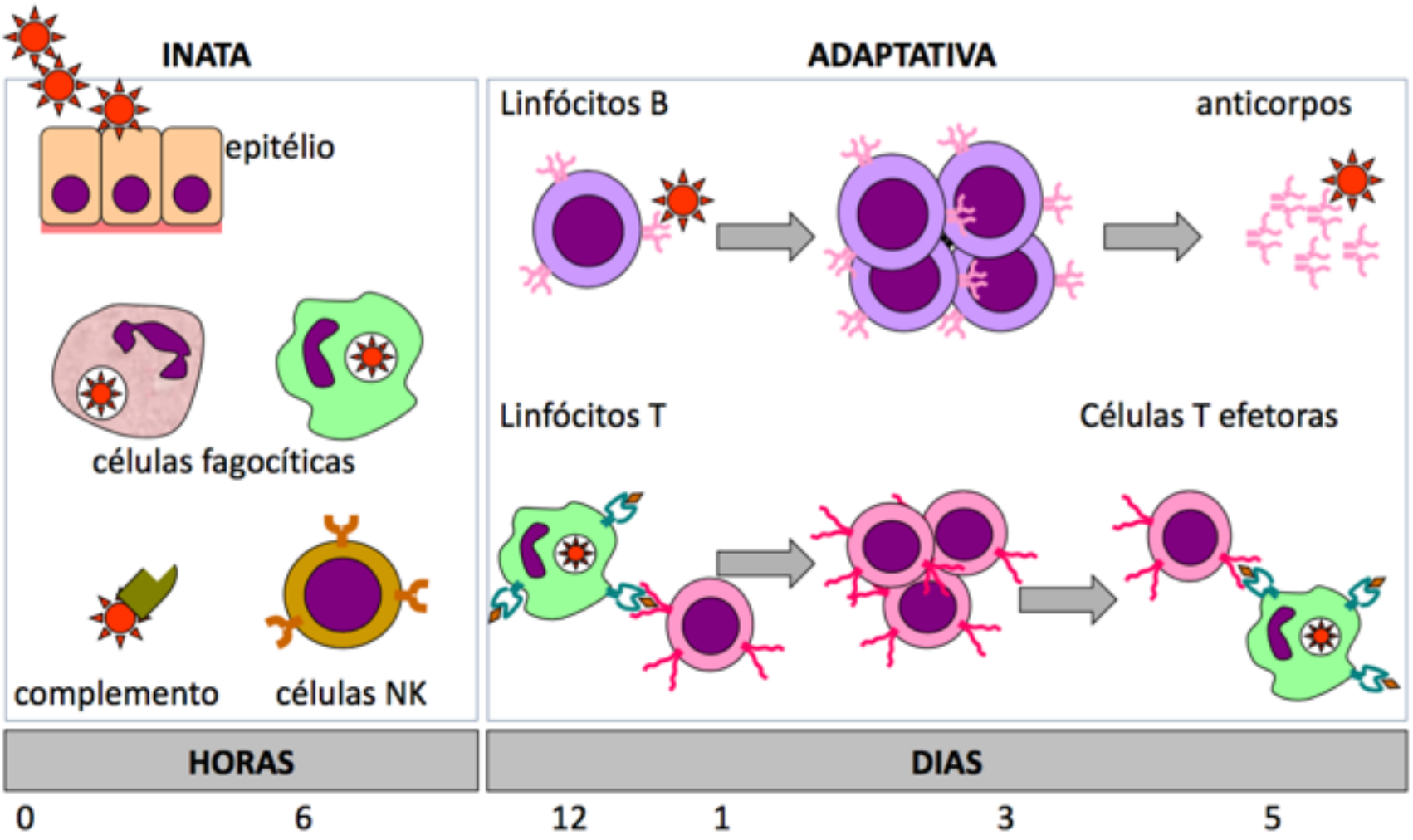
TIPOS DE RESPOSTA



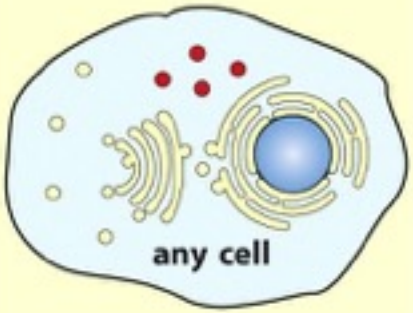
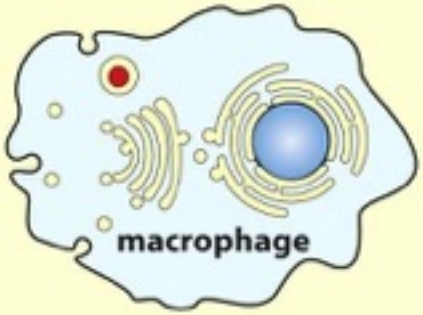
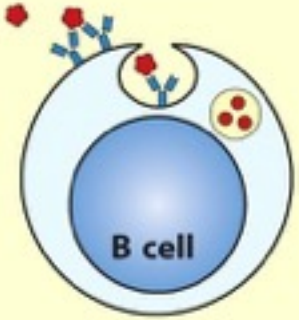
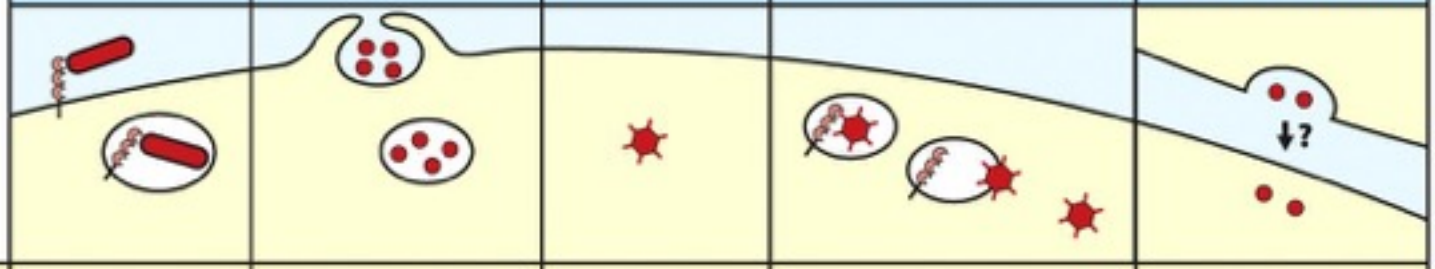
	Cytosolic pathogens	Intravesicular pathogens	Extracellular pathogens and toxins
			
Degraded in	Cytosol	Endocytic vesicles (low pH)	Endocytic vesicles (low pH)
Peptides bind to	MHC class I	MHC class II	MHC class II
Presented to	Effector CD8 T cells	Effector CD4 T cells	Effector CD4 T cells
Effect on presenting cell	Cell death	Activation to kill intravesicular bacteria and parasites	Activation of B cells to secrete Ig to eliminate extracellular bacteria/toxins

Figure 6.2 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

Routes of antigen processing and presentation by dendritic cells



	Receptor-mediated phagocytosis	Macro-pinocytosis	Viral infection	Cross-presentation after phagocytic or macropinocytic uptake	Transfer from incoming dendritic cell to resident dendritic cell
Type of pathogen presented	Extracellular bacteria	Extracellular bacteria, soluble antigens, virus particles	Viruses	Viruses	Viruses
MHC molecules loaded	MHC class II	MHC class II	MHC class I	MHC class I	MHC class I
Type of naive T cell activated	CD4 T cells	CD4 T cells	CD8 T cells	CD8 T cells	CD8 T cells

Figure 9.12 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

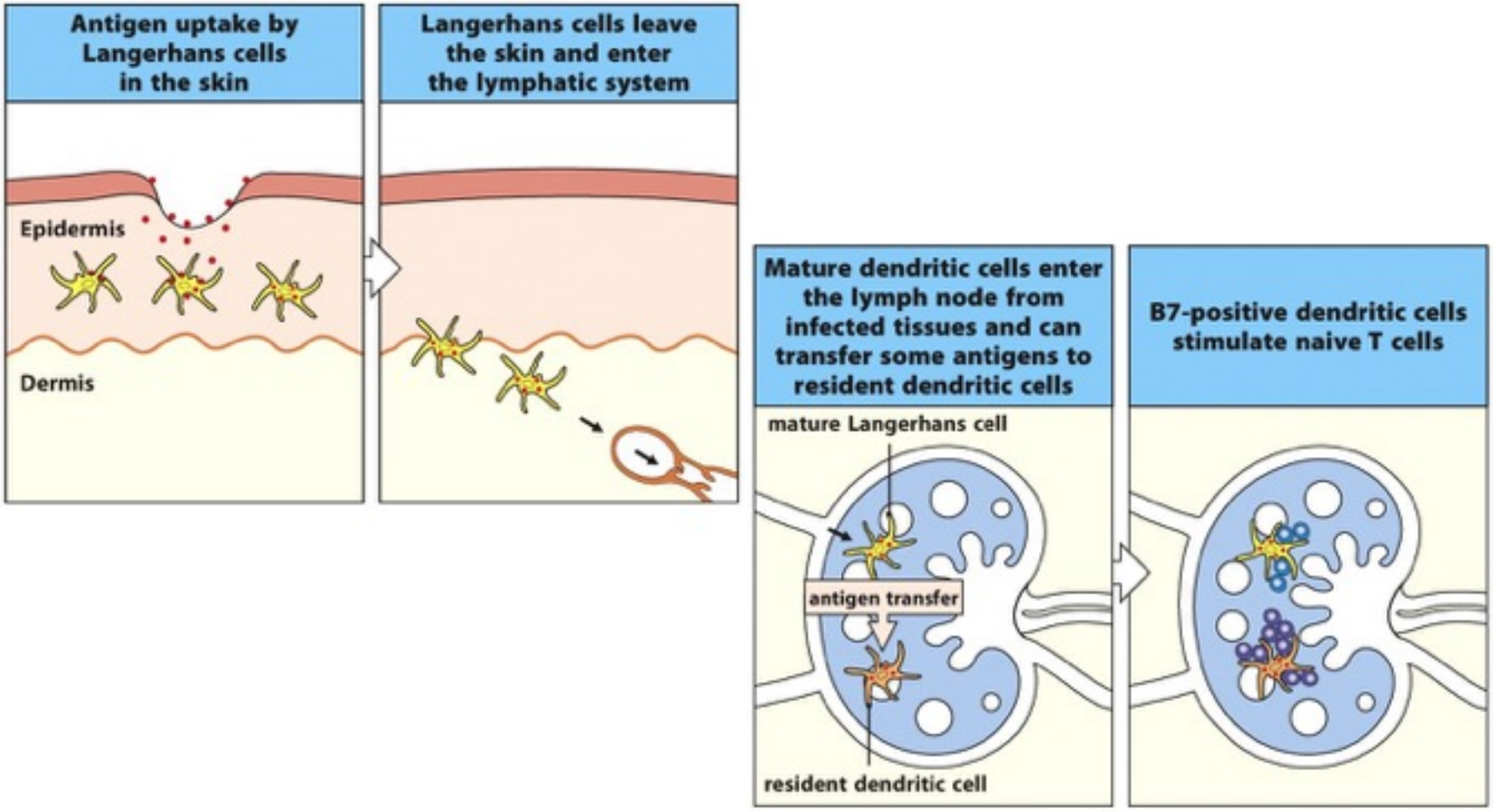


Figure 9.13 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

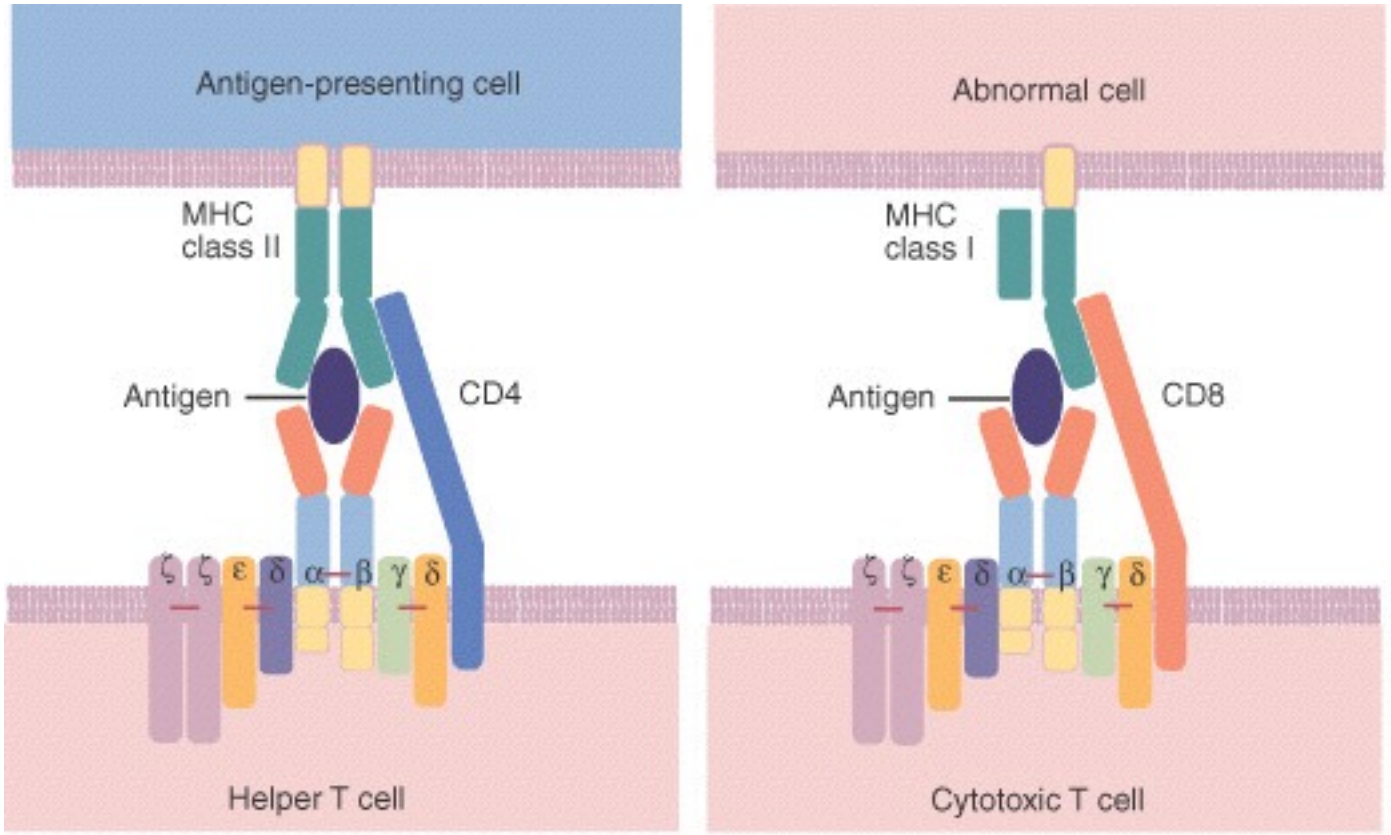


FIGURE 12-5 Role of CD4 and CD8 in promoting T cell responses. These molecules link the T cell to the antigen-presenting cell, binding the two cells together and ensuring that an effective signal is transmitted between them. CD4 binds to major histocompatibility complex *(MHC)* class I molecules. This interaction is seen in Chapter 8, Figure 8-6, *A*.

