

Cells and Tissues of the Immune System



Normal Blood Cell Counts

	Mean Number per Microliter	Normal Range
White blood cells (leukocytes)	7400	4500-11,000
Neutrophils	4400	1800-7700
Eosinophils	200	0-450
Basophils	40	0-200
Lymphocytes	2500	1000-4800
Monocytes	300	0-800



Hematopoiesis

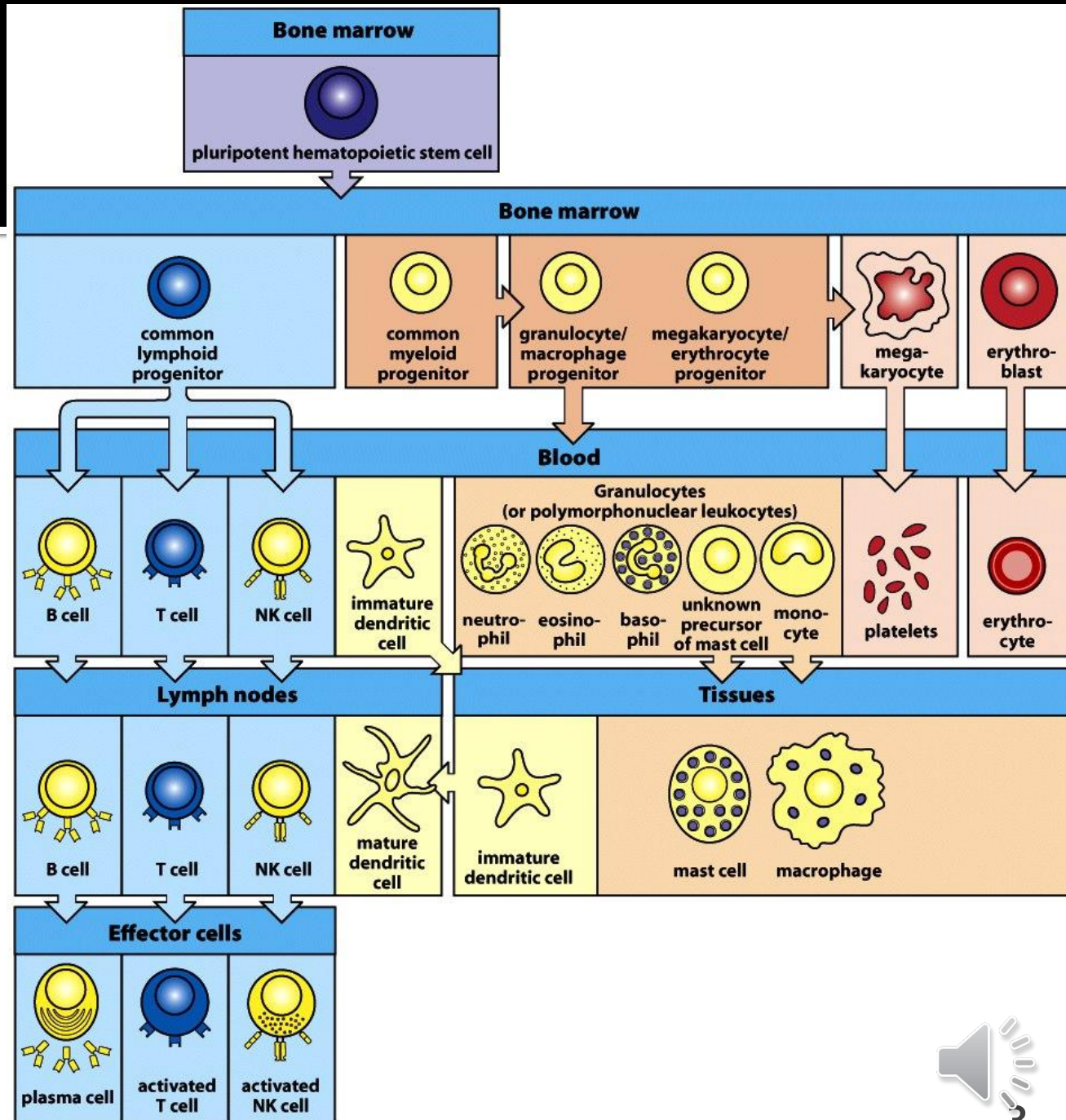


Figure 1-3 Immunobiology, 7ed. (© Garland Science 2008)



Neutrophils

Cell

**Activated
function**

Neutrophil



**Phagocytosis
and activation
of bactericidal
mechanisms**

Figure 1-4 part 3 of 6 Immunobiology, 7ed. (© Garland Science 2008)

Mononuclear Phagocytes

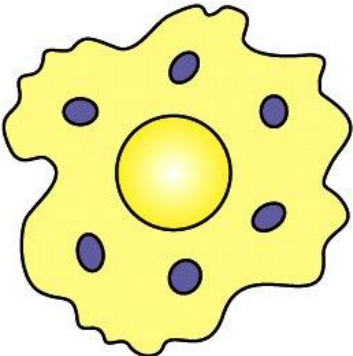
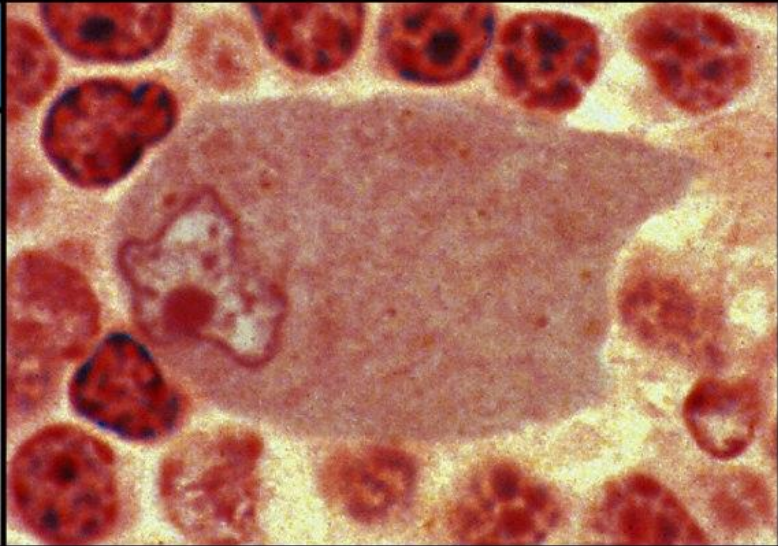
Cell	Activated function
<p>Macrophage</p>  <p>A schematic diagram of a macrophage, showing a yellow, irregularly shaped cell with a large central nucleus and several smaller, dark blue nuclei.</p>	 <p>A micrograph showing a large, pale, irregularly shaped macrophage in the center, surrounded by several smaller, dark red, rounded cells.</p> <p>Phagocytosis and activation of bactericidal mechanisms</p> <p>Antigen presentation</p>

Figure 1-4 part 1 of 6 Immunobiology, 7ed. (© Garland Science 2008)

