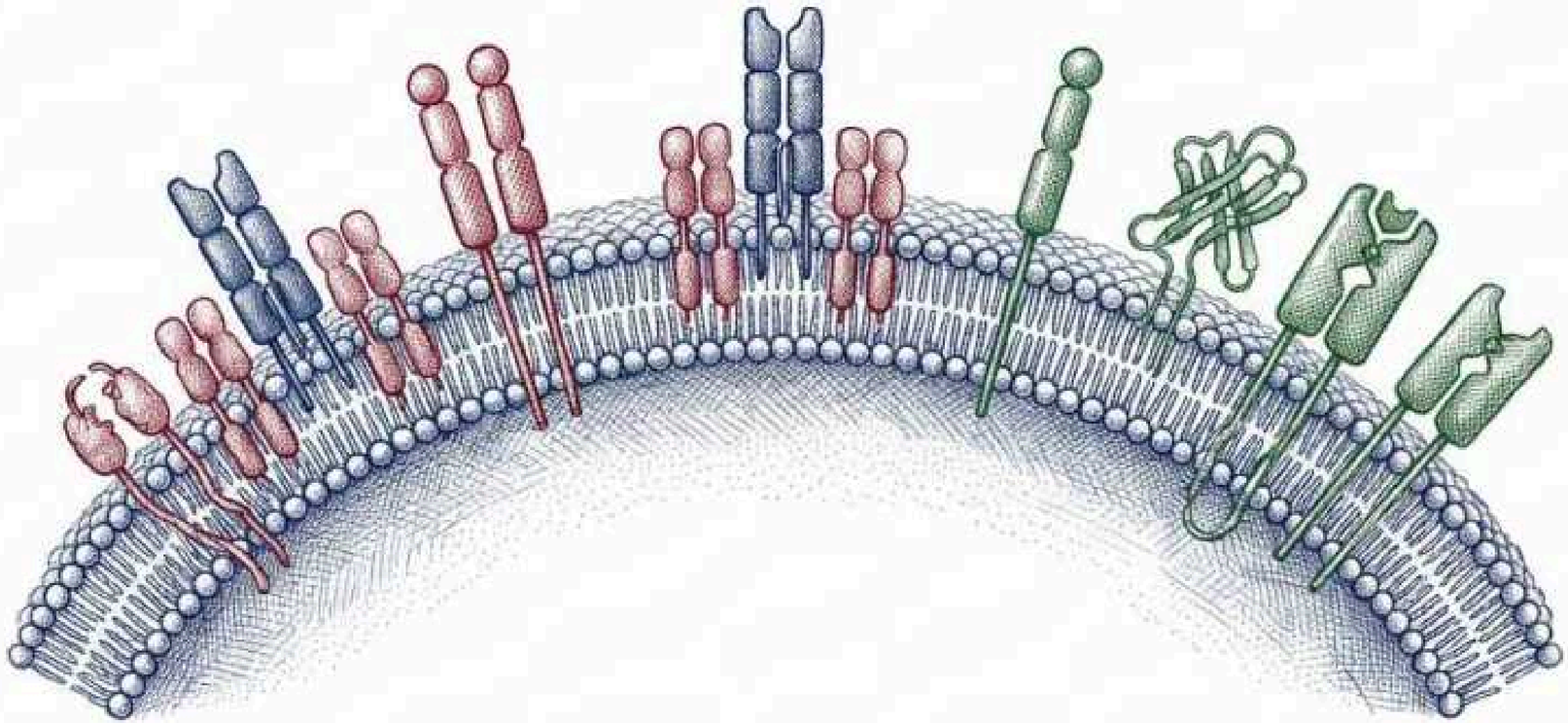
T Cells and Antigen Presentation

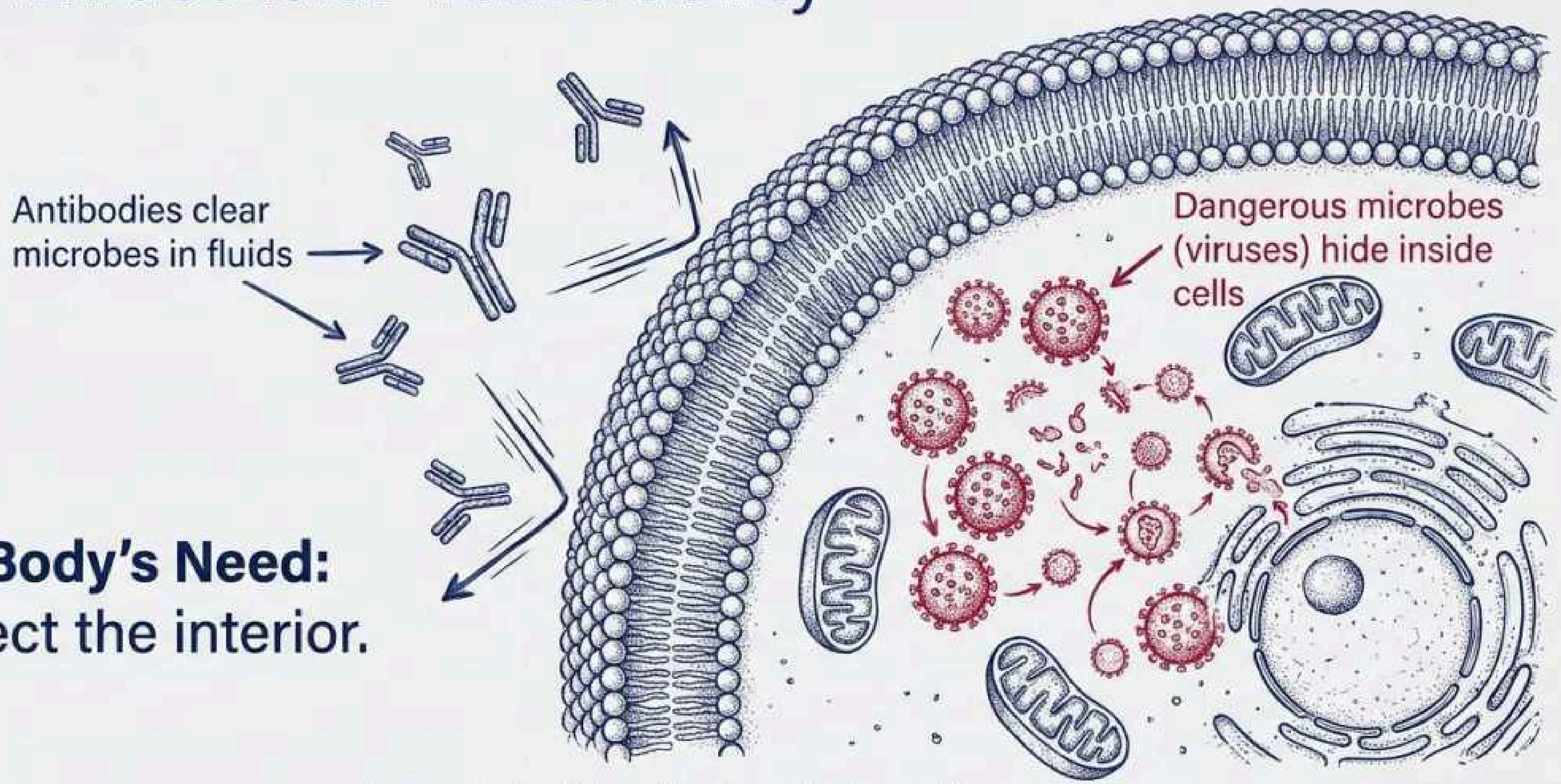
Inspecting the Inside of the Cell



Questions or feedback: garyanderson@mail.grokbot.com · X: @garyanderson

The Intracellular Vulnerability

[¶ 4.1]