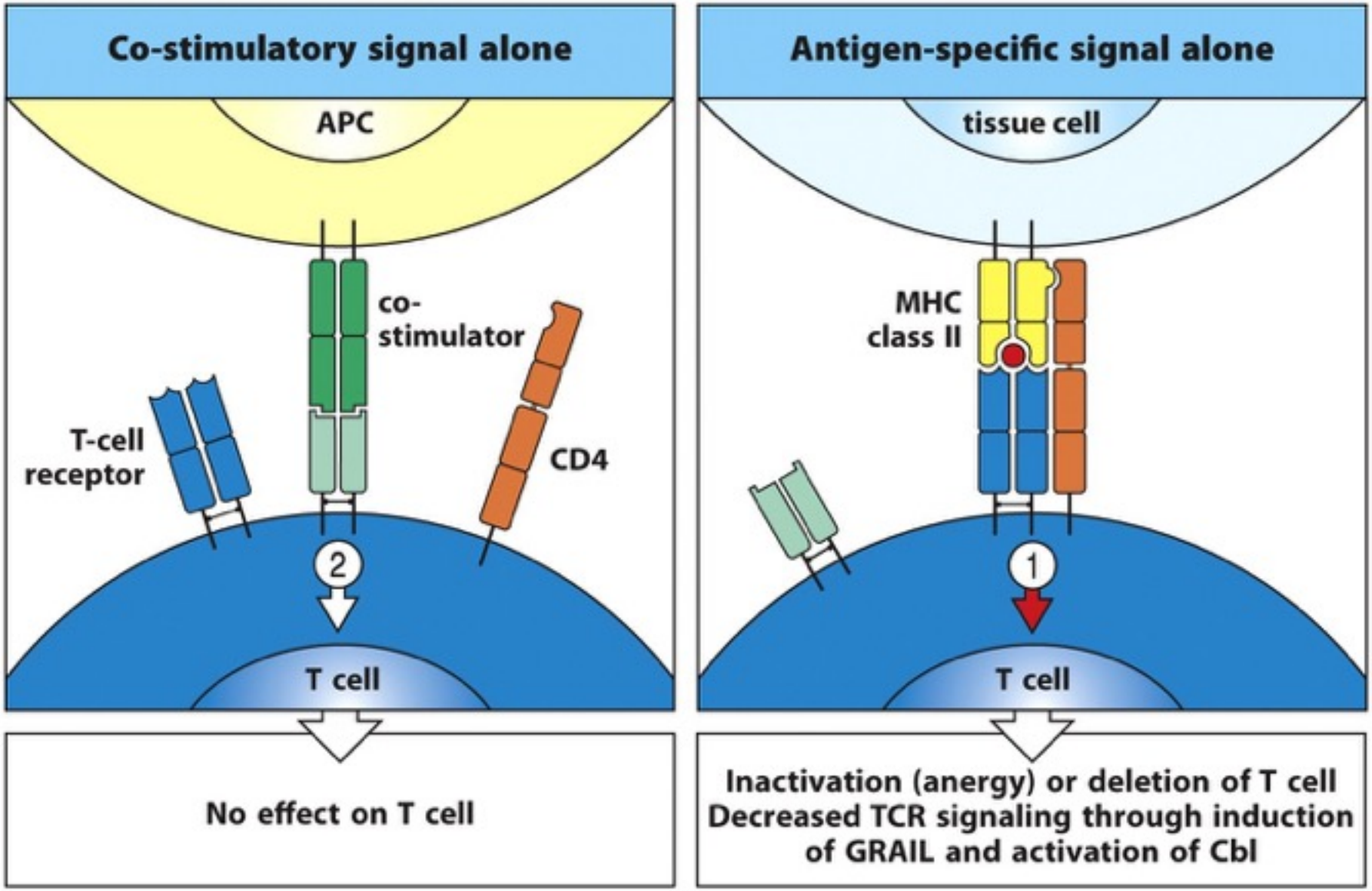


Figure 9.23 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

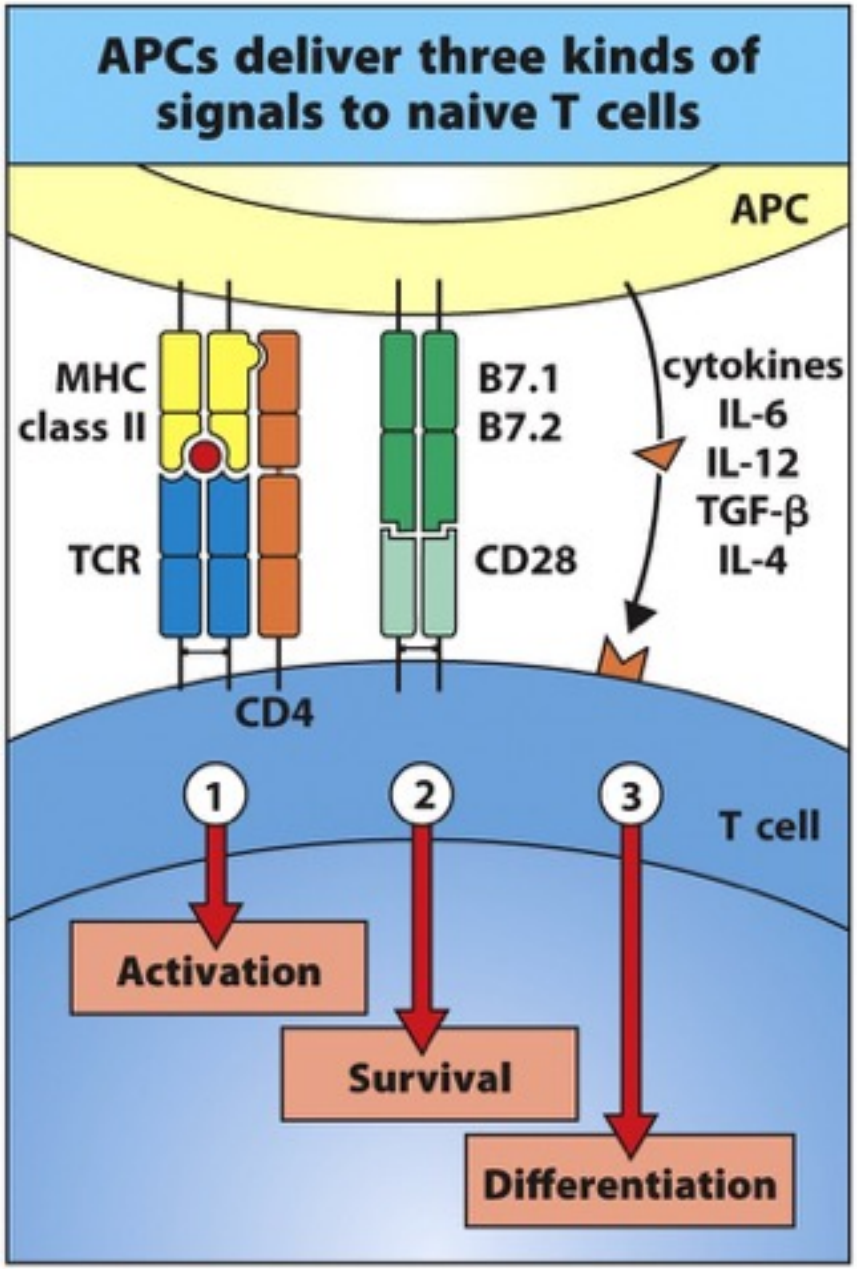


Figure 9.19 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

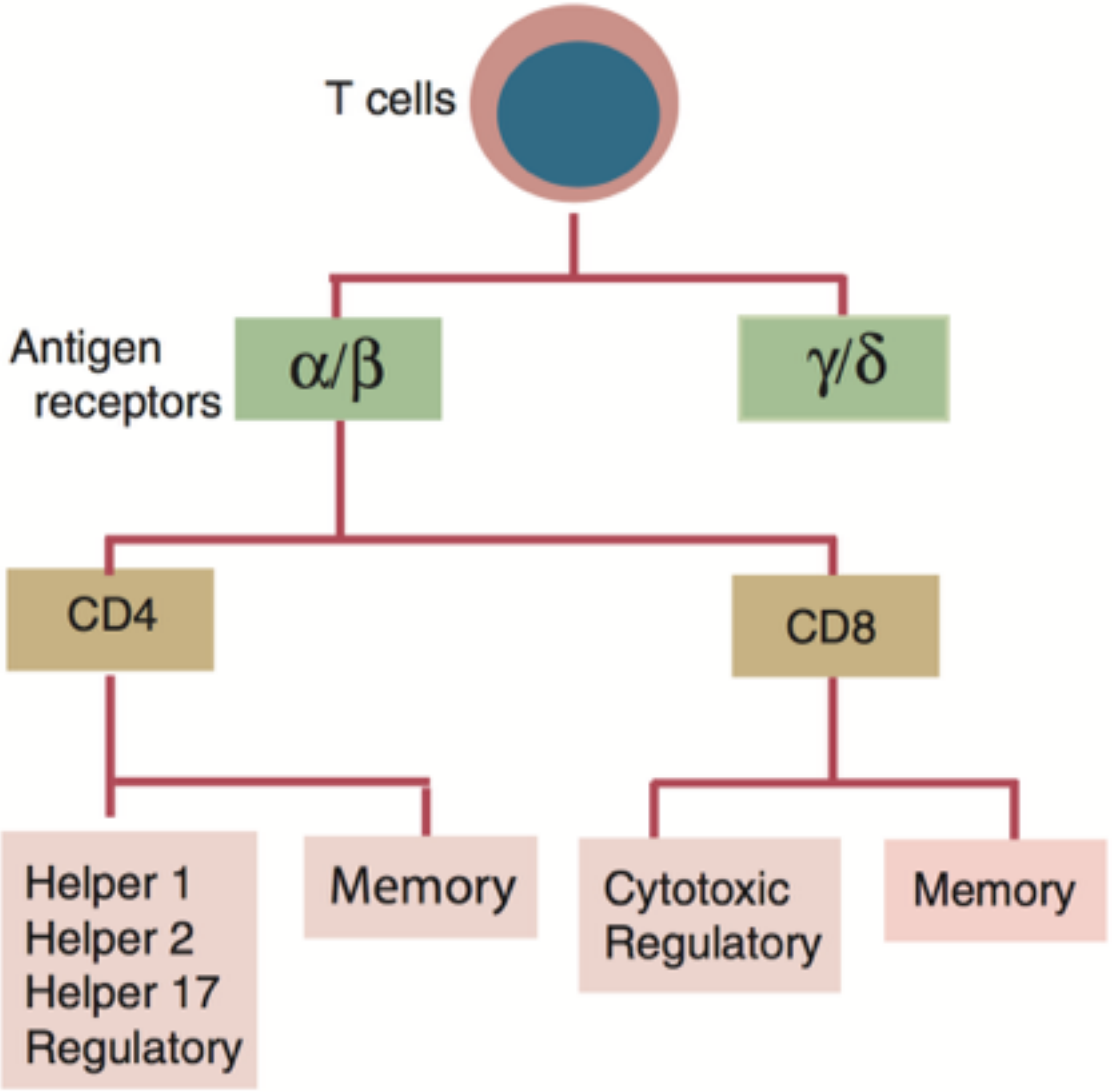


FIG. 14.2 T cells can be divided into many different subpopulations based on the antigen receptors they employ, on the accessory molecules that support their activity, and ultimately on their functions.

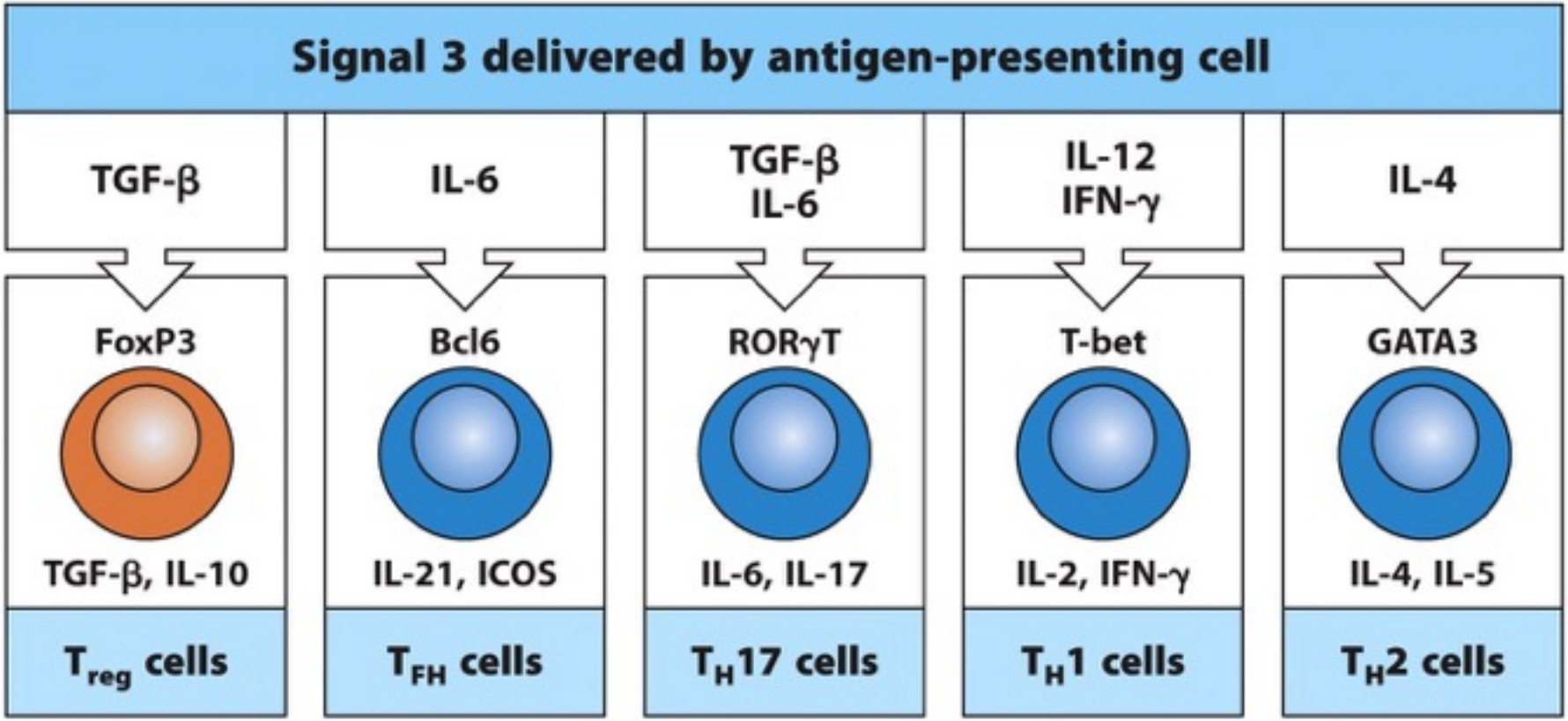


Figure 9.29 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

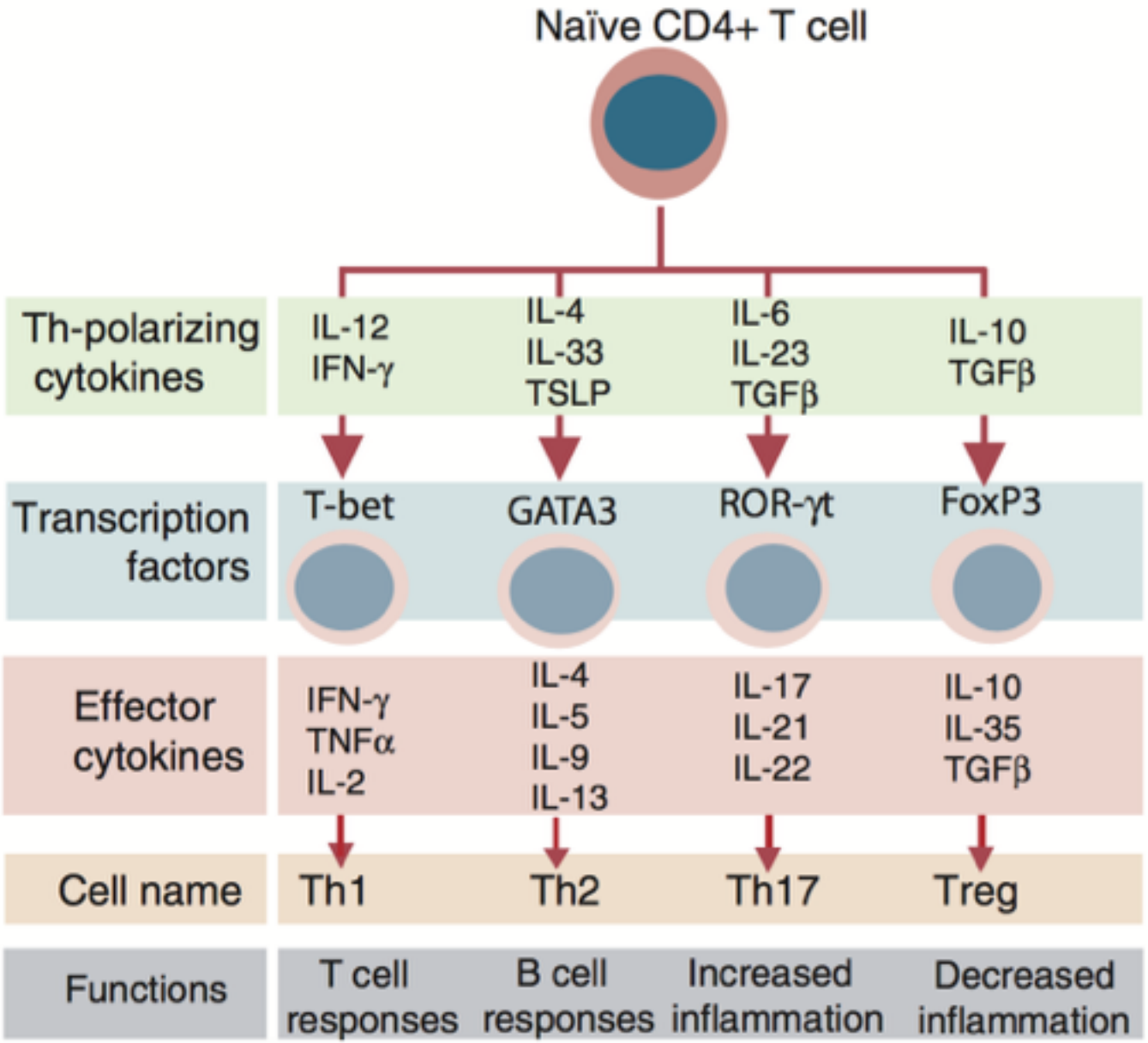


FIG. 14.13 The major populations of helper T cells. Note that their differentiation is induced by different mixtures of polarizing cytokines. These induce specific transcription factors in each population. Once polarized, the T cells synthesize and secrete different mixtures of effector cytokines.

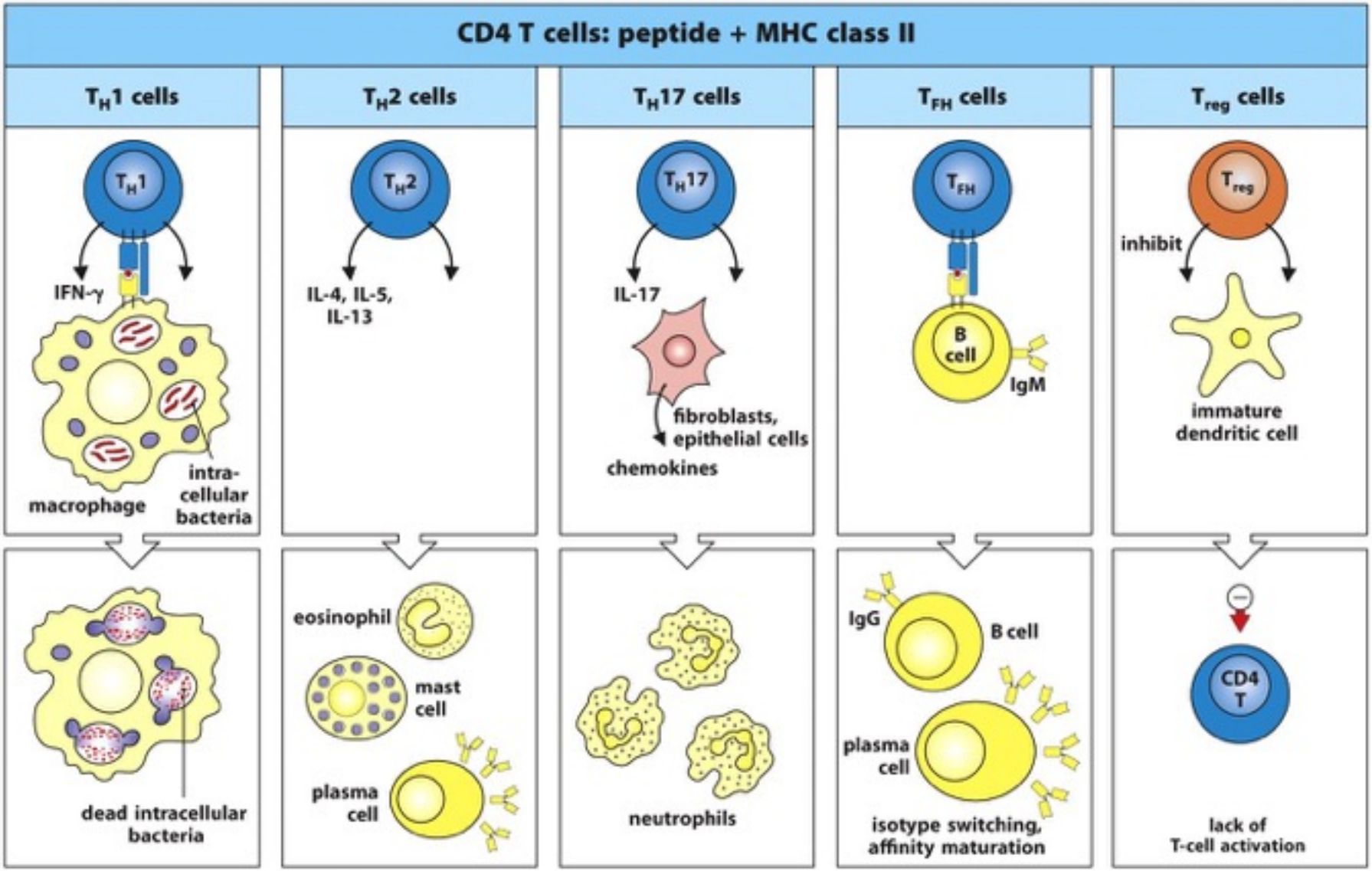


Figure 9.28 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

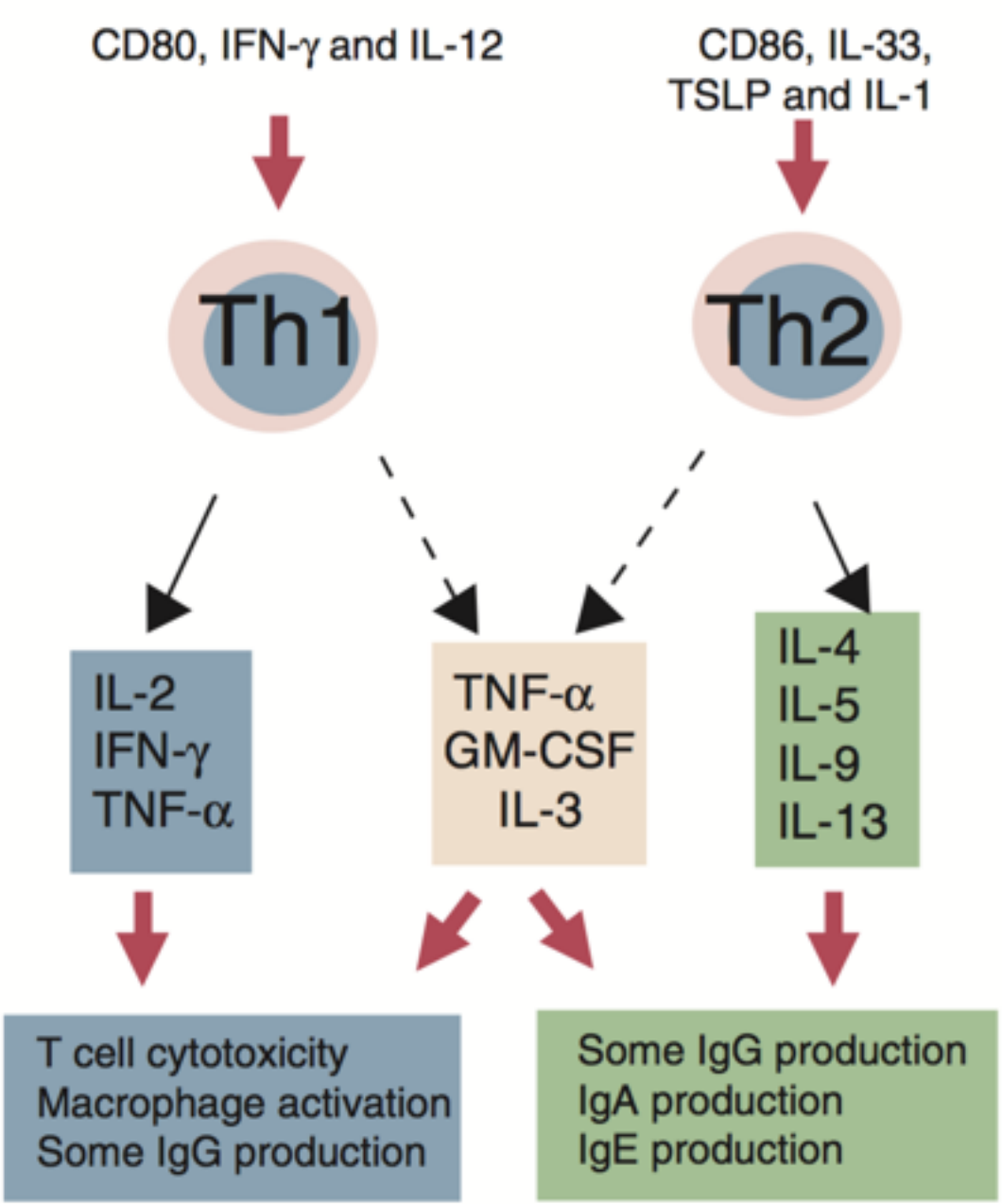


FIG. 14.14 Major differences between Th1 and Th2 populations. Note that the polarizing cytokines that trigger them are different, as are the set of effector cytokines they secrete.

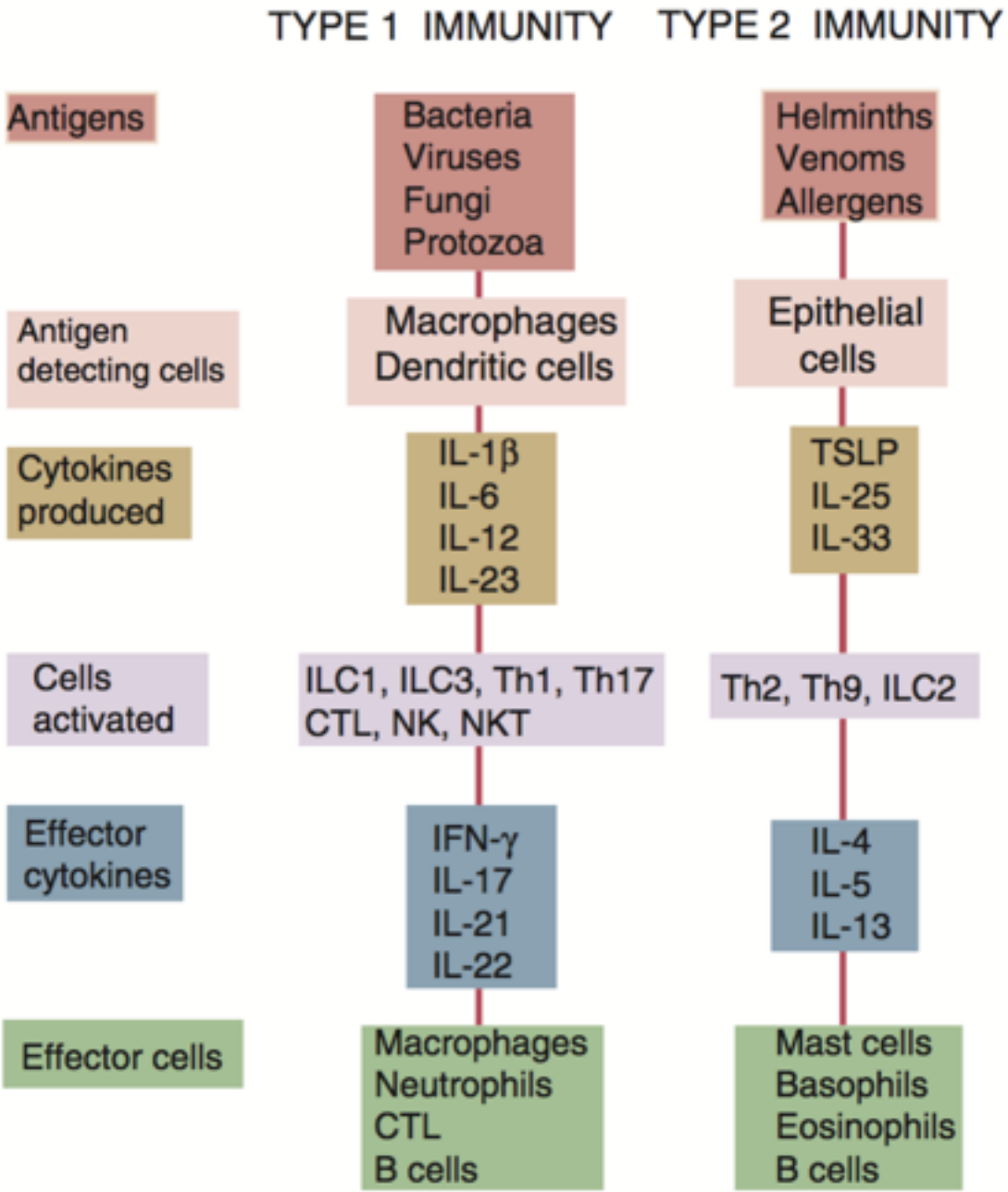


FIG. 14.17 A comparison of the key features of type 1 and type 2 immune responses.