Dendritic Cells

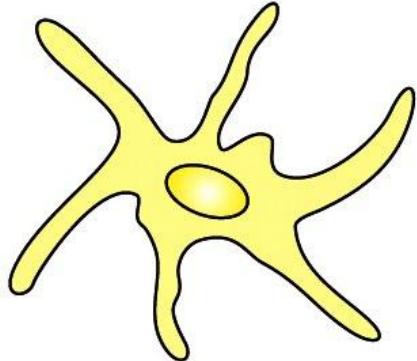

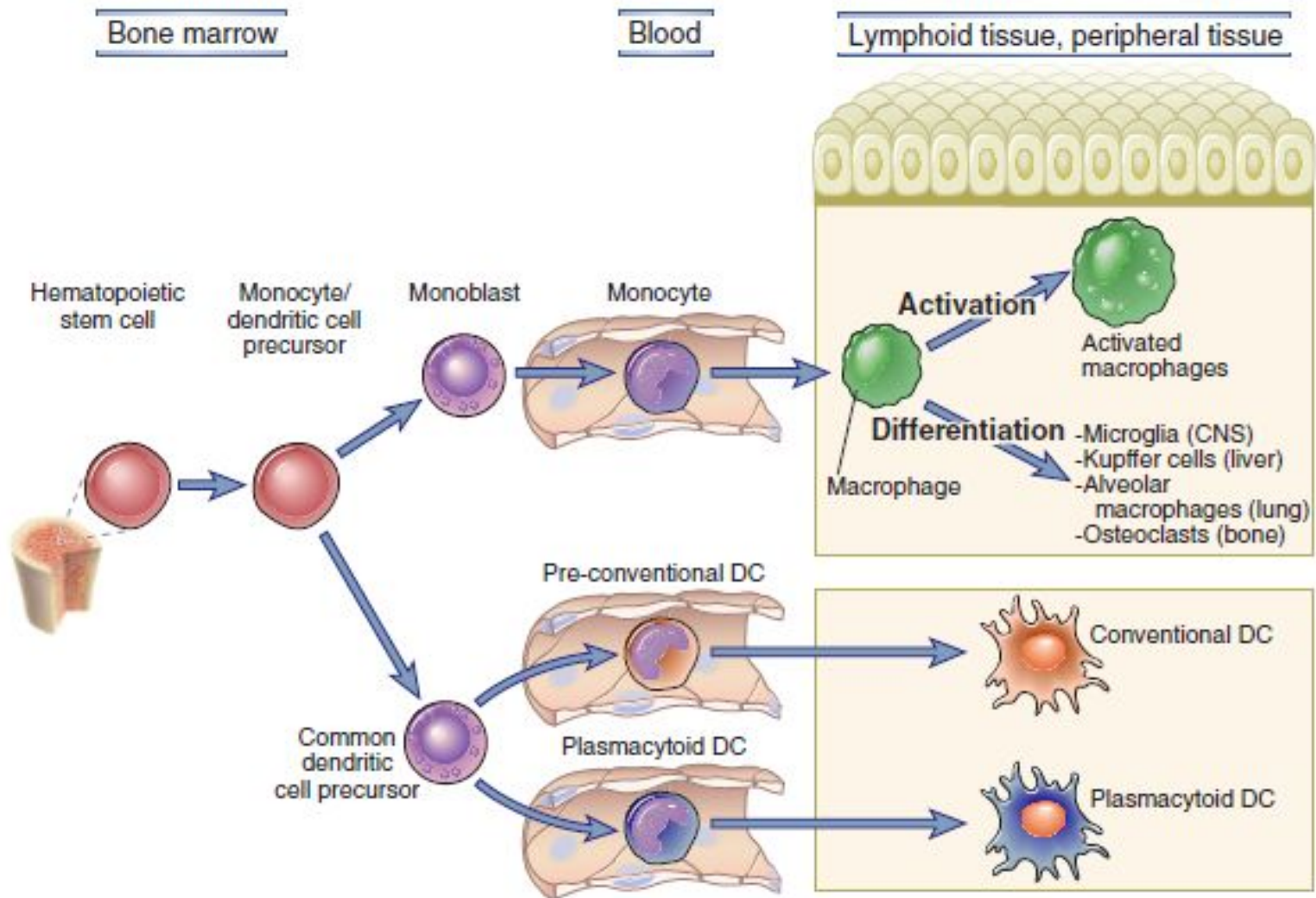
Cell	Activated function
<p>Dendritic cell</p> 	 <p>Antigen uptake in peripheral sites</p> <p>Antigen presentation</p>

Figure 1-4 part 2 of 6 Immunobiology, 7ed. (© Garland Science 2008)



Maturation of mononuclear phagocytes and dendritic cells.



Mast Cells

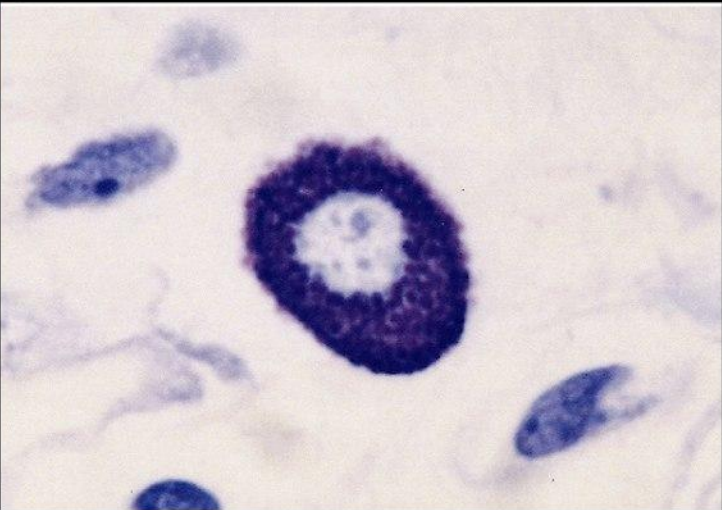
Cell	Activated function
<p>Mast cell</p>  A diagram of a mast cell, showing a yellow oval cell with a central yellow nucleus and several smaller blue granules scattered throughout the cytoplasm.	 A micrograph of a mast cell, showing a large, dark purple granule-filled cell with a central, lighter-colored nucleus. Other smaller cells are visible in the background.

Figure 1-4 part 6 of 6 Immunobiology, 7ed. (© Garland Science 2008)



Basophils

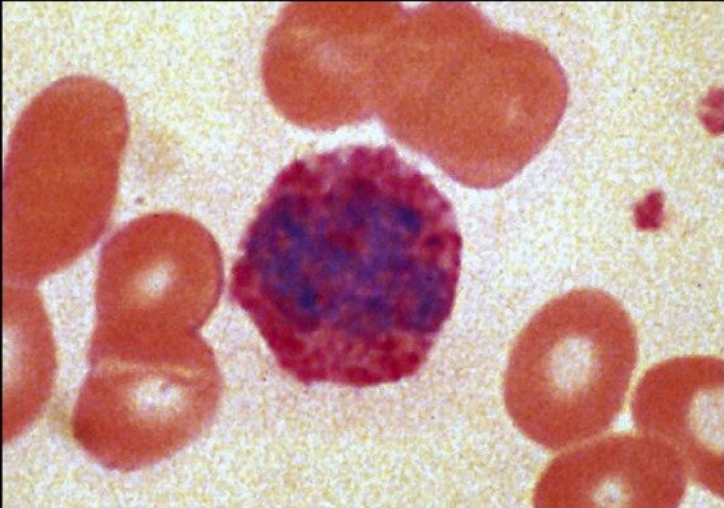
Cell	Activated function
<p>Basophil</p> 	 <p>Unknown</p>

Figure 1-4 part 5 of 6 Immunobiology, 7ed. (© Garland Science 2008)



Eosinophils


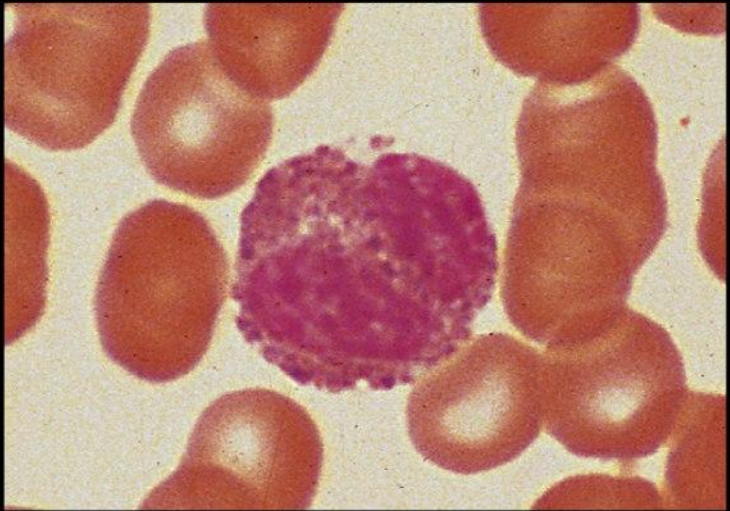
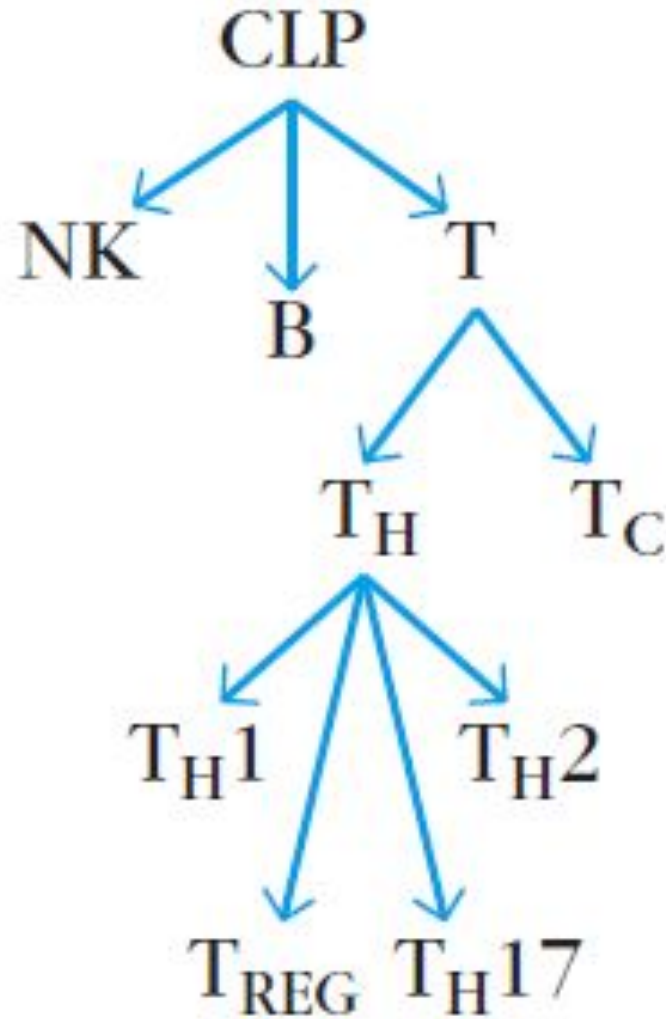
Cell	Activated function
<p>Eosinophil</p> 	 <p>Killing of antibody-coated parasites</p>