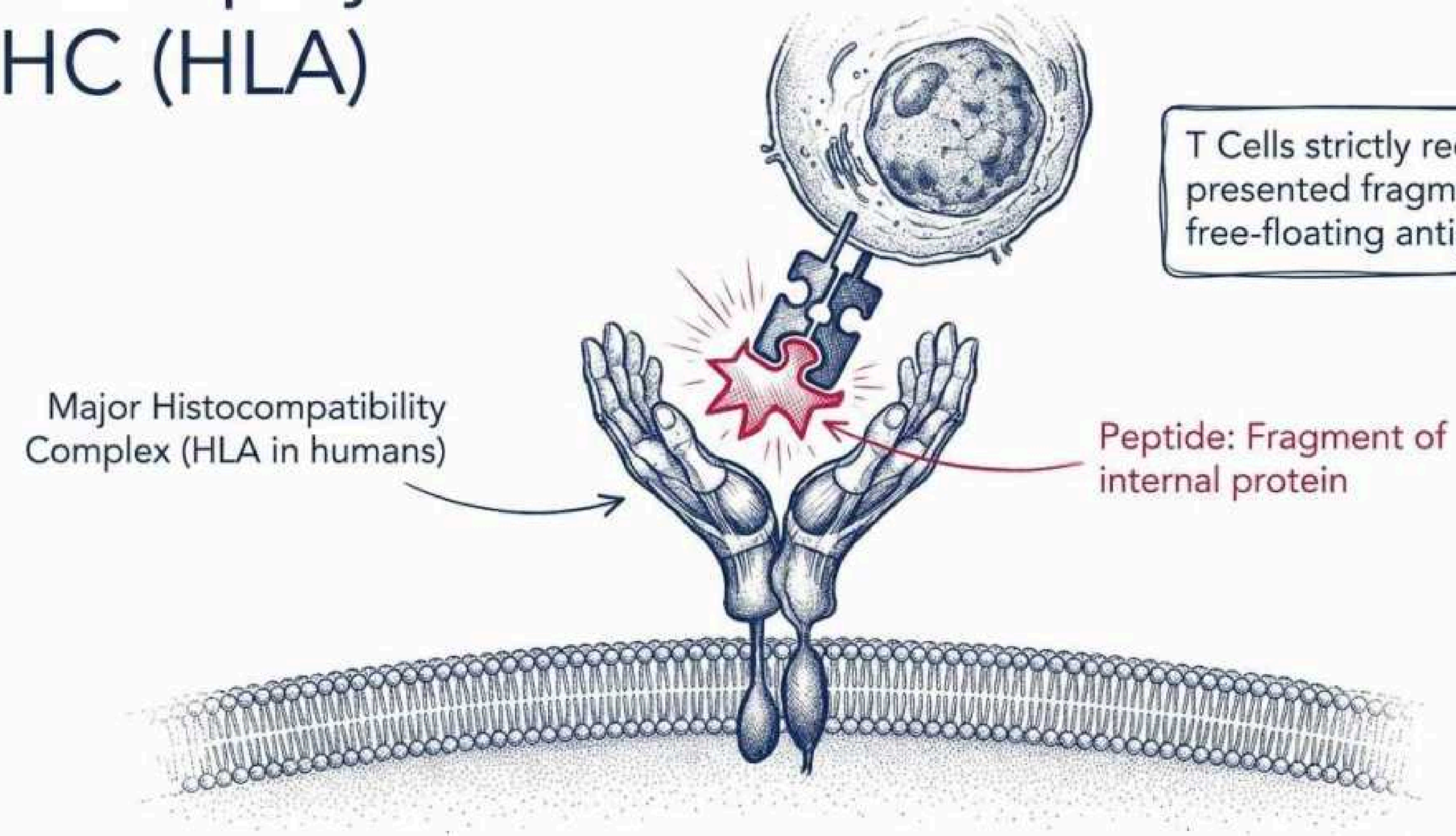
The Body's Need:
Inspect the interior.

That is the job of T cells.

The Display Mechanism: MHC (HLA)

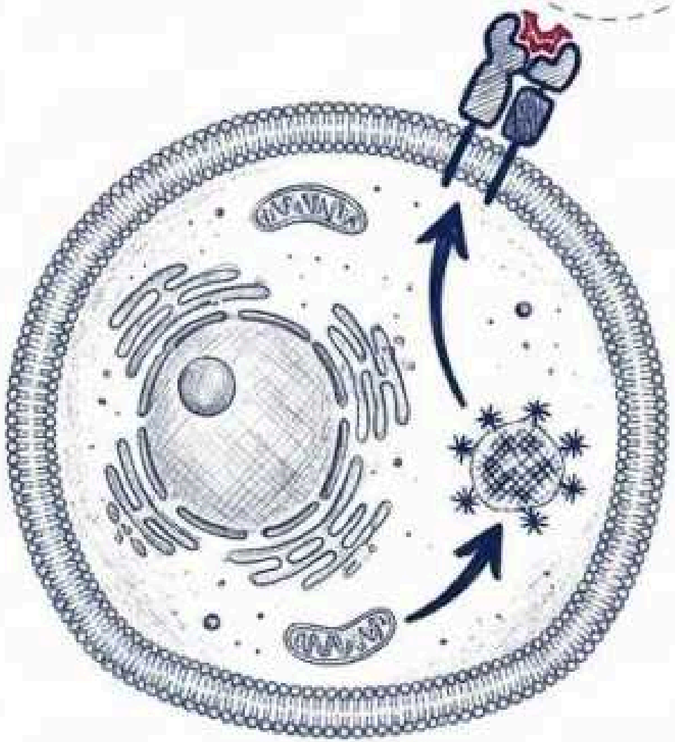
[¶ 4.2]

T Cells strictly recognize presented fragments, never free-floating antigens.



