A course on Basic and Translational Immunology, with emphasis on immunologic diseases and therapeutic strategies

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Developed as an education program of the Federation of Clinical Immunology Societies (FOCIS)

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Themes of the course

- The nomenclature of immunology
- Basic principles: mechanisms underlying immune responses
- Emerging concepts, and their potential clinical and therapeutic implications

What does the immune system do?

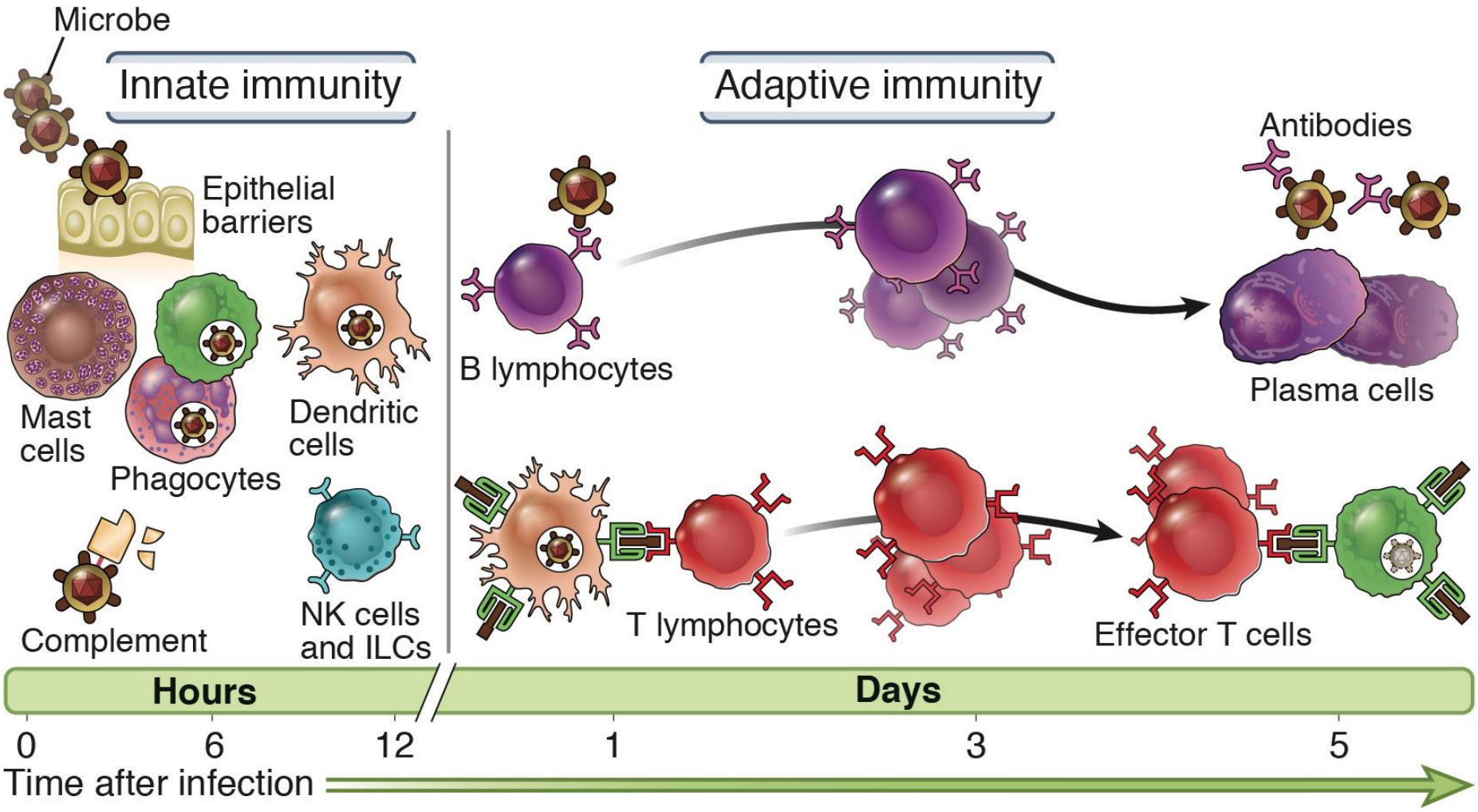
Normal functions

- Defense against infections
- Defense against some tumors

Disease and therapeutic implications

- Cause of disease (autoimmunity, allergy)
- Barrier to transplantation, gene therapy

