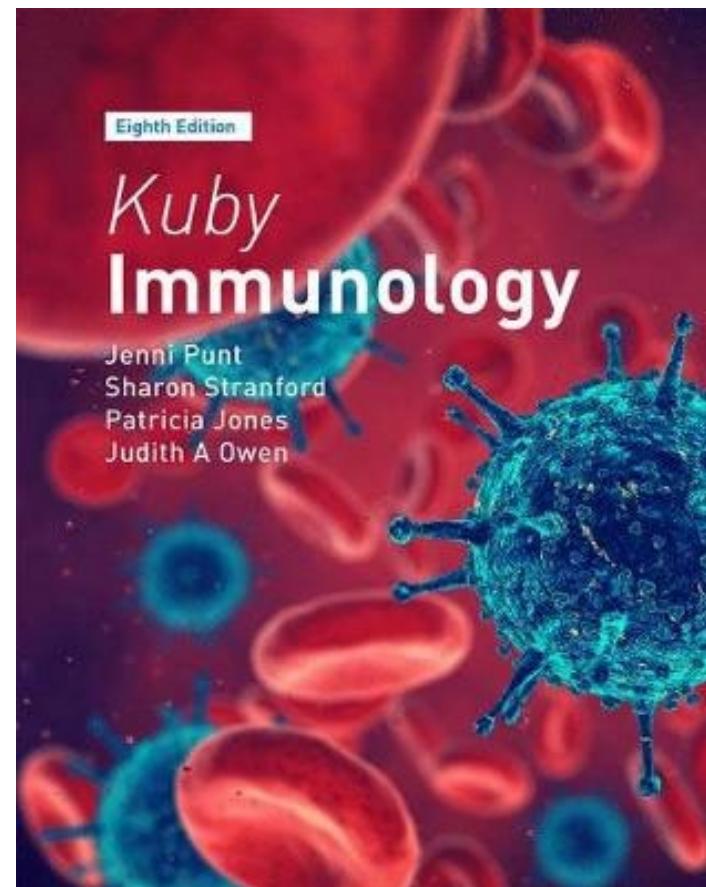


Immunologie 1: Introduction to the Immune System



Na het bestuderen van de behandelde stof kan de student:

1. De basis van vaccinatie beschrijven
2. De bloedcellen en organen van het immuunsysteem herkennen en beschrijven
3. De componenten en karakteristieken van de twee lijnen van afweer waaruit het aangeboren immuunsysteem bestaat identificeren en beschrijven
4. Het basisprincipe van PRRs en PAMPs en effect van activatie beschrijven
5. Cellen en weefsels koppelen aan de effector functies van het aangeboren immuunsysteem
6. Onderdelen van het aangeboren en verworven immuunsysteem koppelen en beschrijven hoe het aangeboren immuunsysteem helpt een effectieve adaptieve immuunrespons op te wekken voor een specifiek pathogeen
7. De drie routes van het complementsysteem en effecten van complementactivatie beschrijven en de gevolgen van een immuundeficiëntie van complement componenten inzichtelijk maken
8. Het gedrag van het aangeboren en verworven immuunsysteem voor en tijdens een immuunrespons visualiseren

Het immuunsysteem biedt bescherming tegen infecties

Indeling immuunsysteem:

Nonspecific defense mechanisms		Specific defense mechanisms (immune system)
First line of defense	Second line of defense	Third line of defense
<ul style="list-style-type: none">• Skin• Mucous membranes• Secretions of skin and mucous membranes	<ul style="list-style-type: none">• Phagocytic white blood cells• Antimicrobial proteins• The inflammatory response	<ul style="list-style-type: none">• Lymphocytes• Antibodies
Aangeboren immuunsysteem (Innate)		Verworven immuunsysteem (Adaptive)

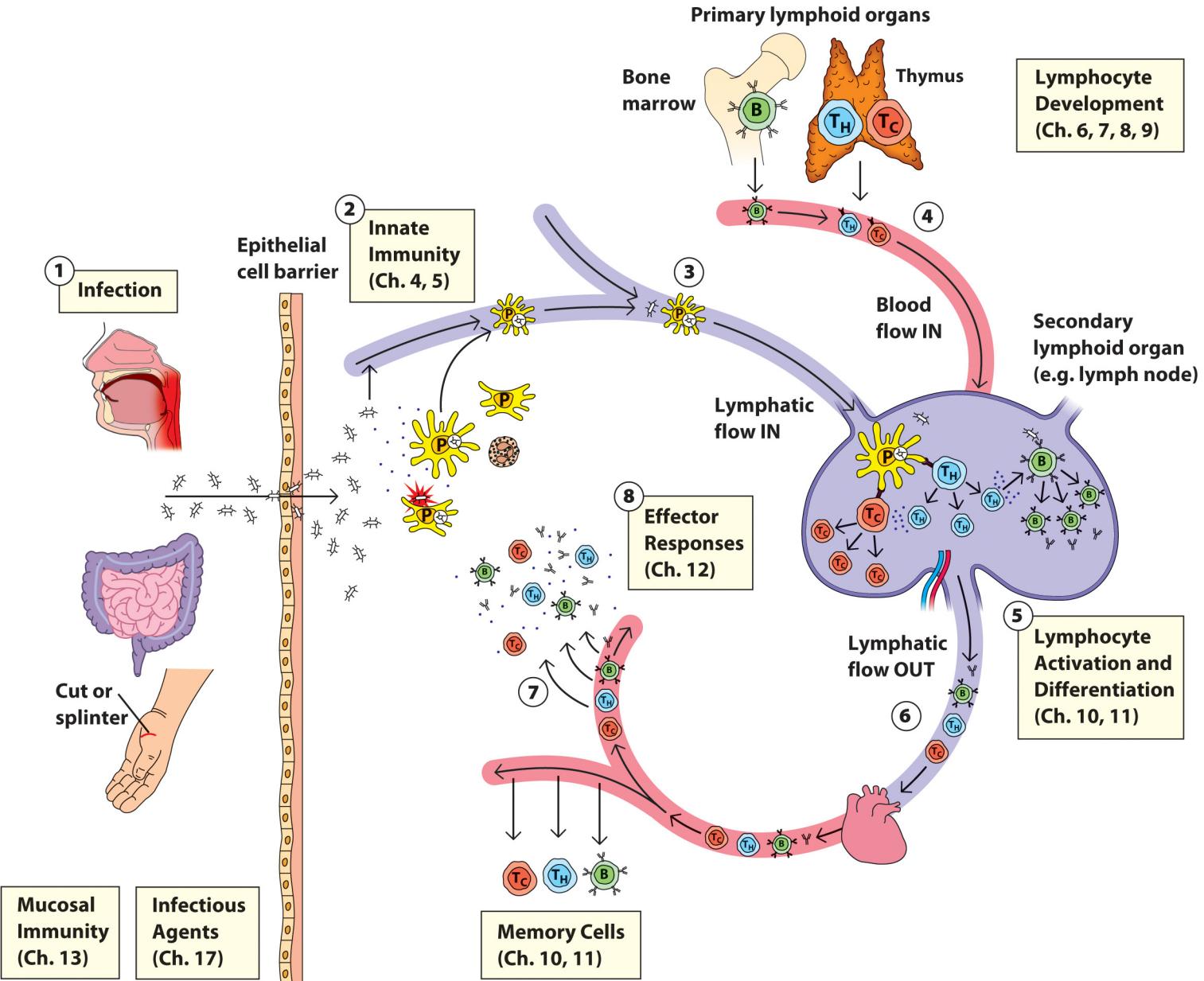


Figure 1-7

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Punt • Stranford • Jones • Owen