Two Platforms for Display

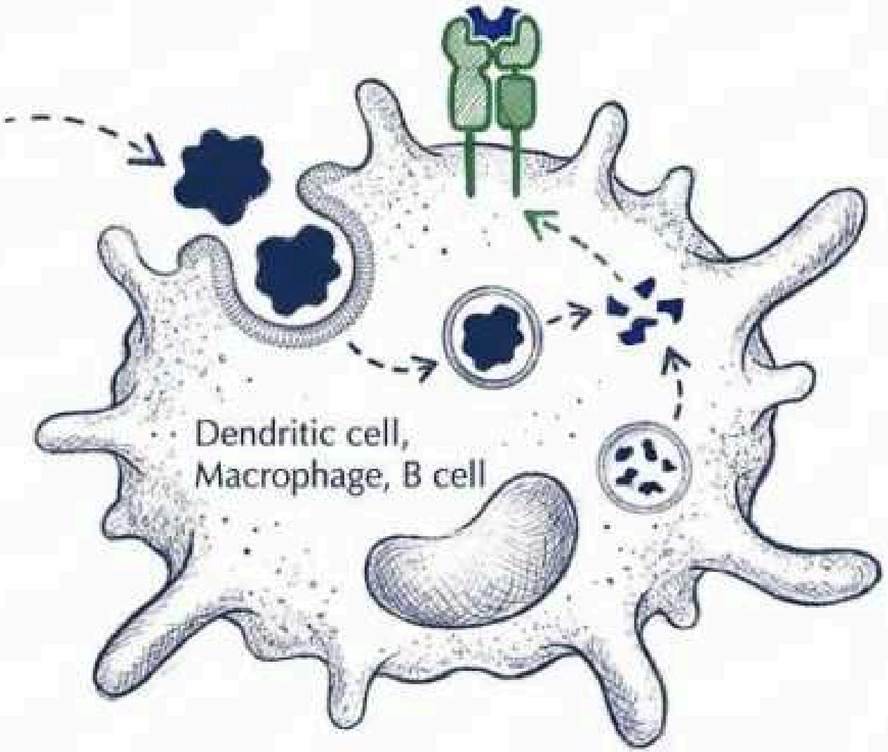
[¶ 4.3]



MHC Class I

Almost every nucleated cell

Displays internal proteins (e.g., viral factories)