Innate and adaptive immunity

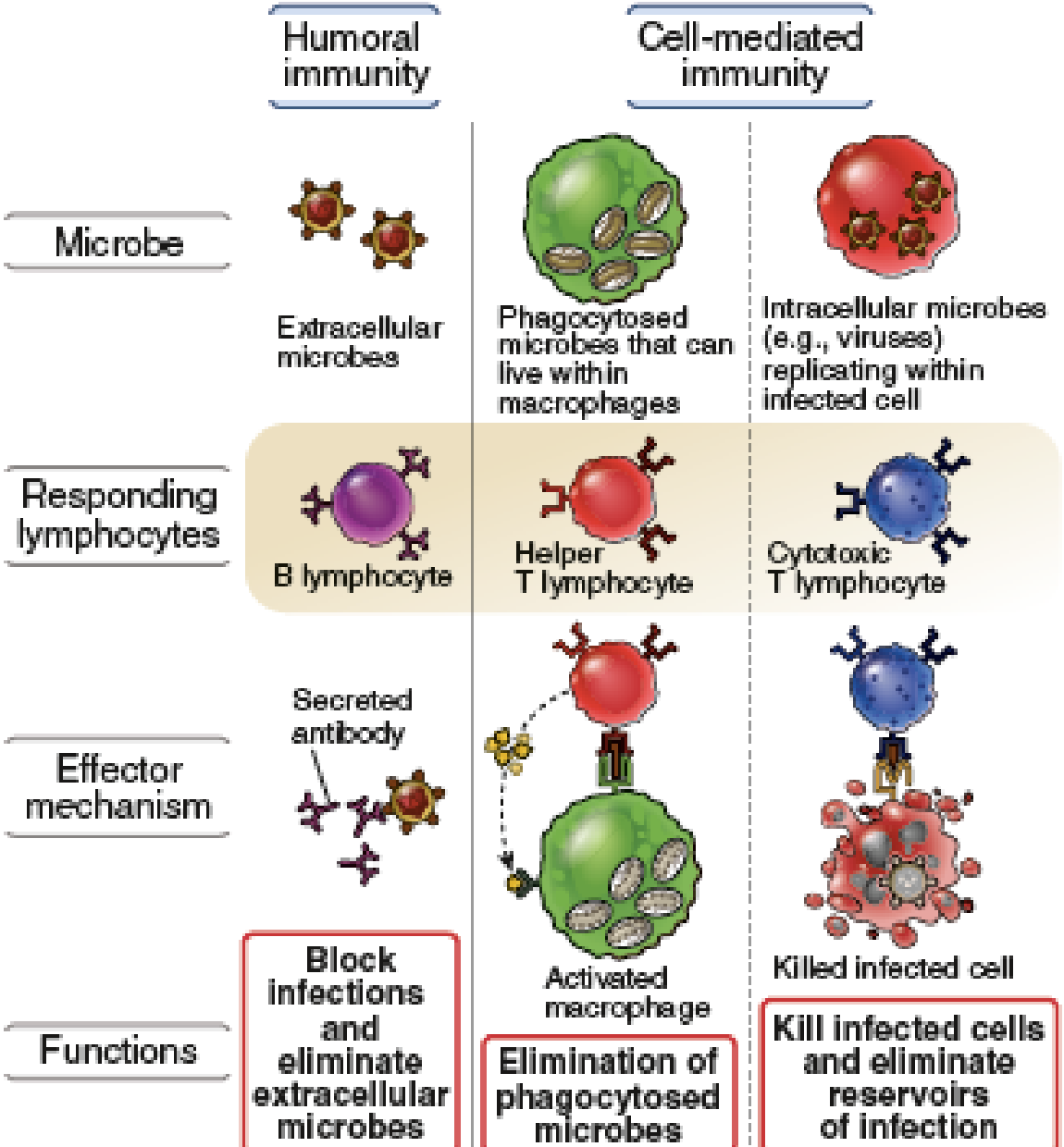


Abbas, Lichtman and Pillai. *Basic Immunology*, 5th edition, 2016, Elsevier

Innate immunity: ***always present (ready to attack); many pathogenic microbes have evolved to resist innate immunity***