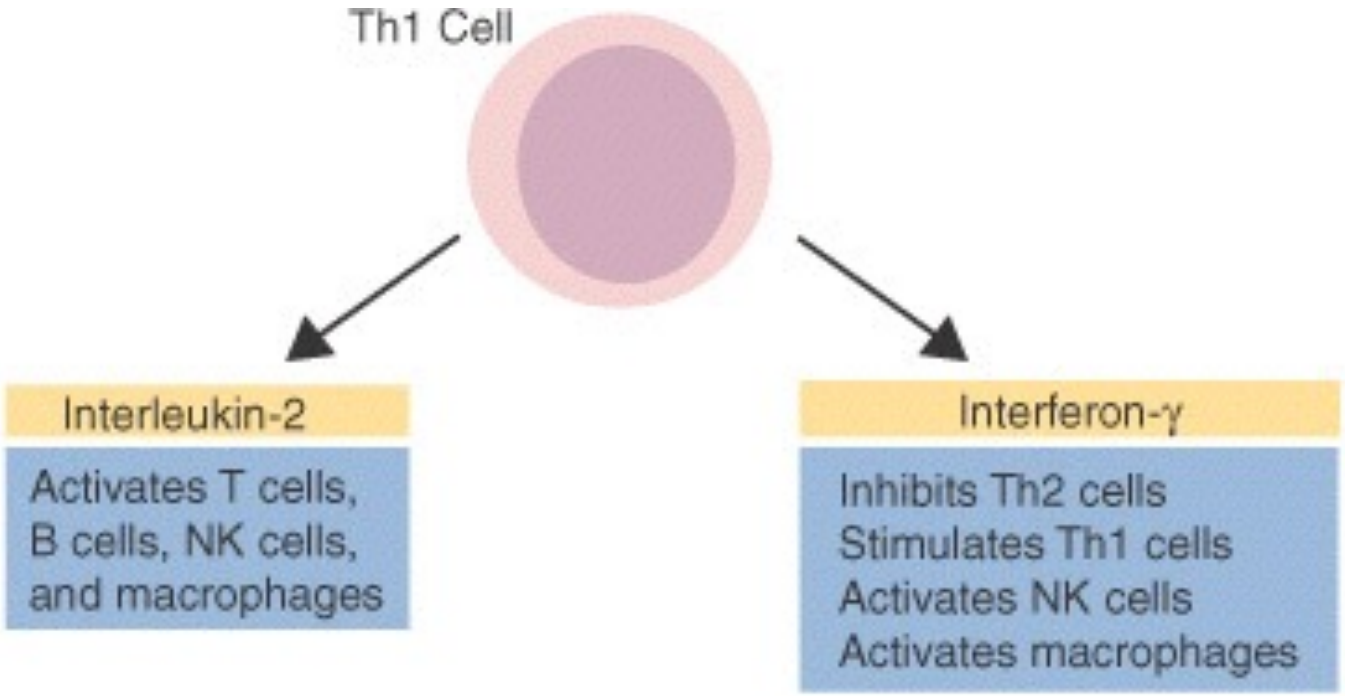


FIGURE 12-13 The cytokines produced by Th1 cells and their major properties.

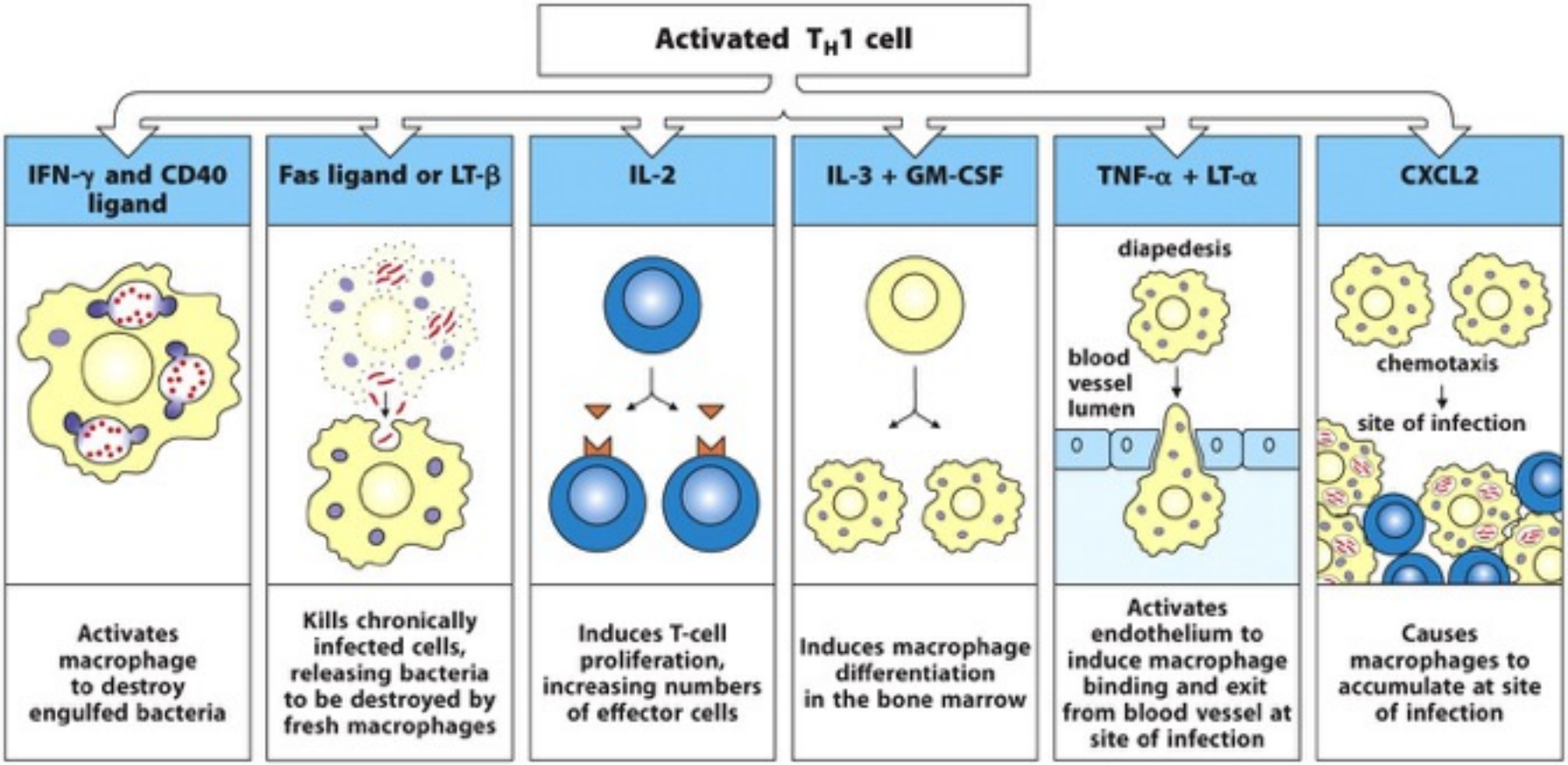


Figure 9.42 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

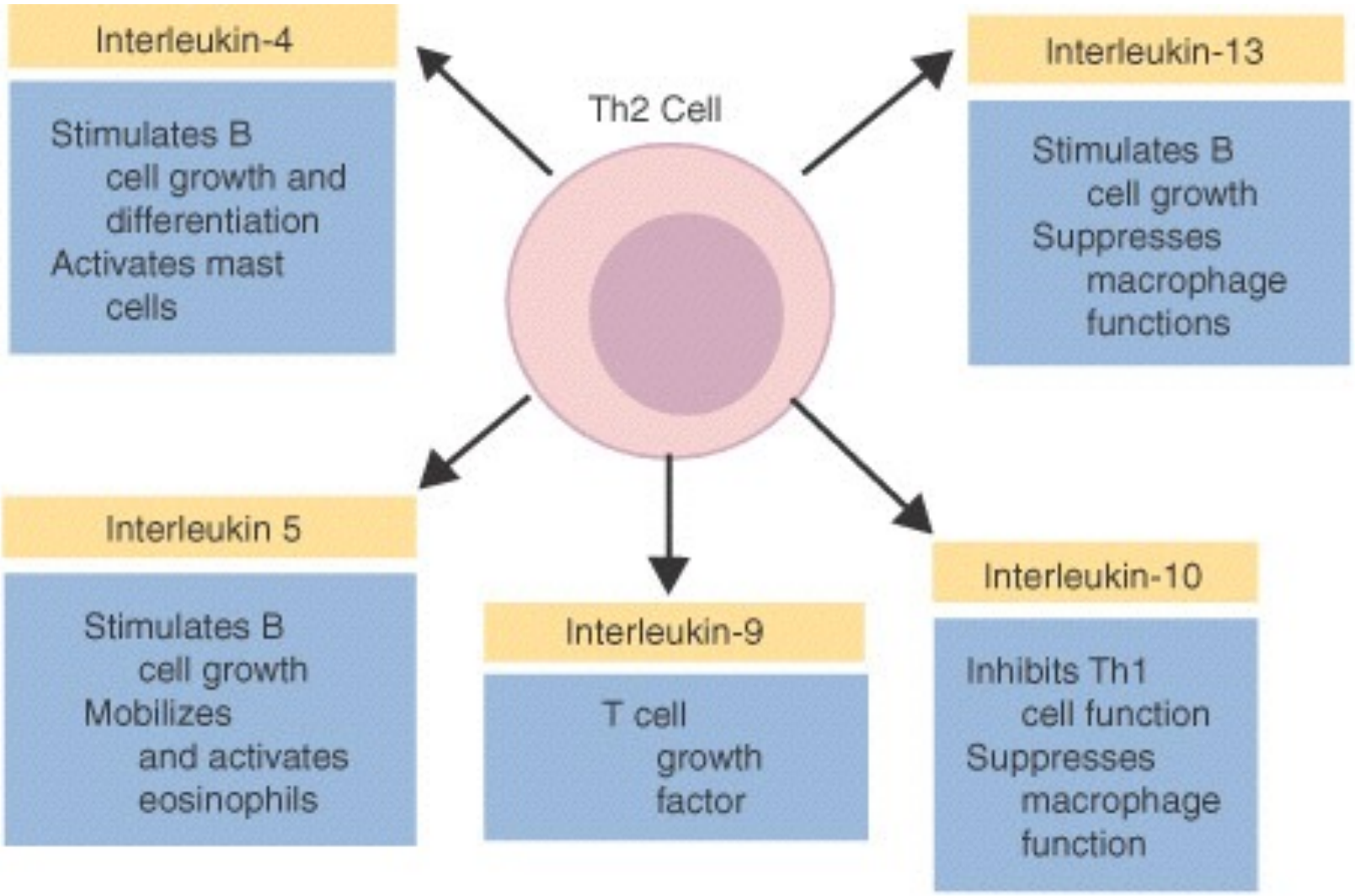


FIGURE 12-15 The cytokines produced by Th2 cells and their major properties.

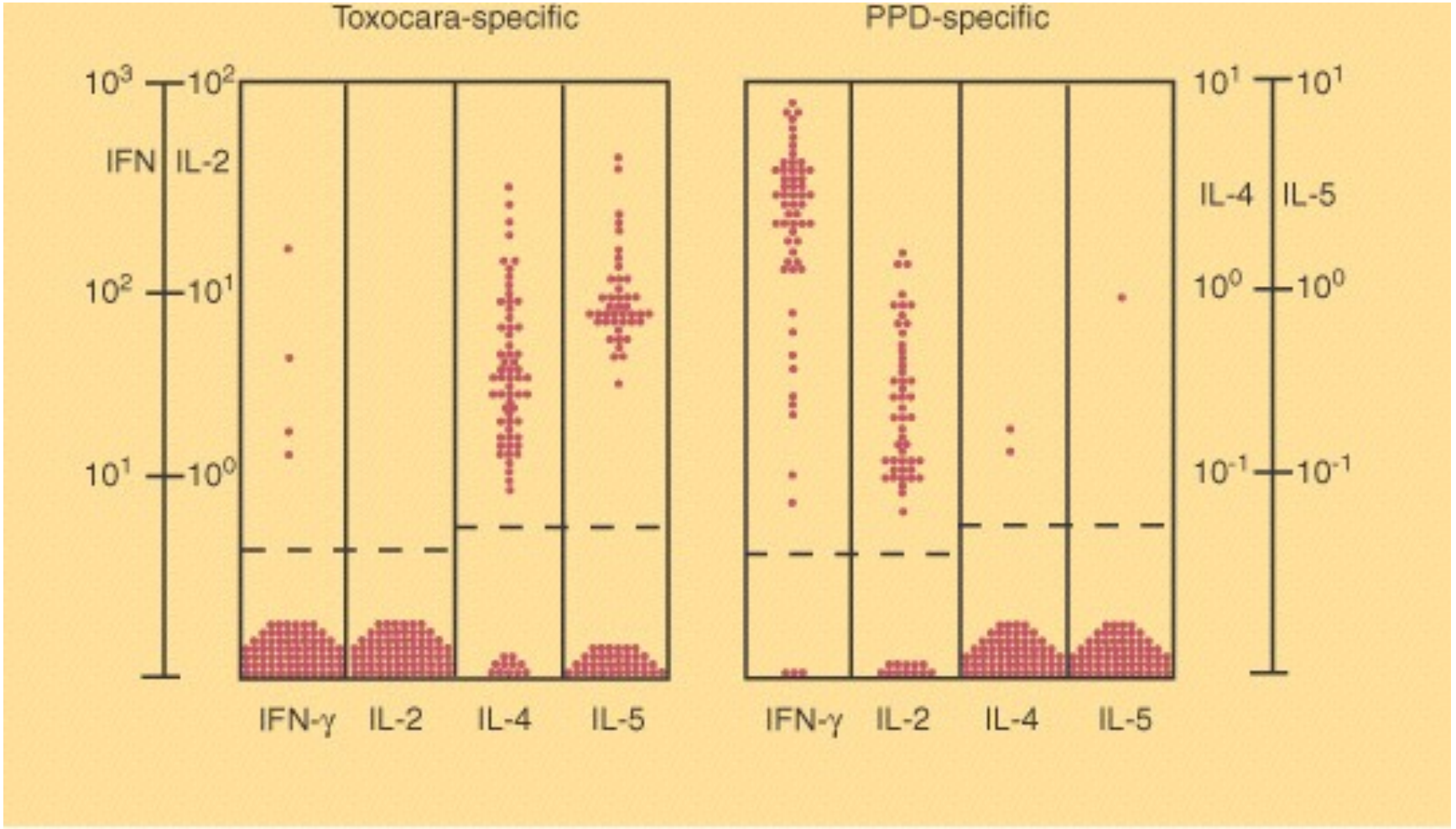
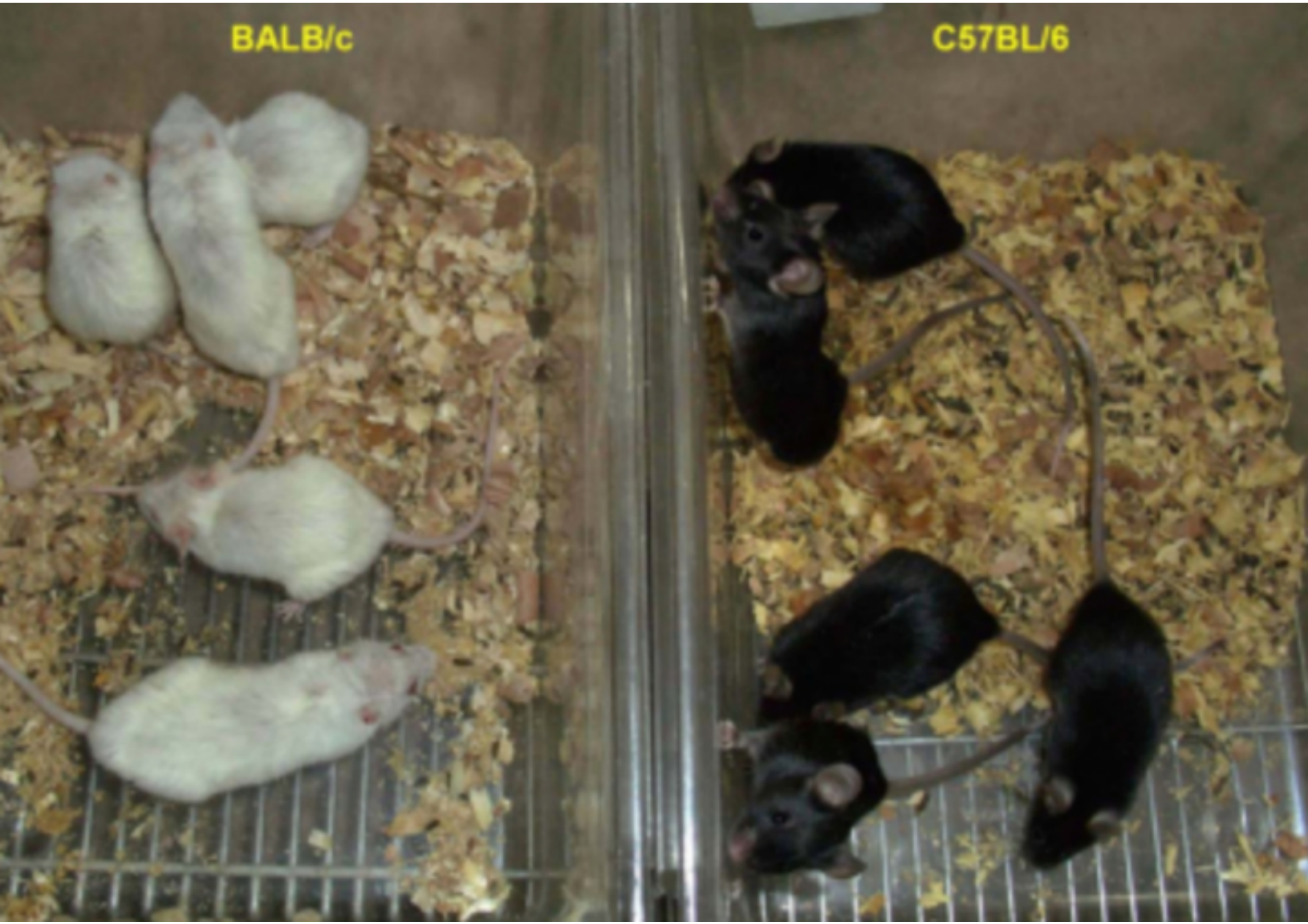
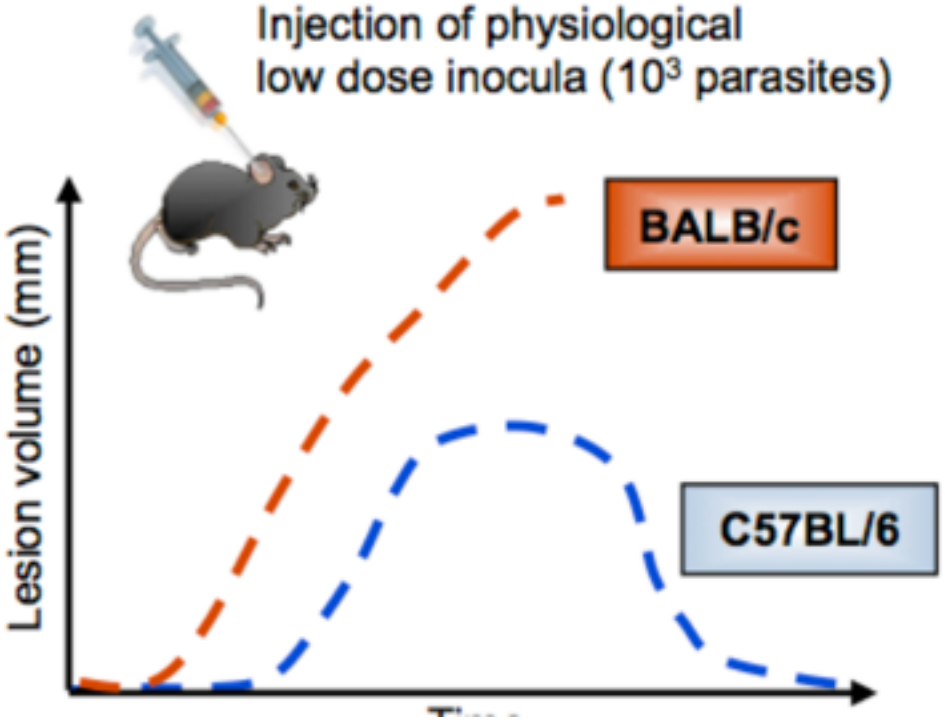
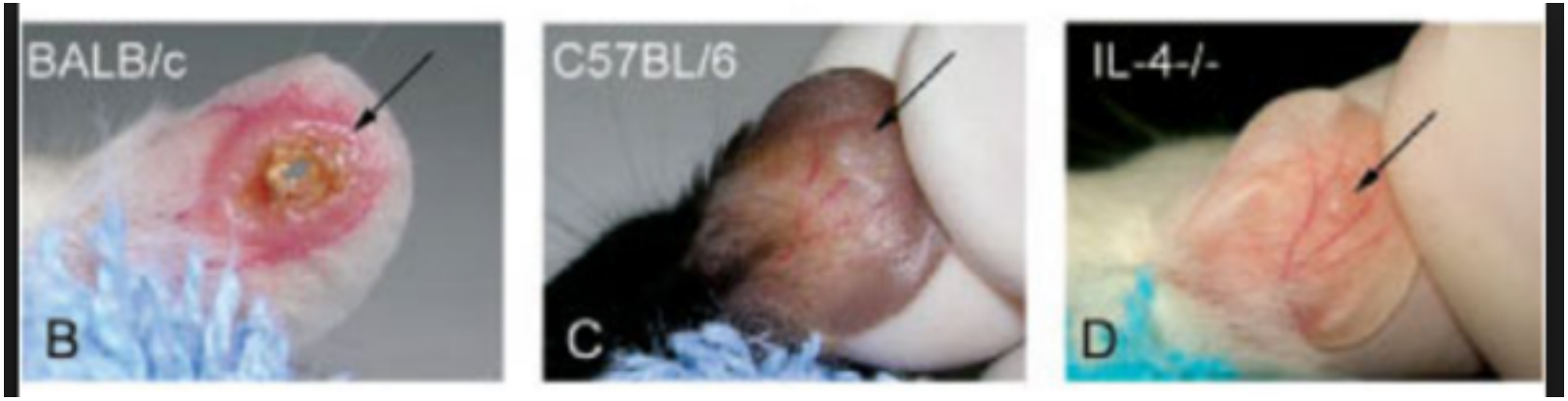


FIGURE 12-14 Different antigens can trigger distinctly different Th cell subpopulations. For example, T cells exposed to a parasite antigen from the roundworm *Toxocara canis* mount a Th2 response and secrete primarily interleukin-4 *(IL-4)* and IL-5. In contrast, T cells exposed to purified protein derivative *(PPD)*, an antigen from *Mycobacterium tuberculosis*, mount a Th1 response characterized by secretion of interferon-γ *(IFN-γ)* and IL-2.