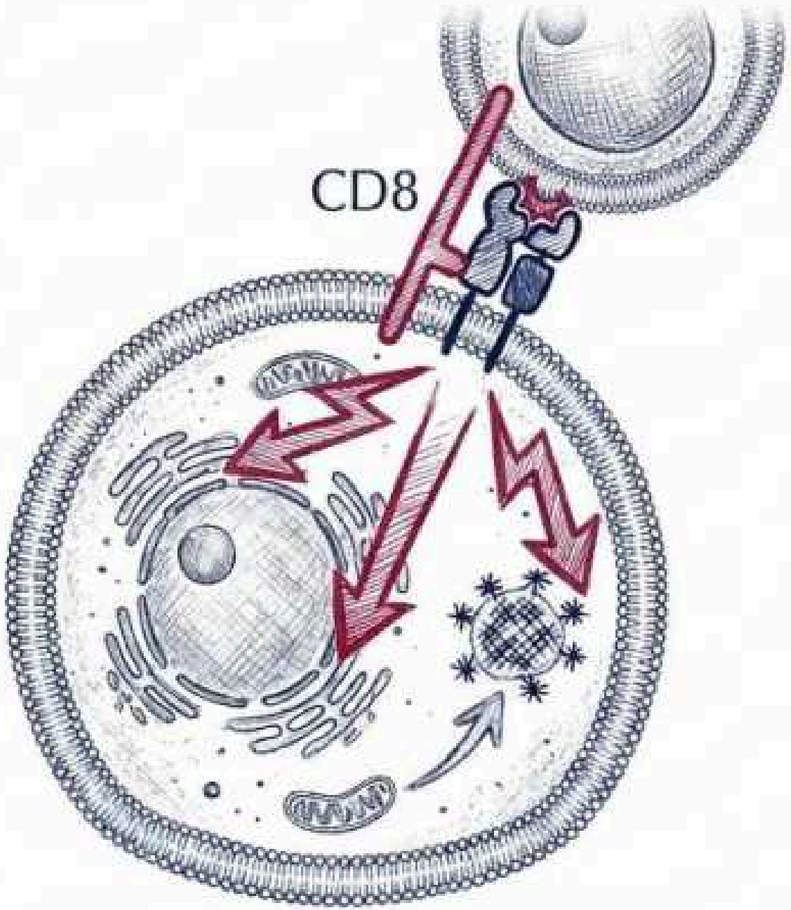
MHC Class II

Specialized Antigen-Presenting Cells only

Displays external engulfed material

Two Readers for the Display

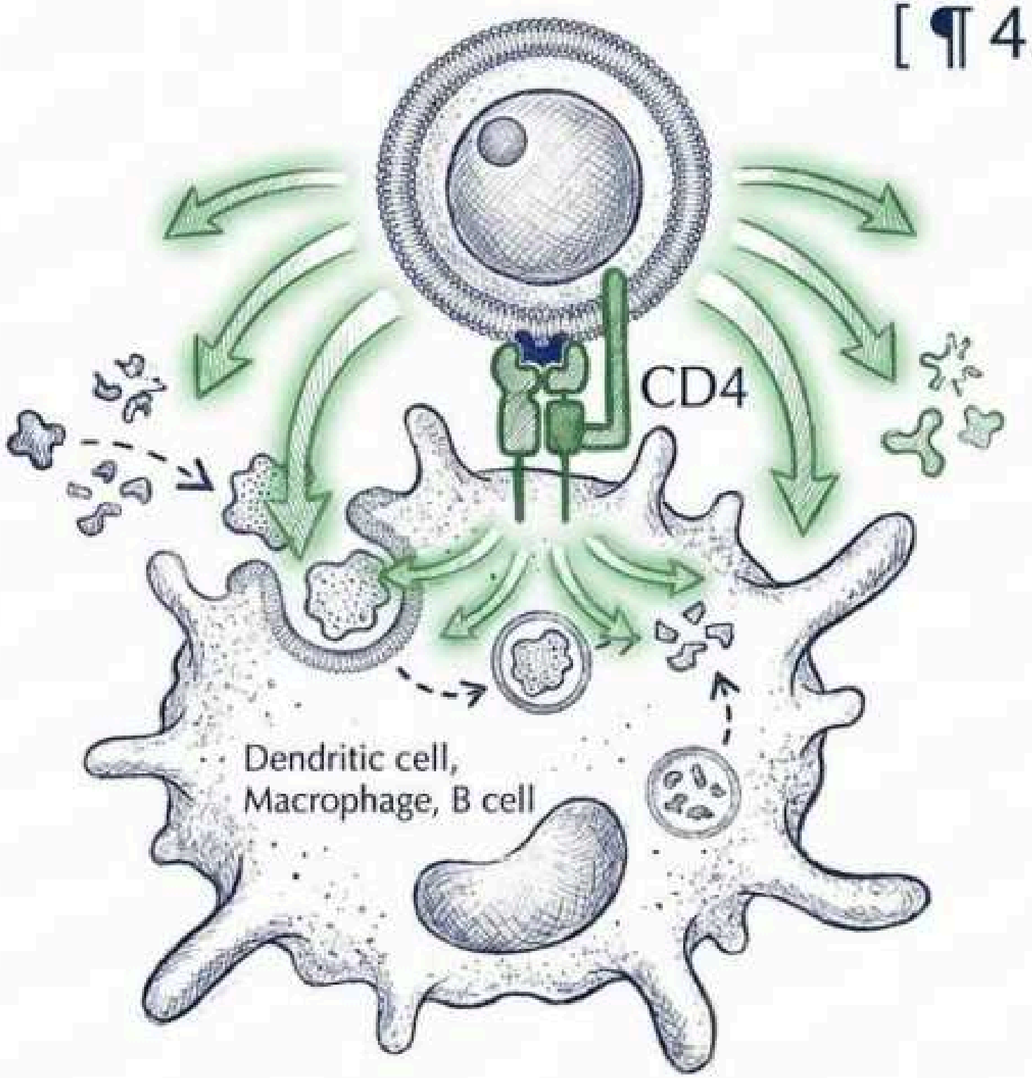
[¶ 4.4]



Cytotoxic (Killer) T Cell

Reads MHC I via CD8

Action: Forces infected cell to destroy itself.



Helper T Cell

Reads MHC II via CD4

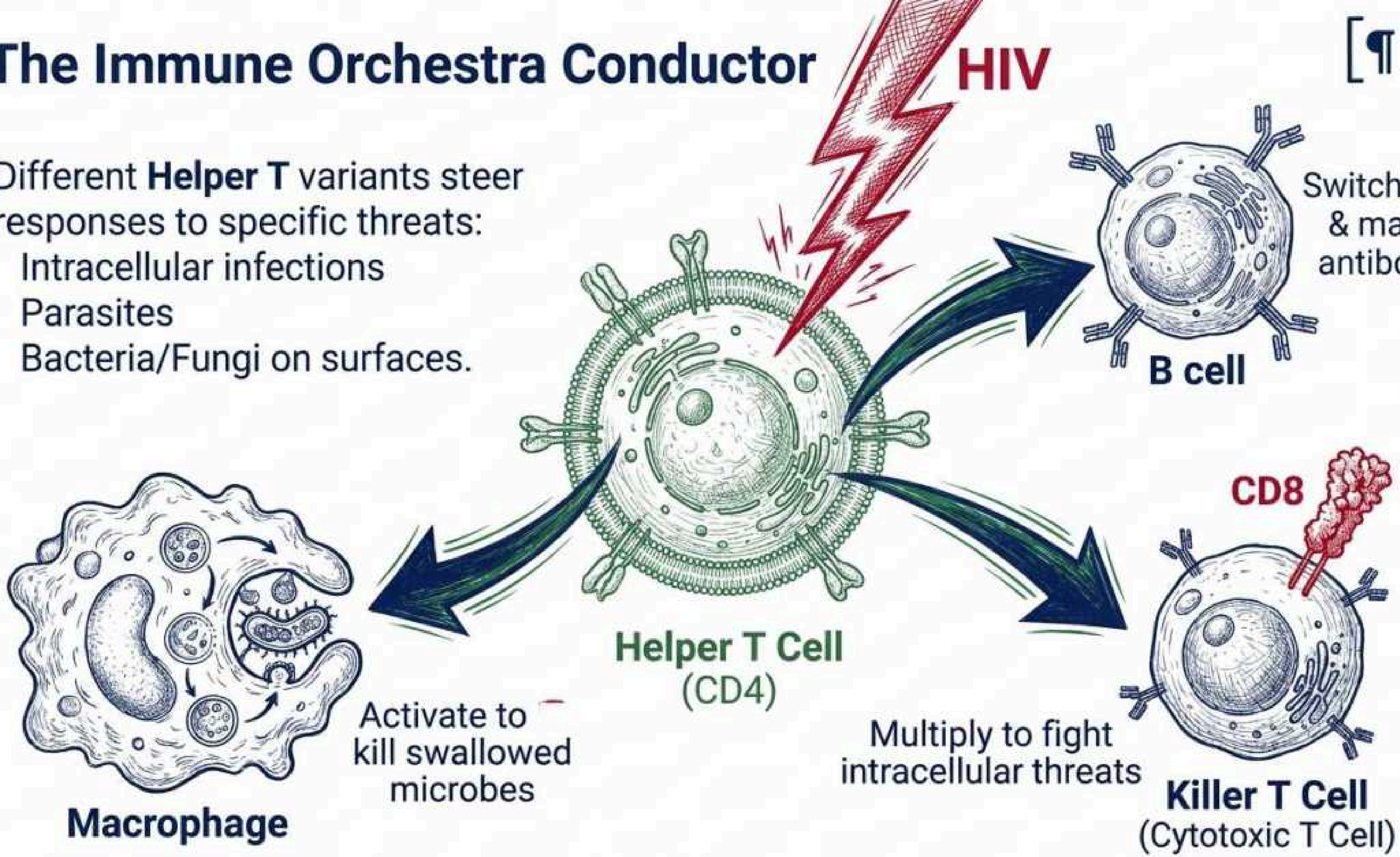
Action: Coordinates response via cytokines.

