¶ 6.1

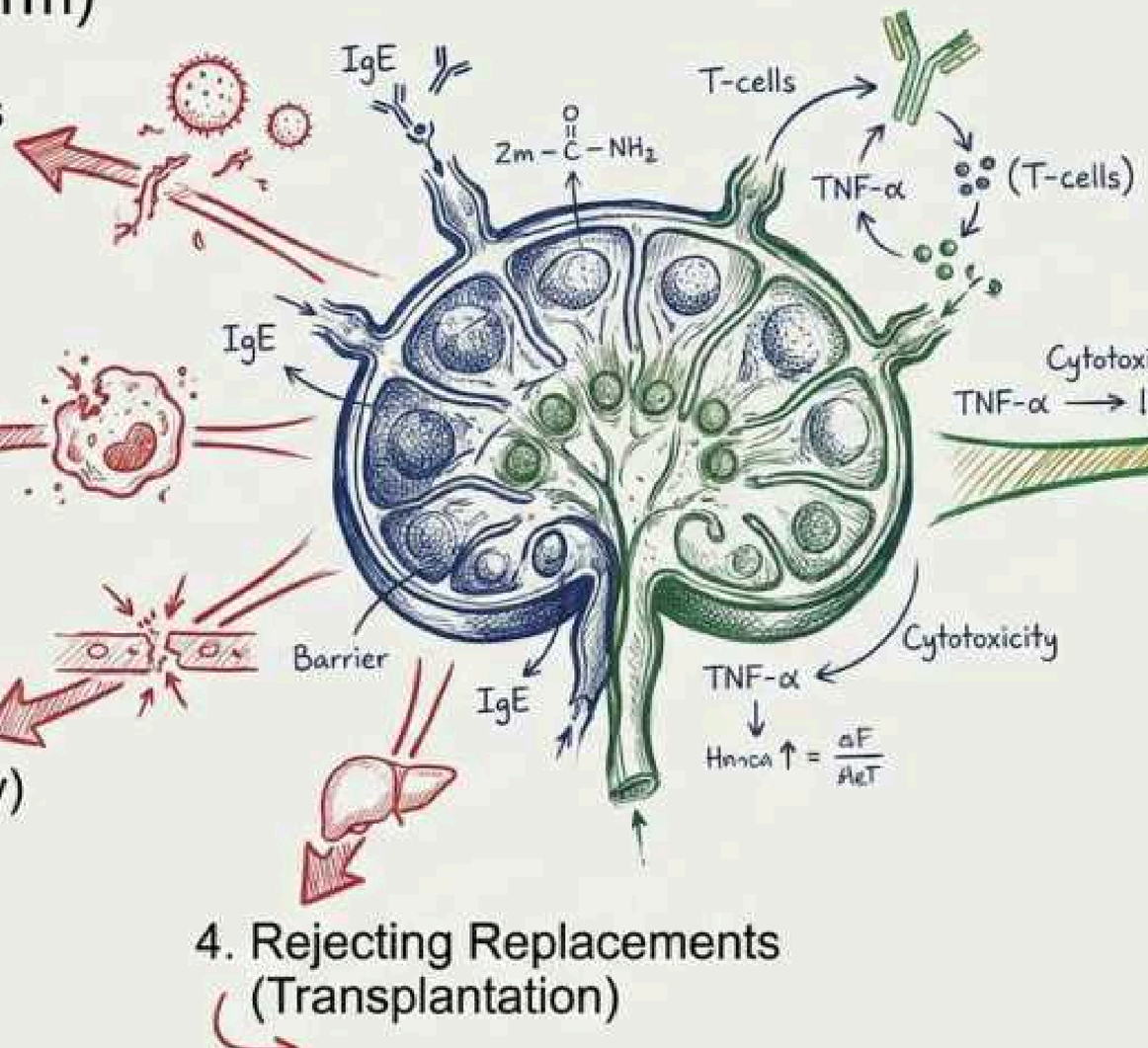
Misdirected Power (Harm)

1. Reacting to Harmless Elements (Allergy)
   ...

2. Attacking the Self (Autoimmunity)
   ...

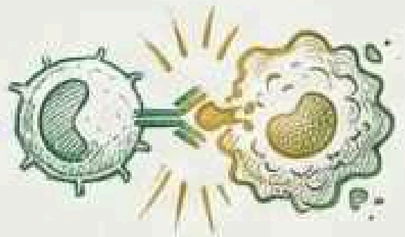
3. Failing to Defend (Immunodeficiency)
   ...

4. Rejecting Replacements (Transplantation)
   ...



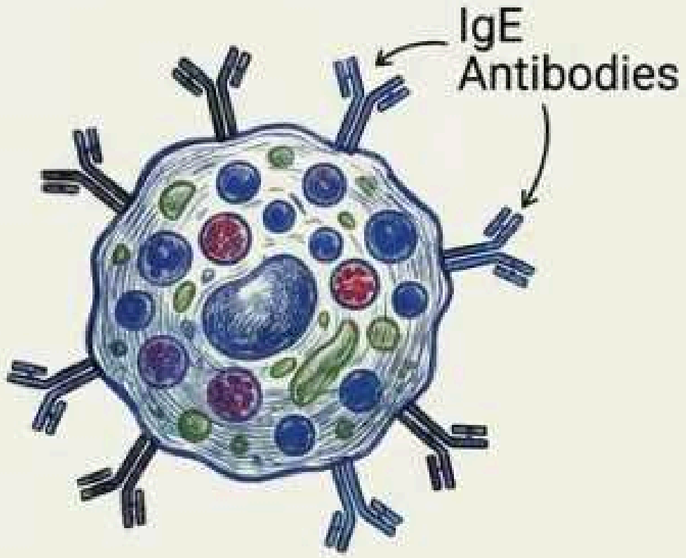
Harnessed Power (Triumph)