(From Del Prete G, De Carli M, Mastromauro C, et al: *J Clin Invest* 88:346-350, 1991.)


BALB/c
C57BL/6


Injection of physiological
low dose inocula (10^3 parasites)
Lesion volume (mm)
BALB/c
C57BL/6


BALB/c
B
C57BL/6
C
IL-4-/-
D

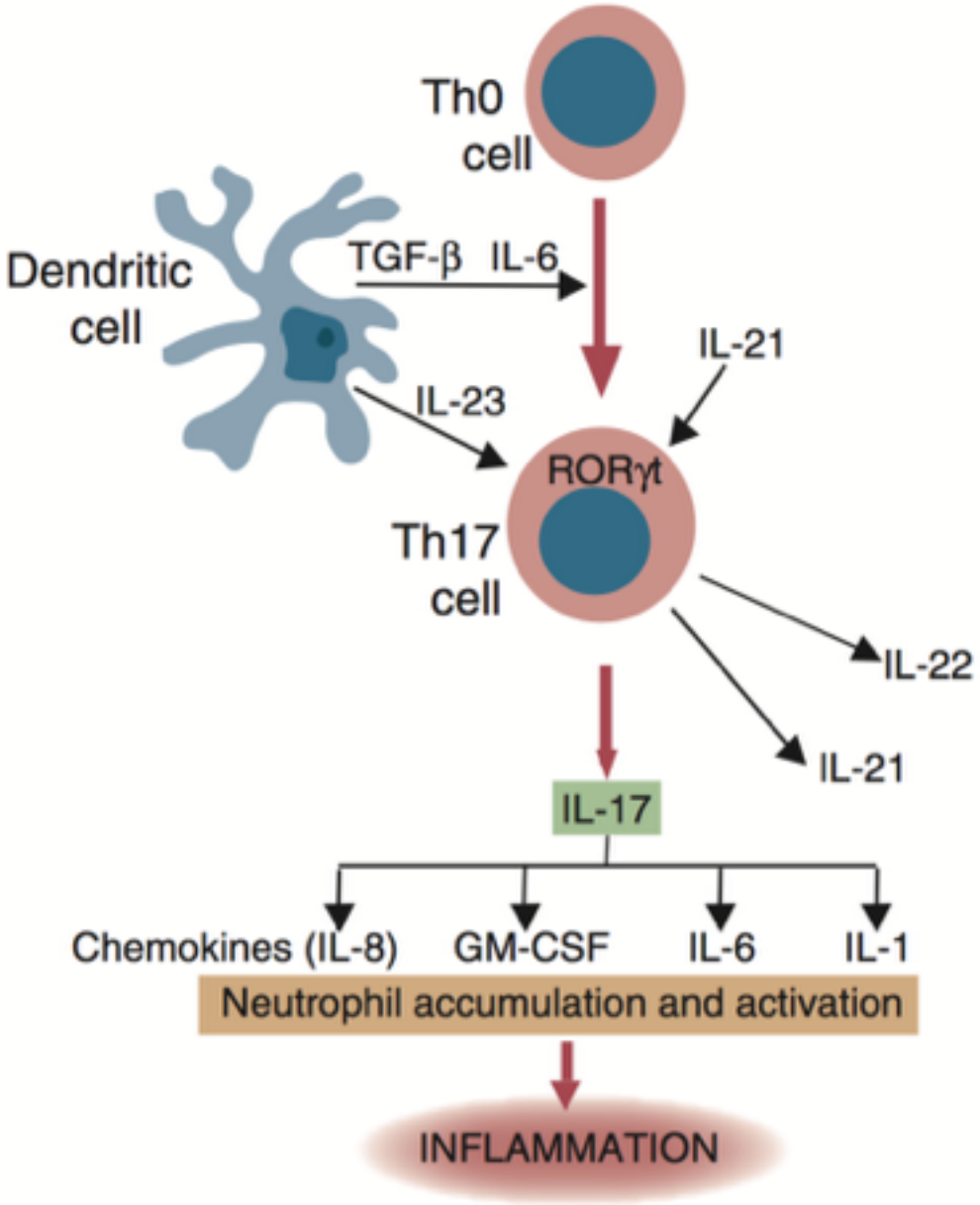
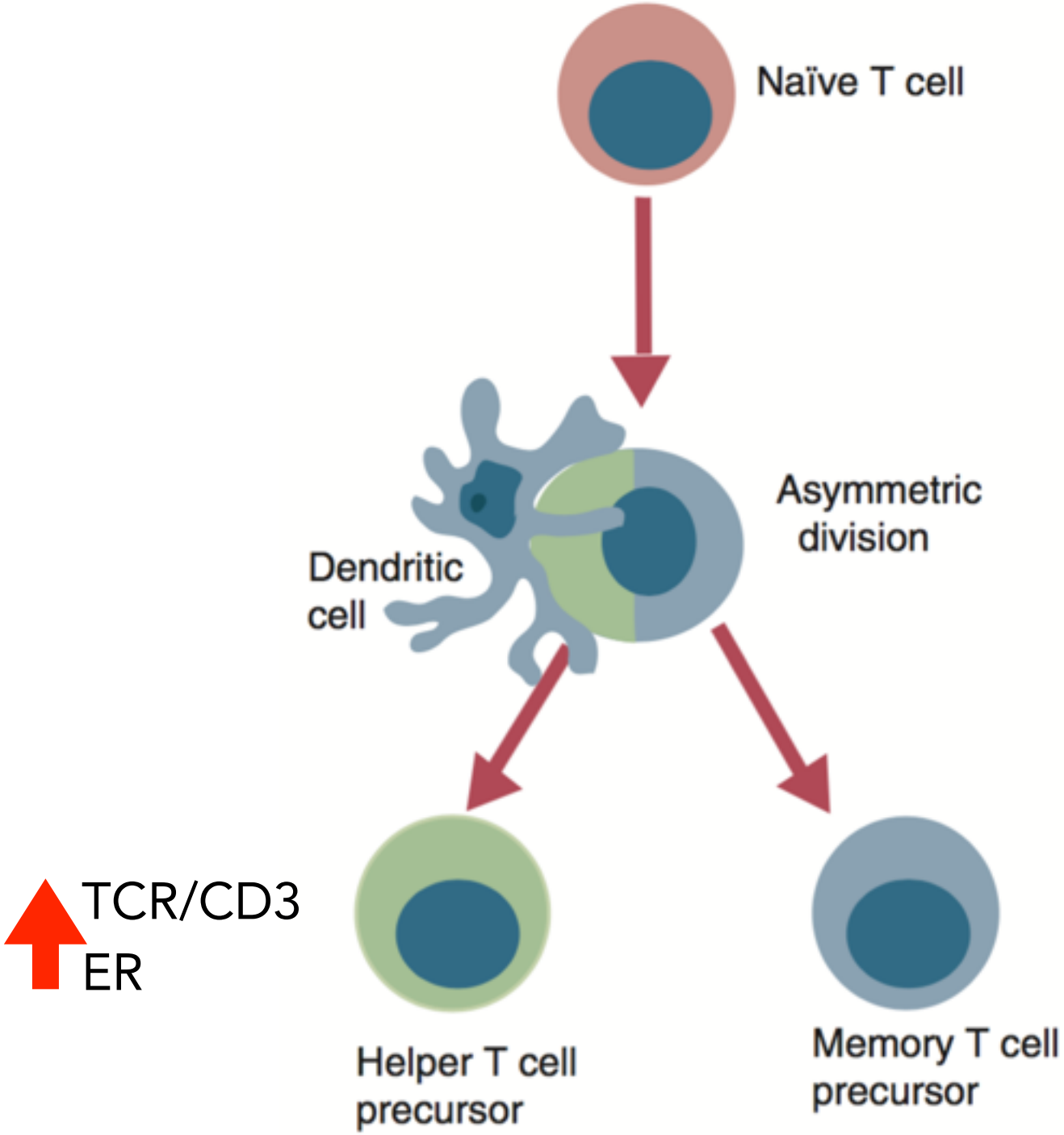


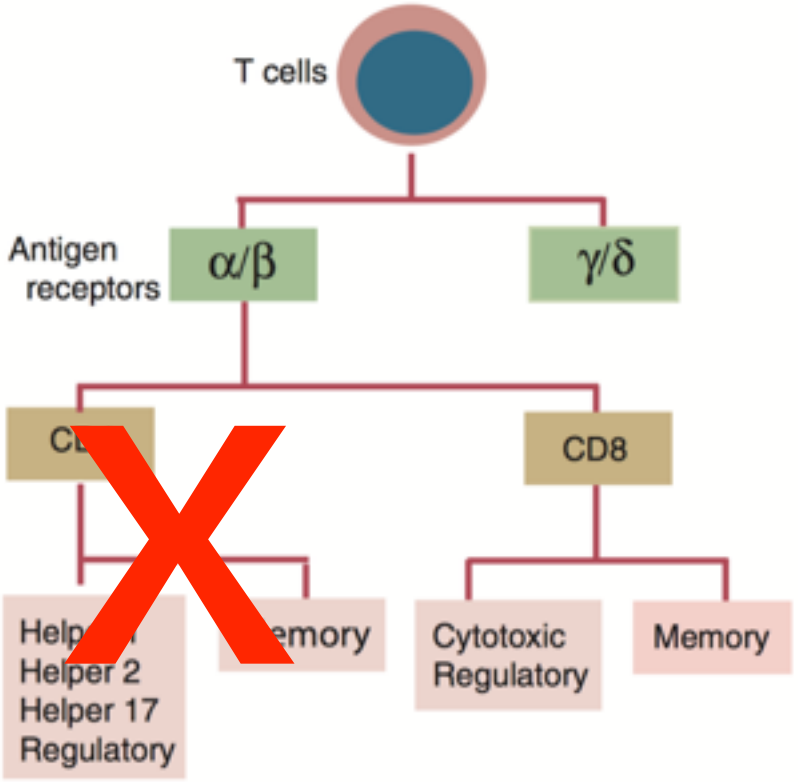
FIG. 14.8 The induction of Th17 cells by exposure to a cytokine mixture containing TGF-β and IL-6. Differentiation is promoted by IL-21 and maintained by IL-23. Th17 cells promote neutrophil accumulation and acute inflammation.

	CD8 cytotoxic T cells	CD4 T_H1 cells	CD4 T_H2 cells	CD4 T_H17 cells	T_{FH} cells	CD4 regulatory T cells (various types)
Types of effector T cell						
Main functions in adaptive immune response	Kill virus-infected cells	Activate infected macrophages Provide help to B cells for antibody production	Provide help to B cells for antibody production, especially switching to IgE	Enhance neutrophil response Promote barrier integrity (skin, intestine)	B-cell help Isotype switching Antibody production	Suppress T-cell responses
Pathogens targeted	Viruses (e.g. influenza, rabies, vaccinia) Some intracellular bacteria	Microbes that persist in macrophage vesicles (e.g. mycobacteria, *Listeria*, *Leishmania donovani*, *Pneumocystis carinii*) Extracellular bacteria	Helminth parasites	*Klebsiella pneumoniae* Fungi (*Candida albicans*)	All types	

Figure 9.1 Janeway's Immunobiology, 8ed. (© Garland Science 2012)


Naïve T cell
Asymmetric division
Dendritic cell
TCR/CD3
ER
Helper T cell precursor
Memory T cell precursor

O bacalhau do Atlântico
não possui MHC-II,
logo,
não possui resposta
mediada por T auxiliar




PLAYTIME
RULES
SHARE YOUR TOYS
MAKE NEW FRIENDS
TAKE TURNS
LAUGH AND GIGGLE
TIDY UP AFTER YOURSELF
PLAY FUN GAMES
SAY PLEASE AND THANK YOU
NO FIGHTING
BE NICE TO EACH OTHER
HAVE FUN!

Resposta mediada por célula inata

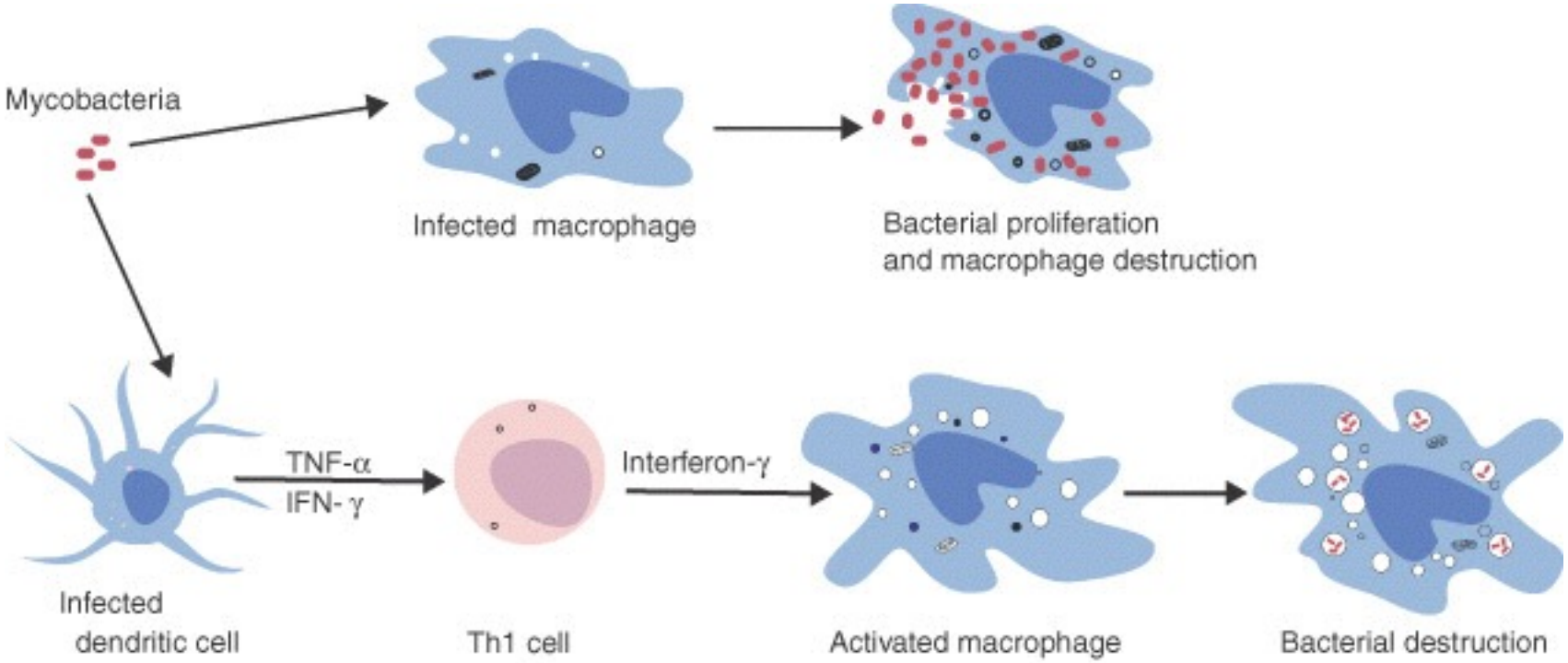


FIGURE 16-11 Normal macrophages are killed by growing intracellular bacteria. Interferon-γ *(IFN-γ)* and interleukin-2 released by Th1 cells can activate macrophages and so enable them to kill otherwise resistant intracellular bacteria.

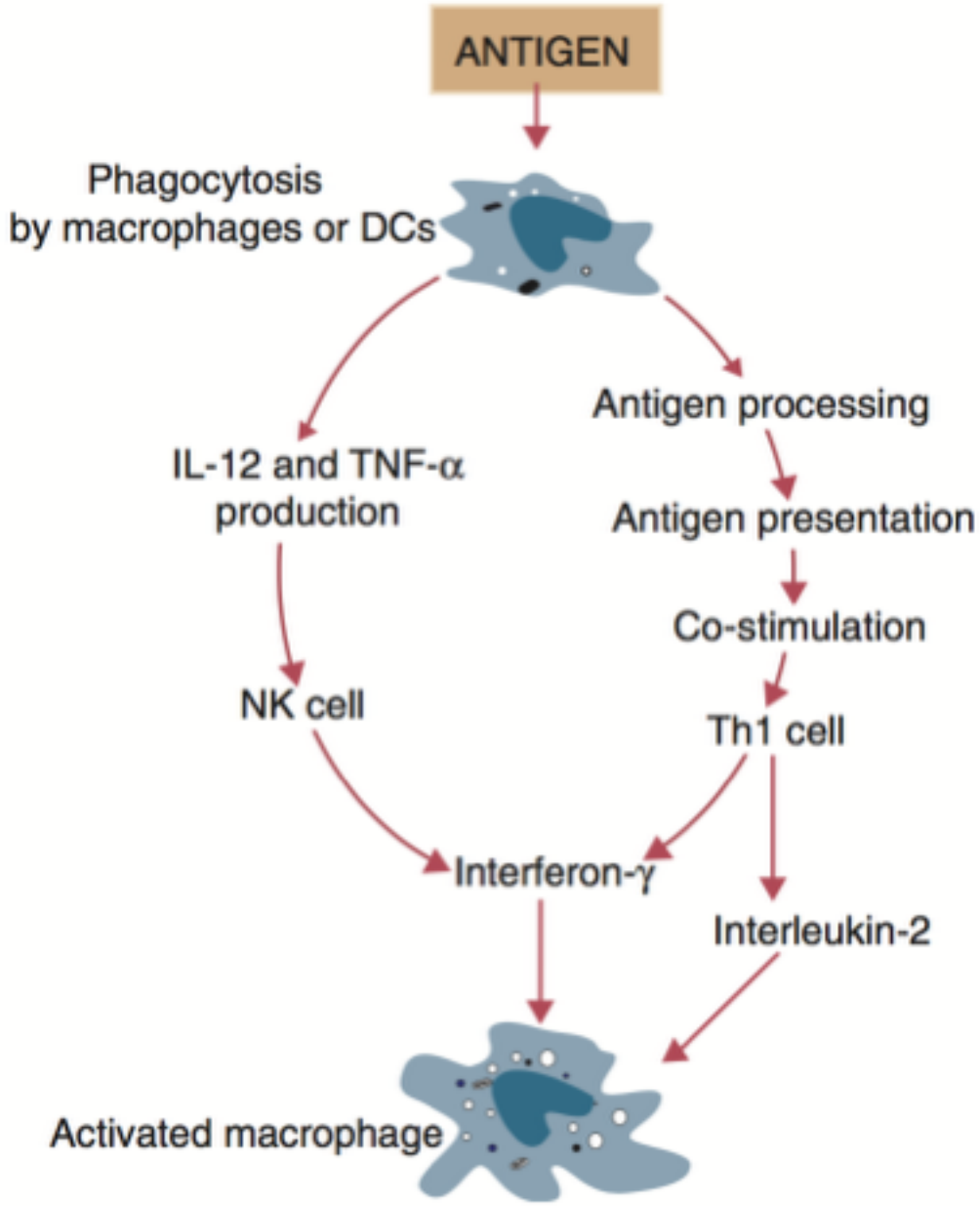


FIG. 18.13 The two pathways by which macrophages can be activated. One involves IFN-γ production by natural killer cells and is thus an innate pathway. The other is mediated by IFN-γ from Th1 cells and is an adaptive response.