Adaptive immunity: ***stimulated by exposure to microbe; more potent***

Types of adaptive immunity



Different types of immune responses are mediated by different classes of lymphocytes and defend against different types of microbes

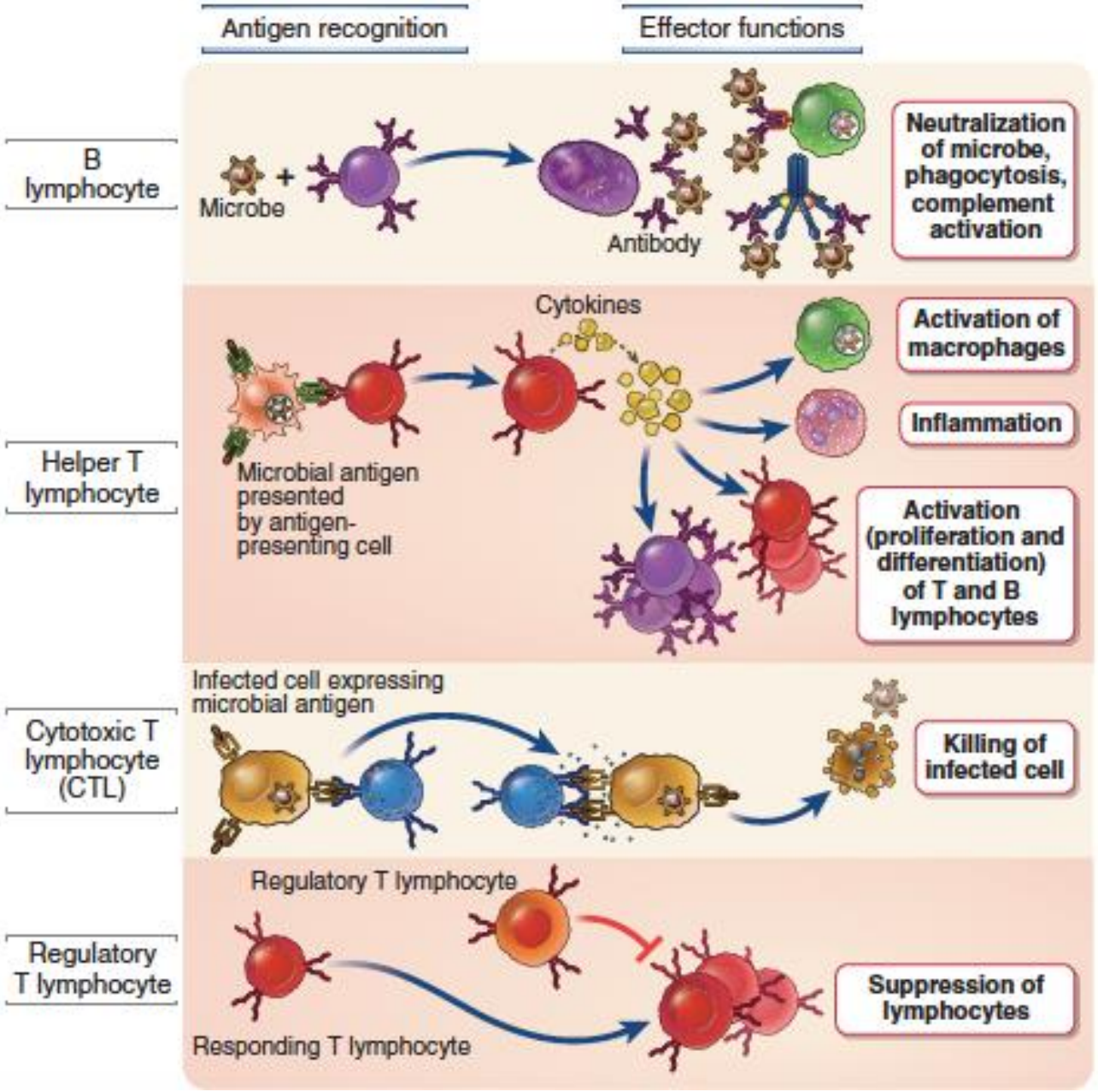
Cells of the immune system

- **Lymphocytes:** the cells of adaptive immunity; recognize antigens and develop (differentiate) into cells that perform the defense functions