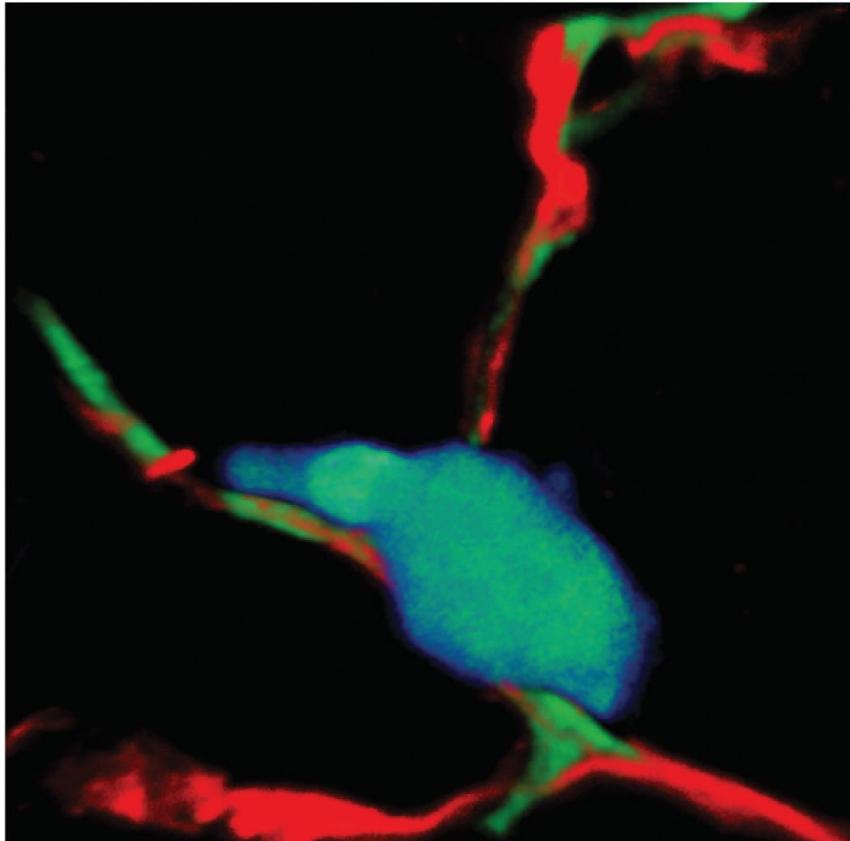
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Lecture PowerPoint

CHAPTER 14

The Adaptive Immune Response in Space and Time



Chapter 14 Opener
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Overview

- Dynamic imaging techniques now exist for visualizing immune cell movement within organisms
- It is strongly recommended that students take the time to watch the various accompanying videos related to the materials in this chapter
 - Each movie icon is hyperlinked to an accompanying video. Clicking the icon will take you to that video. You can also view it from the textbook's accompanying portal website.

Immune cell behavior before antigen is introduced

- Naïve lymphocytes circulate between secondary and tertiary lymphoid tissues
 - By moving into the tissues from the blood, lymphocytes constantly scan for Ag to which it can respond
 - How immune cells move into and out of tissues during innate and adaptive immune responses is an area of study

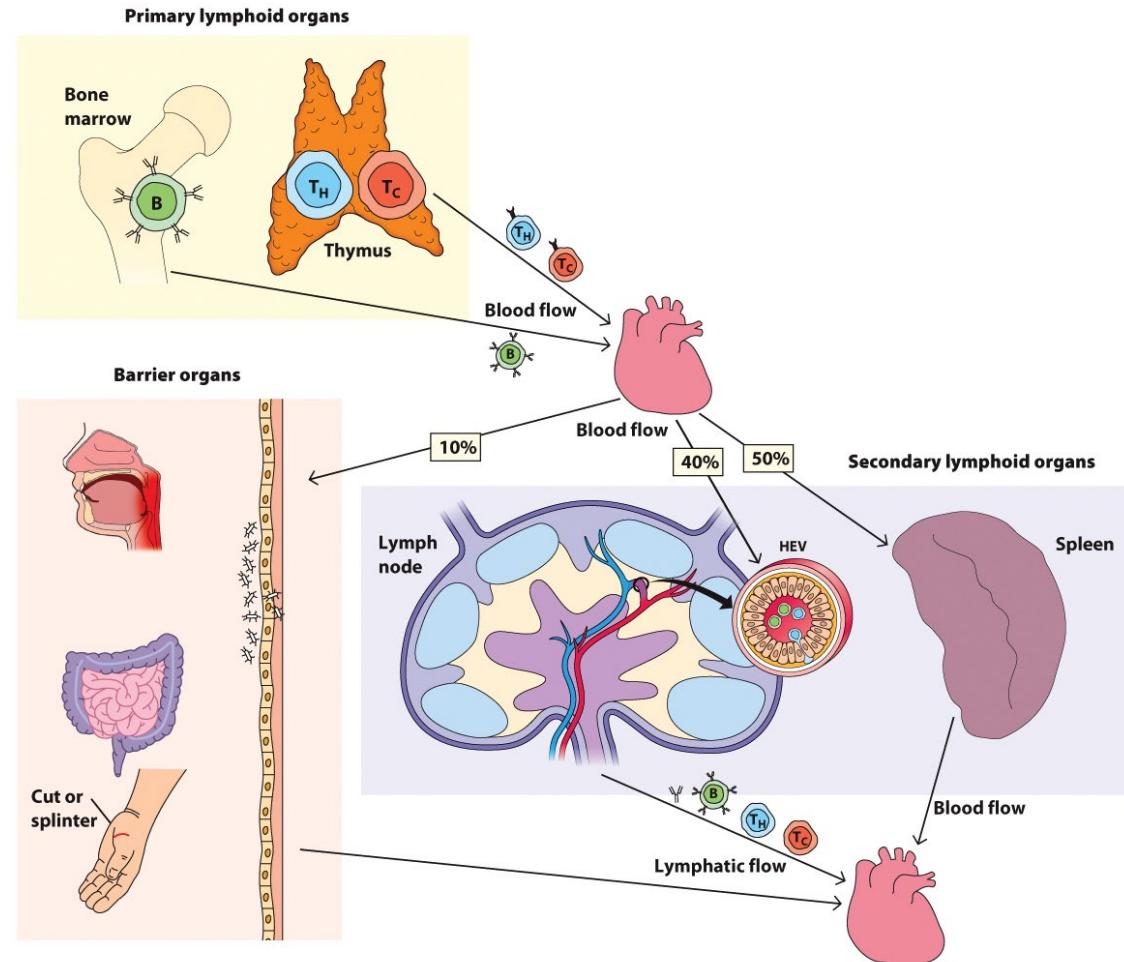


Figure 14-1
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Immune cell behavior before antigen is introduced