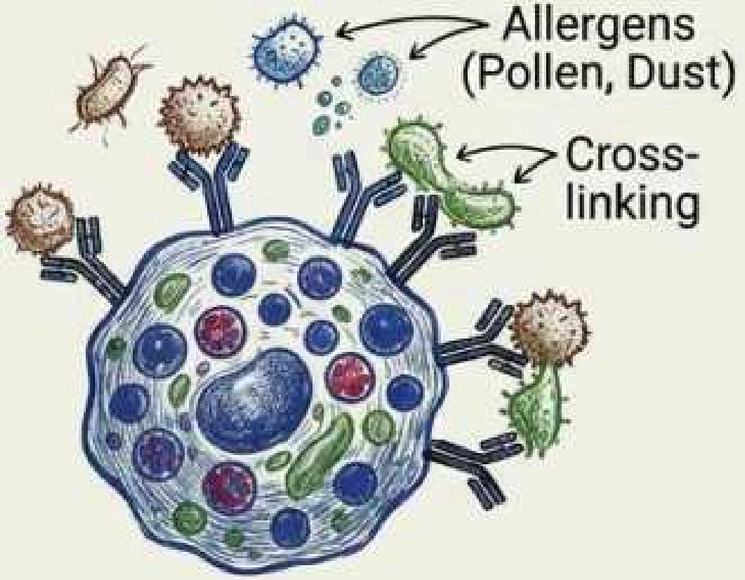
Cytotoxicity
TNF-α ⟶ I↑

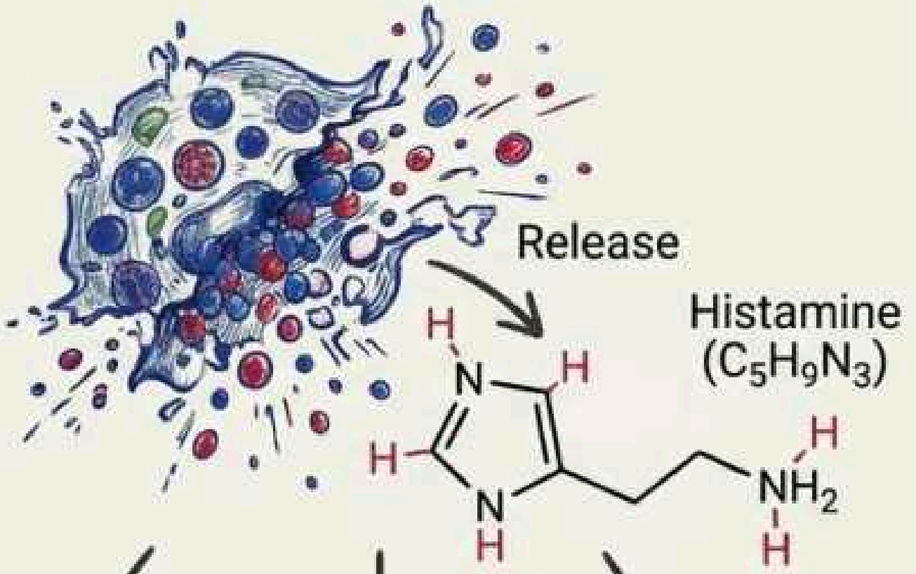


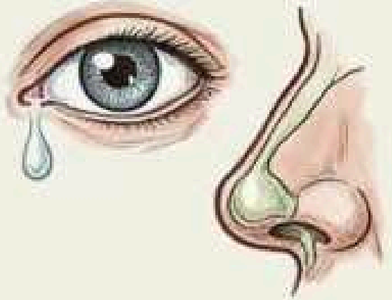
Harnessing the system to fight cancer.

