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Introduction into the immune system

The cells involved in a “normal” immune response

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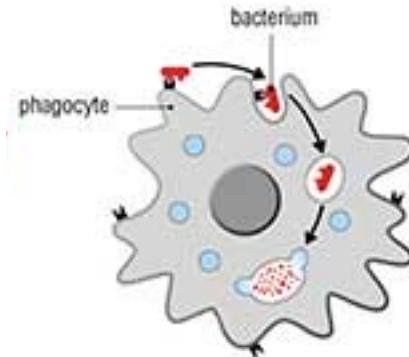


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The immune systems

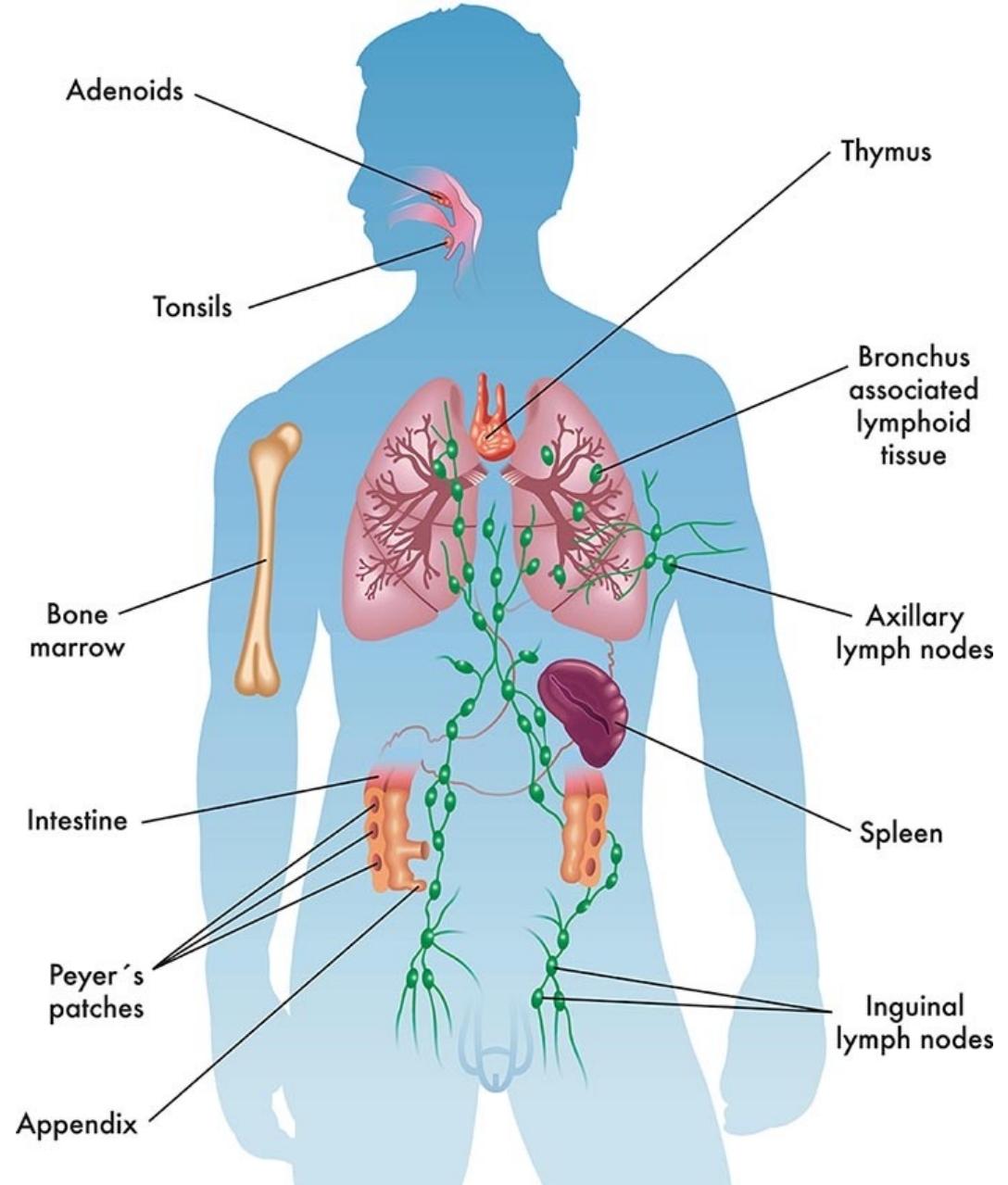
Innate immune system:

- „*fast but stupid*“
- Mechanical Barriers:
 - Skin, sweat, microbiome
 - Mucus membranes
 - stomach (acid)
- Cells:
 - Macrophages, Neutrophils,
 - ...