The Immune Orchestra Conductor

[¶ 4.5]

Different **Helper T** variants steer responses to specific threats:

- Intracellular infections
- Parasites
- Bacteria/Fungi on surfaces.

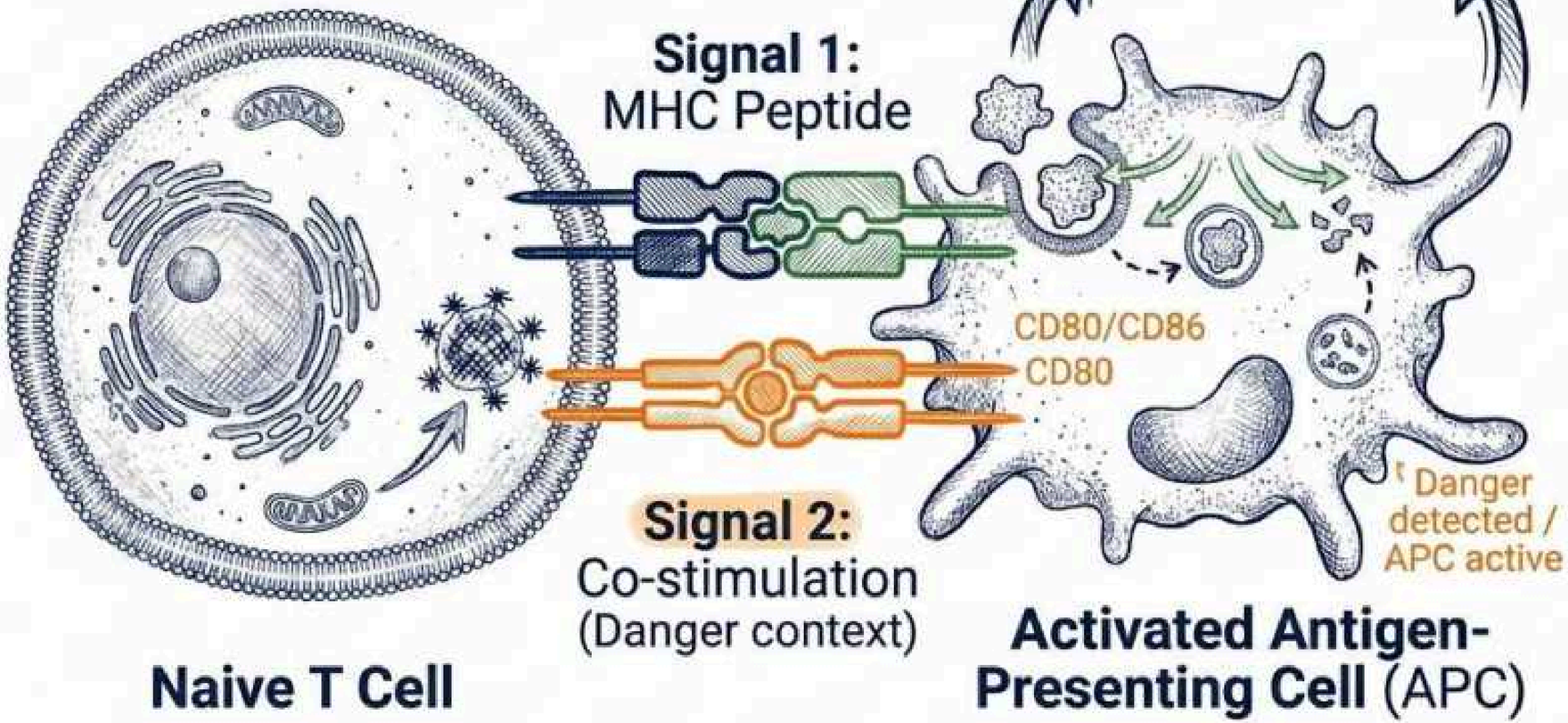


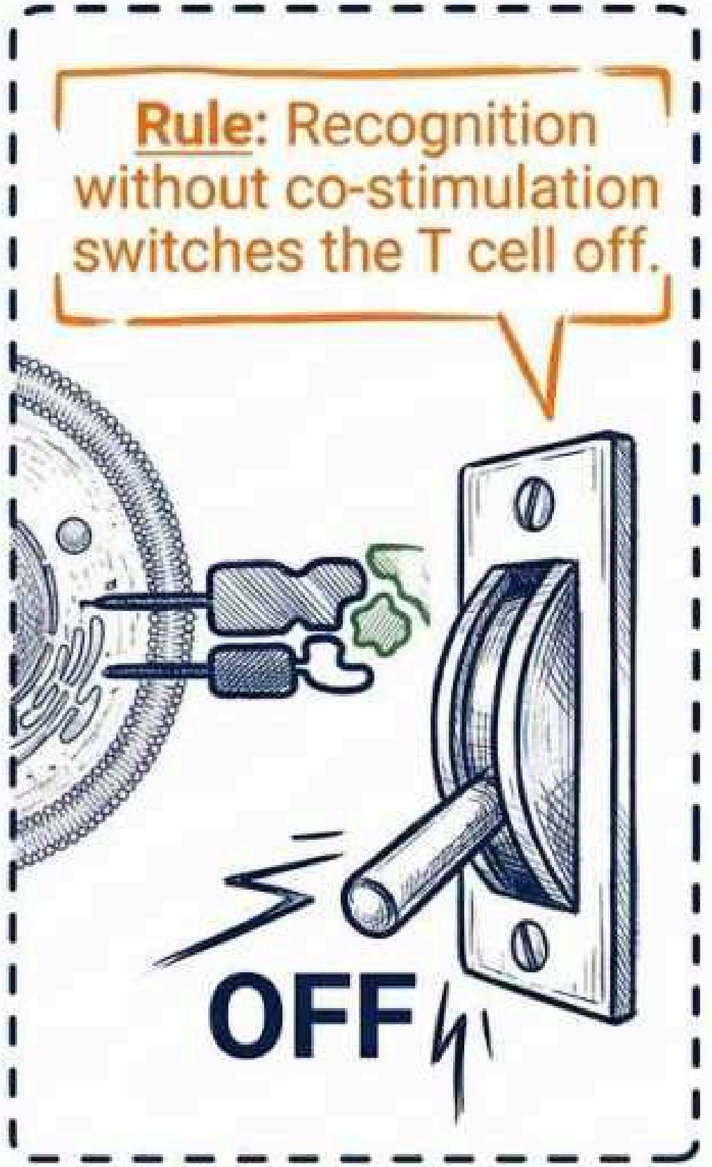
The Two-Signal Safeguard

[¶ 4.6]