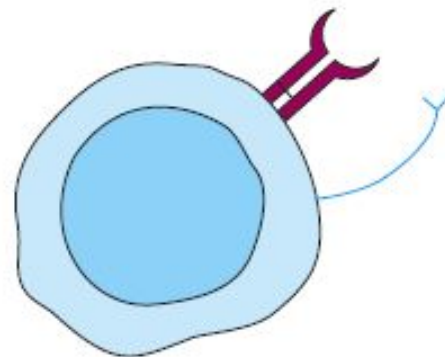
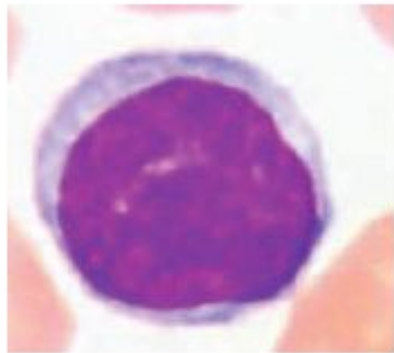
Figure 1-4 part 4 of 6 Immunobiology, 7ed. (© Garland Science 2008)

Lymphocytes

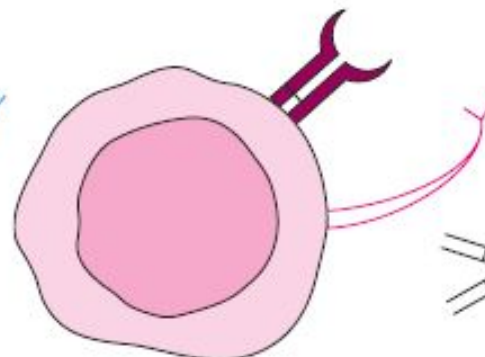


T cells and B cells

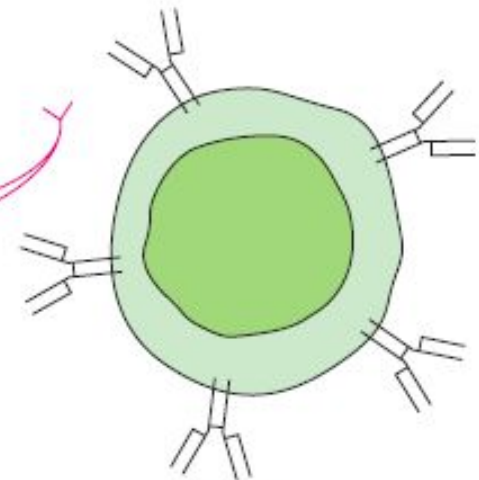
(a) Lymphocyte



T_H helper cell



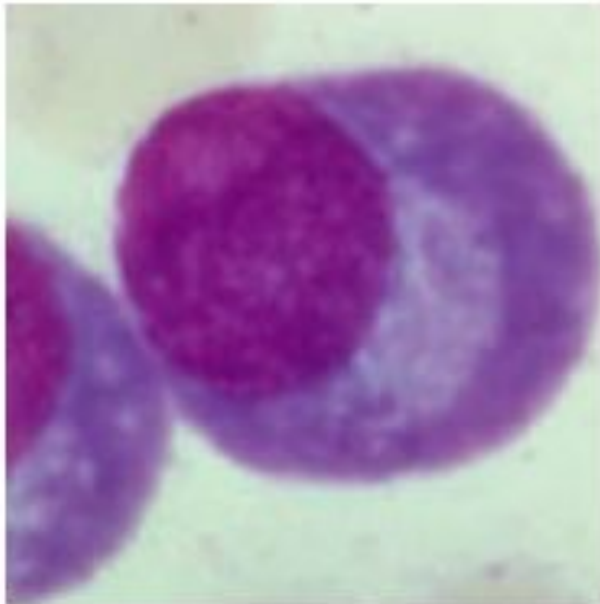
T_C cytotoxic T cell



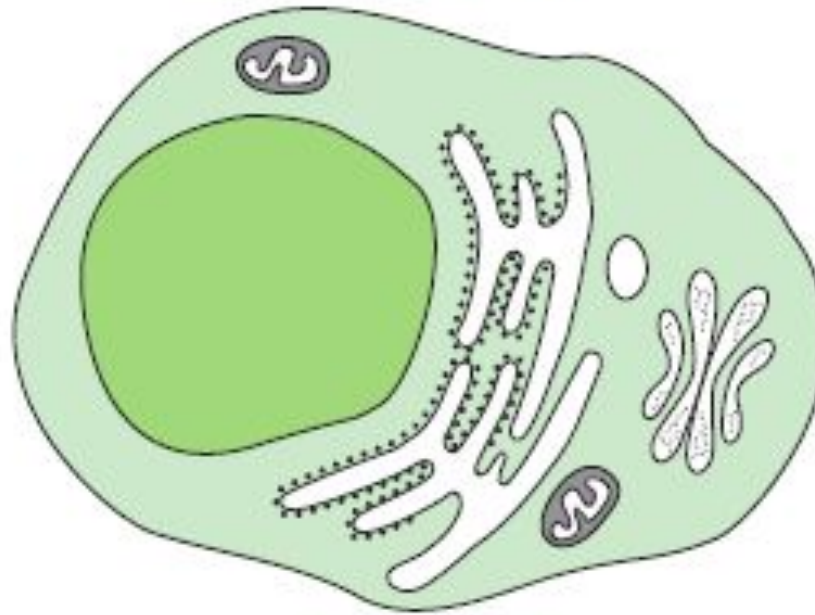
B cell

Plasma cell

(c) Plasma cell

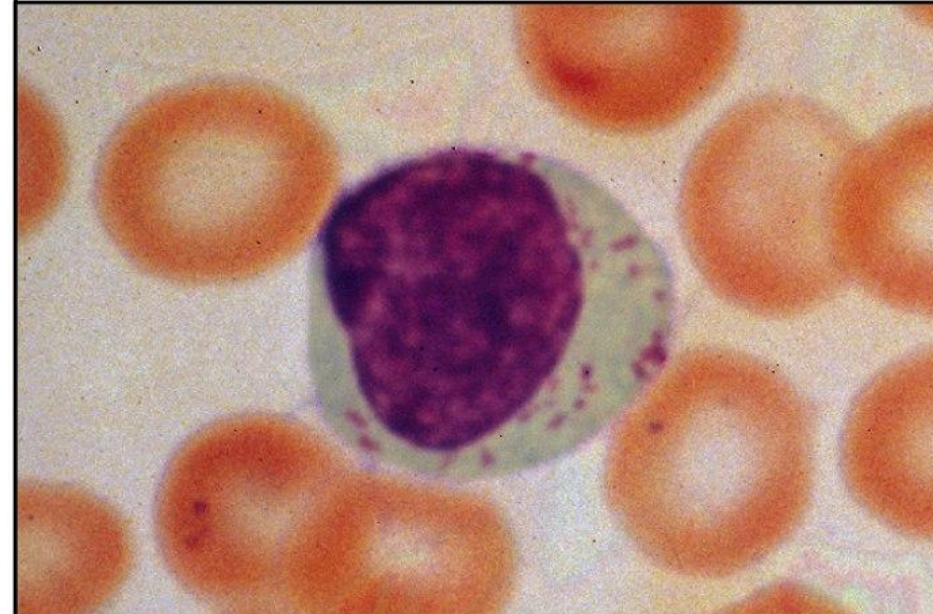
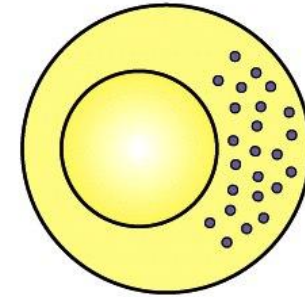