Step 1: Sensitization → Step 2: Exposure → Step 3: Degranulation

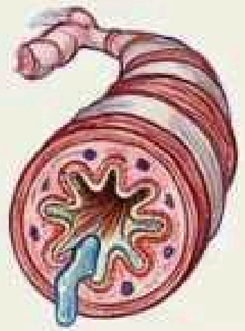




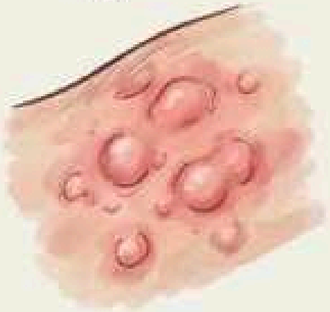




Hay Fever

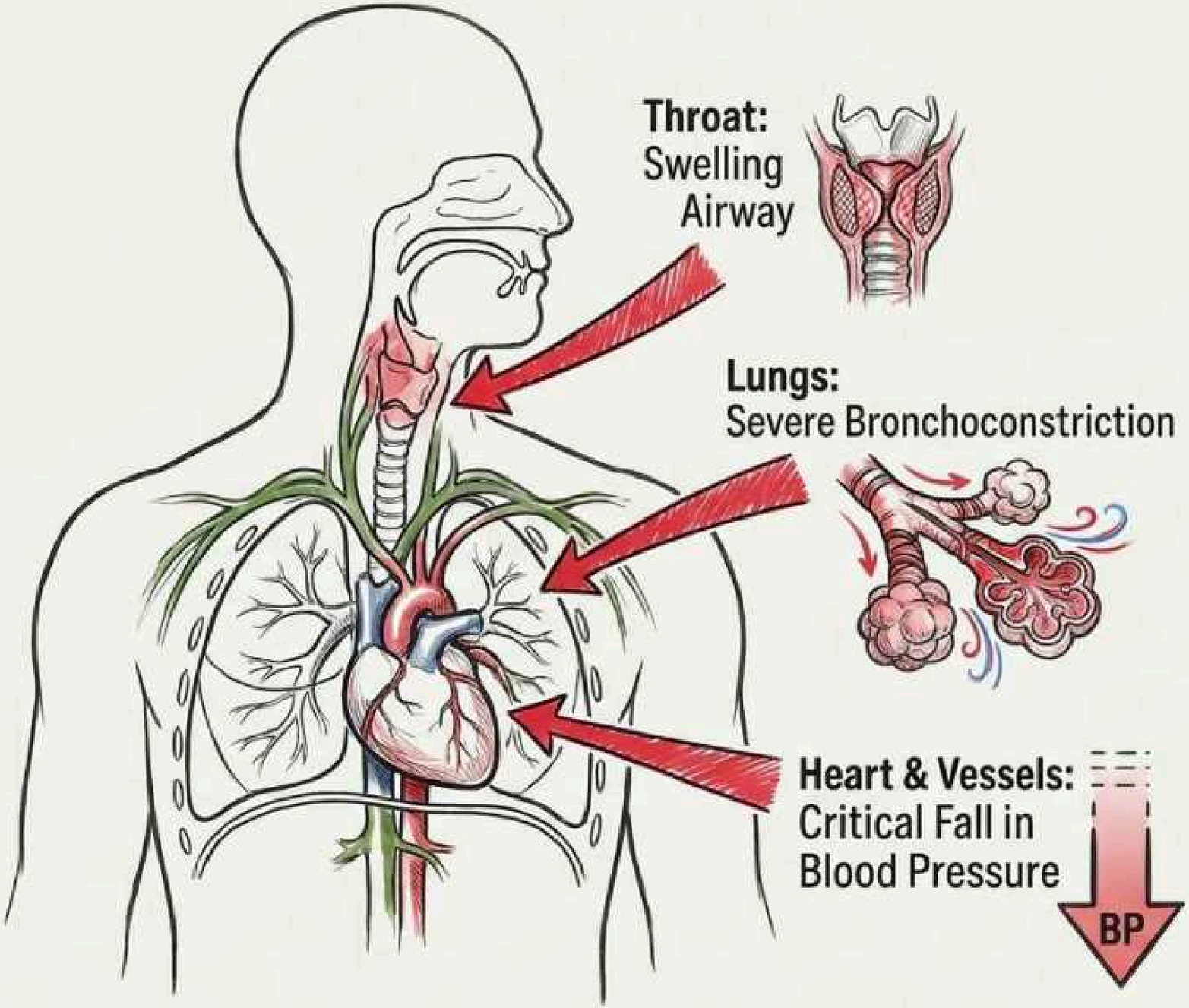


Allergic Asthma



Hives

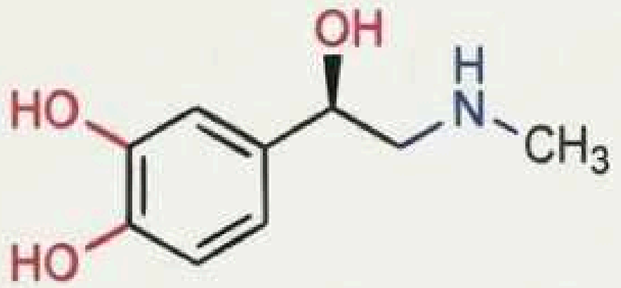
¶ 6.3



Throat:
Swelling
Airway

Lungs:
Severe Bronchoconstriction

Heart & Vessels:
Critical Fall in
Blood Pressure

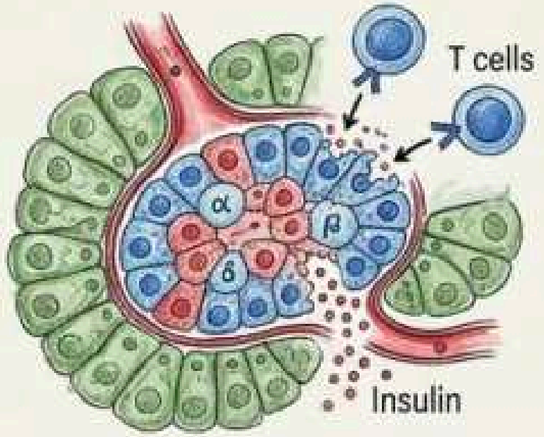


Epinephrine ($C_9H_{13}NO_3$)

Immediate emergency override.

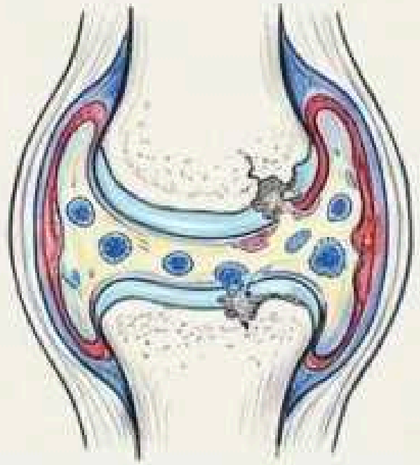


Type 1 Diabetes



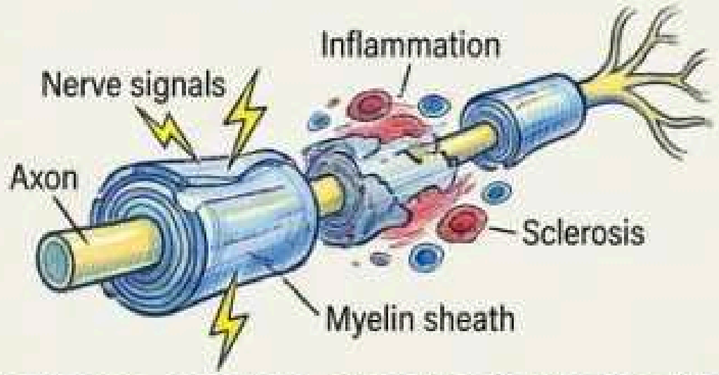
T cells destroy insulin-making cells.