Adaptive immune system:

- „*slow and clever*“
- cells:
 - B-cells, T-cells, ...



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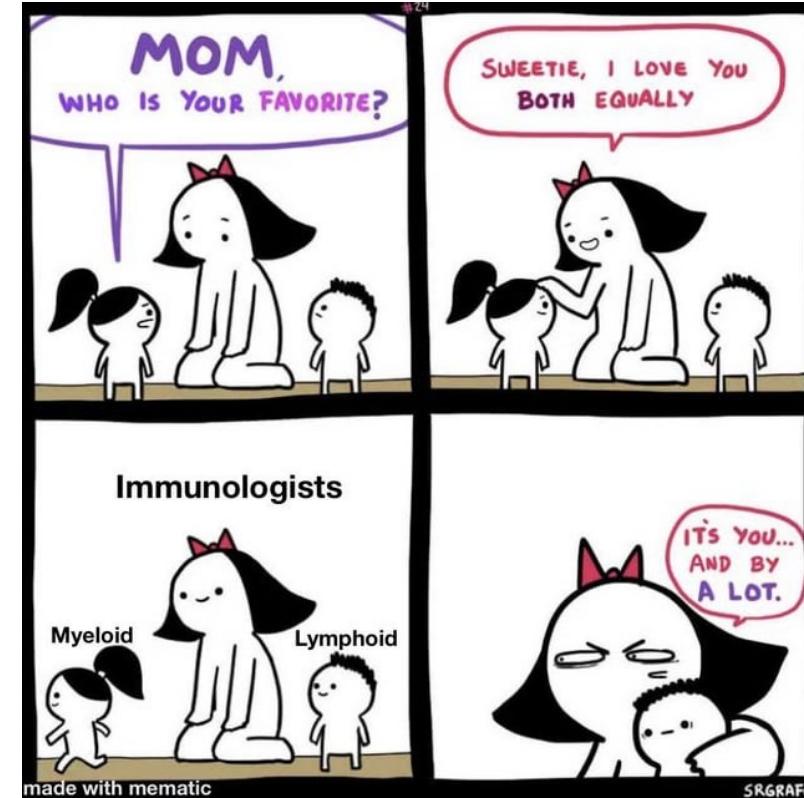
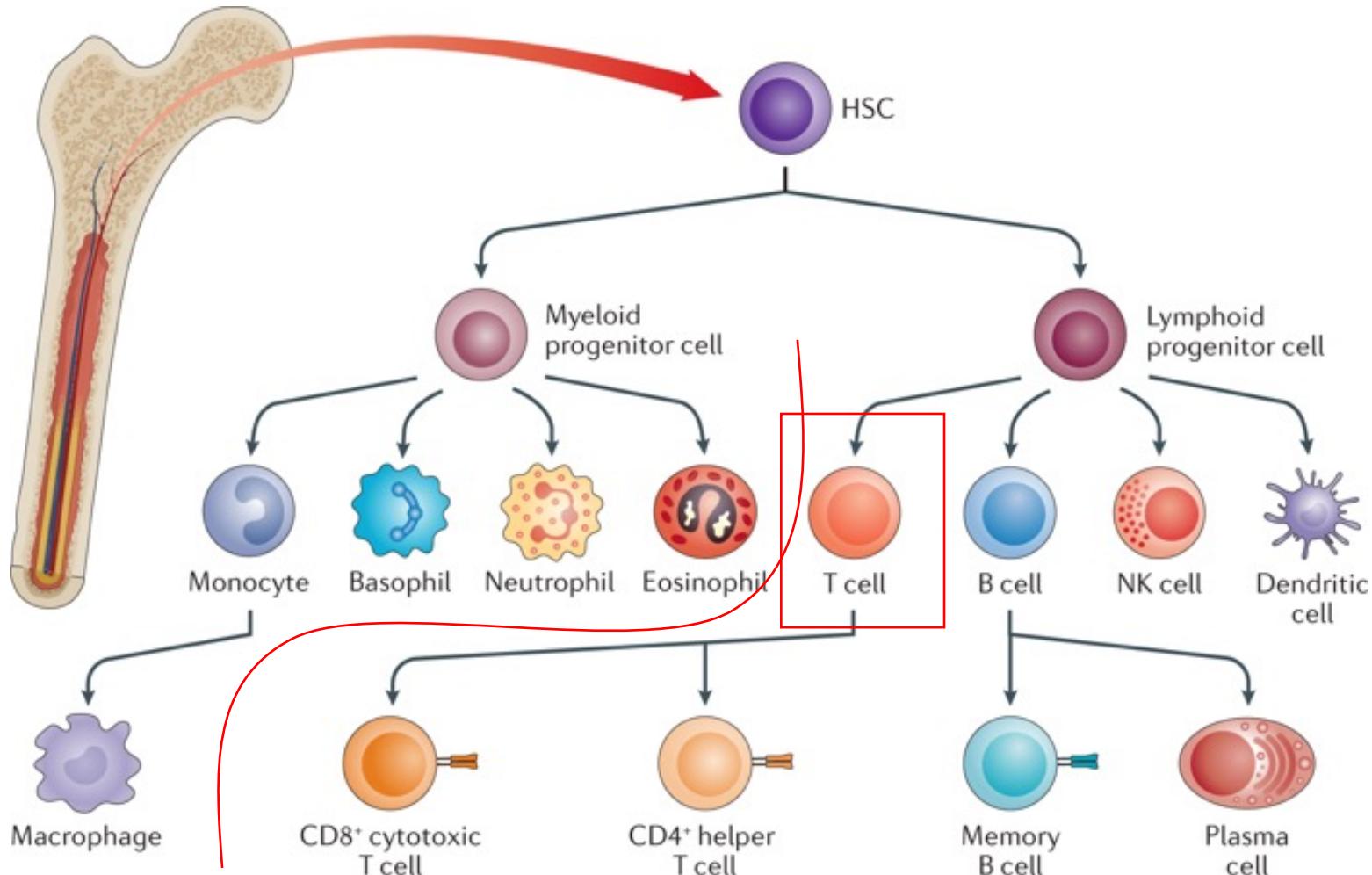
David Vetter – „Bubble Boy“