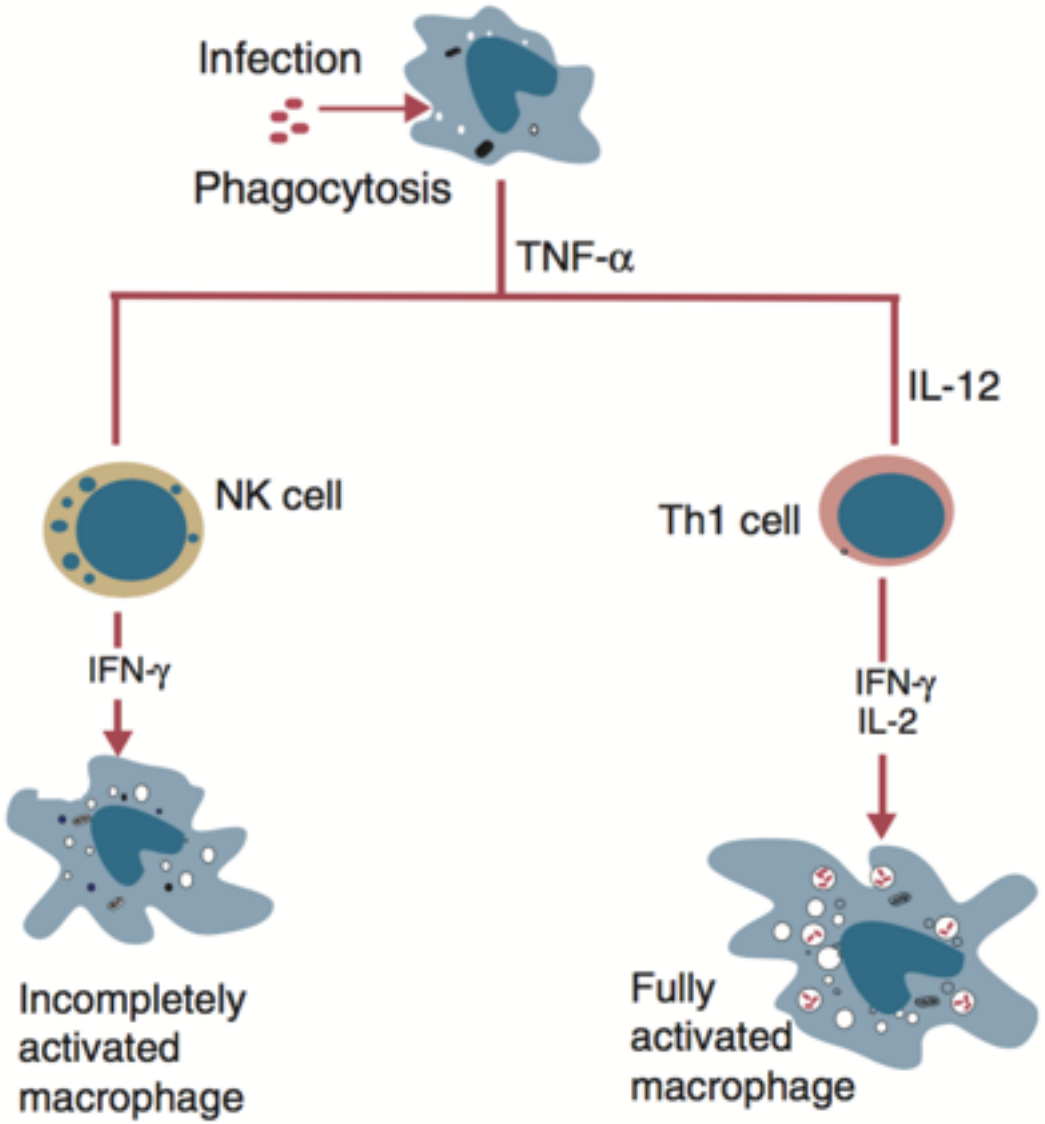


FIG. 18.14 M1 macrophage activation probably develops in stages. Thus IFN-γ produced by NK cells probably activates macrophages in the early stages of an immune response. If this is insufficient, then Th1 cells are activated, and the combination of IFN-γ and IL-2 that they produce causes maximal M1 activation and polarization.

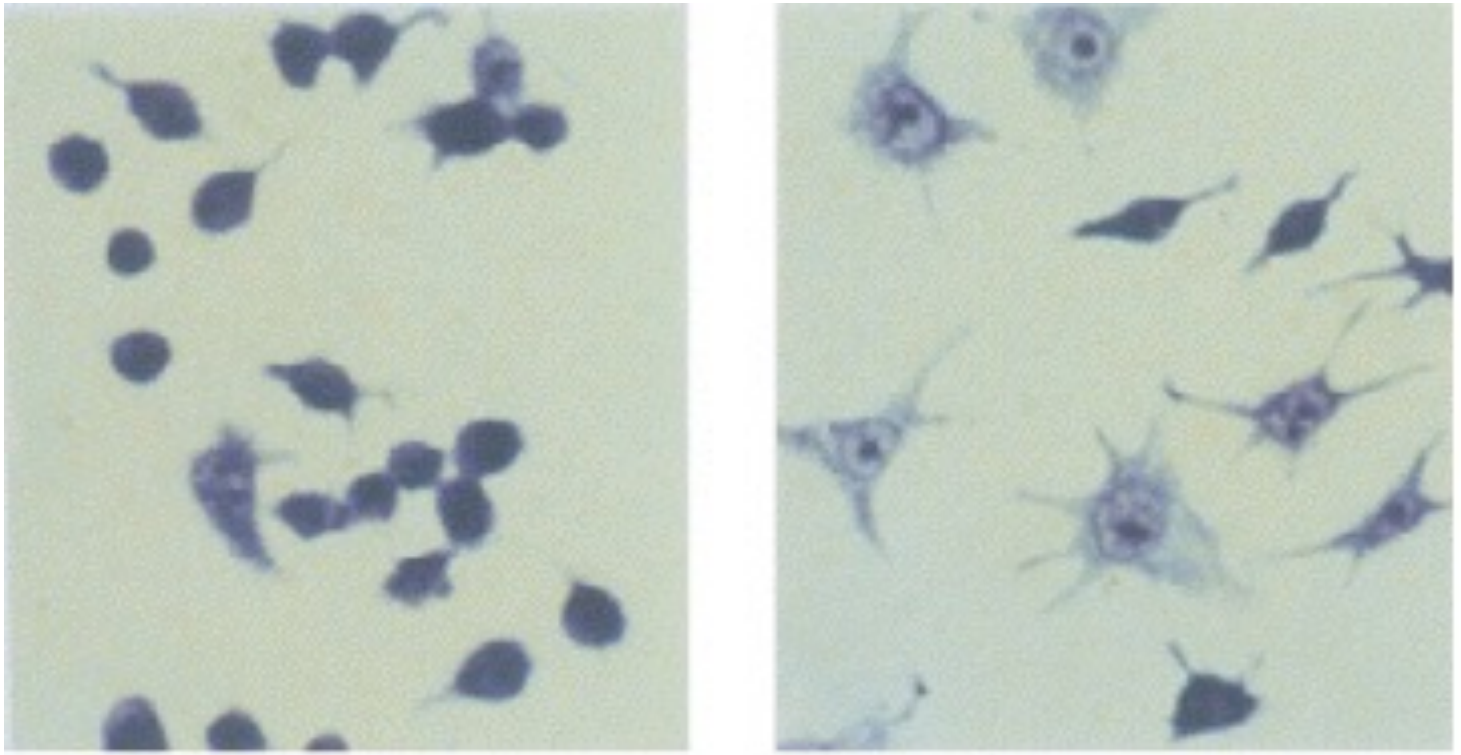


FIGURE 16-14 Stained cultures of mouse macrophages grown under identical conditions: *Left,* Normal unstimulated macrophages. *Right,* Macrophages activated by exposure to interferon-γ and acemannan. Note the cytoplasmic spreading of the activated cells. These cells secrete large quantities of cytokines and nitric oxide. Original magnification ×400.

(Courtesy Dr. Linna Zhang.)

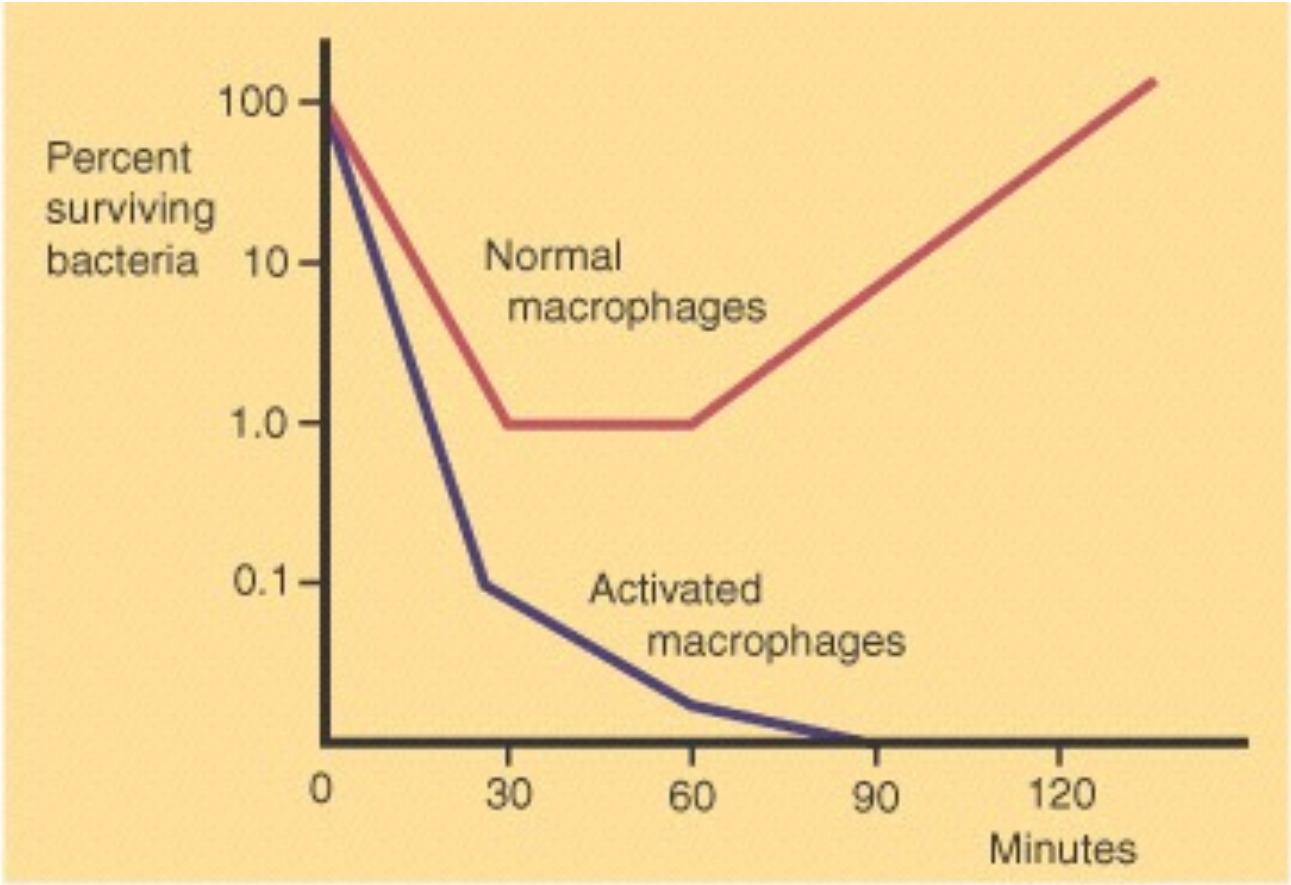
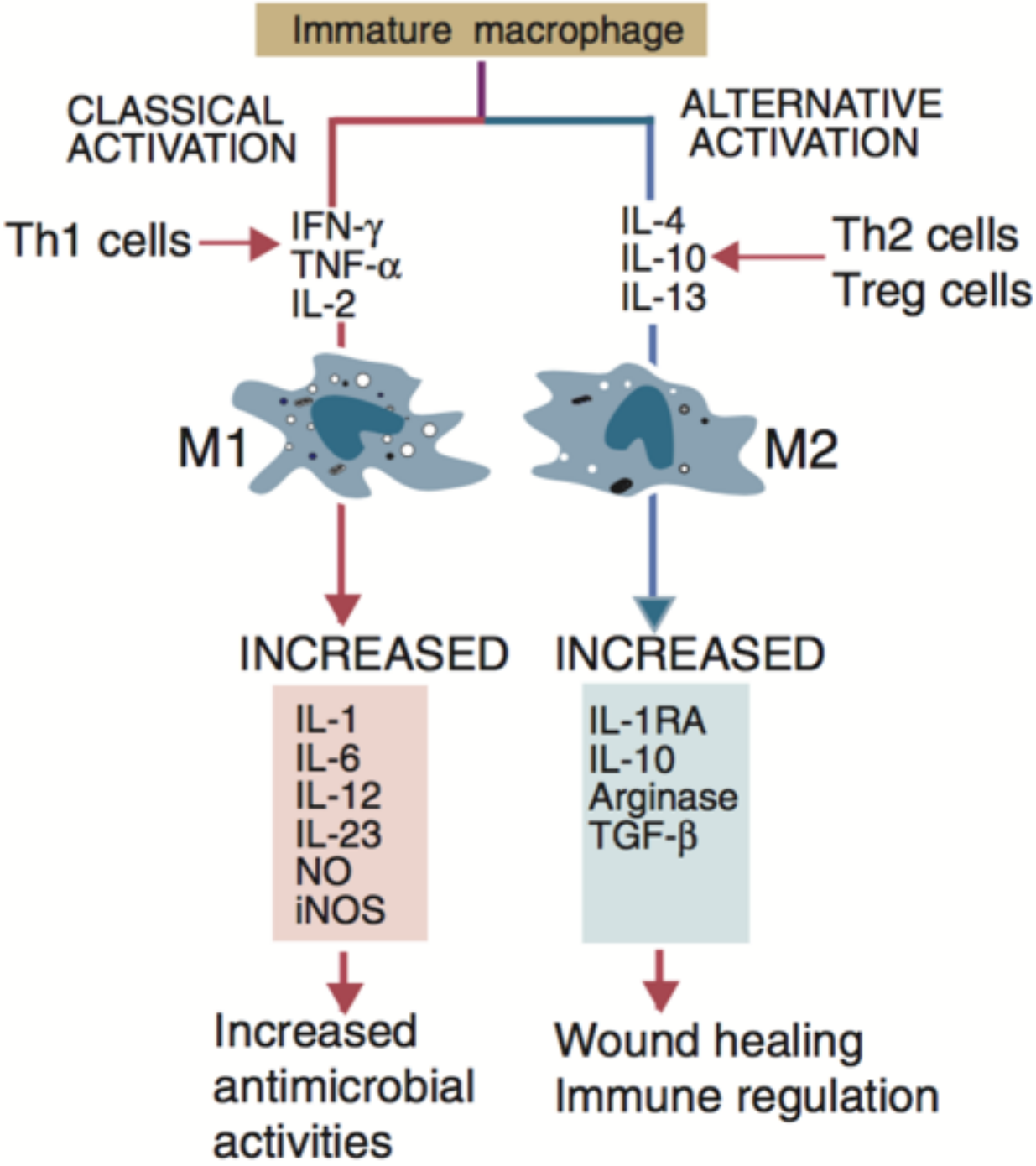


FIGURE 16-15 The destruction of *Listeria monocytogenes* when mixed in vitro with cultures of normal macrophages and "activated" macrophages from *Listeria*-infected mice.


Immature macrophage
CLASSICAL ACTIVATION
ALTERNATIVE ACTIVATION
Th1 cells
IFN-γ
TNF-α
IL-2
IL-4
IL-10
IL-13
Th2 cells
Treg cells
M1
M2
INCREASED
INCREASED
IL-1
IL-6
IL-12
IL-23
NO
iNOS
IL-1RA
IL-10
Arginase
TGF-β
Increased antimicrobial activities
Wound healing
Immune regulation

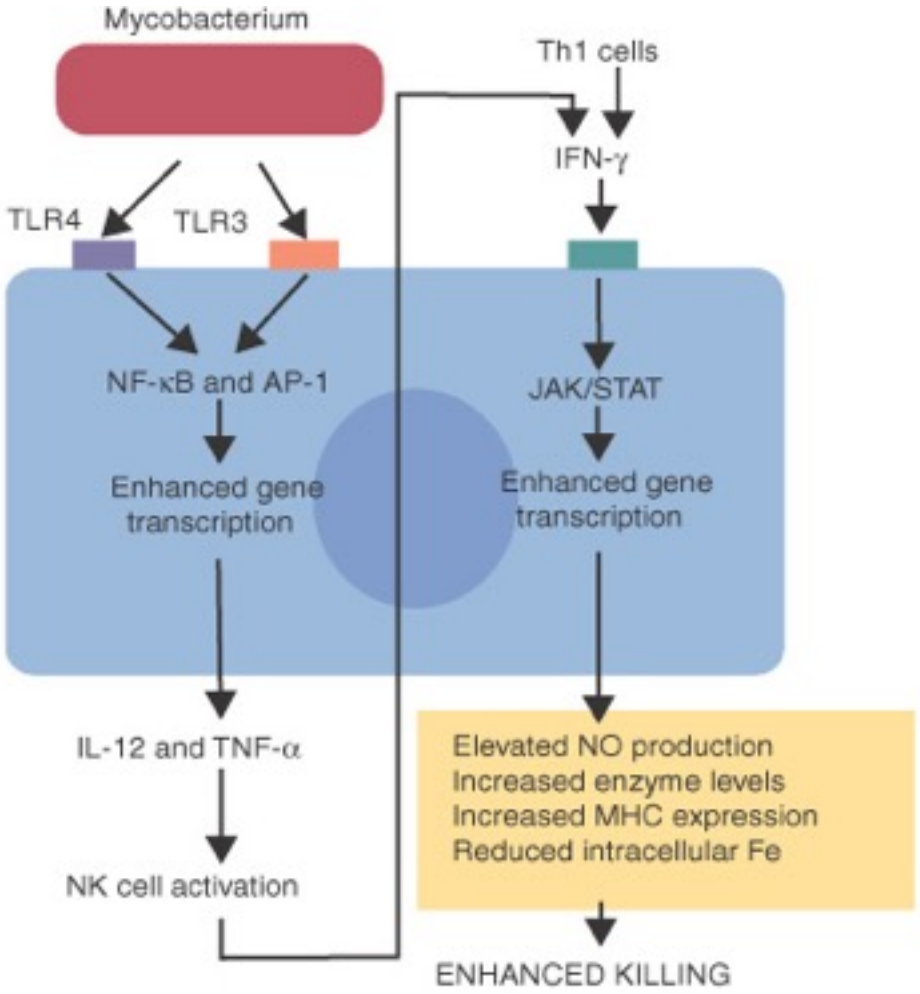
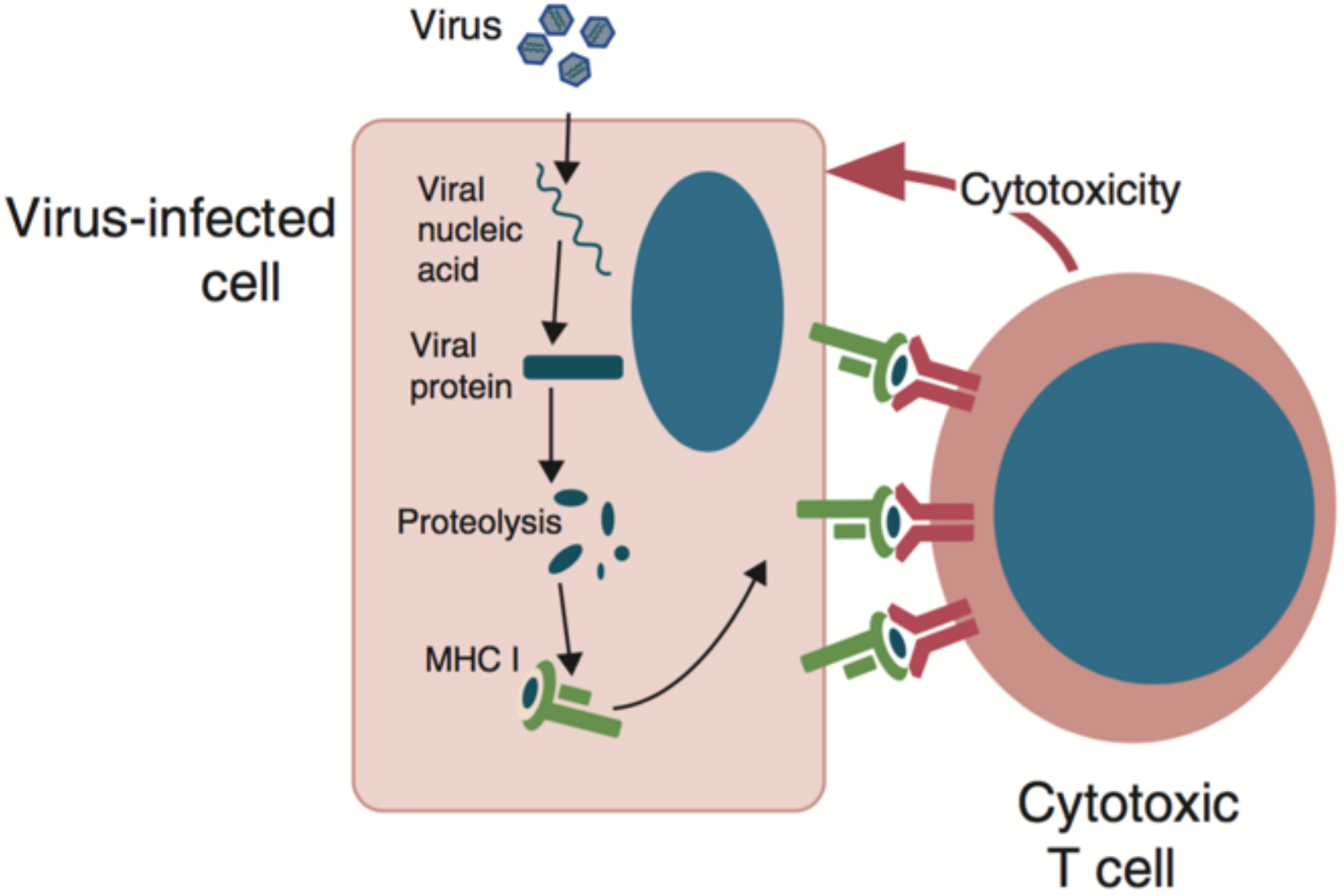


FIGURE 16-13 M1 macrophage activation occurs through two linked signaling pathways. Microbial pathogen-associated molecular patterns acting through toll-like receptors *(TLR)* and nuclear factor kappa-B *(NF-κB)* leads to enhanced production of interleukin-12 *(IL-12)* and tumor necrosis factor-α *(TNF-α)*. The second mechanism acts through the interferon-γ *(IFN-γ)* receptor and the Janus kinase/signal transducer and activator of transcription *(JAK/STAT)* pathway.