Rheumatoid Arthritis



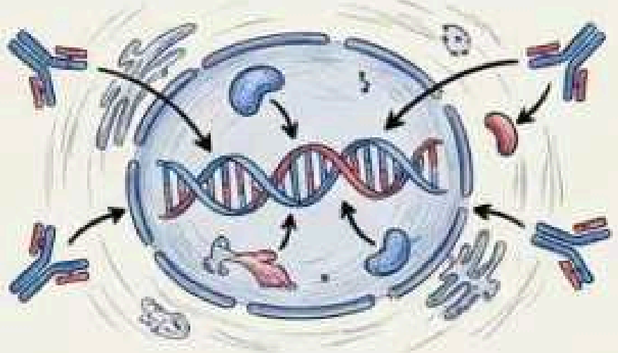
Inflammation damages joint lining.

Multiple Sclerosis



Immune system attacks fatty myelin sheaths in brain and spinal cord.

Systemic Lupus



Antibodies target cell nucleus parts, causing multi-organ inflammation.

Origin: Genetic Risk (MHC variants) + Environmental Triggers ♀ Higher prevalence in women.

Immunodeficiency: A Weakened Defense

Inherited

SCID (Severe Combined Immunodeficiency)

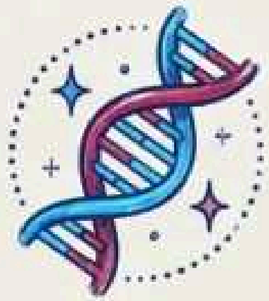


Empty Thymus

Required for survival:



Bone Marrow Transplant



Gene Therapy

Acquired



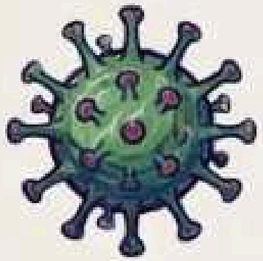
Immunosuppressive Medicines



Cancer Treatment



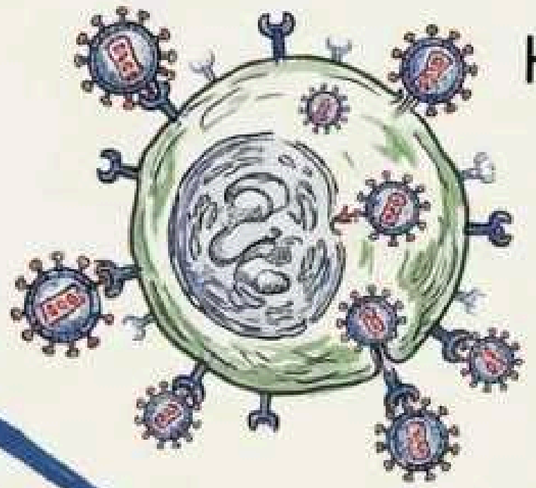
Malnutrition



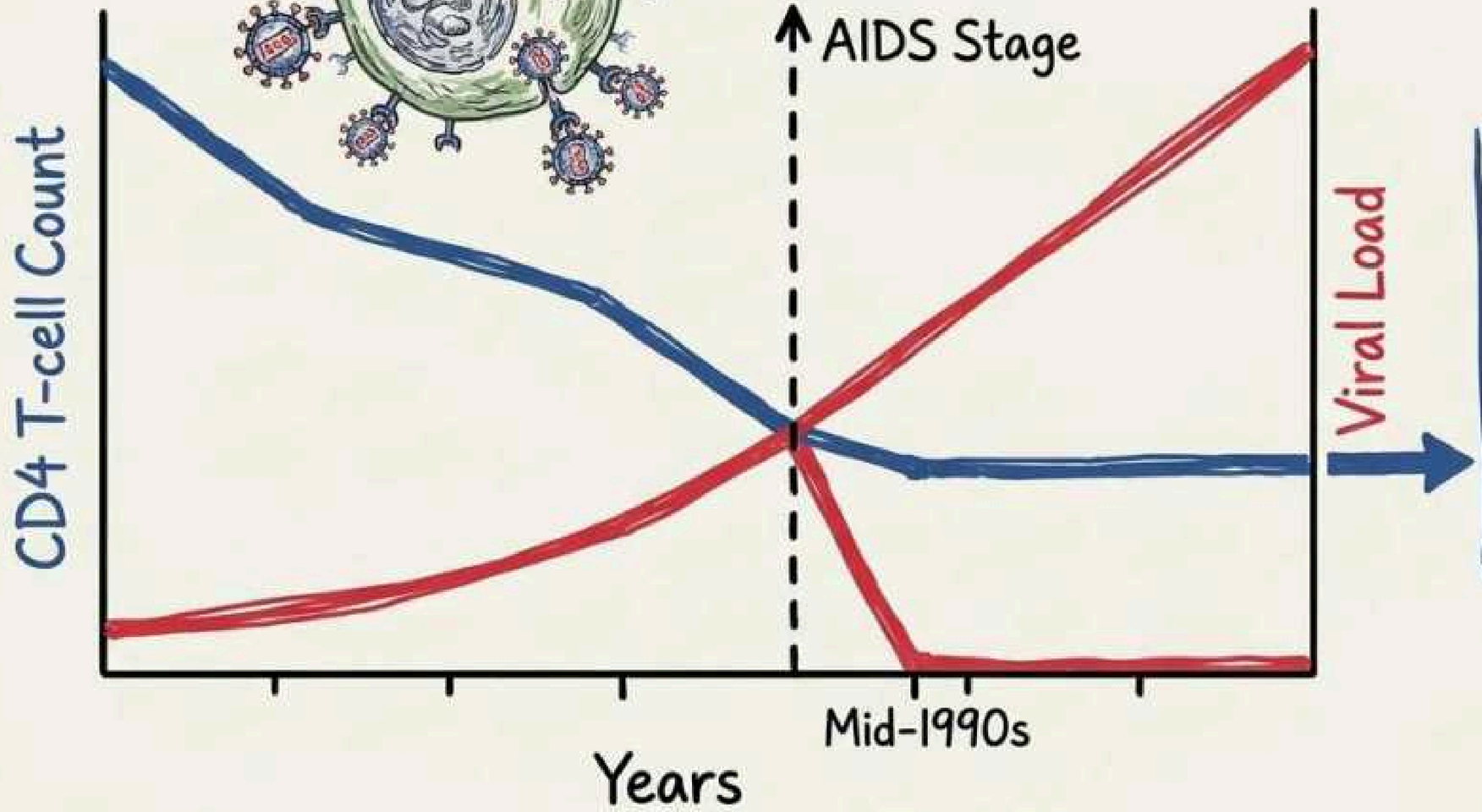
Infection

HIV/AIDS Progression & Treatment

¶ 6.6



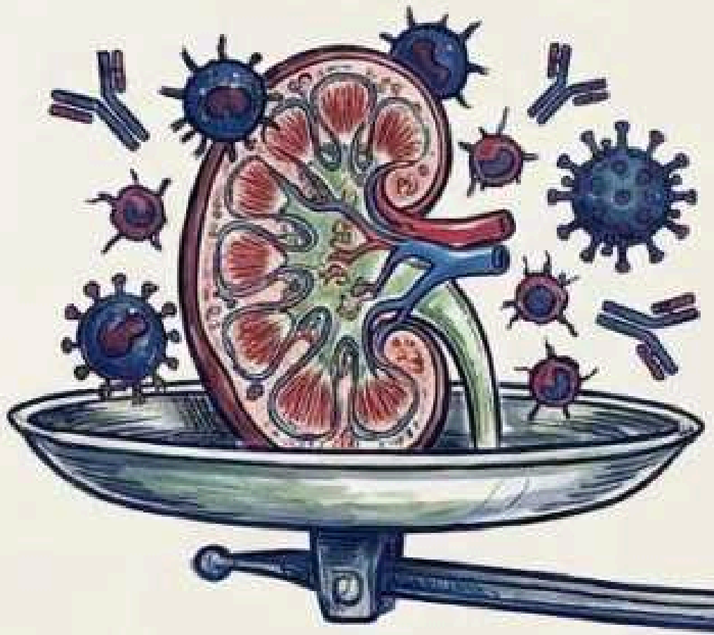
Helper T-Cell (CD4): The Conductor



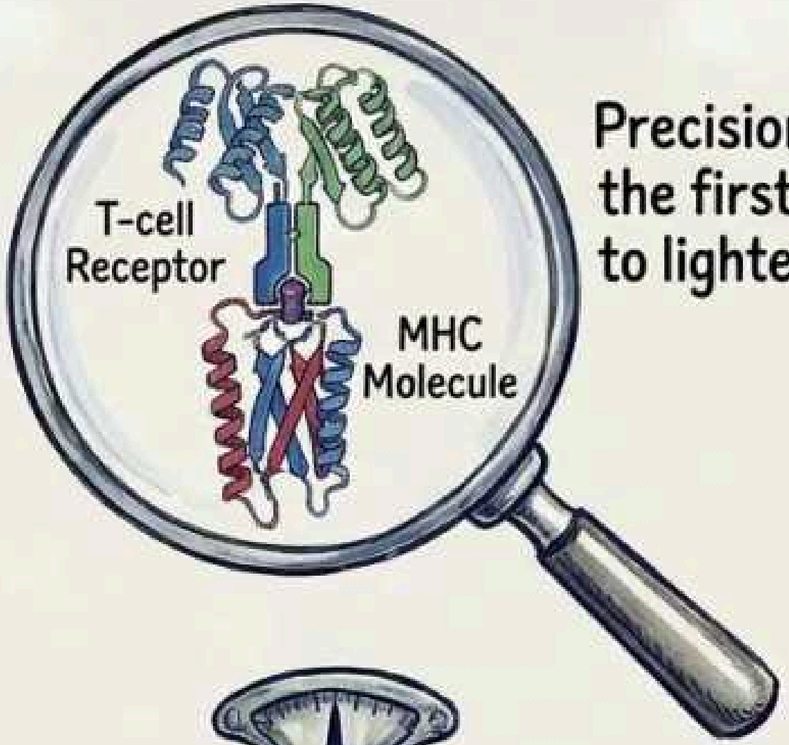
Antiviral combinations transform a near-near-certain death sentence into a manageable long-term condition.

¶ 6.7

Rejection Risk



Recipient's T-cells recognize foreign Donor MHC molecules. Without treatment, rejection is inevitable.



Precision matching is the first critical step to lighten the burden.