Severe Combined Immunodeficiency (SCID)

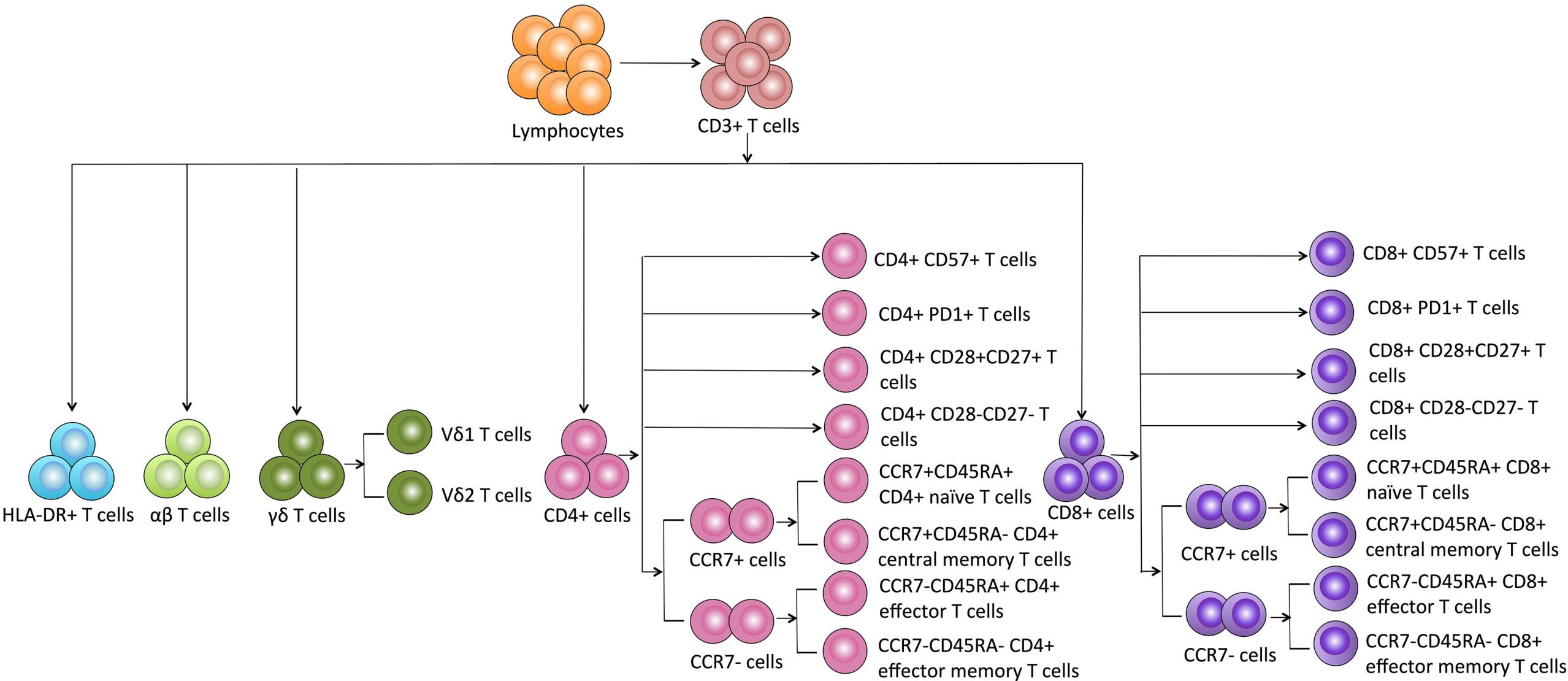
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The cells of the immune system