Deliberately difficult activation

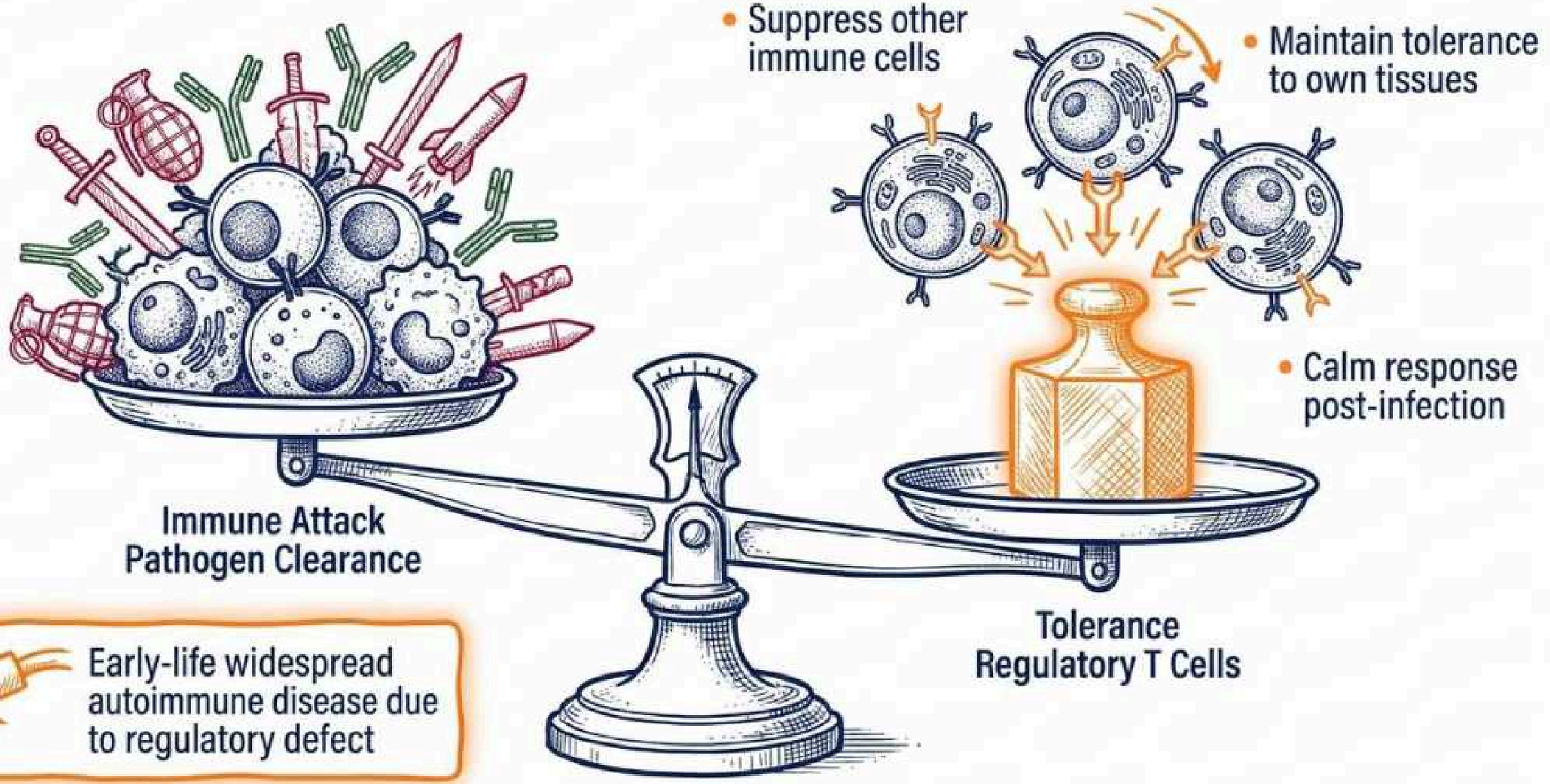
$$S_{MHC} + S_{CoStim} = \Delta T_{active}$$





Applying the Brakes: Regulatory T Cells

[¶ 4.7]



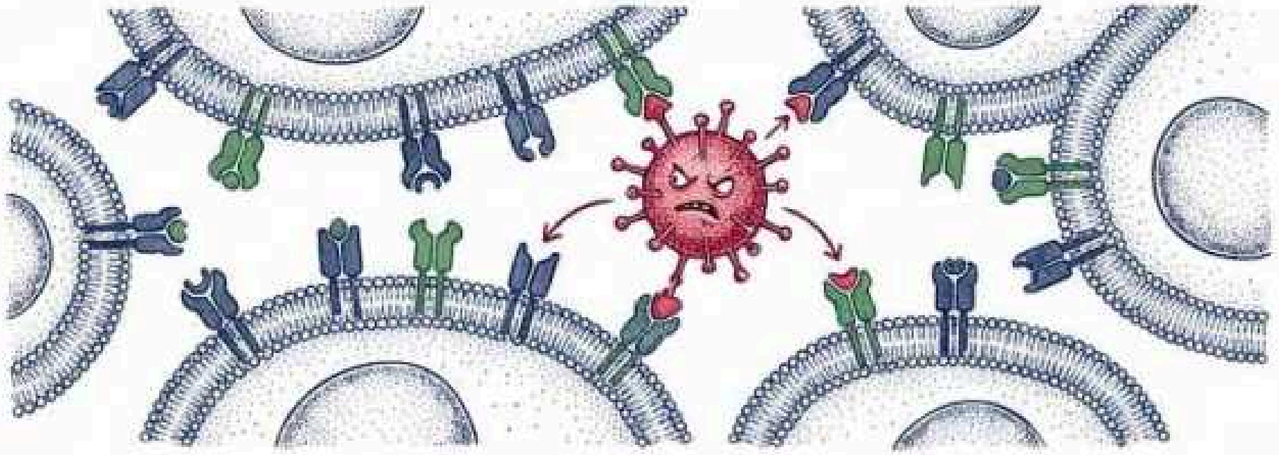
Early-life widespread autoimmune disease due to regulatory defect