Virus
Virus-infected cell
Viral nucleic acid
Viral protein
Proteolysis
MHC I
Cytotoxicity
Cytotoxic T cell

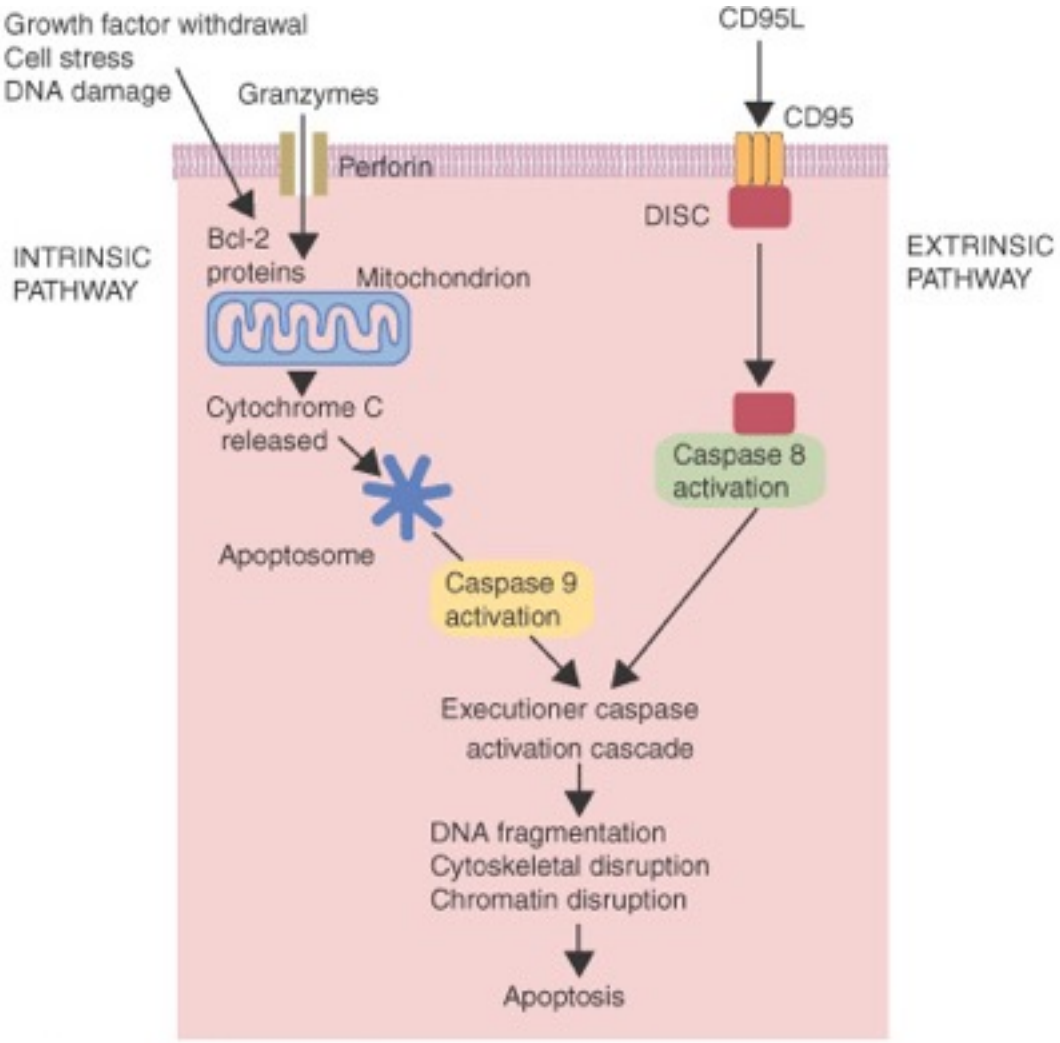


FIGURE 16-2 The two pathways by which apoptosis may be triggered. Both lead to caspase activation, DNA fragmentation, and cell death. The extrinsic pathway is activated by ligation of death receptors such as CD95 and formation of the death-inducing signaling complex *(DISC)*. The intrinsic pathway is initiated by multiple damage signals, including injection of granzymes, and leads to the release of cytochrome C from mitochondria, the formation of an apoptosome, and activation of caspase 9.

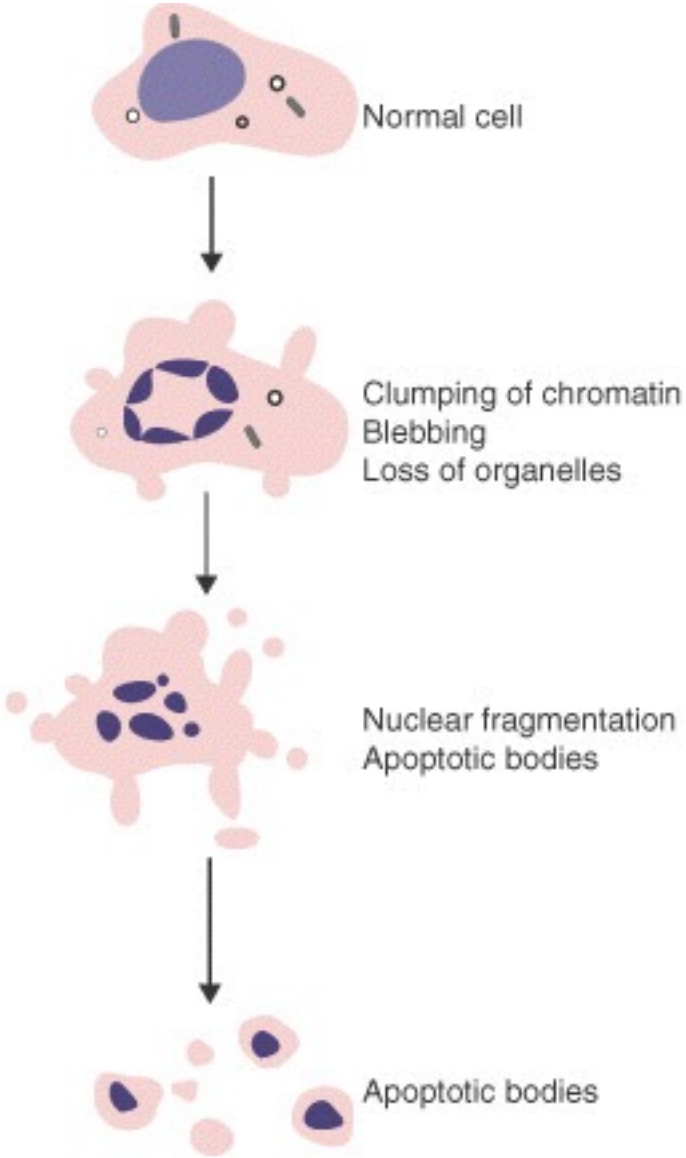


FIGURE 16-3 Major morphological features of cell death by apoptosis.

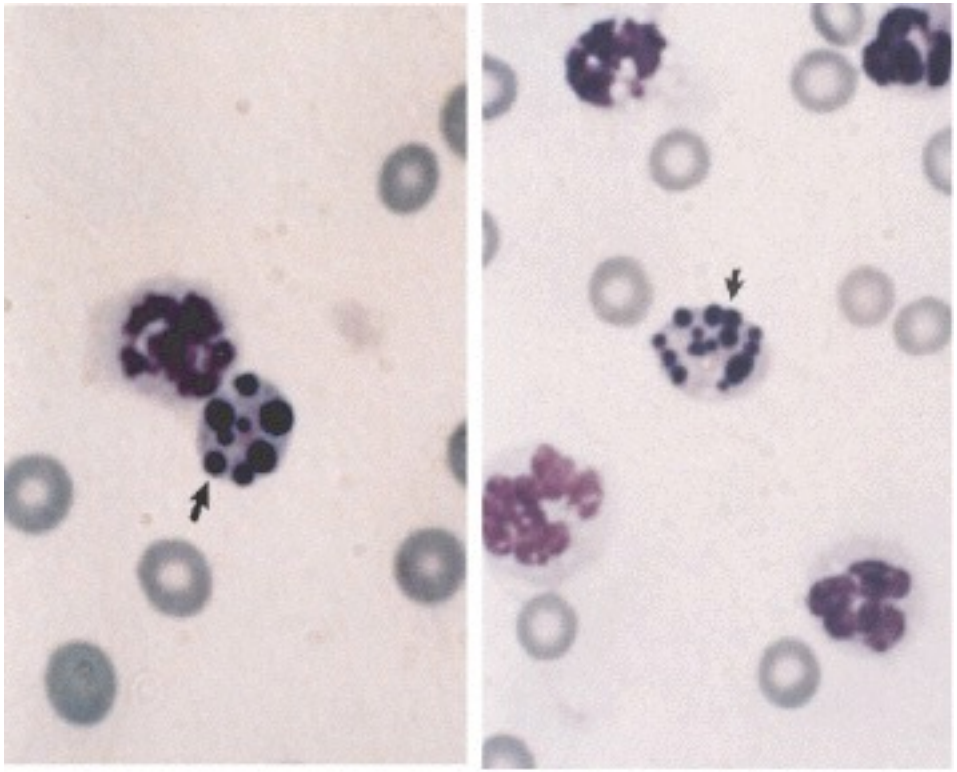


FIGURE 16-4 Two rat neutrophils showing nuclear condensation and fragmentation characteristic of apoptosis.

(Courtesy Ms. K. Kennon.)

TABLE 18.1 Comparison of the Three Major Mechanisms of Cell-Mediated Cytotoxicity

Cytotoxic Cells	Time	Mechanism	MHC Restricted	Antigen Specific
NK cells	24 hr	NK-mediated cytotoxicity	No	No
Normal lymphocytes or macrophages with FcγRIII with specific antibody	6 hr	ADCC activity	No	Yes
Primed T cells	10 min	T cell–mediated cytotoxicity	Yes	Yes

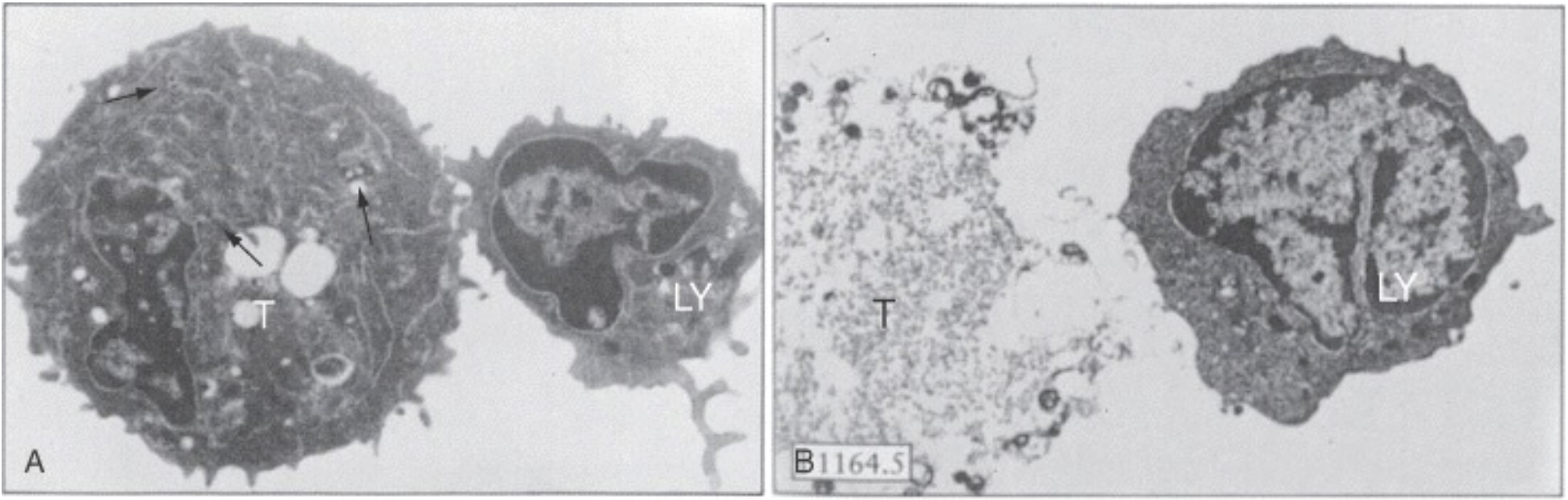


FIGURE 16-5A Destruction of target cells by cytotoxic T cells. **A,** Conjugation between a peritoneal exudate lymphocyte (the small cell on the right) and a target cell. Note the lysosome-like bodies *(LY)* and the nuclear fragmentation of the target cell *(T)*. **B,** A lymphocyte with the remains of a lysed target cell.

(From Zagury D et al: *Eur J Immunol* 5:881, 1975.)

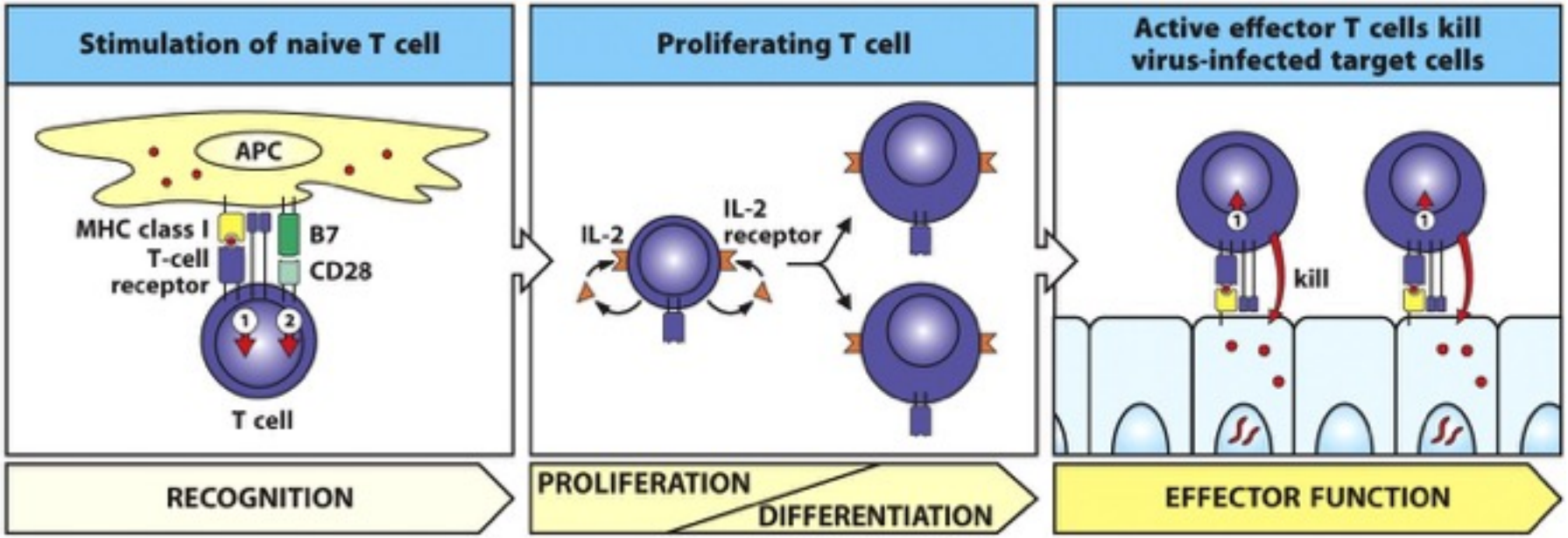


Figure 9.24 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

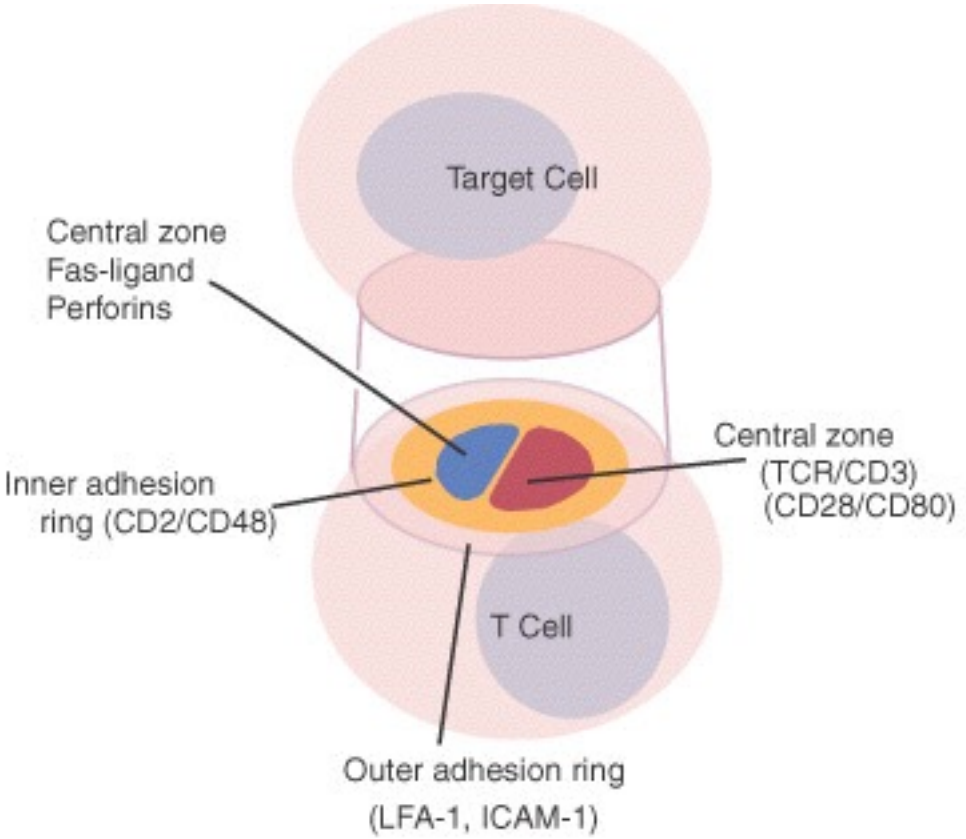


FIGURE 16-6 Structure of the immunological synapse that forms between a cytotoxic T cell and its target. The outer ring of adhesive proteins forms an effective "gasket" that prevents leakage of cytotoxic molecules into tissue fluid. There are however two central supramolecular activation clusters (cSMACs). One is dedicated to signaling and so contains the T cell antigen receptor together with accessory molecules and co-stimulators. The other is dedicated to cytotoxic mechanisms. It is through this cSMAC that perforins, granzymes, and the Fas-FasL signals are transmitted.

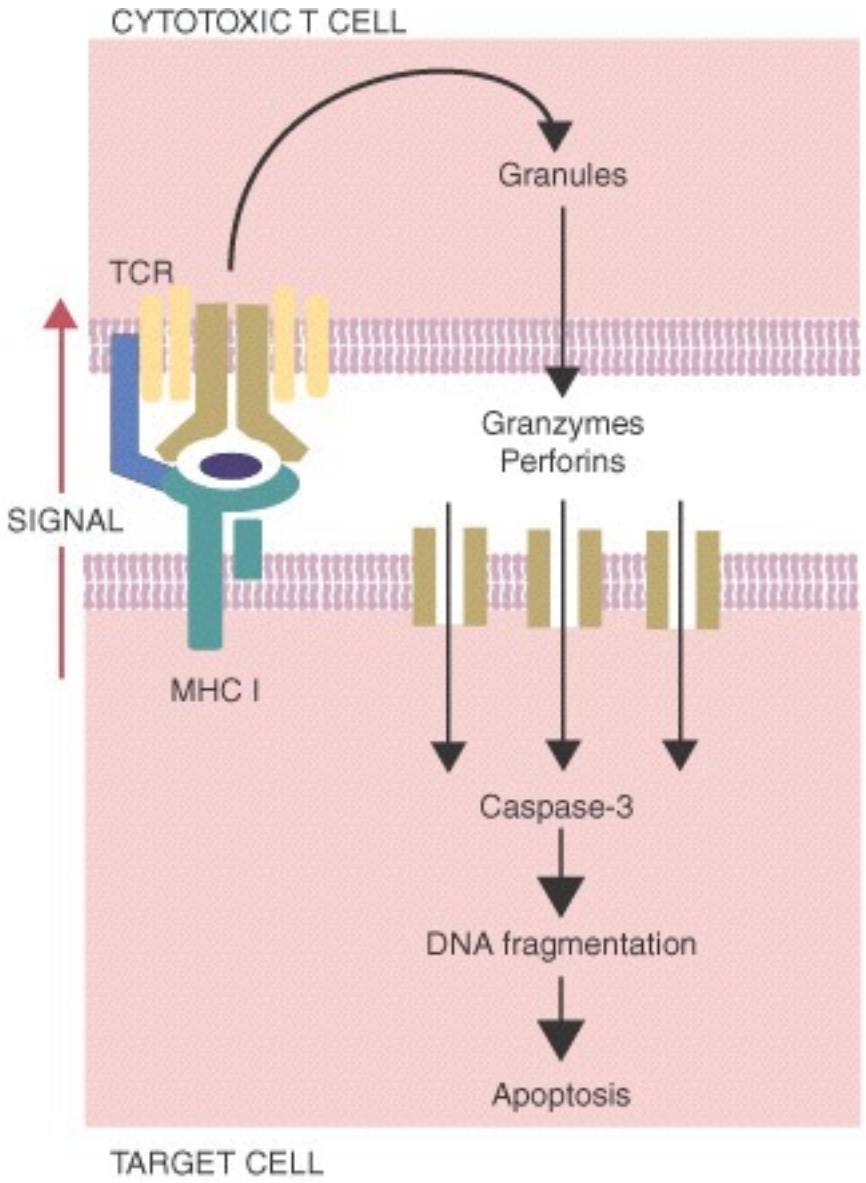


FIGURE 16-7 The perforin pathway by which T cells kill targets.

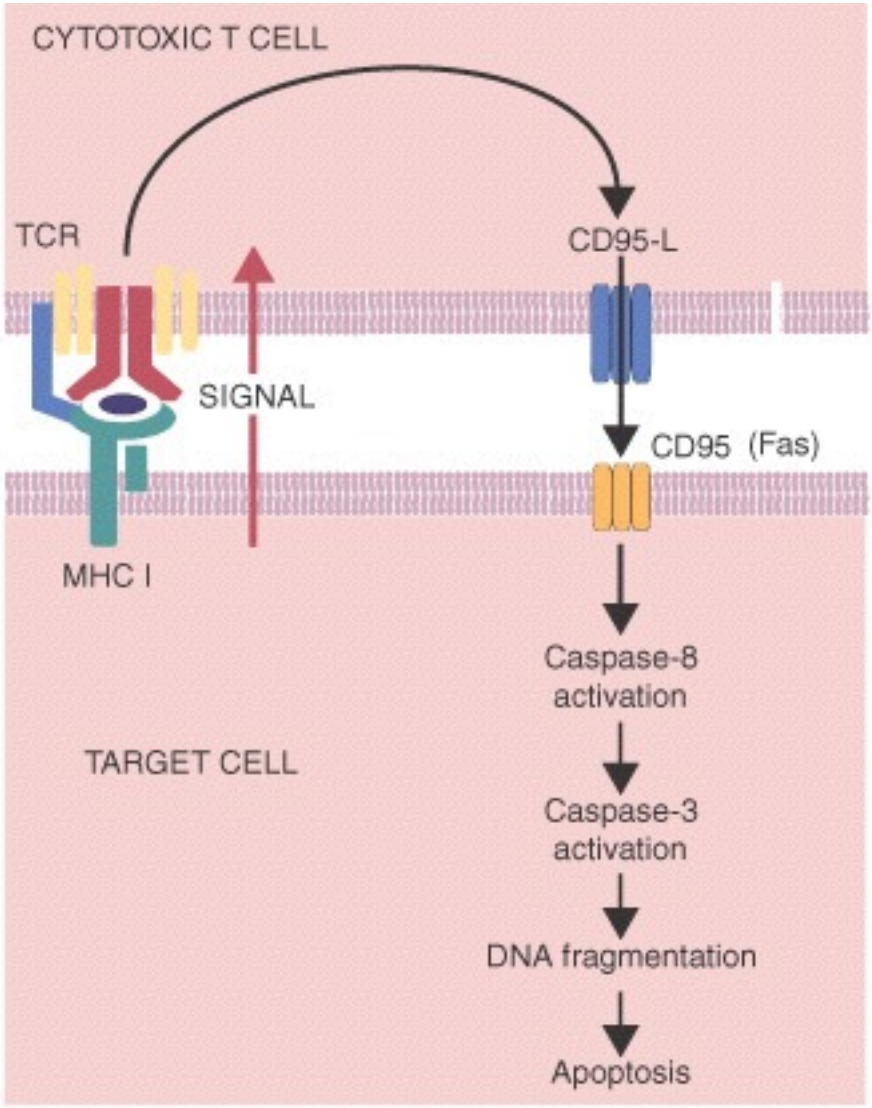


FIGURE 16-8 The CD95 pathway of T cell–mediated cytotoxicity.