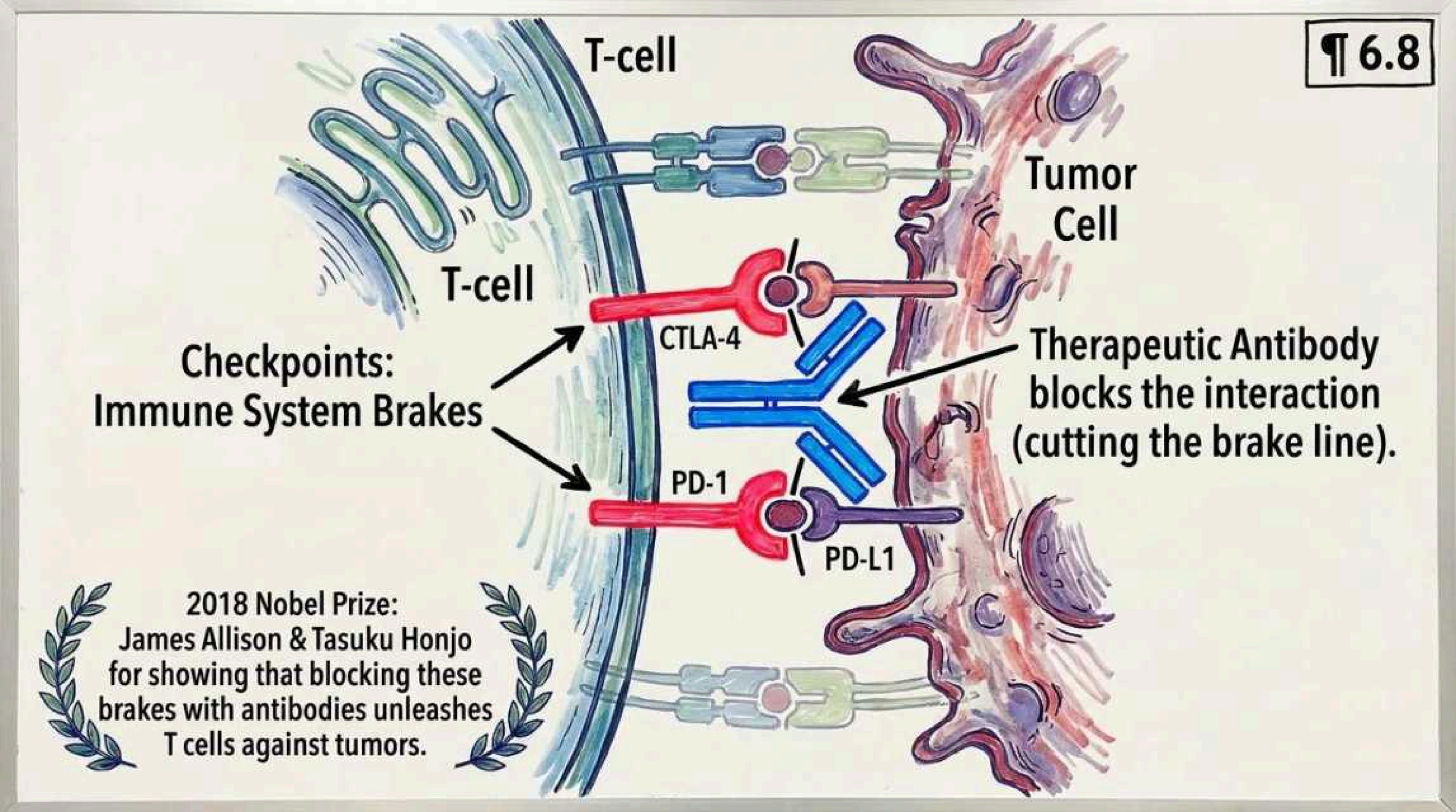


Suppression Risk



Increased risk of infection and certain cancers.

¶ 6.8



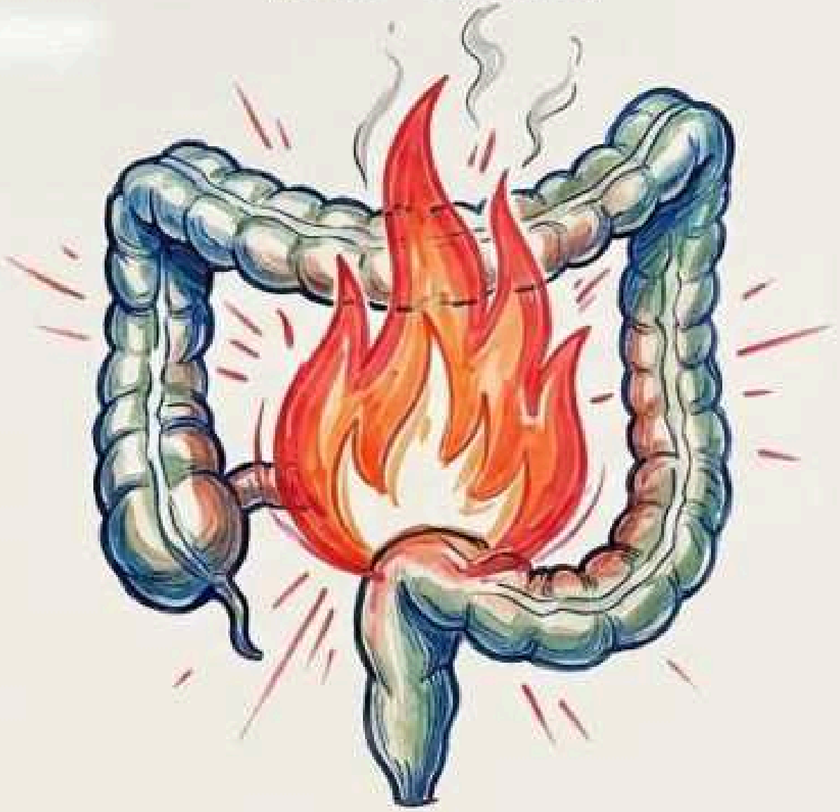
2018 Nobel Prize:
James Allison & Tasuku Honjo
for showing that blocking these
brakes with antibodies unleashes
T cells against tumors.

The Victory



Produces long-lasting responses in cancers that were once almost always fatal. (Note: Does not work for everyone).

The Cost

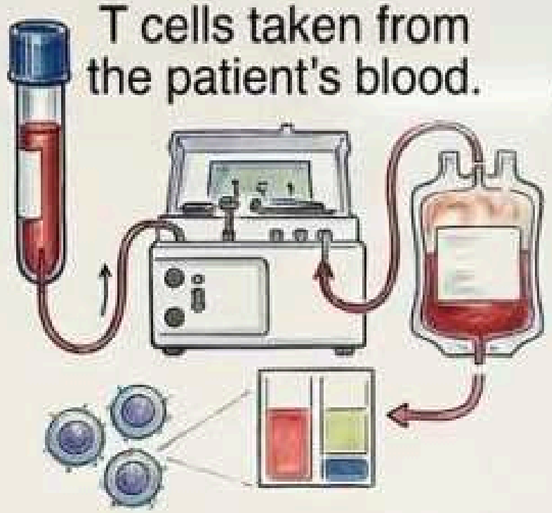


Releasing the brakes causes system-wide inflammation—a medically induced form of autoimmunity.