Plasma cell



NK cell

Natural killer (NK) cell



Releases lytic granules that kill some virus-infected cells

CD marker

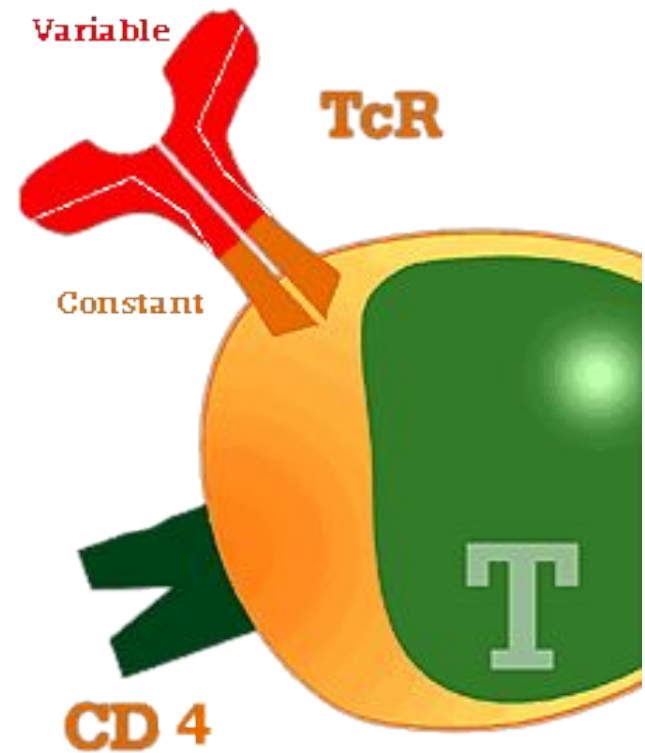


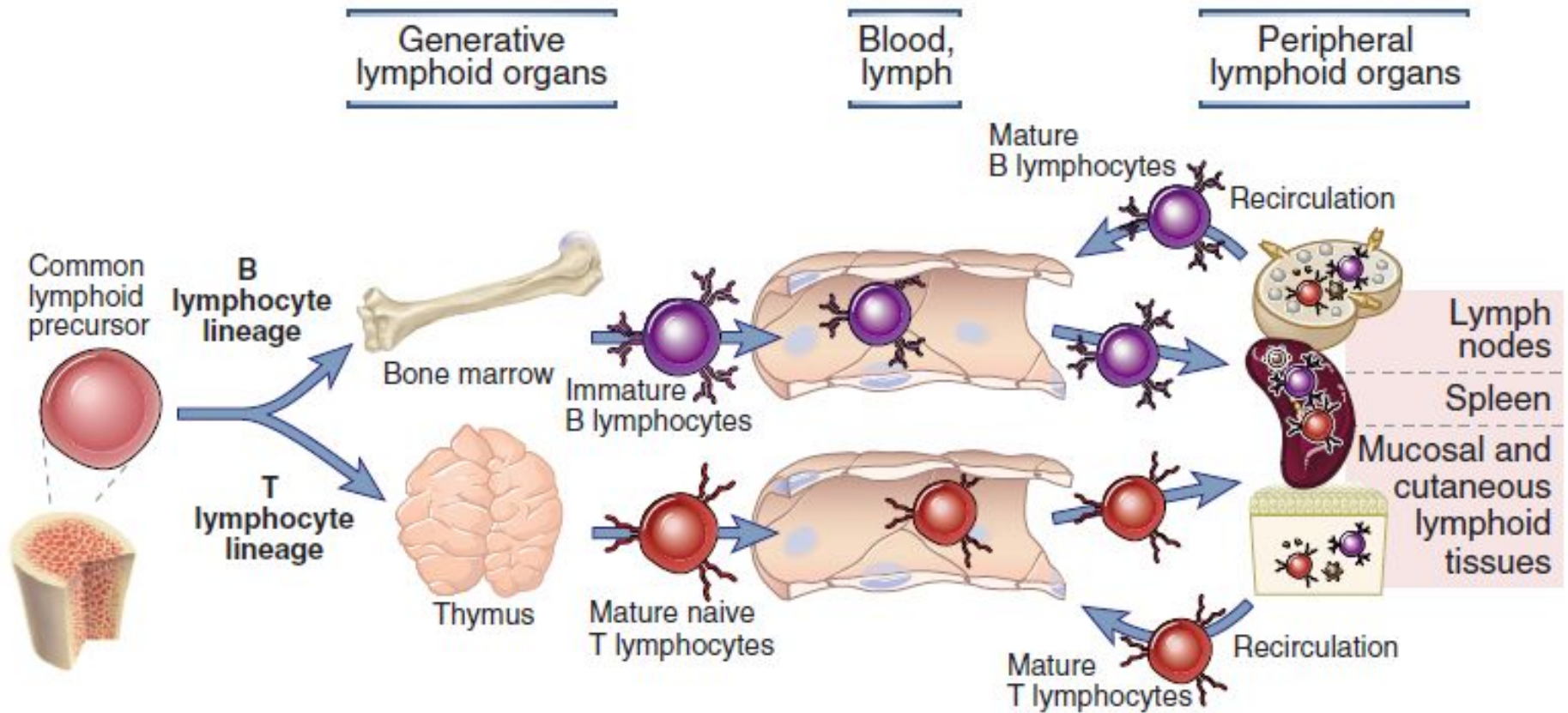
TABLE 2-3

Common CD markers used to distinguish functional lymphocyte subpopulations

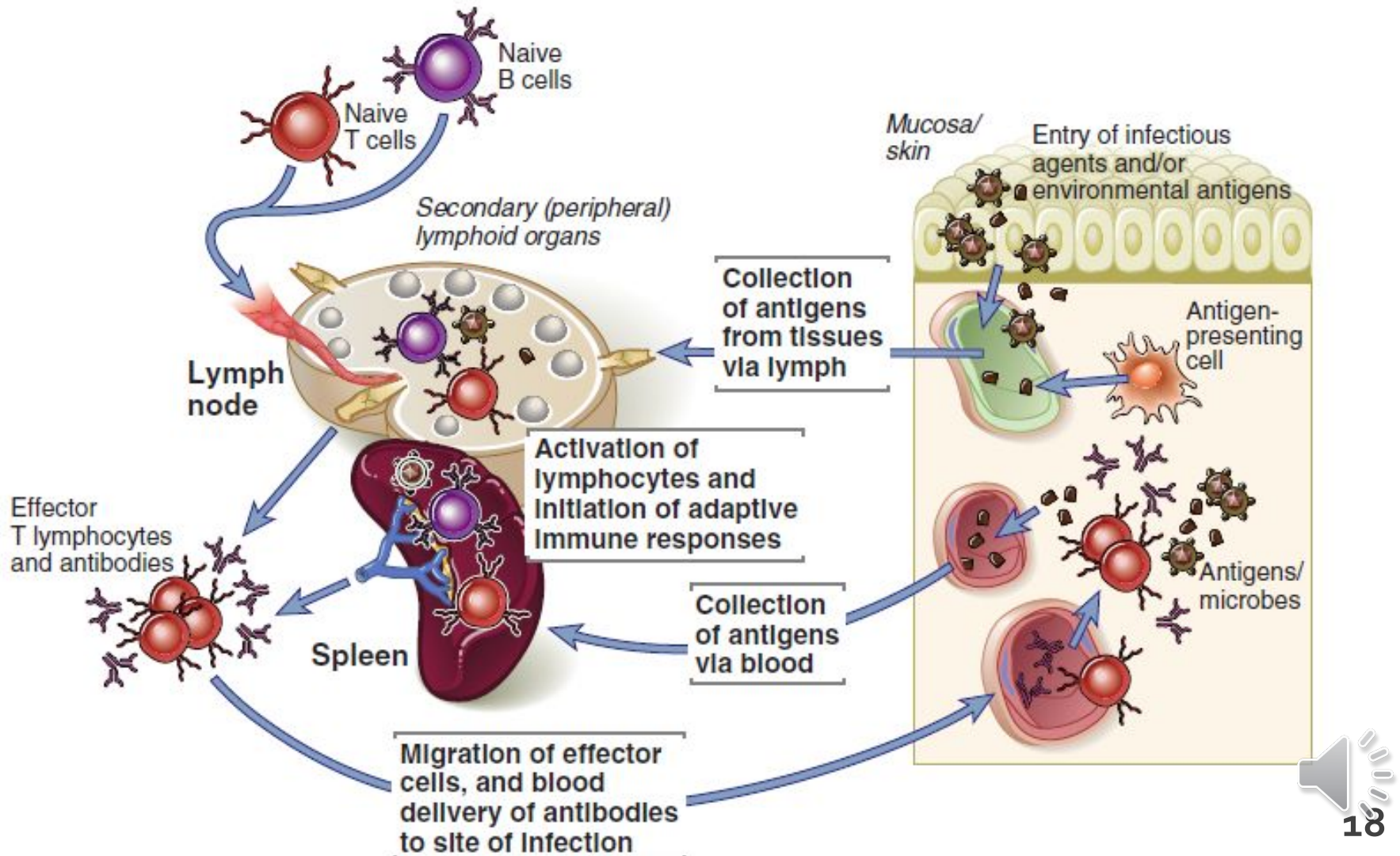
CD designation	Function	B cell	T _H	T _C	NK cell
CD2	Adhesion molecule; signal transduction	–	+	+	+
CD3	Signal transduction element of T-cell receptor	–	+	+	–
CD4	Adhesion molecule that binds to class II MHC molecules; signal transduction	–	+	–	–
CD5	Unknown	+	+	+	+
CD8	Adhesion molecule that binds to class I MHC molecules; signal transduction	–	–	+	(variable)
CD16 (Fc γ RIII)	Low-affinity receptor for Fc region of IgG	–	–	–	+
CD19	Signal transduction; CD21 co-receptor	+	–	–	–
CD21 (CR2)	Receptor for complement (C3d and Epstein-Barr virus)	+	–	–	–
CD28	Receptor for costimulatory B7 molecule on antigen-presenting cells	–	+	+	–
CD32 (Fc γ RII)	Receptor for Fc region of IgG	+	–	–	–
CD35 (CR1)	Receptor for complement (C3b)	+	–	–	–
CD40	Signal transduction	+	–	–	–
CD45	Signal transduction	+	+	+	+
CD56	Adhesion molecule	–	–	–	+



