSF, granulocyte-macrophage colony-stimulating factor; IFN, interferon; IL, interleukin; TNF, tumor necrosis factor. *(Adapted from S Romagnani: CD4 effector cells, in Inflammation: Basic Principles and Clinical Correlates, 3rd ed, J Gallin, R Snyderman [eds]. Philadelphia, Lippincott Williams & Wilkins, 1999, p 177; with permission.)*