- **Antigen-presenting cells:** cells that capture antigens and display them to lymphocytes

- **Effector cells:** leukocytes (white blood cells) that eliminate microbes (the "effect" of the immune response); may be lymphocytes, but are often other leukocytes

Classes of lymphocytes



Antibody production

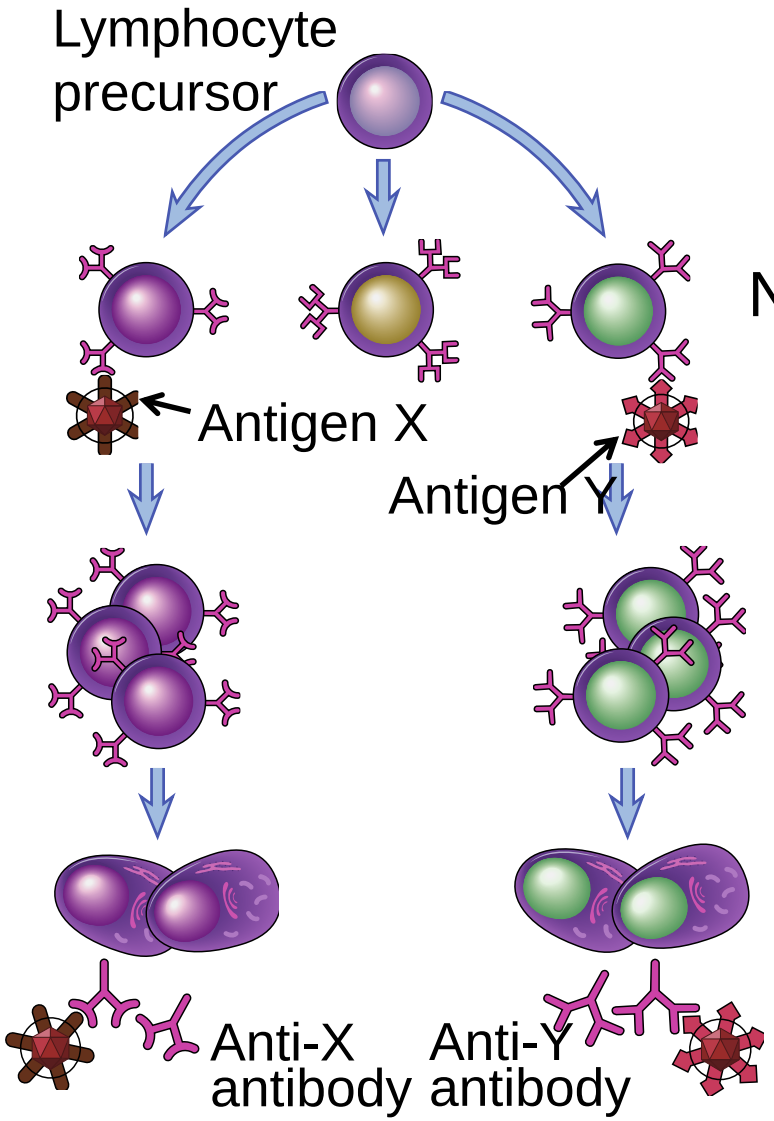
Cytokine secretion

Killing machinery

Suppression of immune responses

Abbas, Lichtman and Pillai. *Cellular and Molecular Immunology, 9th edition, 2017*