Development of Lymphocytes



The anatomy of lymphocyte activation



Immune system

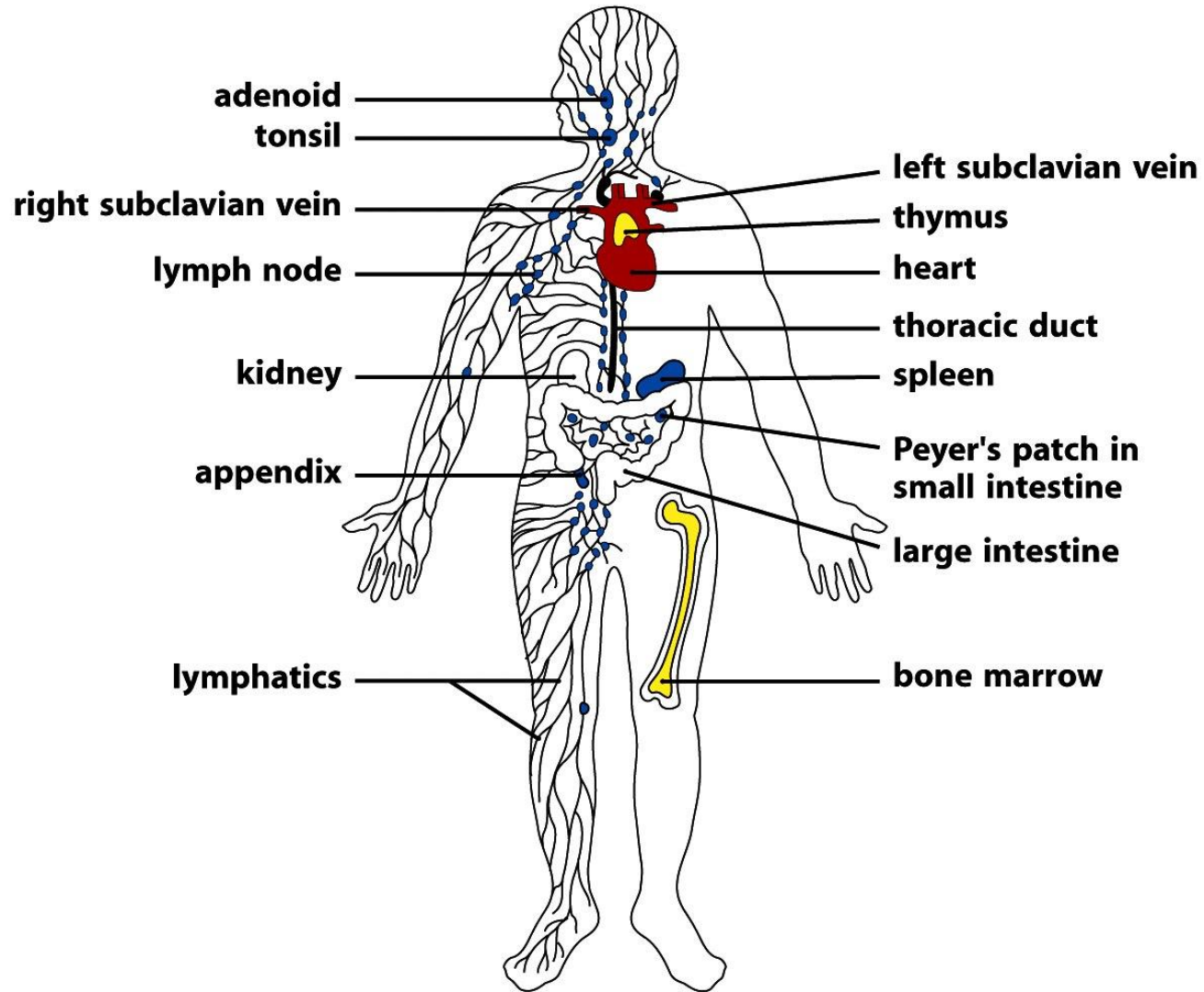
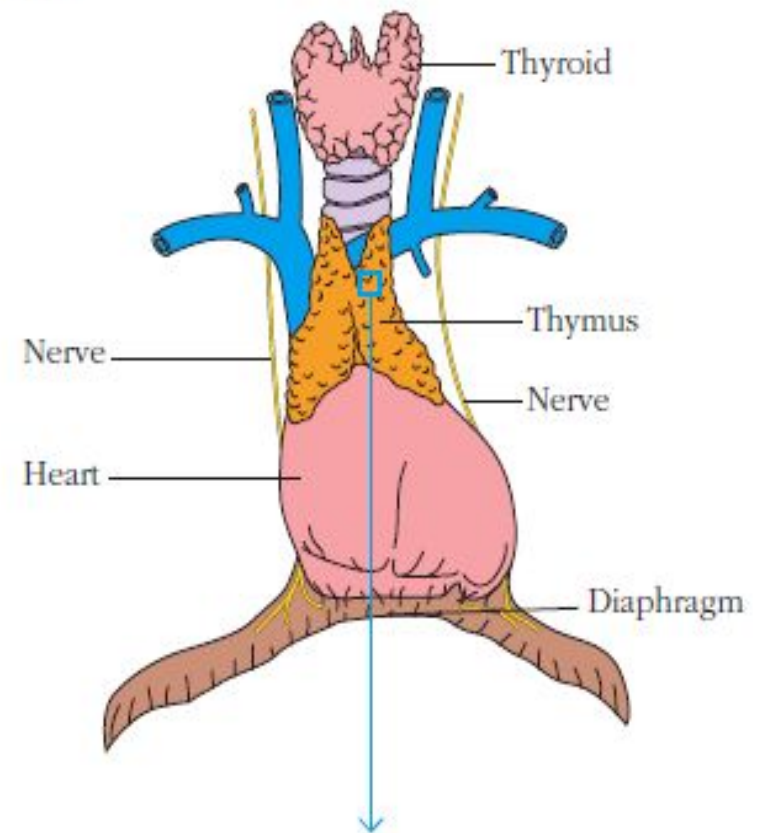
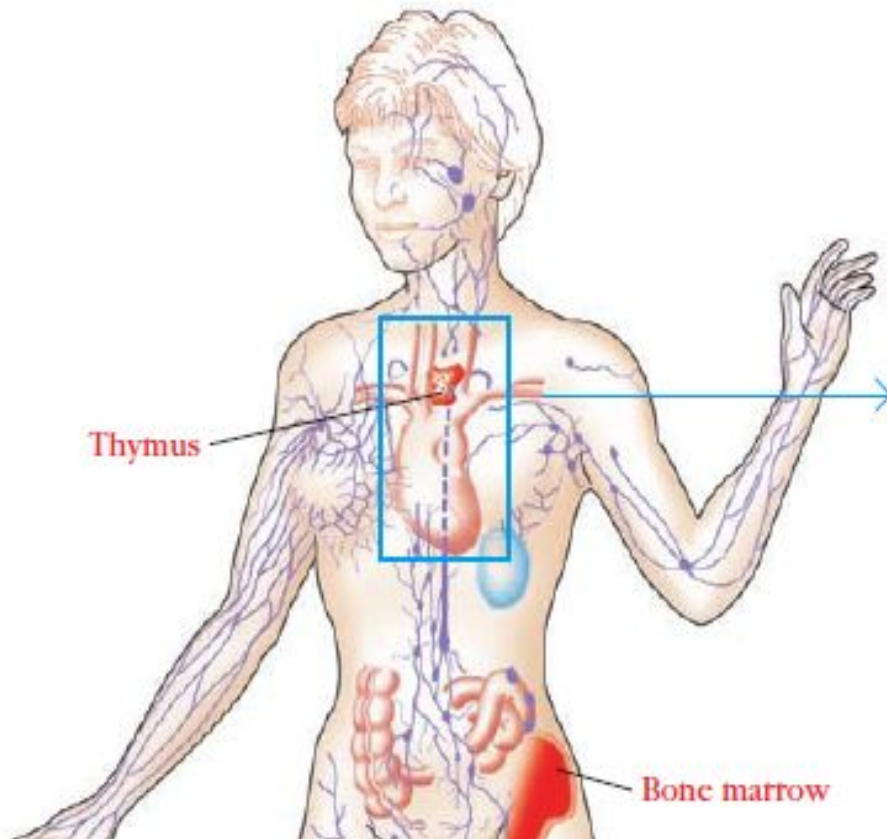
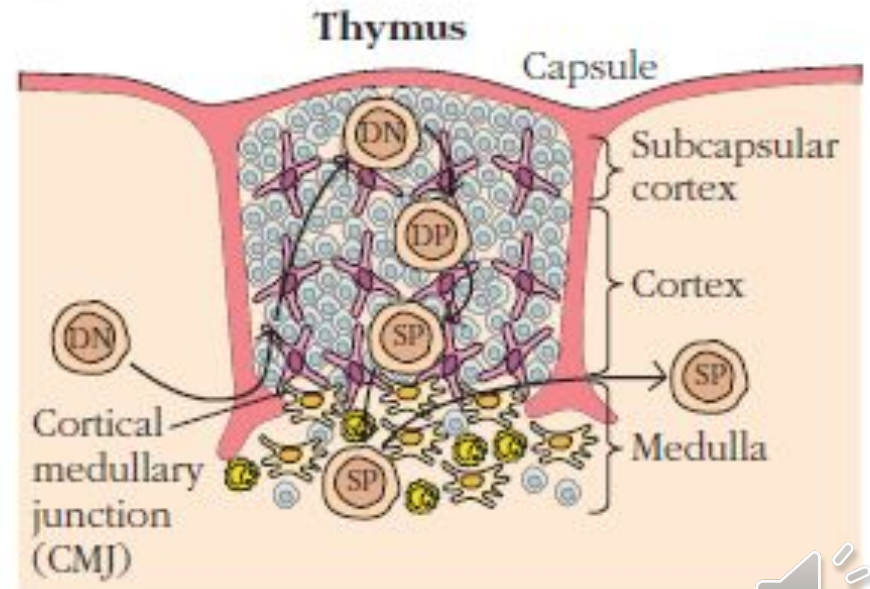
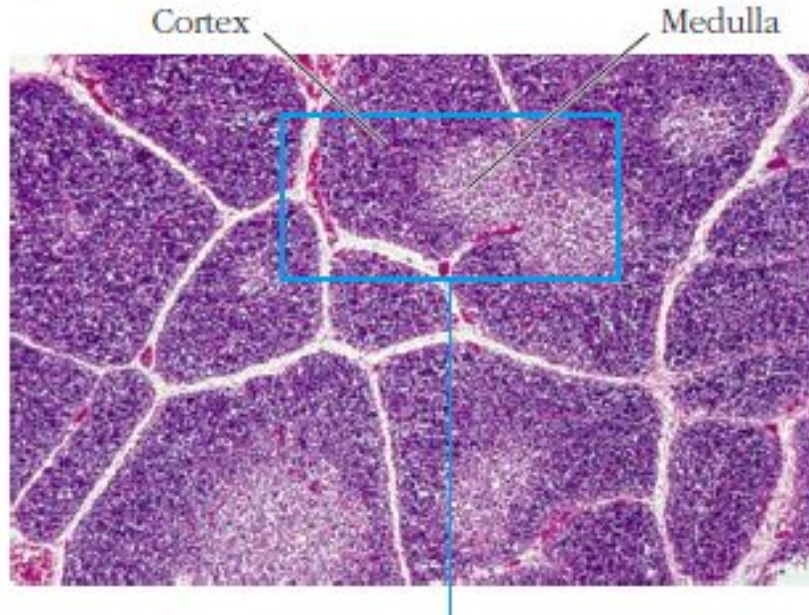