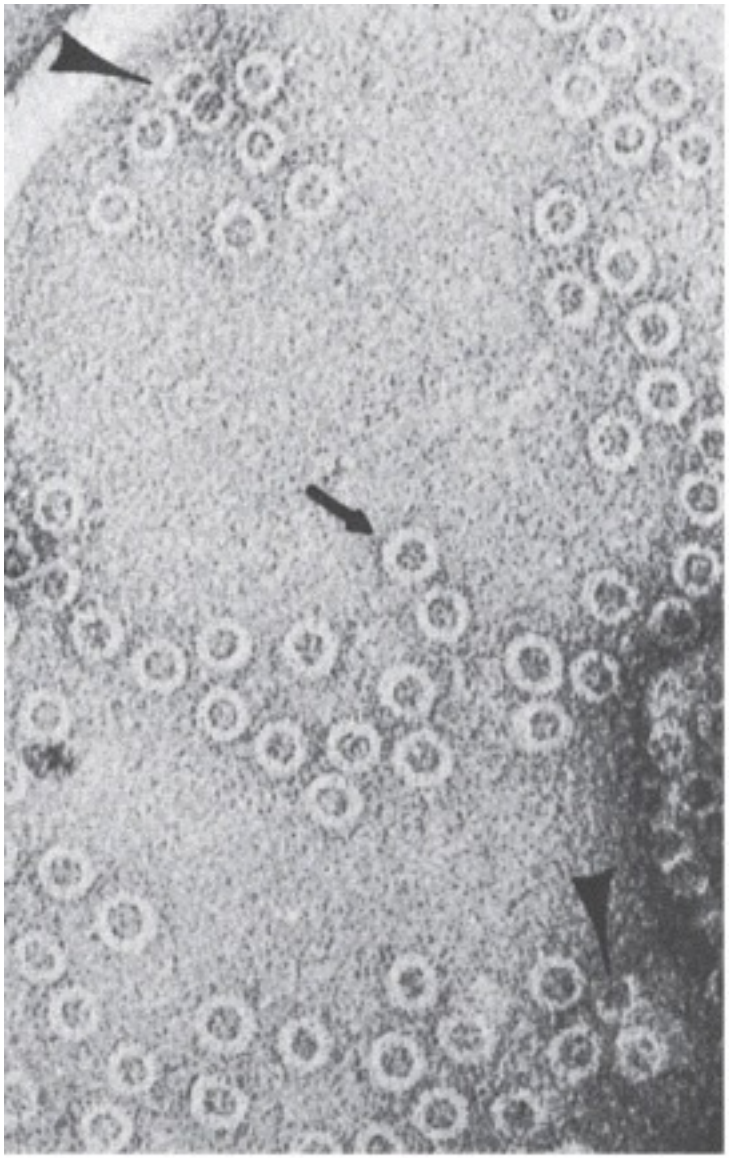


FIGURE 16-9 Perforins from human natural killer cells on the surface of a rabbit erythrocyte target. The arrowheads point to incomplete rings and double rings.

(From Podack ER, Dennert G: *Nature* 301:44, 1983.)

Protein in granules of cytotoxic T cells	Actions on target cells
Perforin	Aids in delivering contents of granules into the cytoplasm of target cell
Granzymes	Serine proteases, which activate apoptosis once in the cytoplasm of the target cell
Granulysin	Has antimicrobial actions and can induce apoptosis

Figure 9.36 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

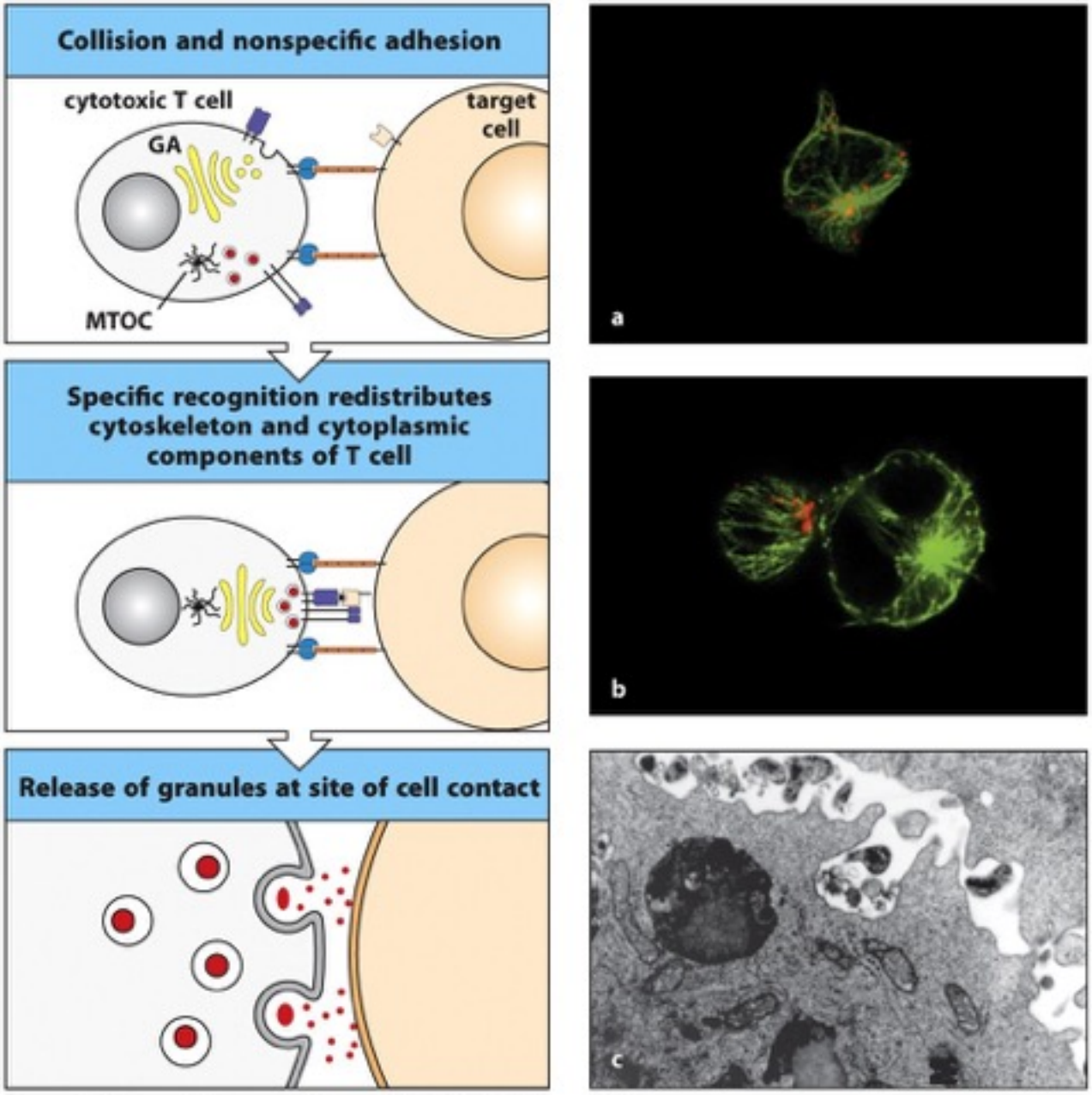


Figure 9.32 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

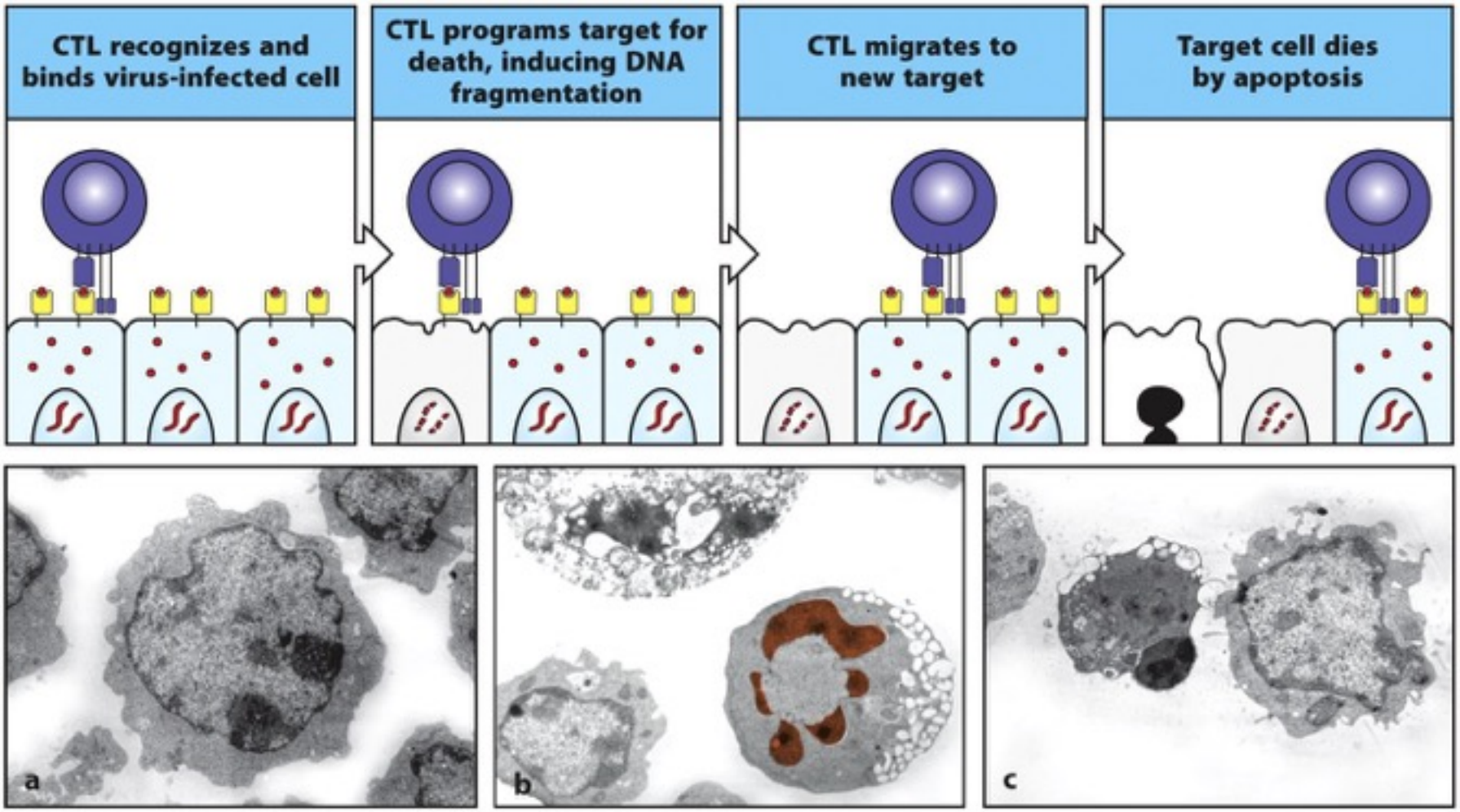


Figure 9.35 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

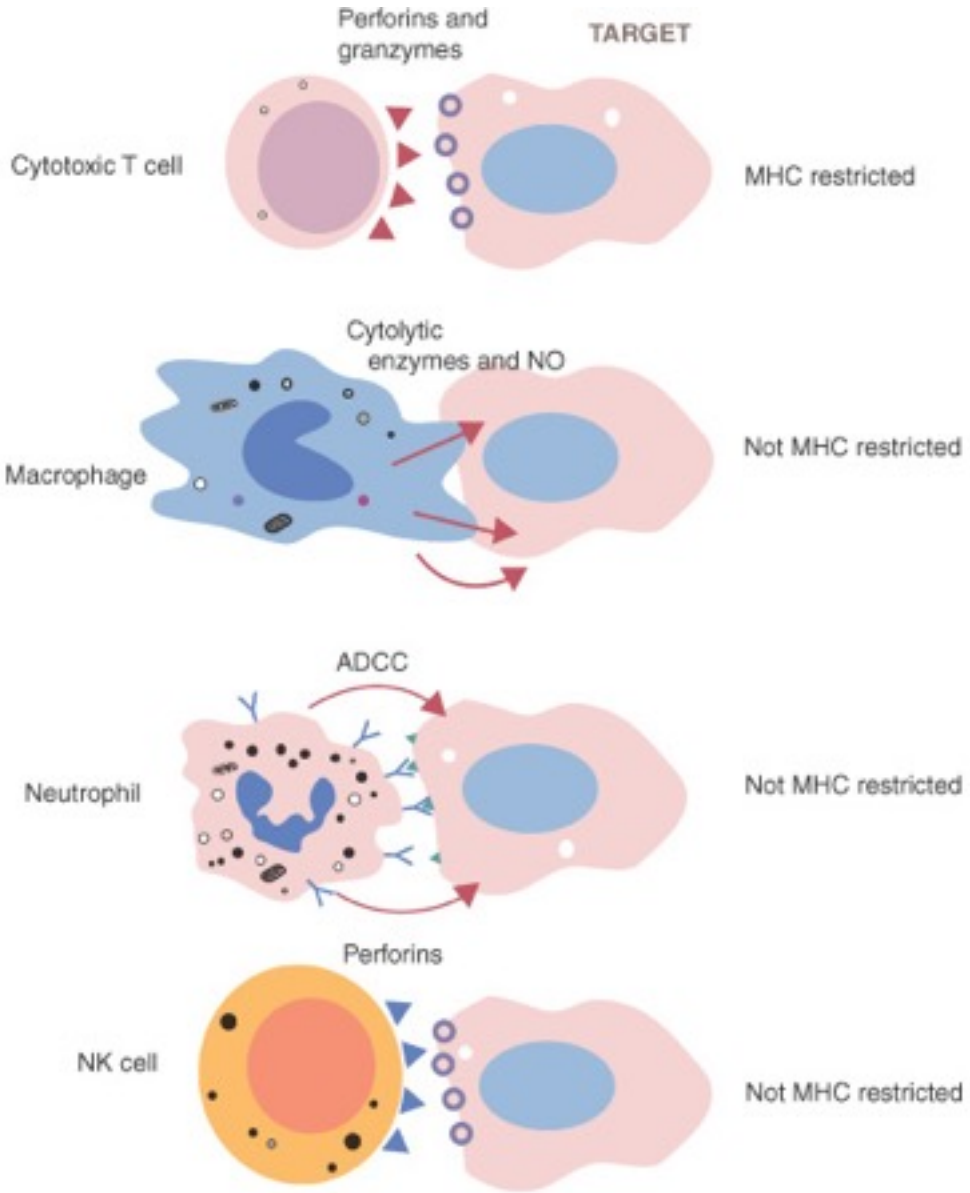
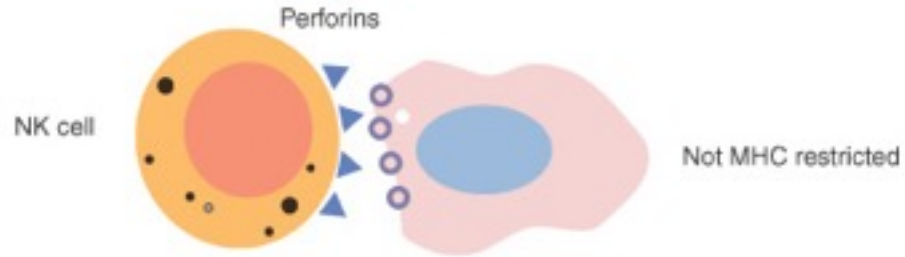


FIGURE 16-10 Major pathways by which the cells of the immune system can kill nucleated target cells. These targets would normally be tumor cells or virus-infected cells.



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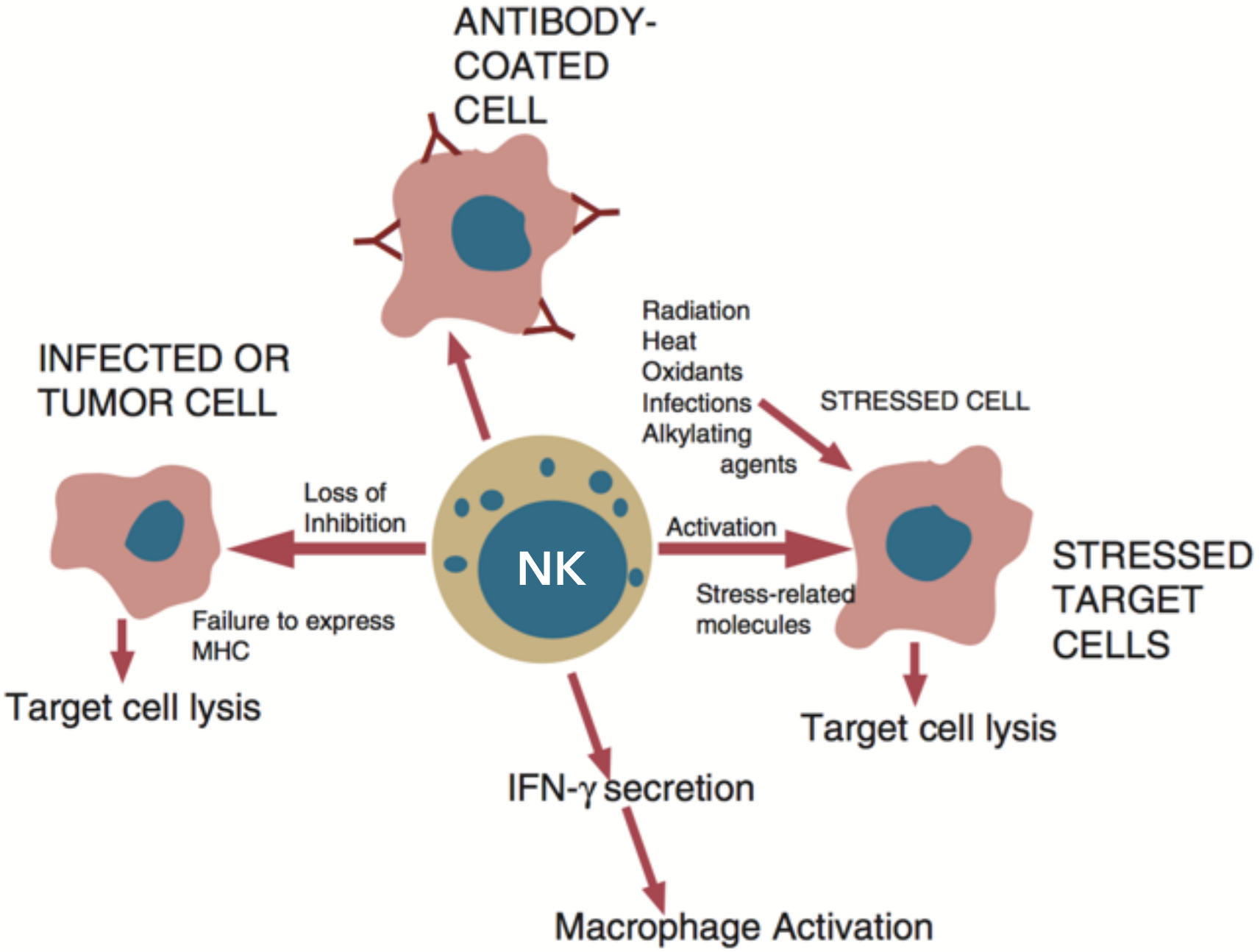
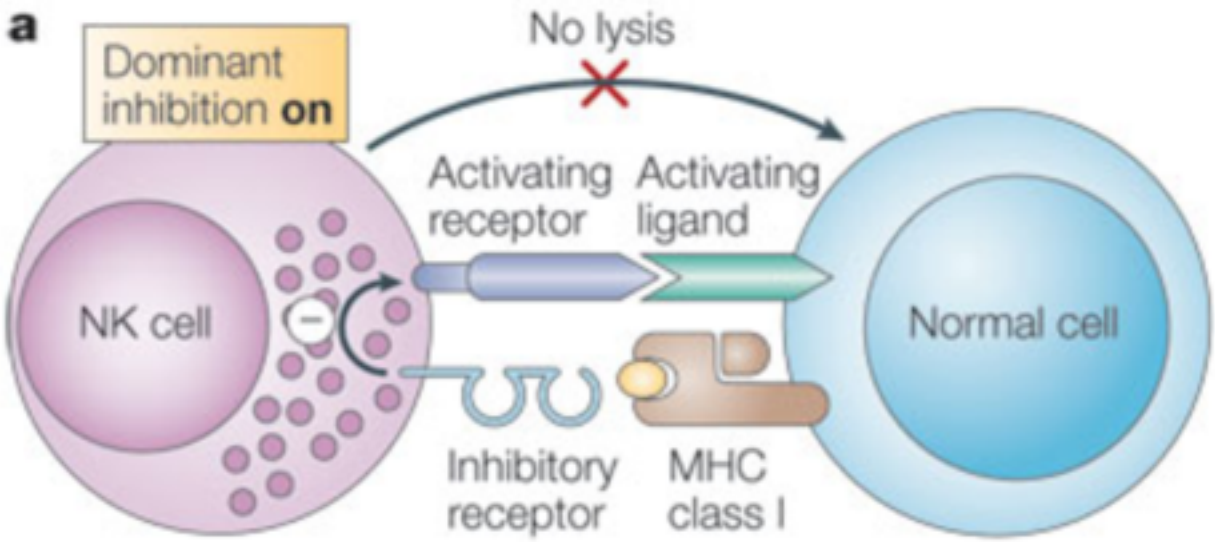
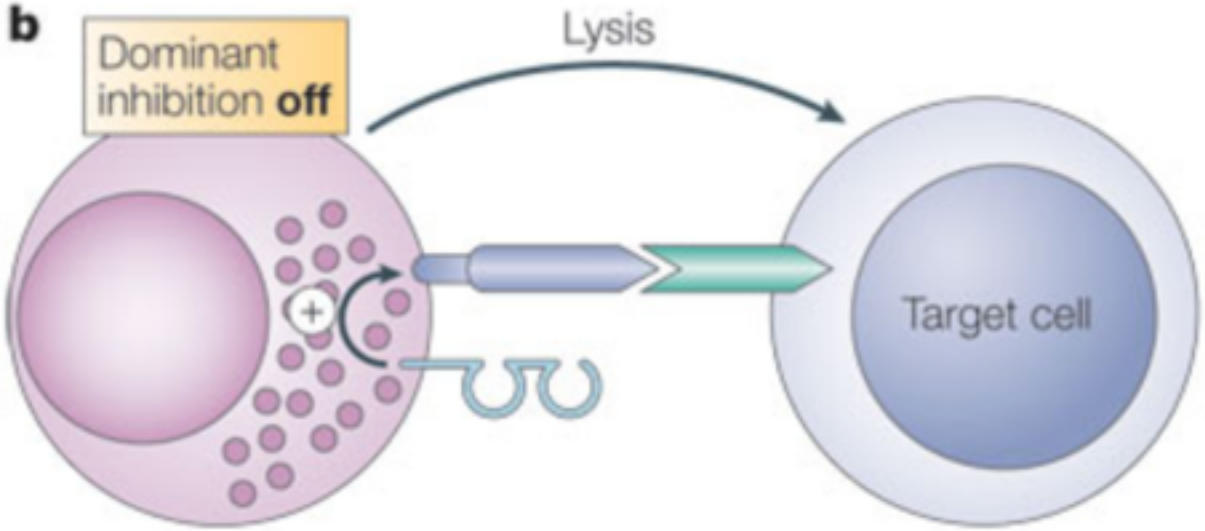