- Naïve lymphocytes circulate between secondary/tertiary lymphoid tissues

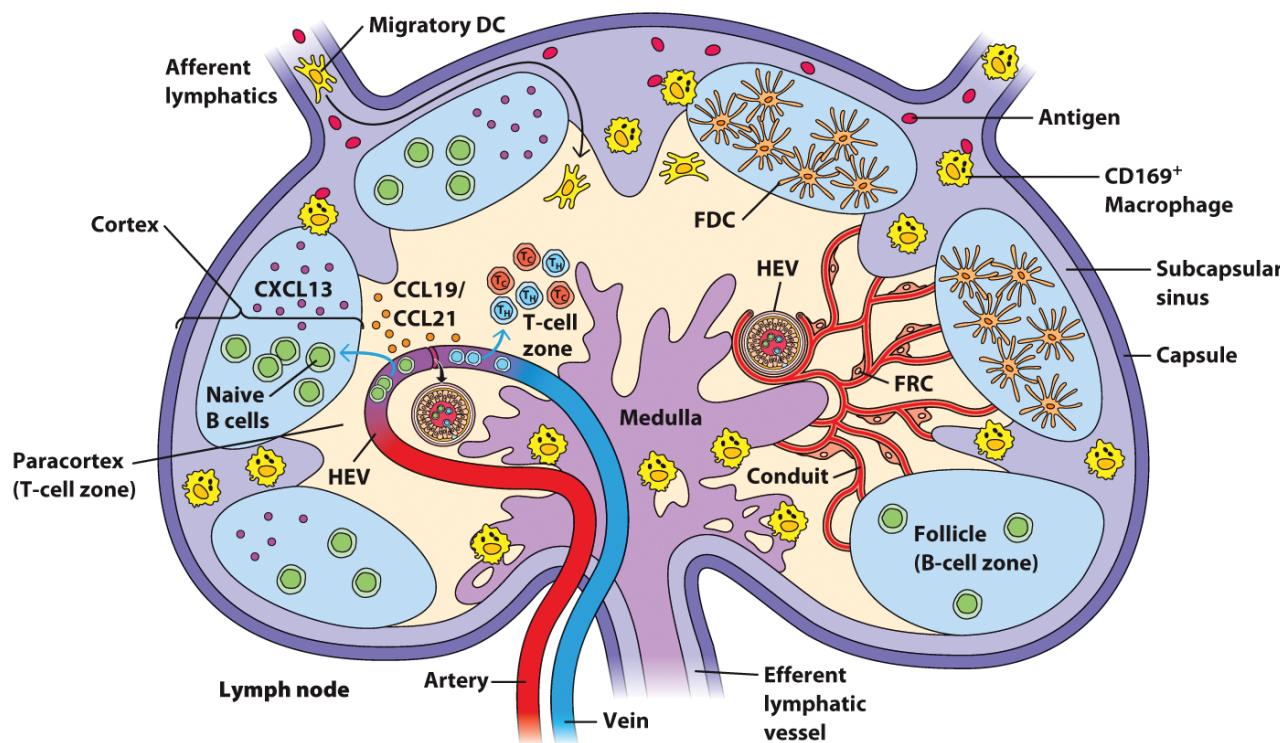


Figure 14-2
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Immune cell behavior before antigen is introduced

- **Naïve lymphocytes** circulate between secondary/tertiary lymphoid tissues
 - Lymphocytes exit blood by **extravasating at high-endothelial venules (HEVs)**
 - **Adhesion molecule** interactions control extravasation
 - HEVs express ligands for **L-selectin**
 - L-selectin is expressed on naïve lymphocytes
 - Contact allows the cells to **slow down** and **roll** along the vessel walls
 - Further interactions with other adhesion molecules **stop** the cells and allow them to squeeze through junctions between the cells

Immune cell behavior before antigen is introduced

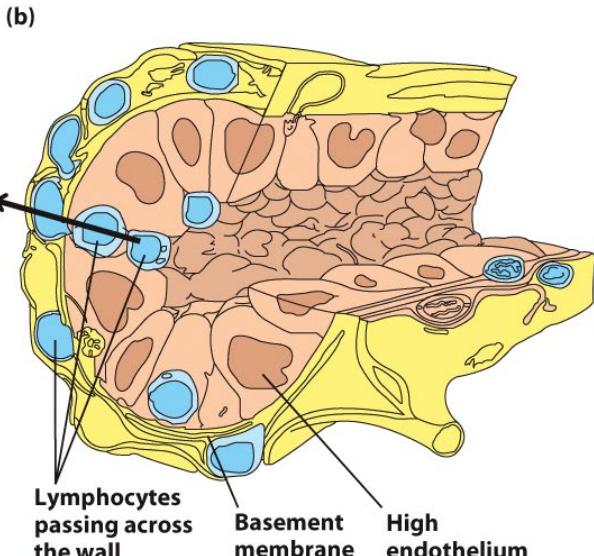
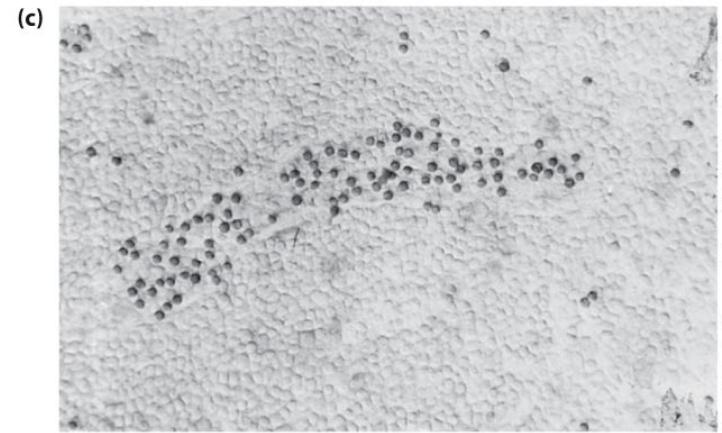
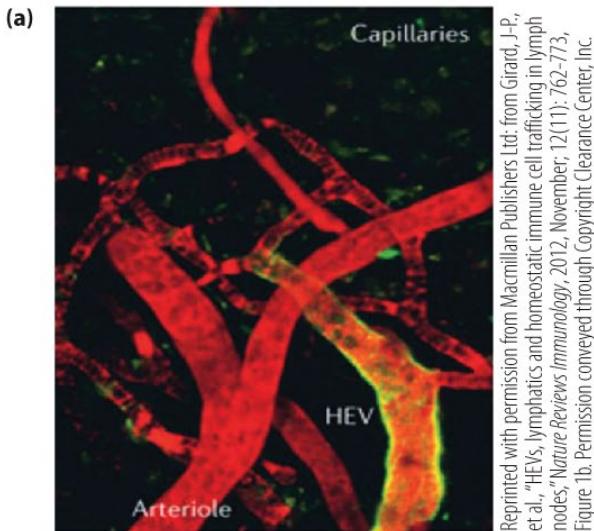
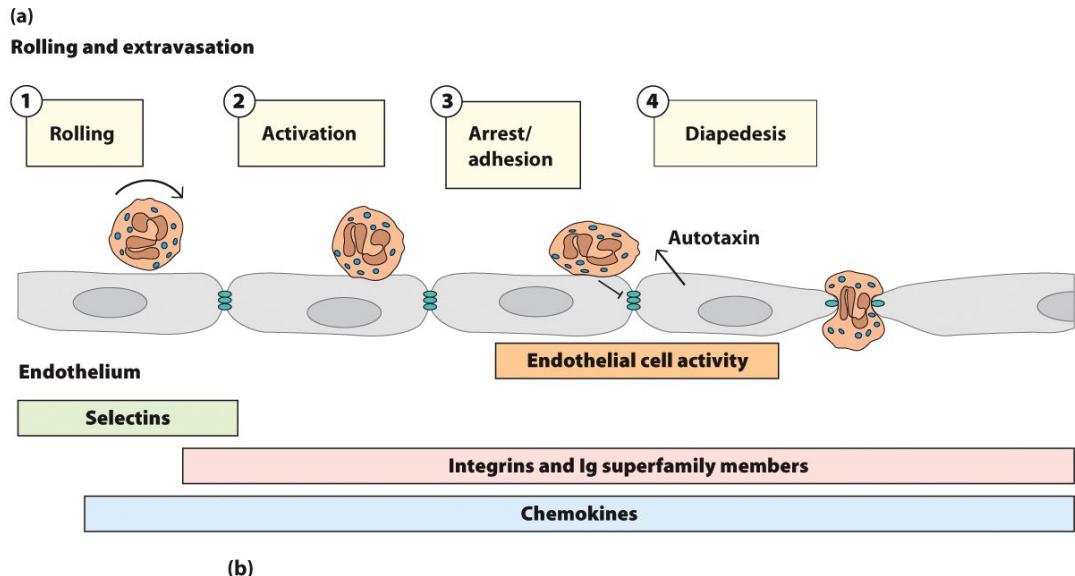