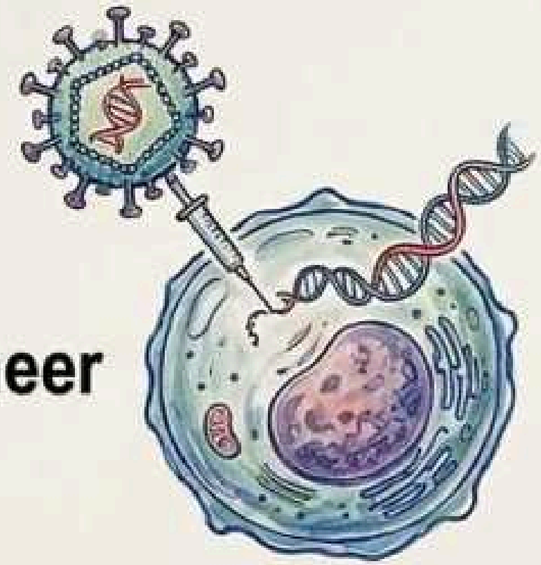
Current Research Focus: Predicting who will benefit and managing the severe side effects of an unbraked immune system.

1. Extract

T cells taken from the patient's blood.

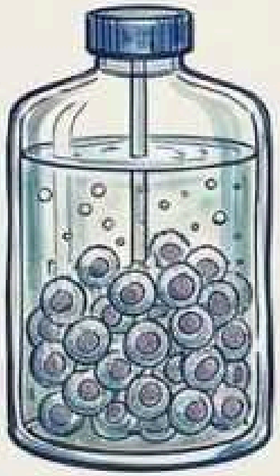


2. Engineer



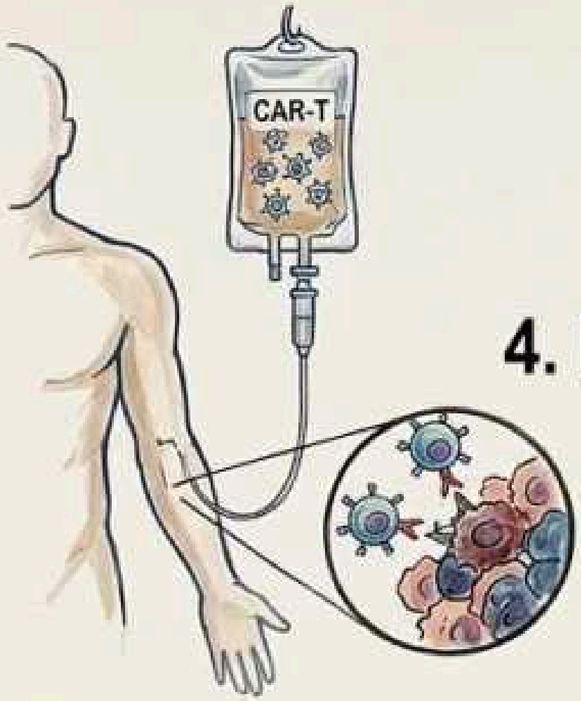
Gene added for a receptor that recognizes specific cancer molecules.

3. Multiply



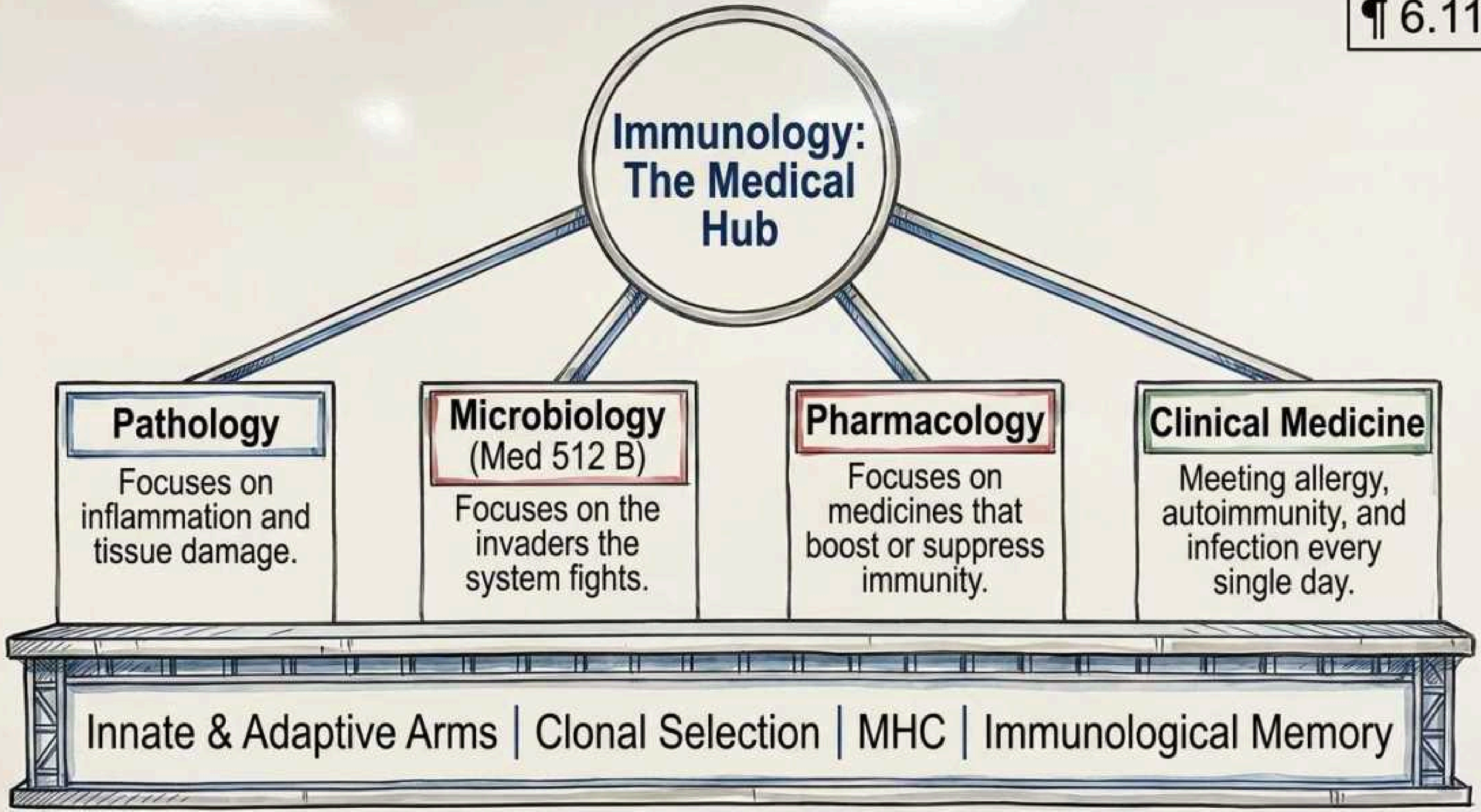
Engineered cells (CAR-T) are expanded in the lab.