ANTIBODY-
COATED
CELL
INFECTED OR
TUMOR CELL
Radiation
Heat
Oxidants
Infections
Alkylating
agents
STRESSED CELL
Loss of
Inhibition
Activation
NK
Failure to express
MHC
Stress-related
molecules
STRESSED
TARGET
CELLS
Target cell lysis
Target cell lysis
IFN-γ secretion
Macrophage Activation





Transformed or tumour cell
(lacks MHC class I molecules)
Virus-infected cell
(downregulated MHC class I
expression)
Transplanted cell
(allogeneic MHC class I molecules)

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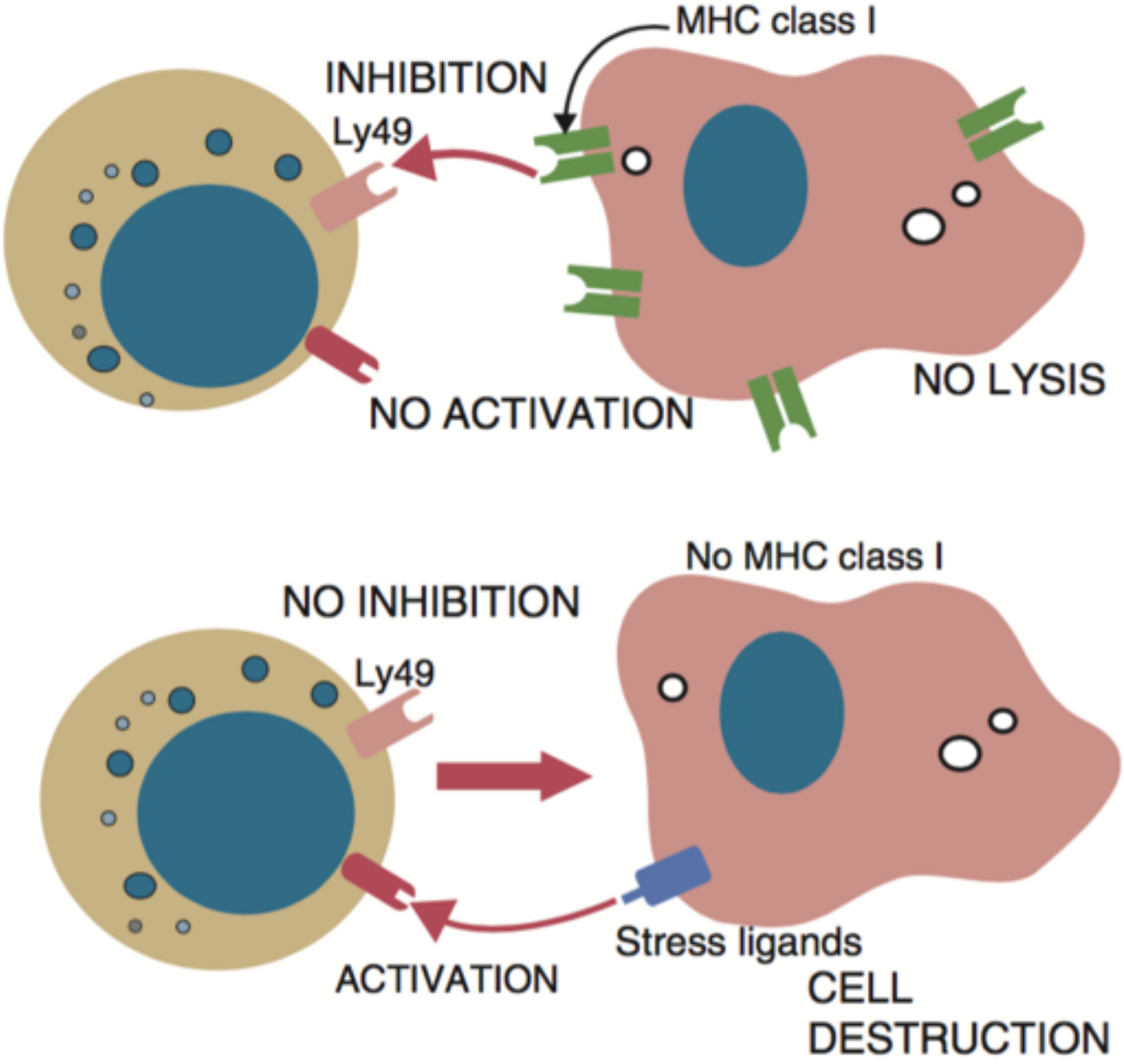
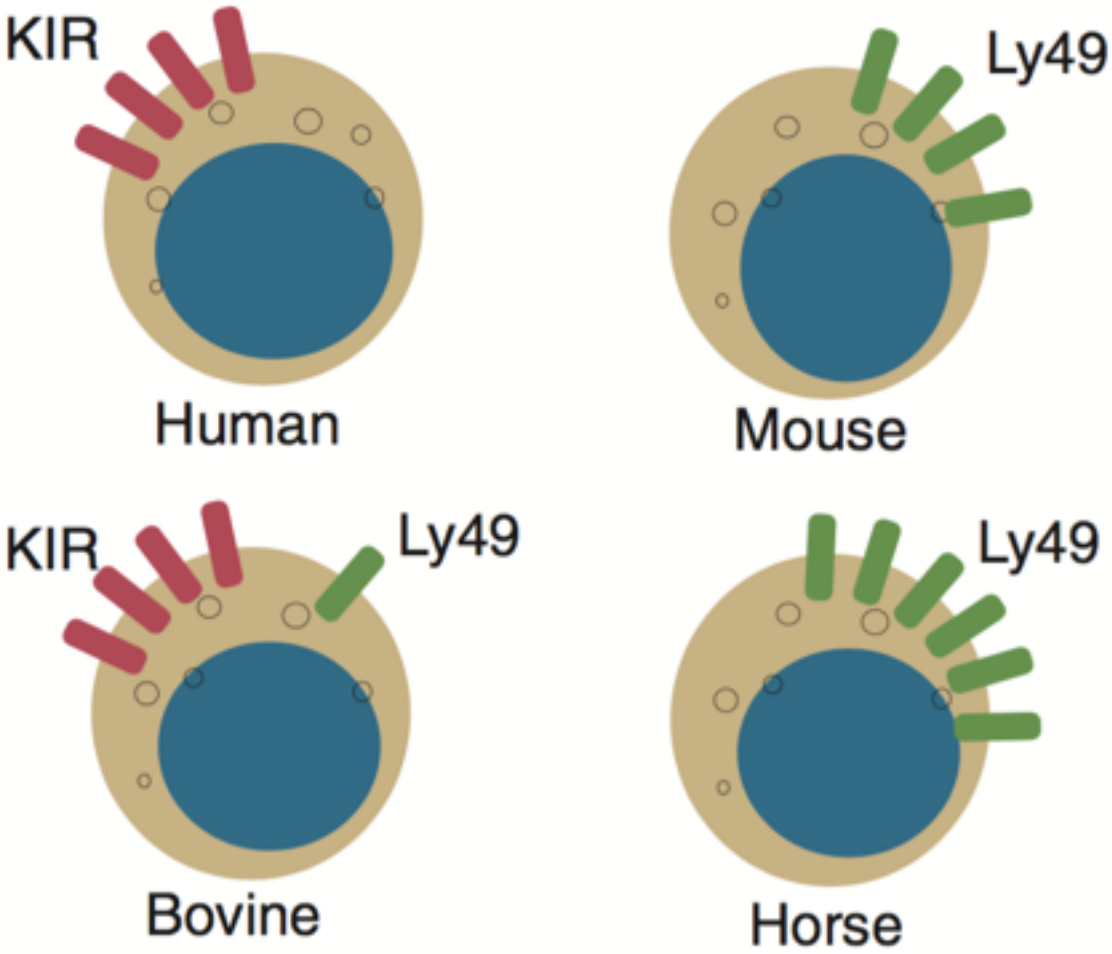
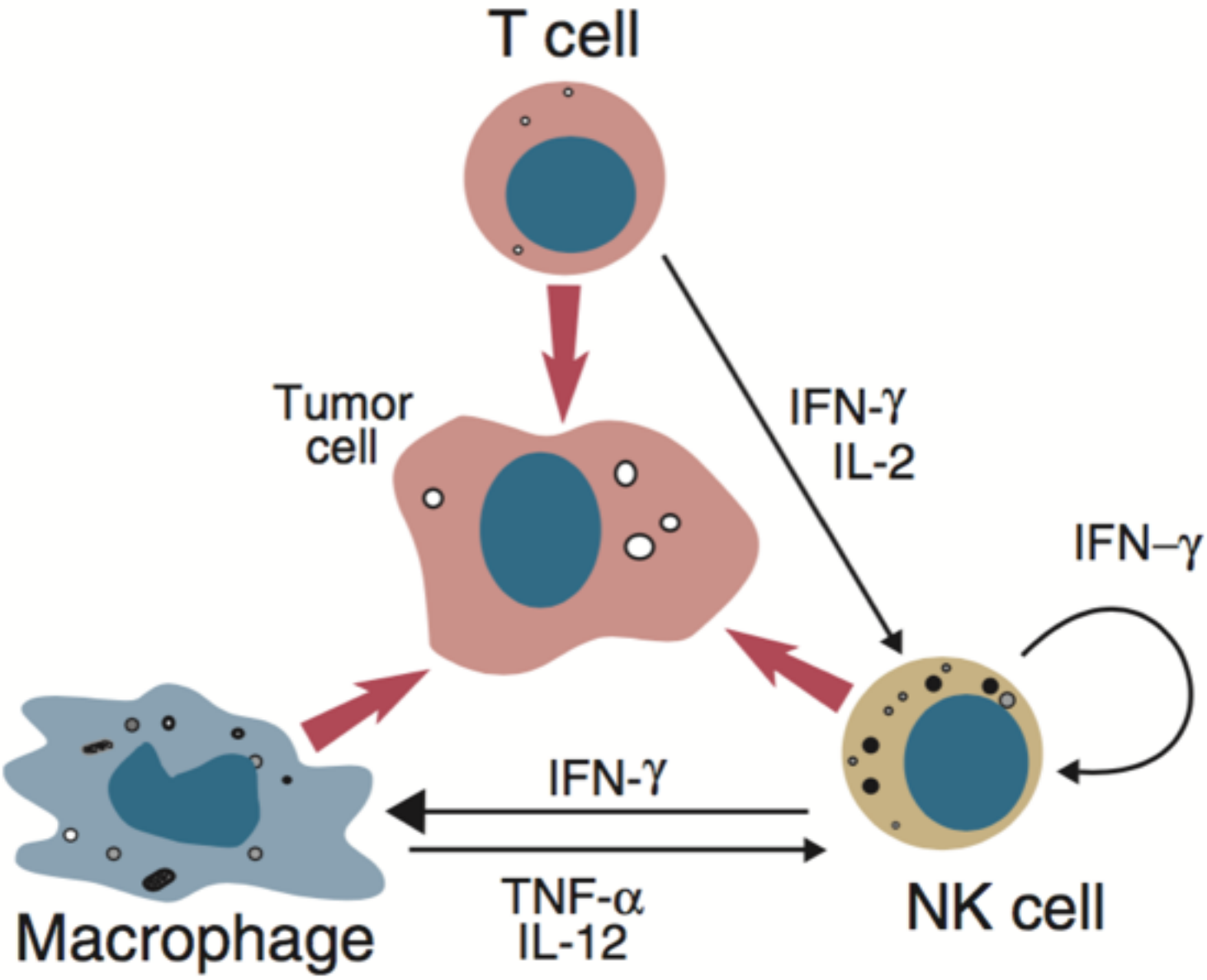
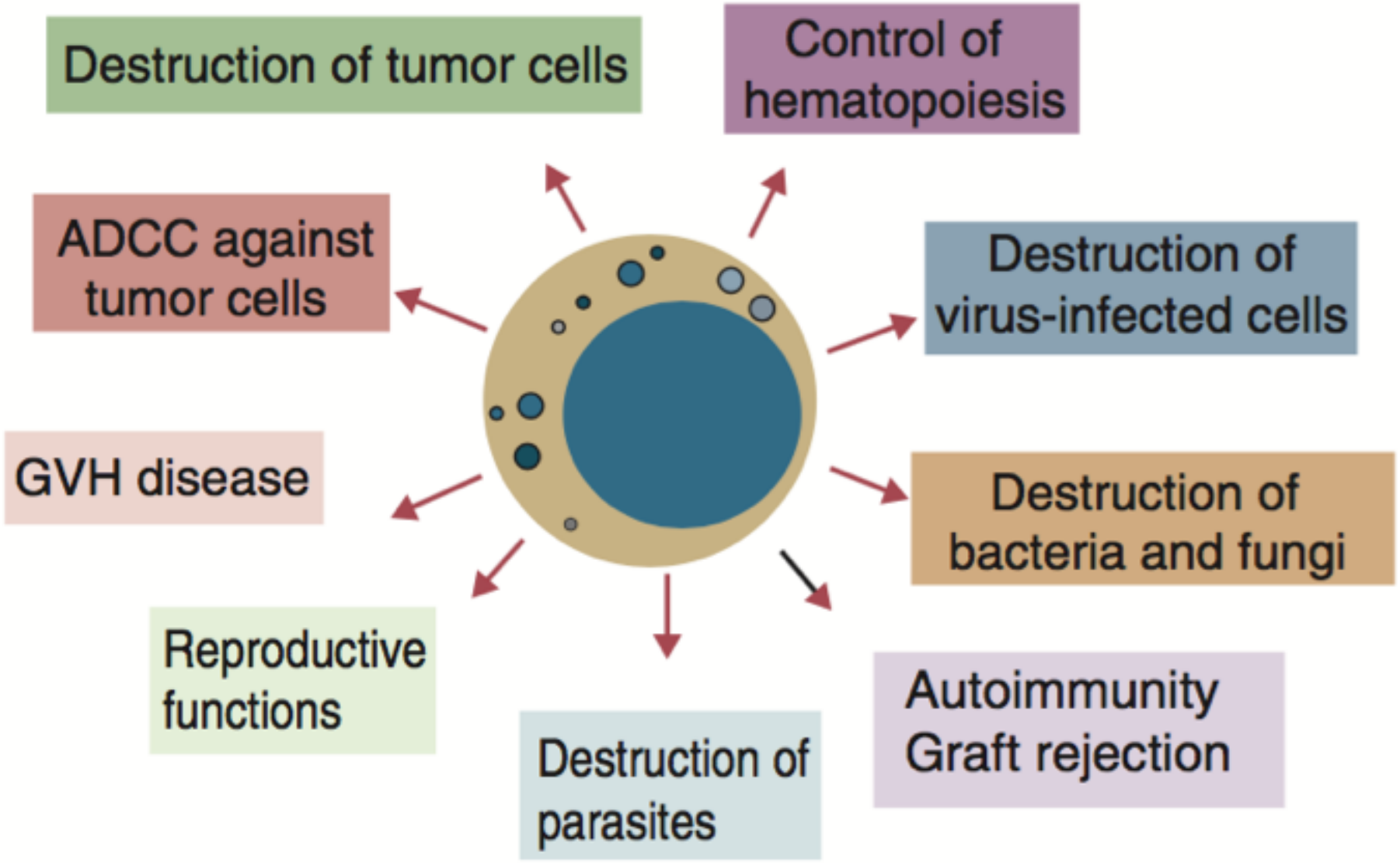

MHC class I
INHIBITION
Ly49
NO ACTIVATION
NO LYSIS
No MHC class I
NO INHIBITION
Ly49
ACTIVATION
Stress ligands
CELL
DESTRUCTION


KIR
Human
Ly49
Mouse
KIR
Ly49
Bovine
Cat
Dog
Pig
Ly49
Horse


T cell
Tumor cell
IFN-γ
IL-2
IFN–γ
IFN-γ
TNF-α
IL-12
Macrophage
NK cell


Destruction of tumor cells
Control of hematopoiesis
ADCC against tumor cells
Destruction of virus-infected cells
GVH disease
Destruction of bacteria and fungi
Reproductive functions
Autoimmunity Graft rejection
Destruction of parasites

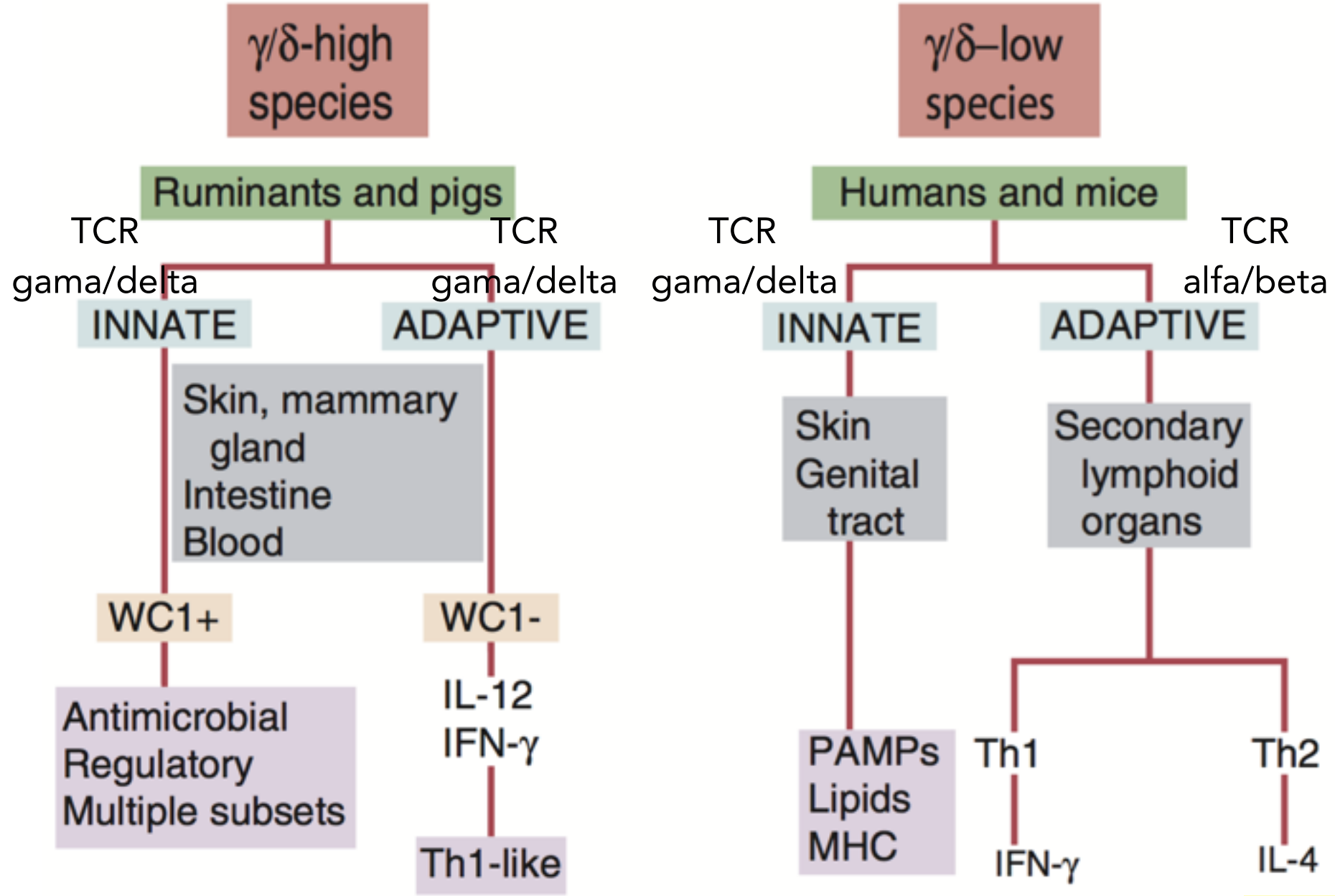


FIG. 14.21 γ/δ T cells may, depending on the species, act as innate immune cells with an invariant antigen receptor. Others may act as classic helper T cells with diverse TCRs of polyclonal origin.