The MHC Diversity Paradox

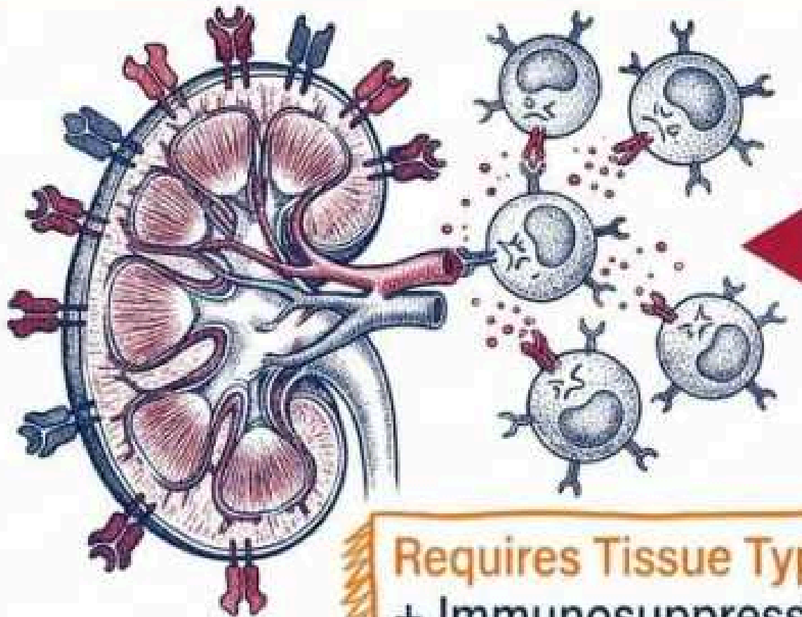
[¶ 4.8]

MHC genes vary enormously; everyone inherits a unique set.

High MHC Diversity
=
Population Survival



High MHC Diversity
=
Transplant Rejection

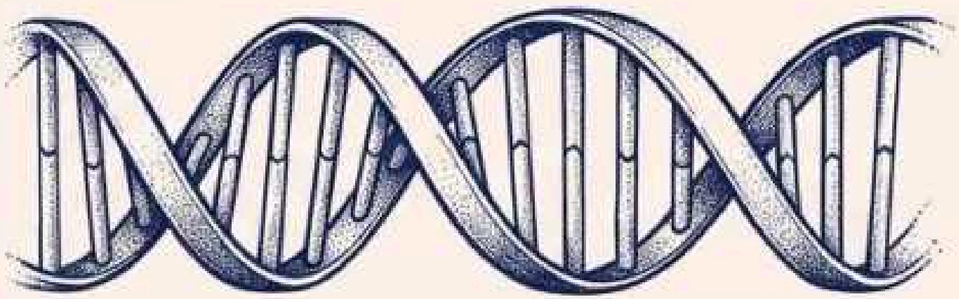


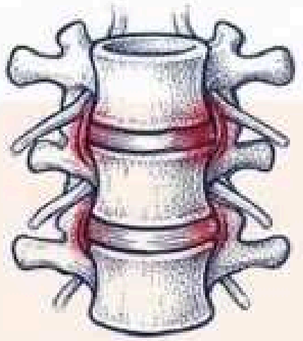
Transplant Complication:
Foreign MHC is attacked as a threat.

Requires Tissue Typing (matching donor/recipient)
+ Immunosuppressive medicines.

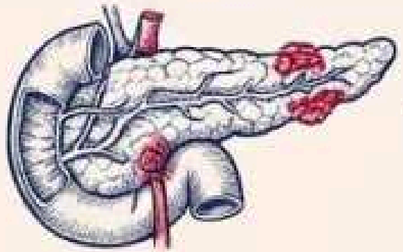
Genetic Links to Disease & Drug Risk

Particular MHC variants carry specific clinical risks.