Figure 14-3
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"Lymphocyte homing: progress and prospects," *Current Opinion in Cell Biology*, 1989, October; 1(5):913-919,
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Immune cell behavior before antigen is introduced



- **Extravasation** is driven by sequential activation of surface molecules



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Figure 14-4
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Immune cell behavior before antigen is introduced

- Extravasation is driven by sequential activation of surface molecule
 - Lymphocytes gain entry into the **splenic white pulp** via distinct homing mechanisms
 - The **spleen** has no HEVs, and selectins do not appear to play a role
 - Arterioles release immune cells directly into the **marginal sinus**

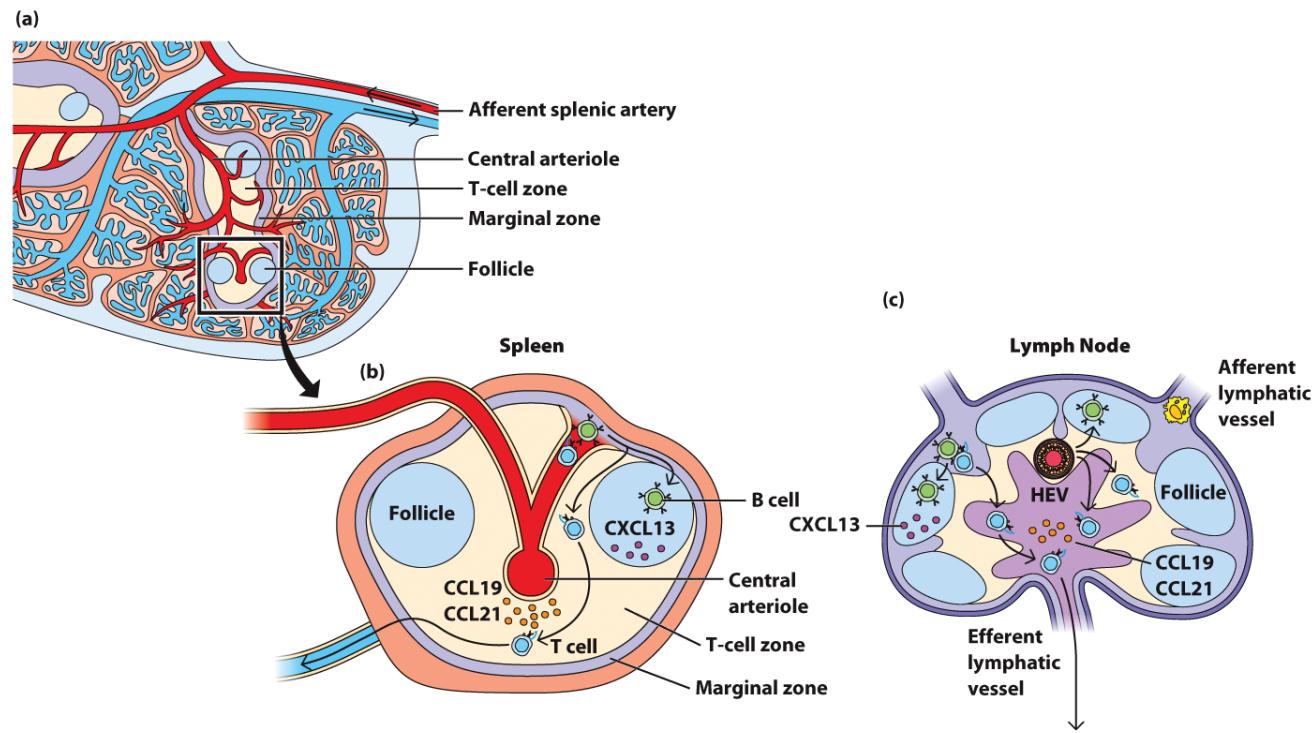


Figure 14-5
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Immune cell behavior during the innate immune responses

- Innate immune cells are activated by Ag binding to PRRs
 - **TLRs** bind pathogen via **pattern recognition receptors (PRRs)**
 - PRR binding generate signals that result in the release of **inflammatory signals**, including chemokines and cytokines
 - **Chemokines** attract innate cells to site of infection
 - Neutrophils are **first responders** to chemokine attraction producing more chemokines that attract APCs and DCs