Figure 1-7 Immunobiology, 7ed. (© Garland Science 2008)

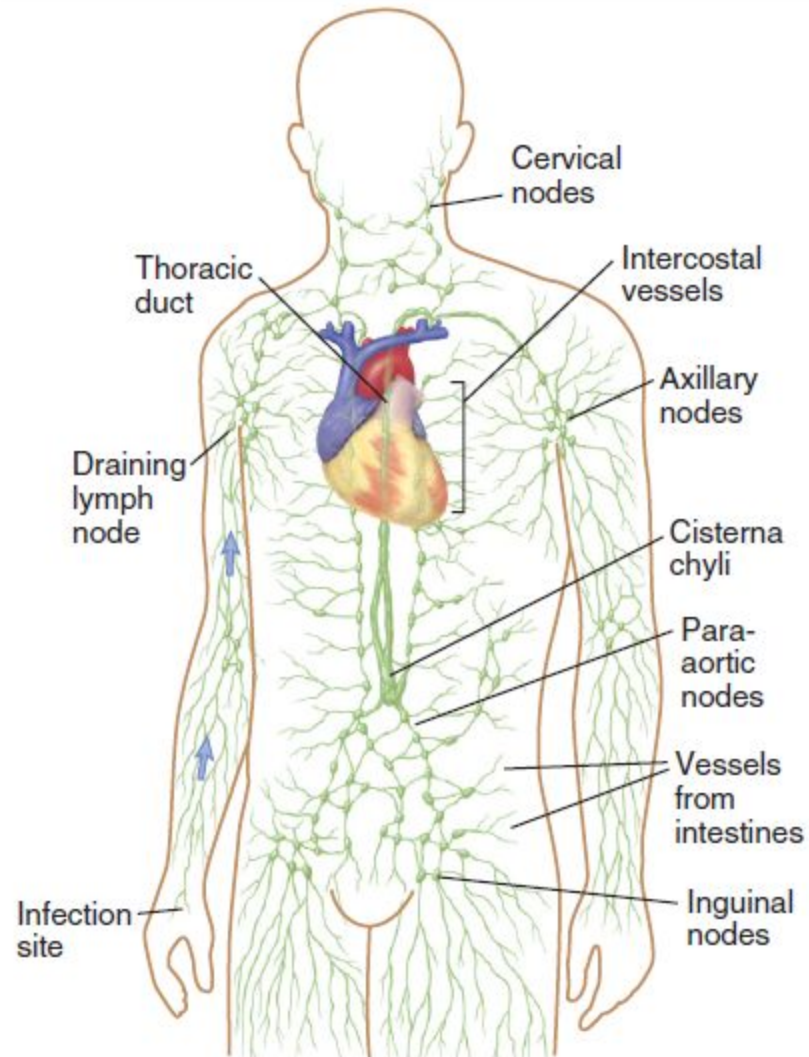
Thymus: Gross anatomy



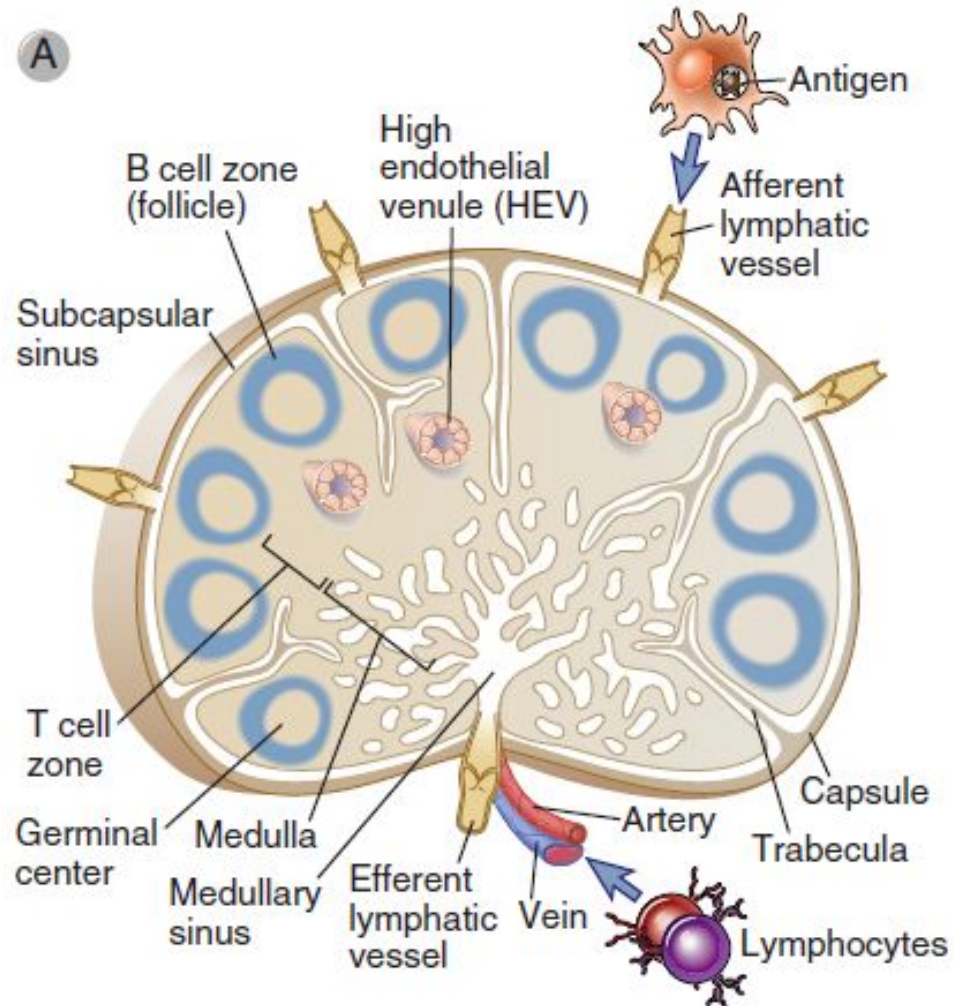
Thymus : morphology



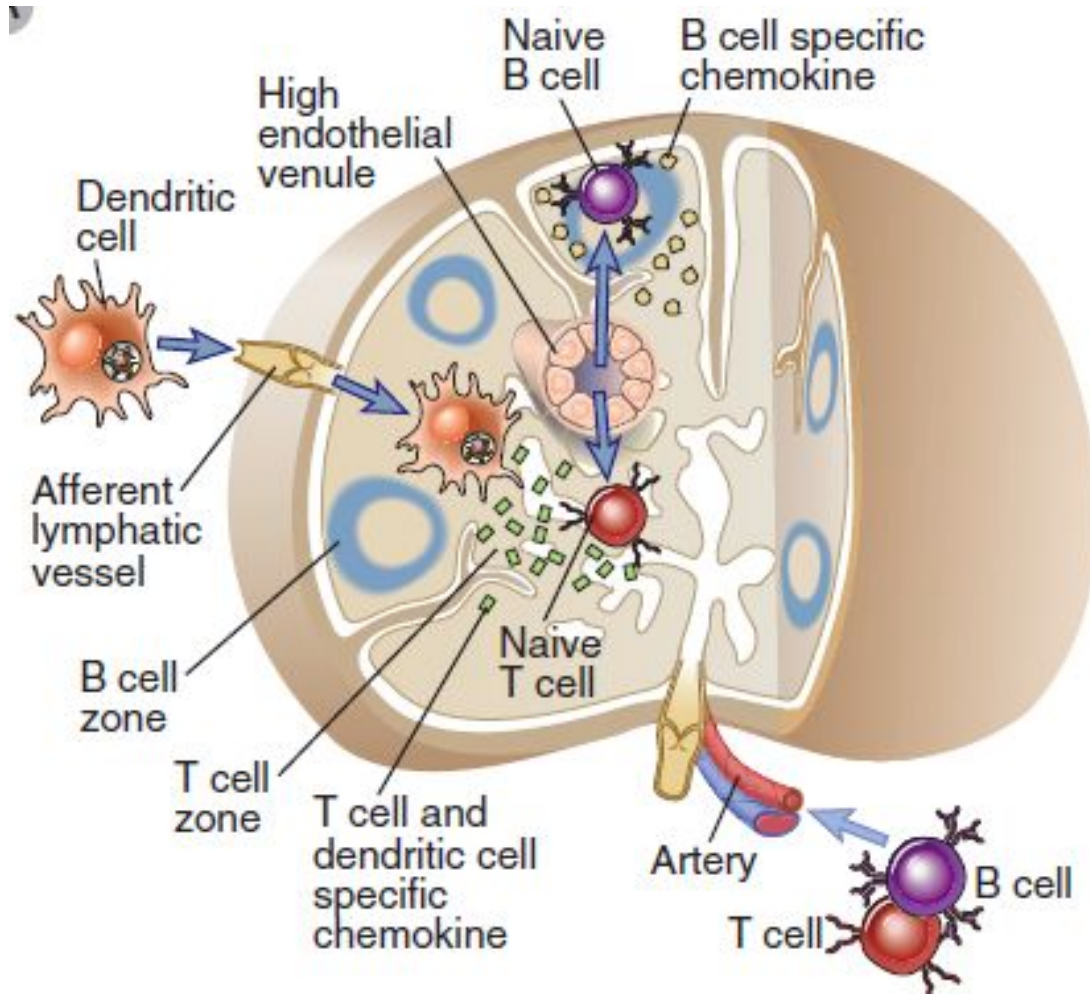
The Lymphatic System