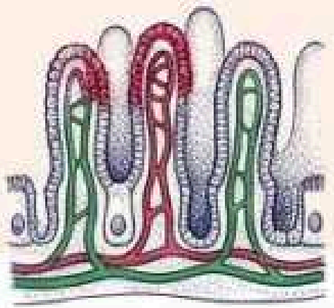




Arthritis of the spine



Type 1 diabetes



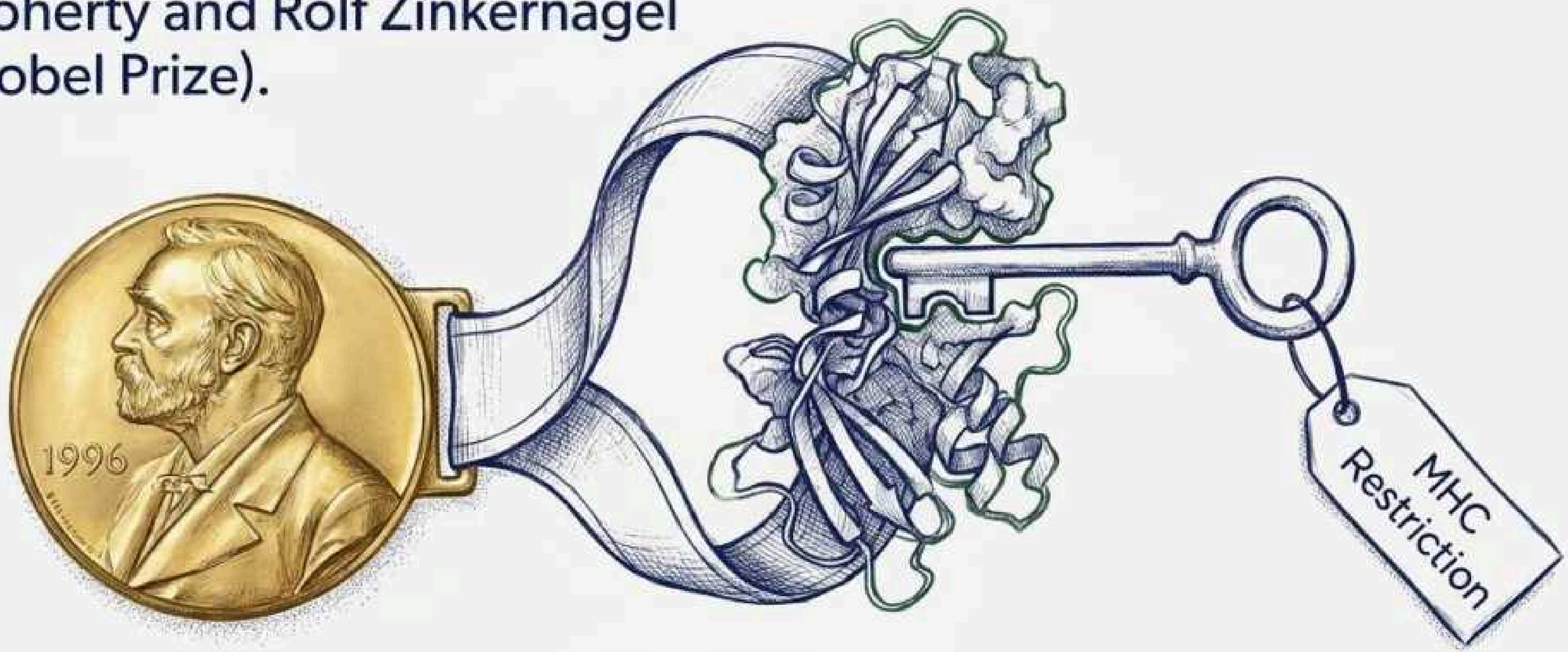
Coeliac disease



Medication Alert: Certain variants predict severe drug reactions, requiring predictive patient testing.

Discovering the Intracellular View

Peter Doherty and Rolf Zinkernagel
(1996 Nobel Prize).

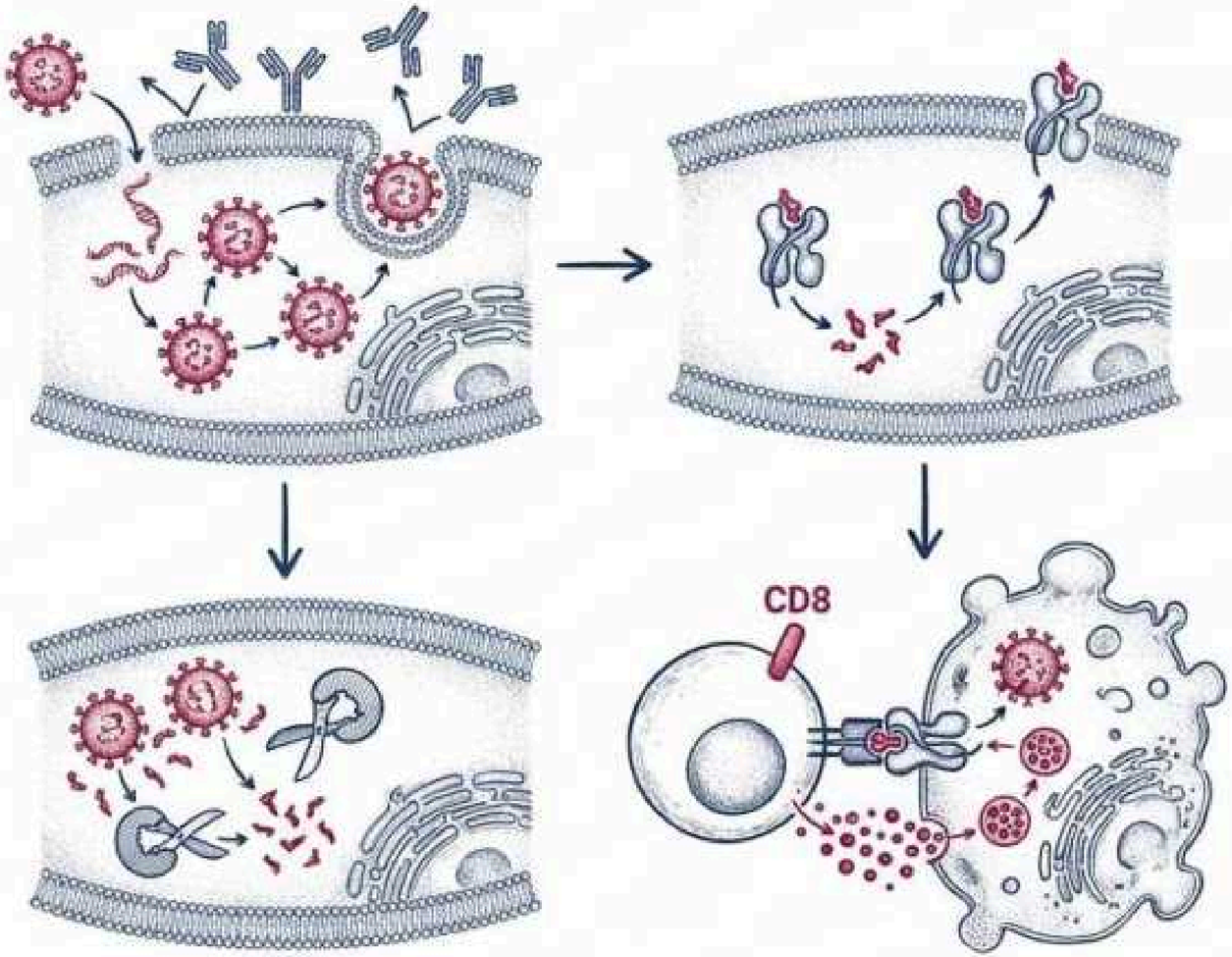


Explained, at last, how the immune system looks inside our cells by proving T cells are restricted to recognizing peptides on the person's own MHC.

Synthesis Question

[¶ 4.11]

A virus infects cells in your lung. Explain how your killer T cells are able to find and destroy those infected cells, when antibodies cannot reach the virus inside them.



Looking Ahead: Lecture 5

How the immune system remembers, and how vaccines utilize that memory.