Immune cell behavior during the innate immune responses

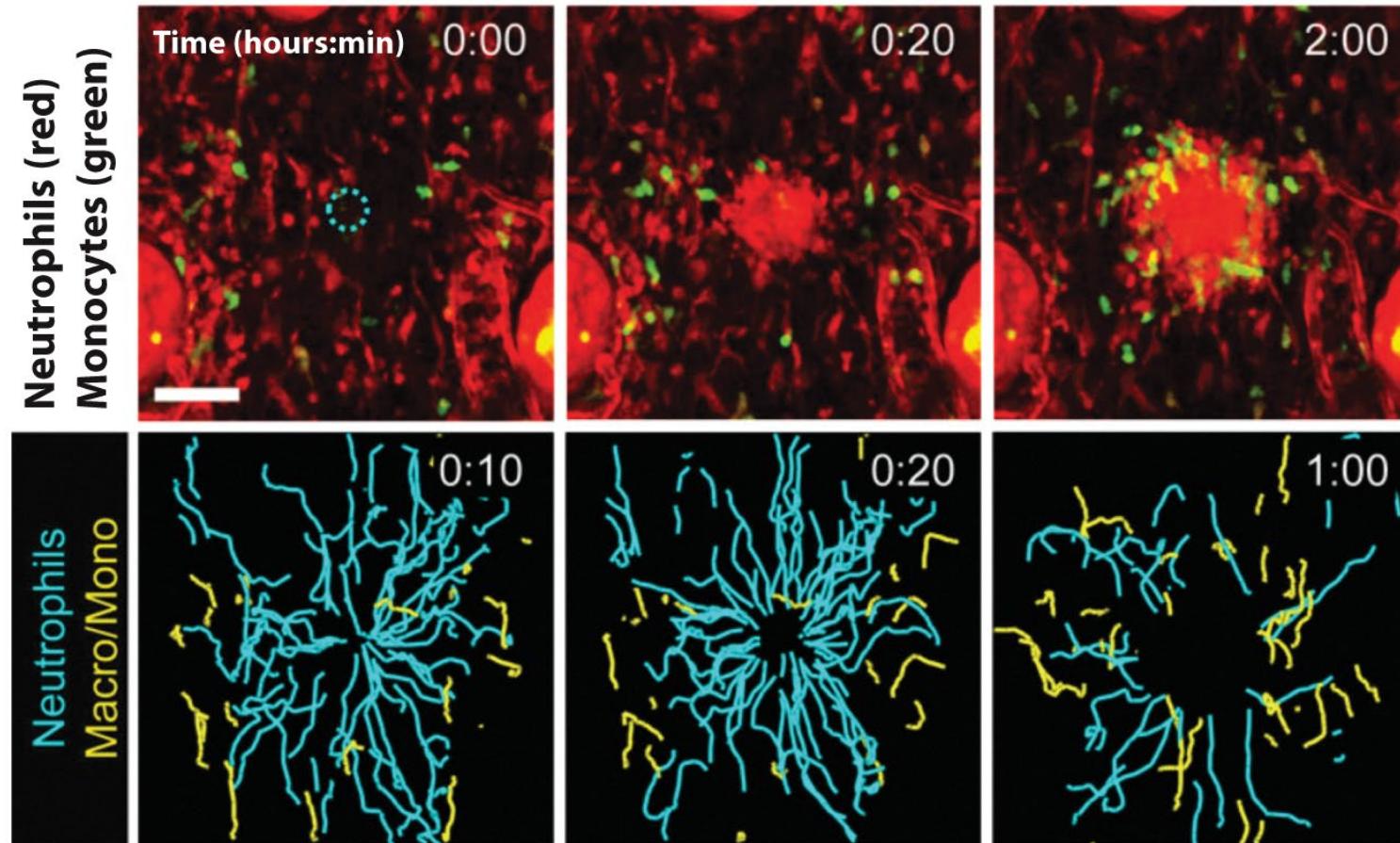


Figure 14-9

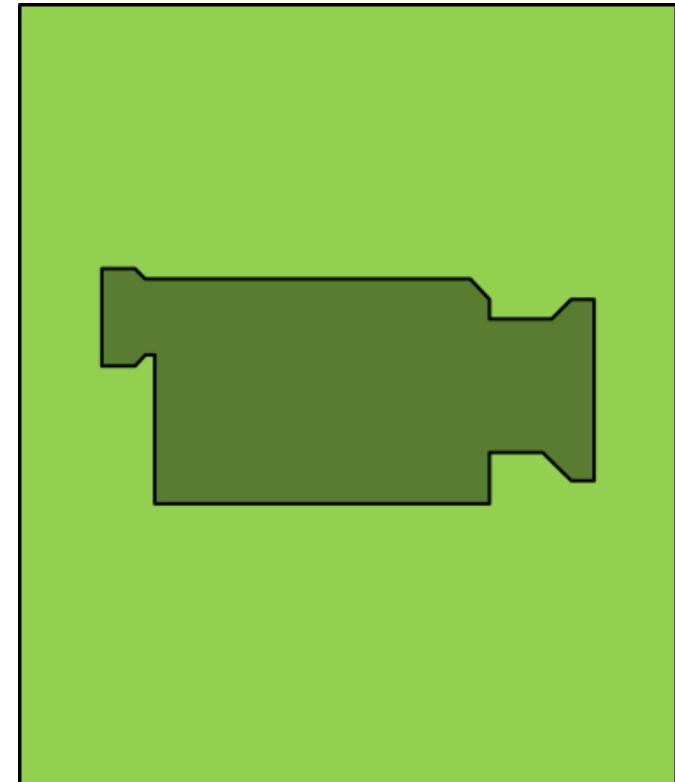
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Video 14-9v

Description:

Simulation of movements of DC and naive lymphocytes in the absence of antigen



Immune cell behavior during the innate immune responses

- Antigen travels in two different forms to secondary lymphoid tissue via afferent lymphatics
 - B cells bind **unprocessed Ag** in lymph node
 - T cells scan lymph node for **Ag peptides** bound to MHC molecules

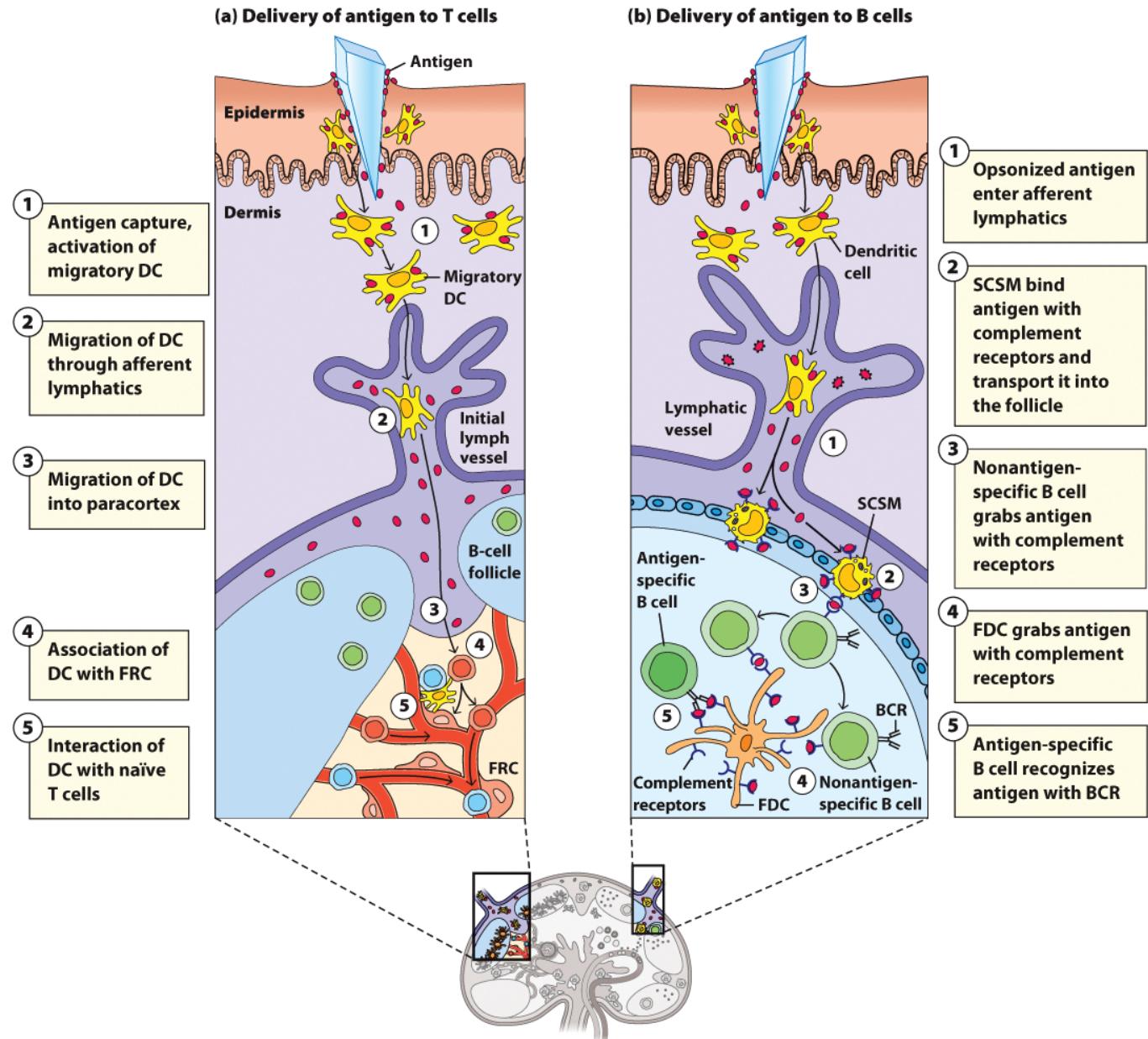


Figure 14-10

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Immune cell behavior during the innate immune responses