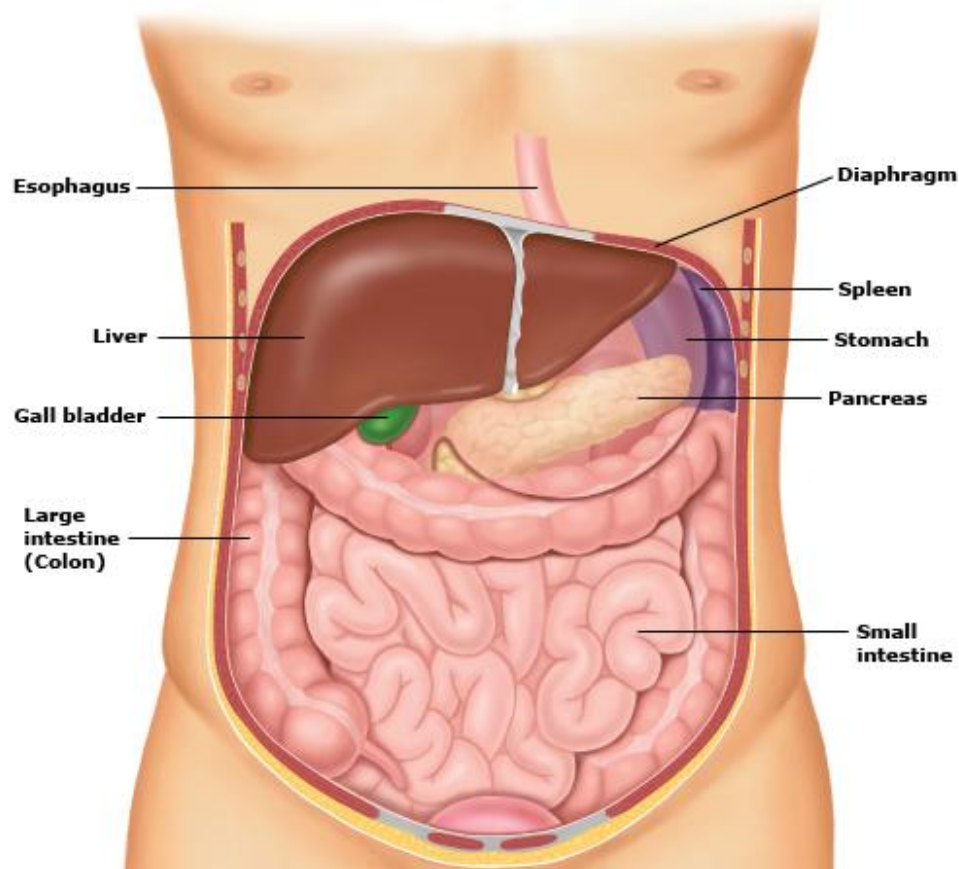
Morphology of a lymph node



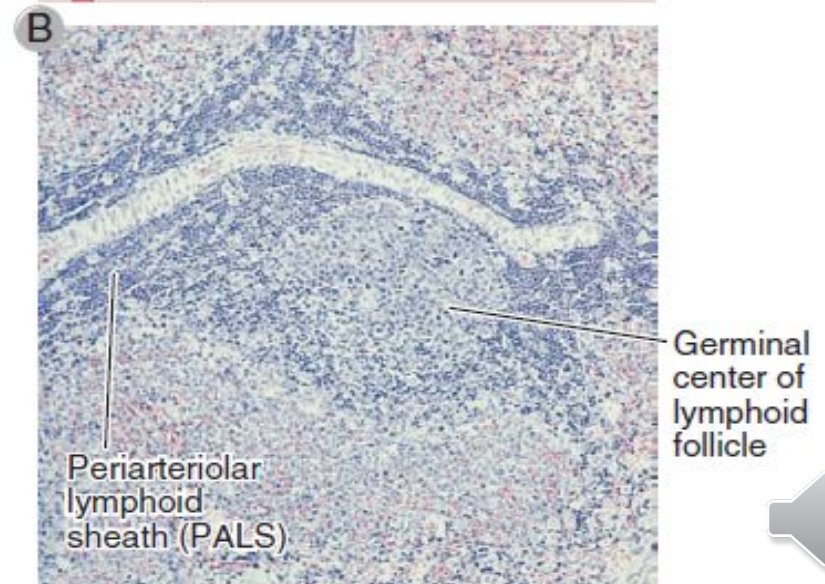
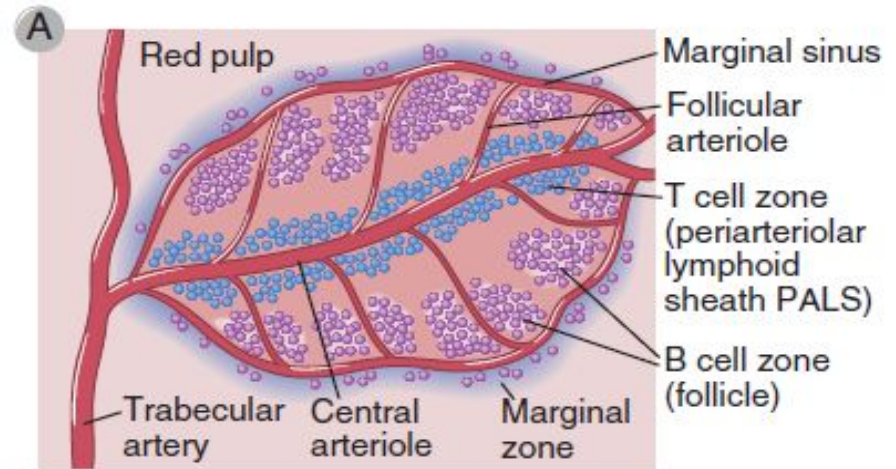
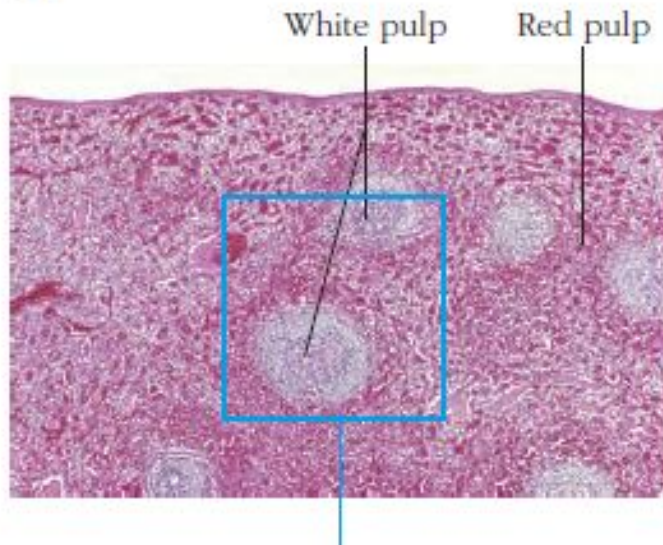
Segregation of B cells and T cells in a lymph node



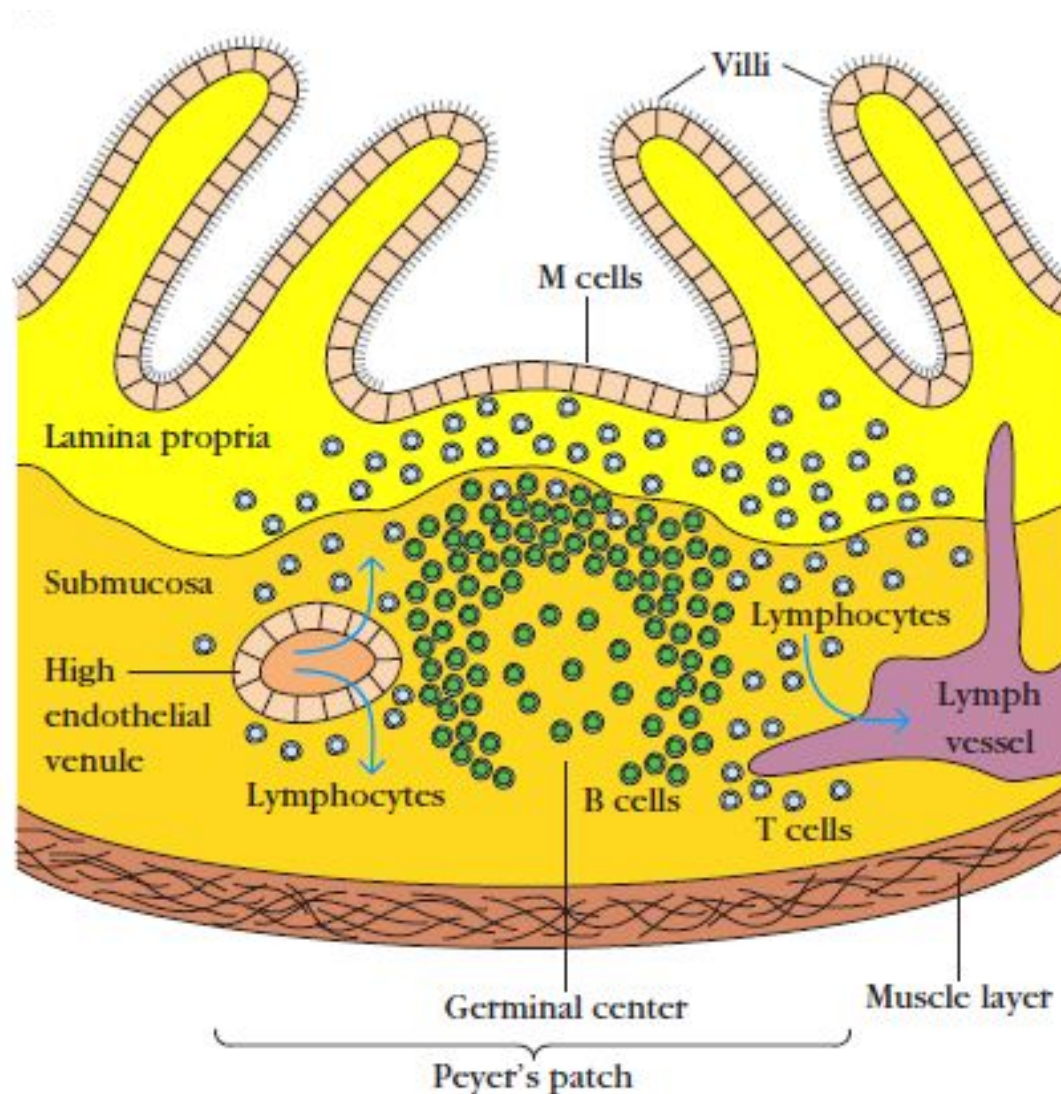
Spleen : Gross anatomy



Spleen : morphology



Mucosa-associated lymphoid tissue (MALT)



پیروزی یعنی: توانایی رفتن از یک شکست به
شکستی دیگر بدون از دست دادن اشتیاق!



**Victory is about moving from one failure to another
without losing the enthusiasm!**