Lymphocyte diversity and clonal selection



Generation of mature lymphocytes with many different antigen receptors

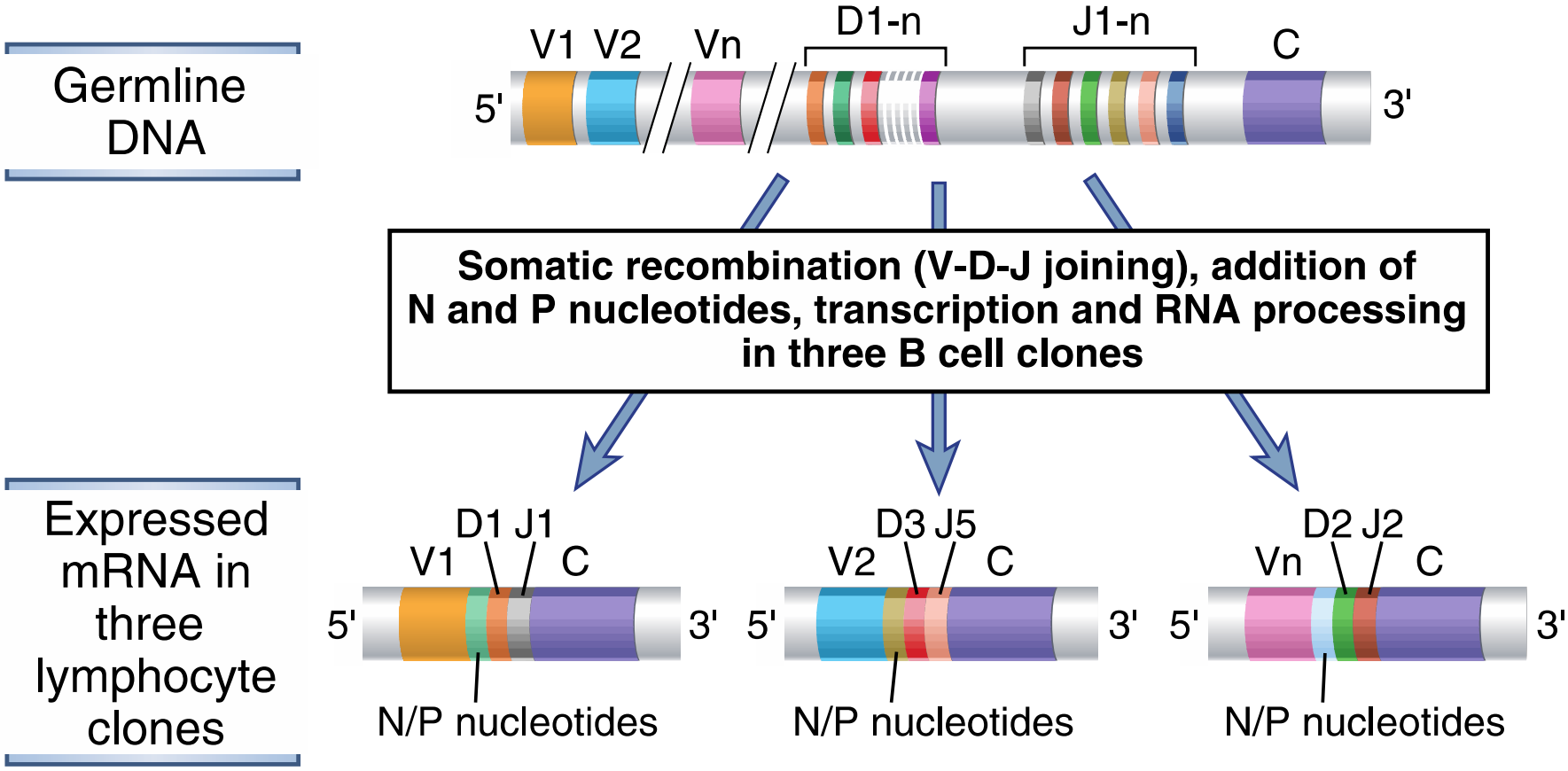
Naïve lymphocytes circulate through lymphoid organs