- **Whole pathogen** can travel directly to lymph nodes from the site of infection
 - **Sporozoites** travel directly to **draining lymph node**
 - Lymph node APCs, and not skin DCs, process and present parasite Ag

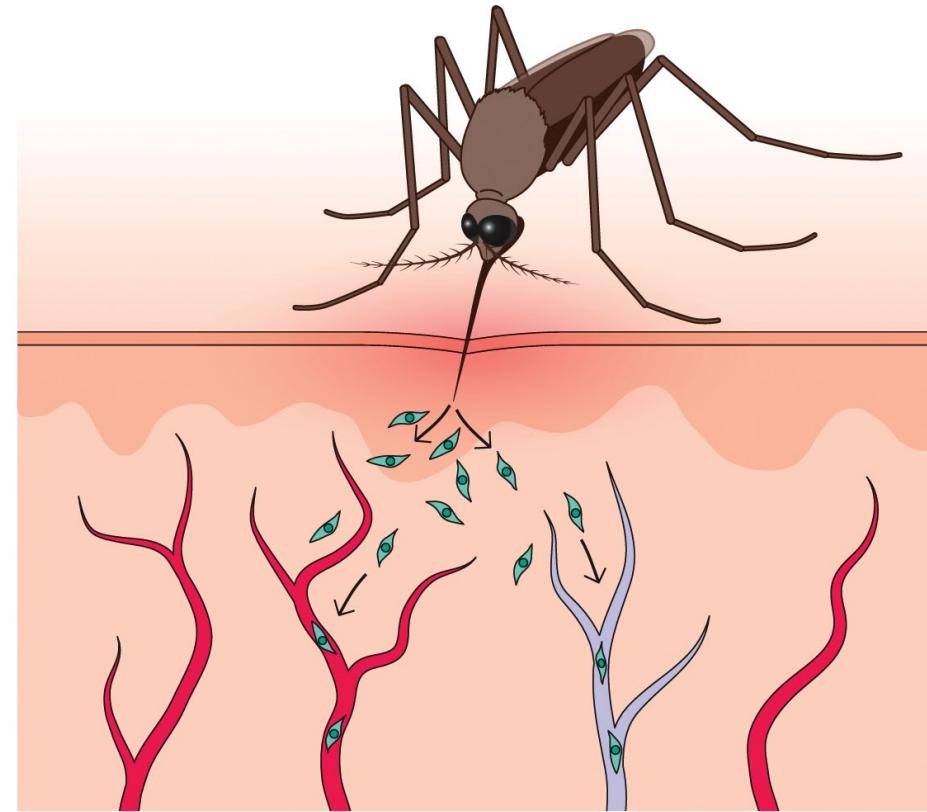
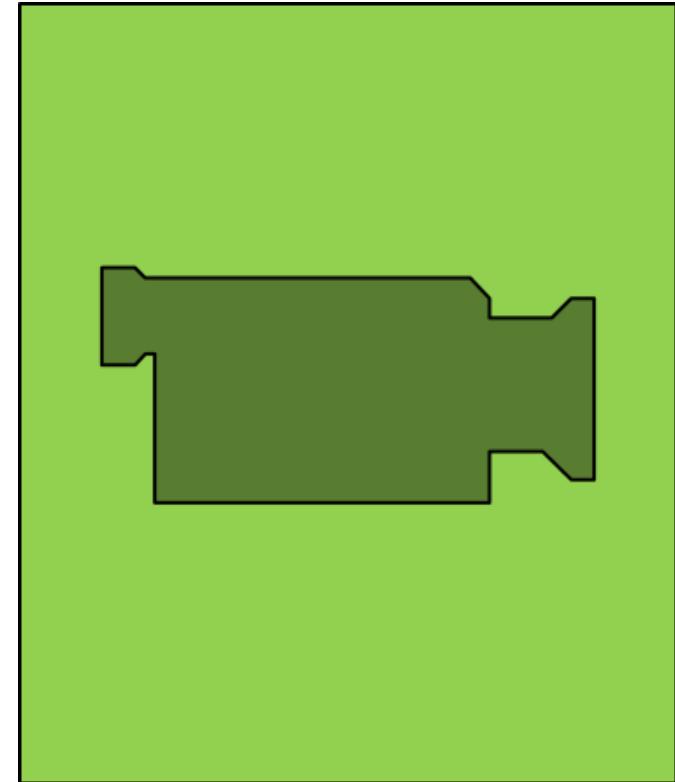


Figure 14-11
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Video 14-11v

Description:

T cells arrest after antigen encounter



Immune cell behavior during the innate immune responses

- Antigen-presenting cells presenting processed antigen travel to the T-cell zones of secondary lymphoid tissue

Immune cell behavior during the adaptive immune response

- Behavior of T cell, B cell, and APC during first 50 hours of a primary immune response in the lymph node