4. Infuse



Cells hunt down certain blood cancers, producing remarkable remissions.

Approved since 2017. Highly complex, costly, and carries serious side effect risks. Restricted to specialized medical centers.


Immunology: The Medical Hub
Pathology
Focuses on inflammation and tissue damage.
Microbiology (Med 512 B)
Focuses on the invaders the system fights.
Pharmacology
Focuses on medicines that boost or suppress immunity.
Clinical Medicine
Meeting allergy, autoimmunity, and infection every single day.
Innate & Adaptive Arms | Clonal Selection | MHC | Immunological Memory

[Select 1: Allergy | Autoimmune | HIV
Transplant | Cancer]

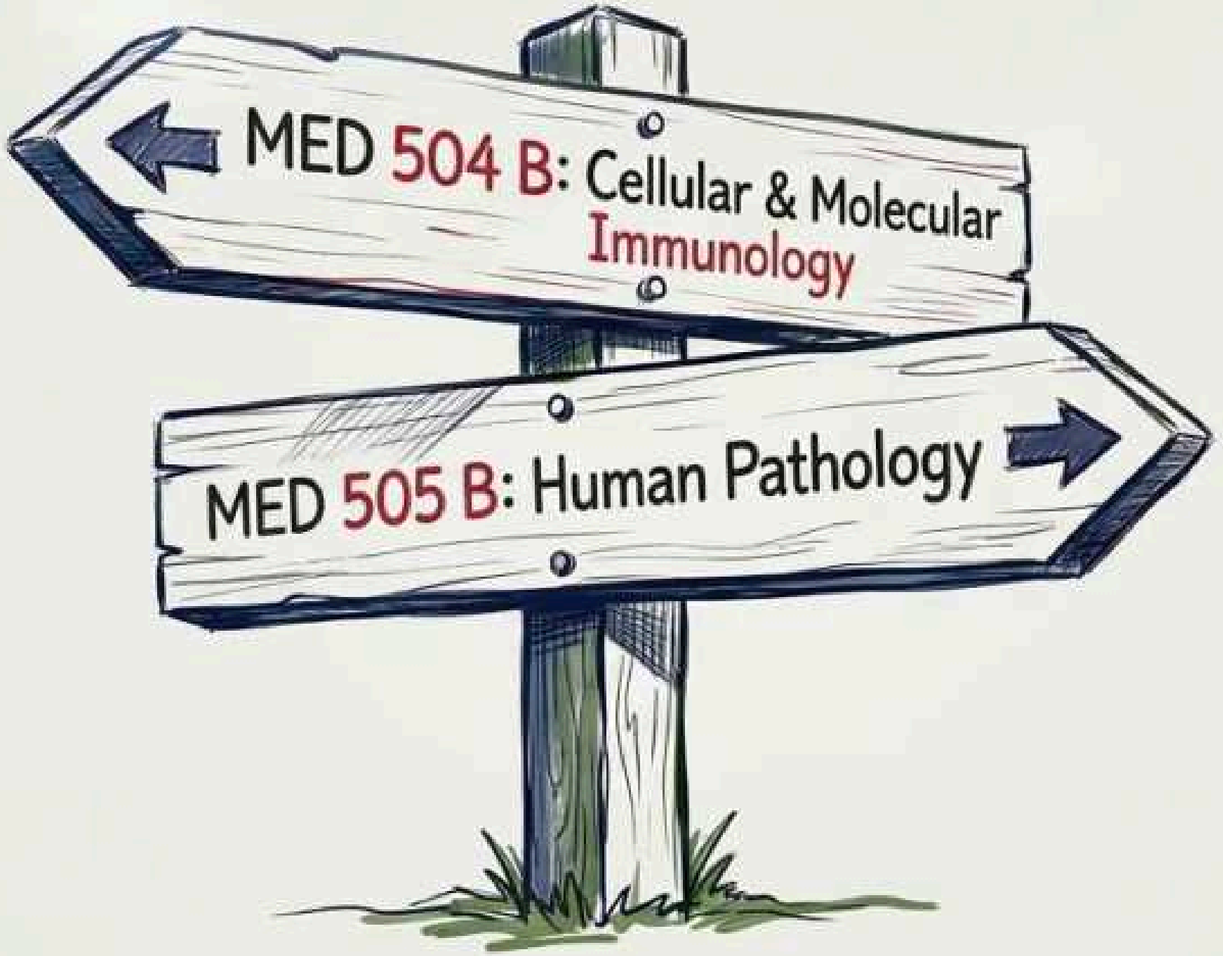
+

[Apply 3 core concepts from Lectures 1-5]

=

Complete Synthesis.

☐ Write your explanation, then check your answer against the official Course Book.



Thank you for taking Medicine 504 B.

References



Janeway's Immunobiology (5th ed) via NCBI Bookshelf



MIT HST.175 / HST.176 (Cellular and Molecular Immunology)



OpenStax Microbiology: Adaptive Specific Host Defenses



The Beautiful Cure by Daniel M. Davis



CDC: Understanding How Vaccines Work



Grokipedia: Immune system & Clonal selection



Anderson Academy Resources: BIO 240 B (Microbiology)



Anderson Academy Resources: MED 500 B (How to Use Medical School Courses)