Specific lymphocytes recognize antigens

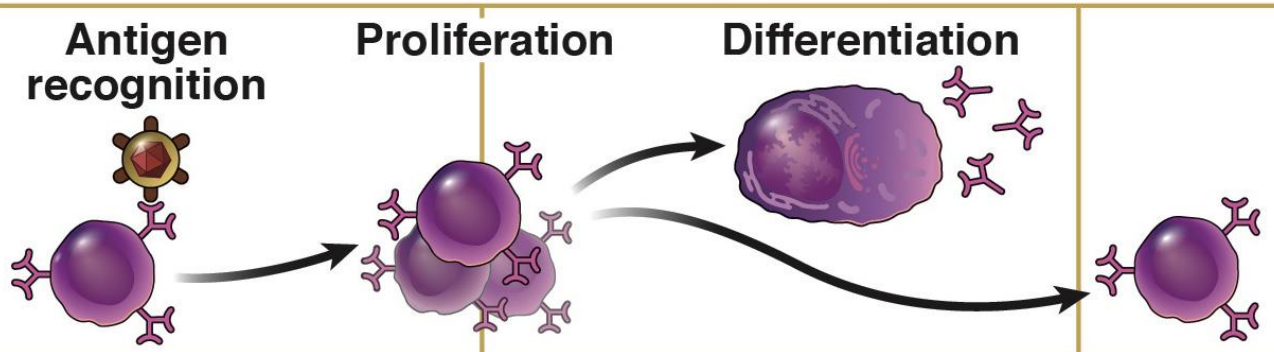
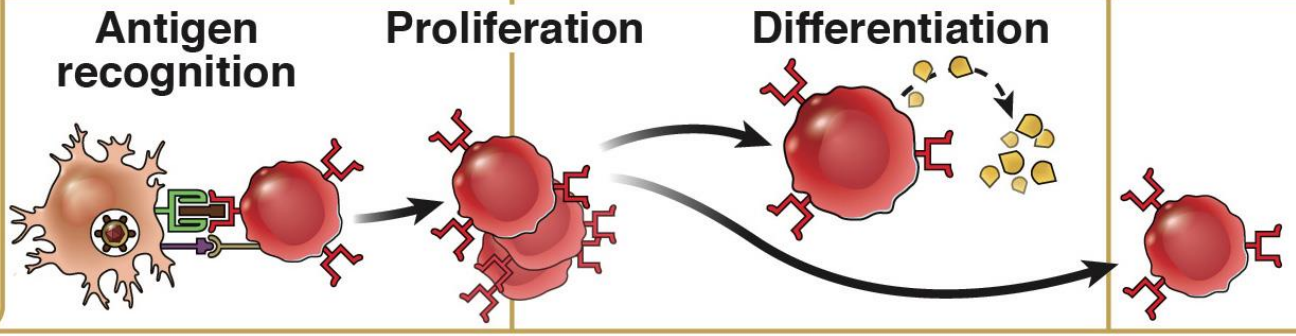
Lymphocytes are activated to proliferate and to differentiate into effector cells

Lymphocytes with highly specific and diverse antigen receptors develop prior to exposure to antigens