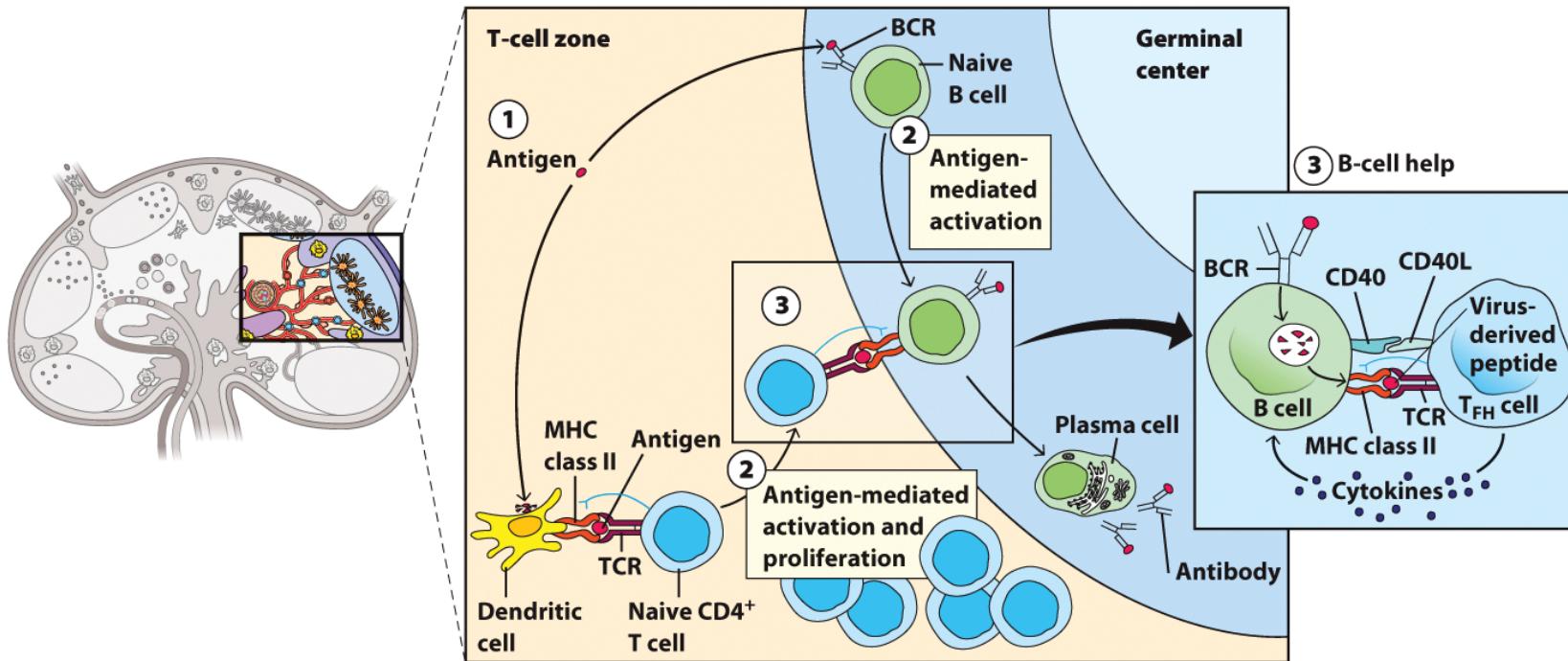


Figure 14-14

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Immune cell behavior during the adaptive immune response

- Naïve CD4⁺ T cells arrest their movements after engaging antigens
 - Kinetics of early encounters depends on **quality, quantity, and availability of Ag** (and DC activation state)
 - T cells become involved in committed, long-term (8 hours or more) relationships with DCs

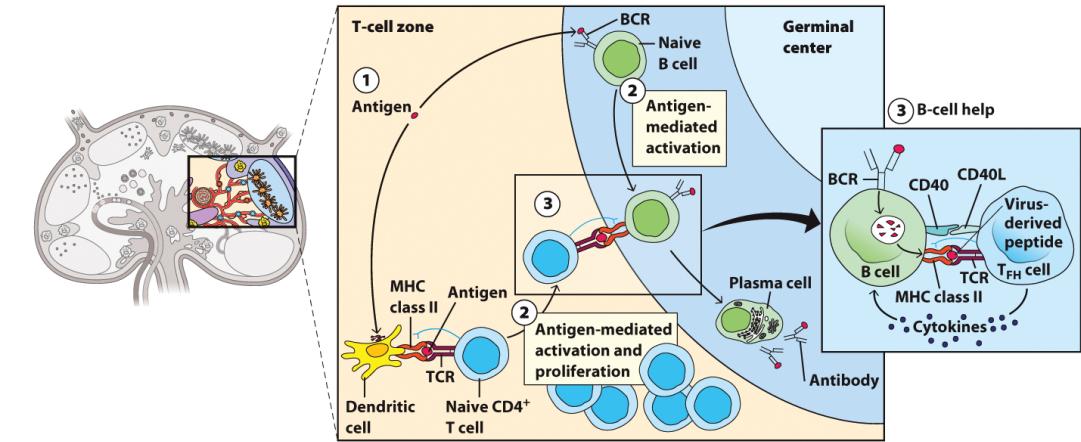
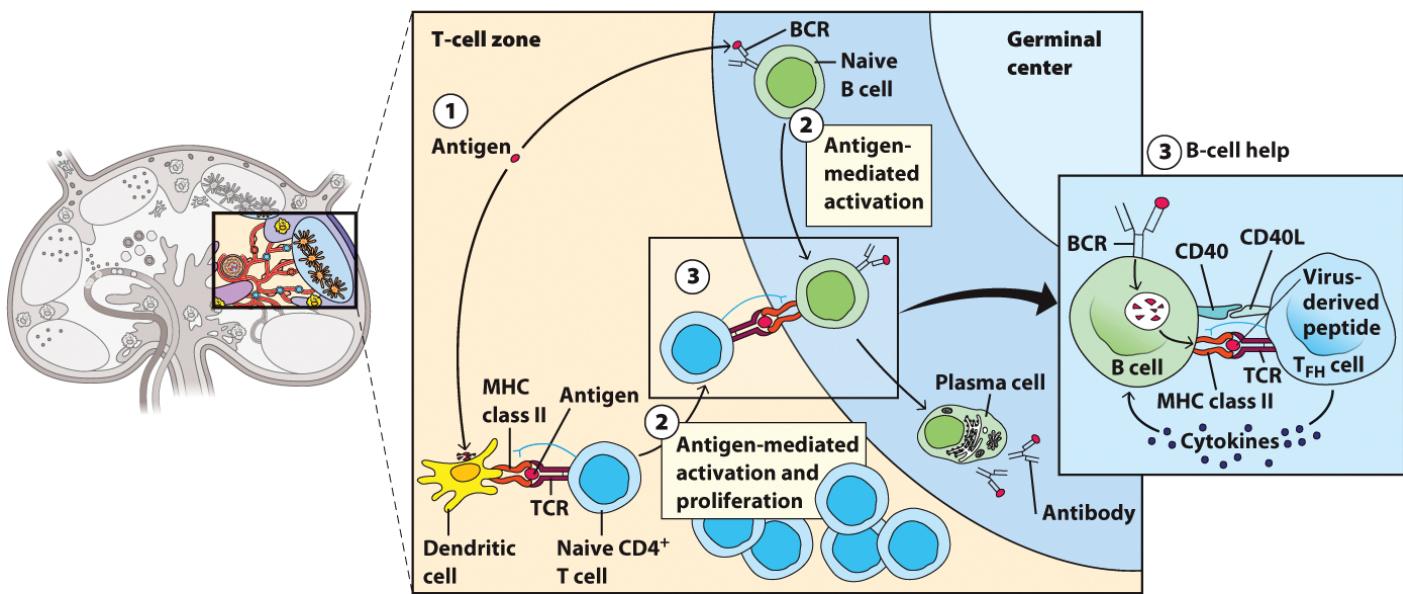


Figure 14-14
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Immune cell behavior during the adaptive immune response



- B cells seek help from CD4⁺ T cells at the **border** between the **follicle and paracortex** of the lymph node
- After binding Ag, B cells **upregulate CCR7**
 - This allows them to follow **chemotactic signals** generated in the paracortex
- T-helper cells attracted to follicle border by **CXCR5 upregulation**
- T-cell/B-cell interactions at **follicle border**

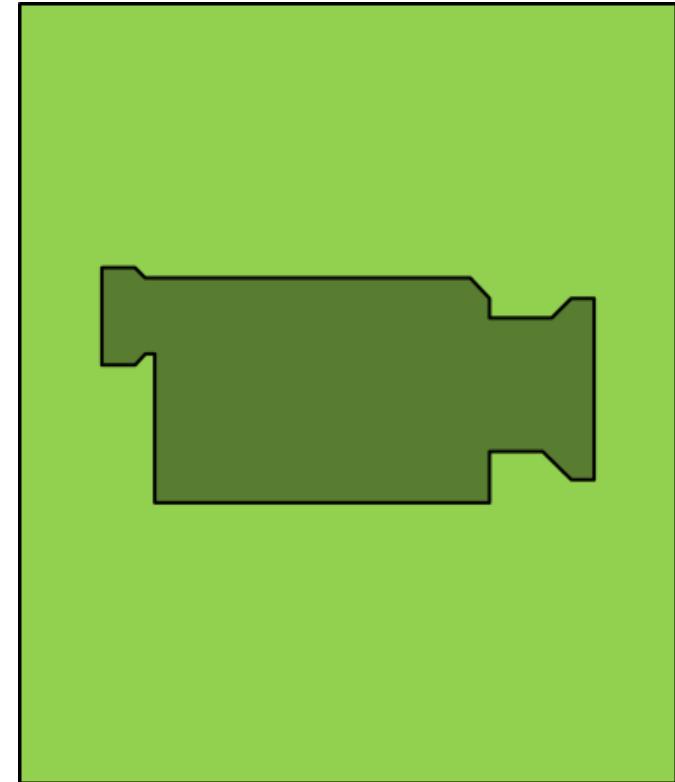
Figure 14-14

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Video 14-14v4

Description:

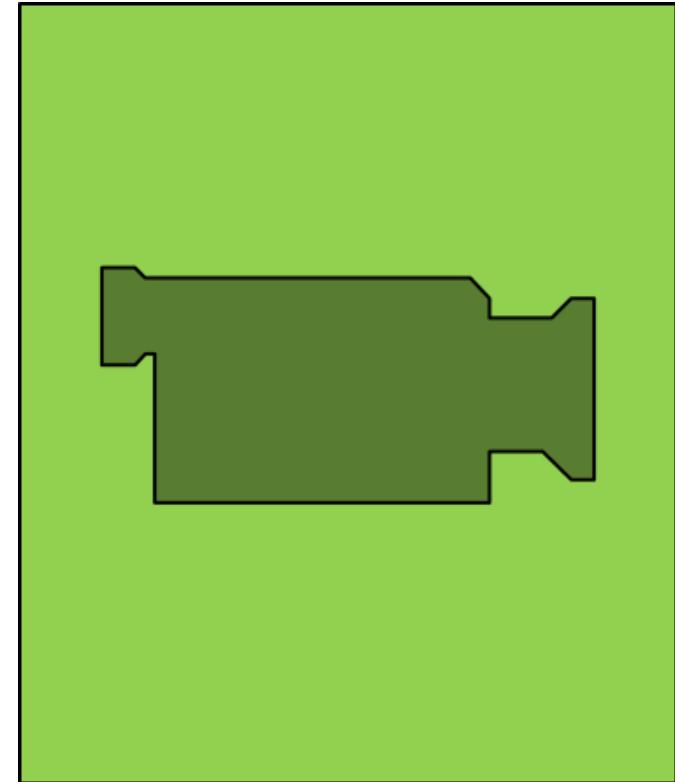
B cells travel to the border
between the follicle and
paracortex after activation



Video 14-14v5

Description:

Antigen-specific B and T cells interact at the border between the follicle and paracortex



Tot dusver Immunologie 1.....

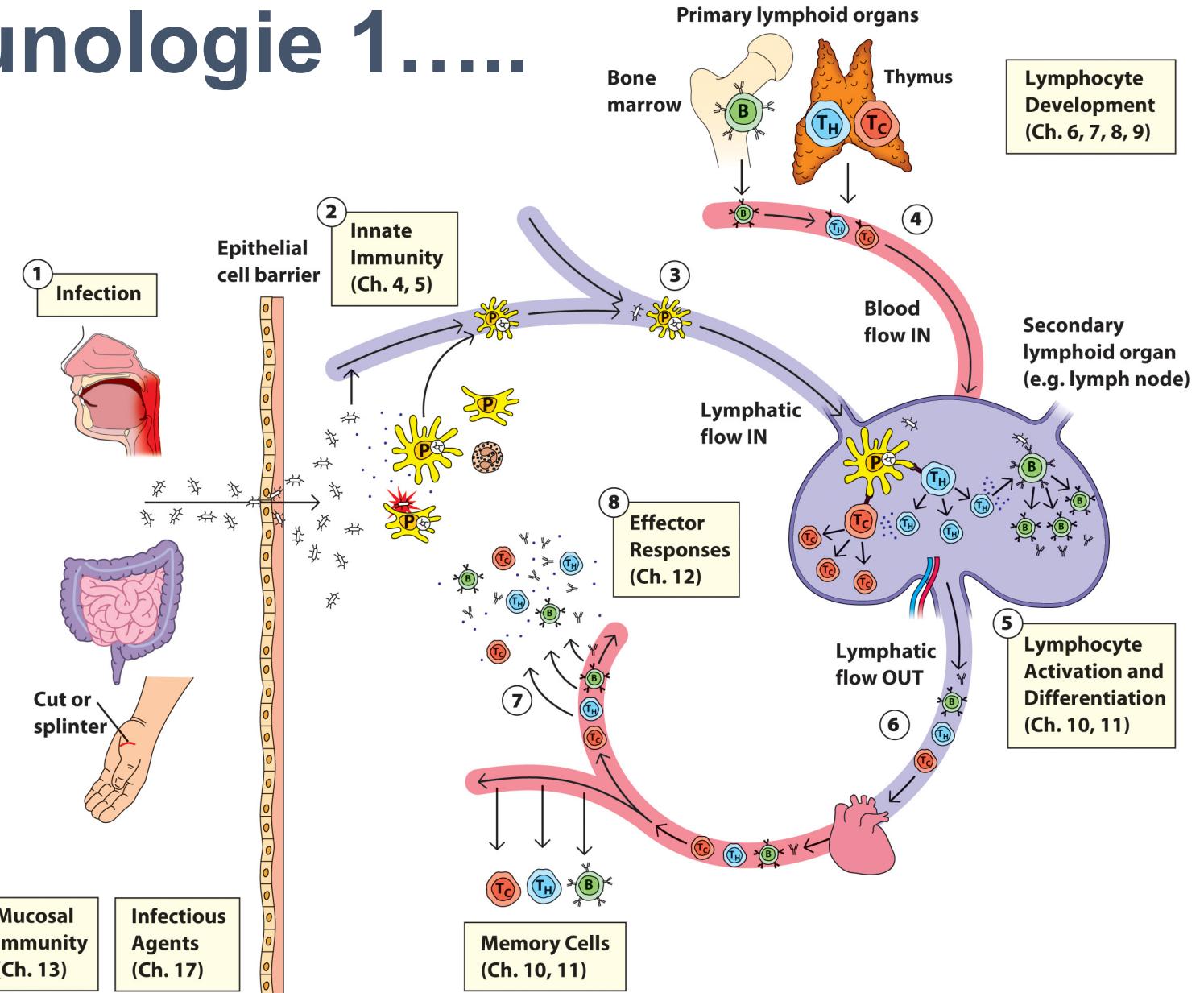


Figure 1-7

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Summary

- Previous chapters have discussed traffic and movement of immune system cells during responses
- This chapter highlights the growing field of dynamic imaging systems using fluorescent markers to visualize these movements