Generation of diversity

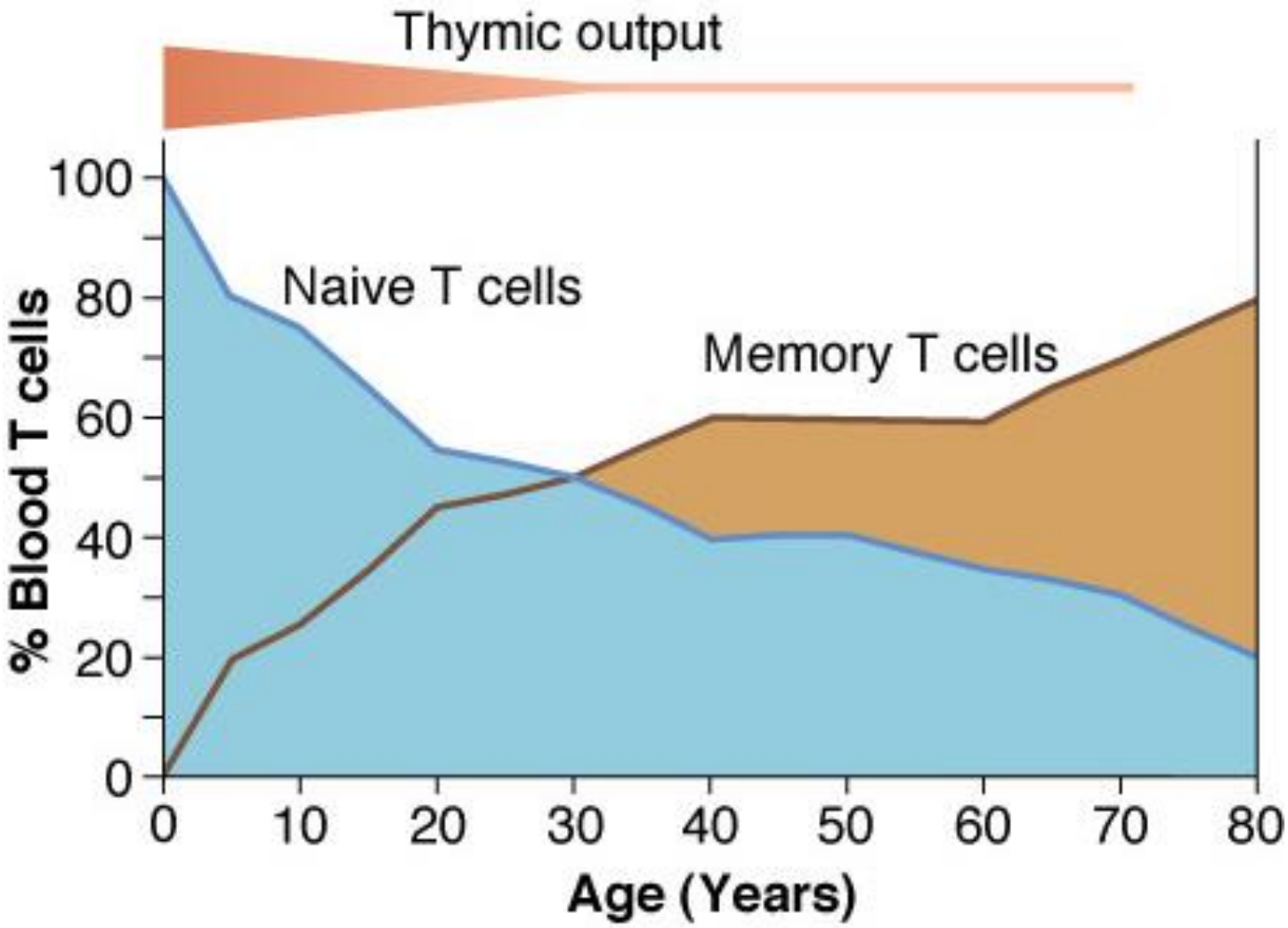


Stages in the life history of lymphocytes

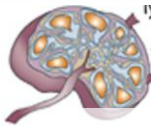
Cell type	Stage		
	Naive cell	Activated or effector lymphocyte	Memory lymphocyte
B lymphocytes			
T lymphocytes			

Proliferation: expands number of antigen-specific cells
Differentiation: converts lymphocytes into effective defenders

Accumulation of memory T cells with age



Immunological basis of human disease




Immune deficiency

Cancer

Allergy

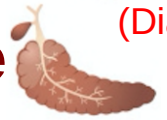
COPD

Response **Tolerance**

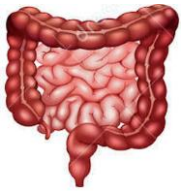
Psychological Disorders
(Alzheimer's, PTSD, depression, bipolar)

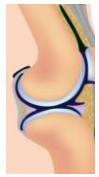
Cardiovascular Disease
(Atherosclerosis, hypertension, stroke)

Metabolic Disorders
(Diabetes, Fatty liver dis.)



Autoimmunity
(T1D, MS, RA, IBD)





Muscular Dystrophy

Transplantation
Tolerance

Osteoporosis

Aging

The significance of recent advances

- Provides a solid foundation of basic principles
- Improved understanding of disease mechanisms
- Development of novel therapies
- Appreciation of the role of the immune system in non-immune diseases

Challenges in Immunology

- Explosion of information creates complexity
  - "Big data" is difficult to interpret, has not yet provided many useful answers
  - Many complex cell populations and pathways
- Translating results from mouse to human
  - Co-housing with dirty mice makes the immune system of lab mice more like humans
- Translating results from cell cultures to in vivo