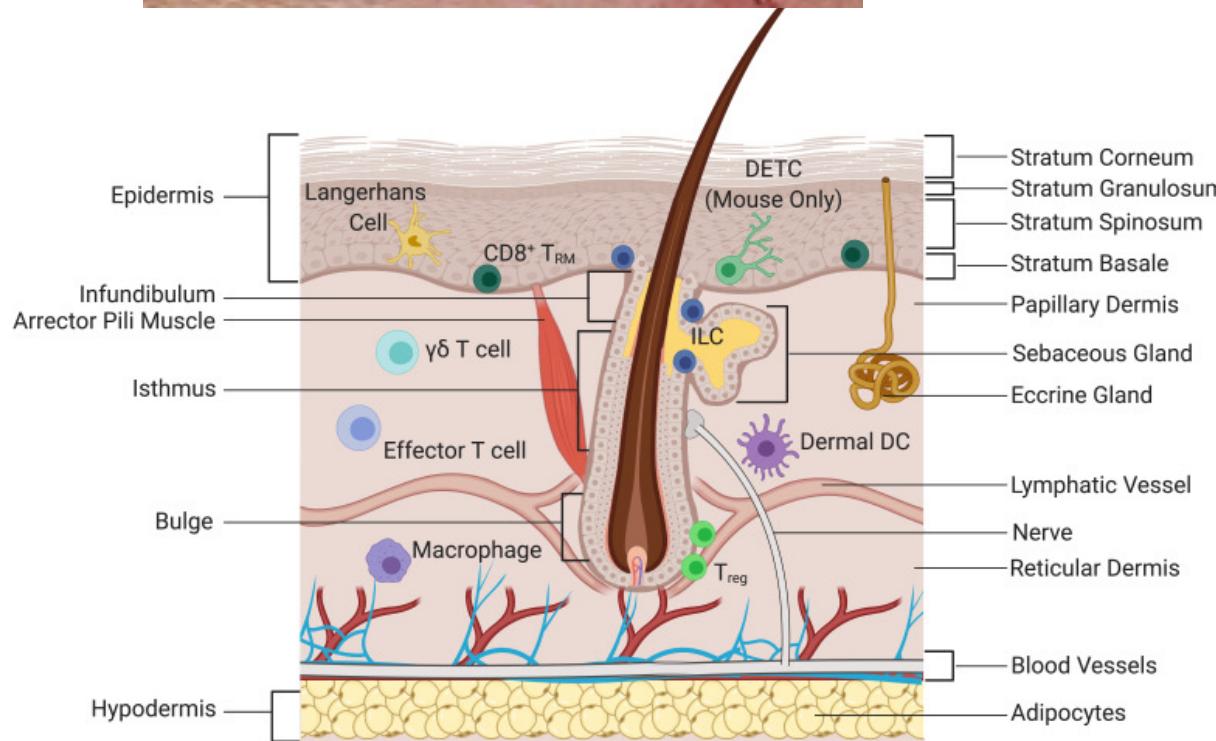
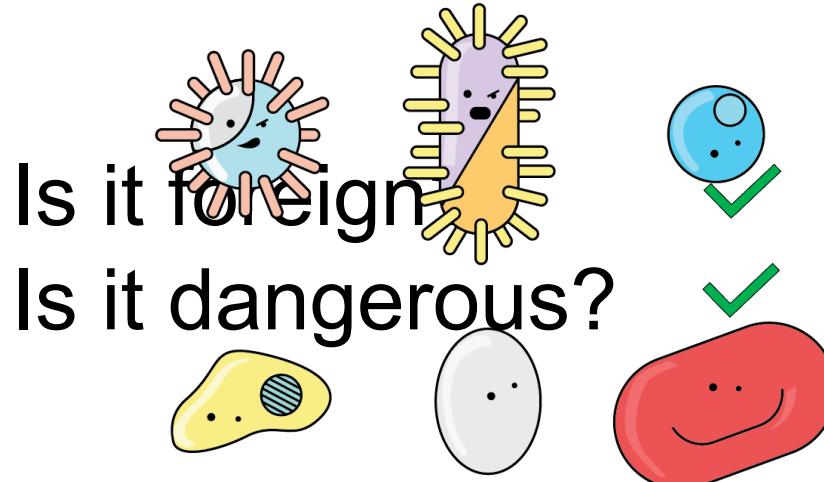


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The world of T cells



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Foreign?

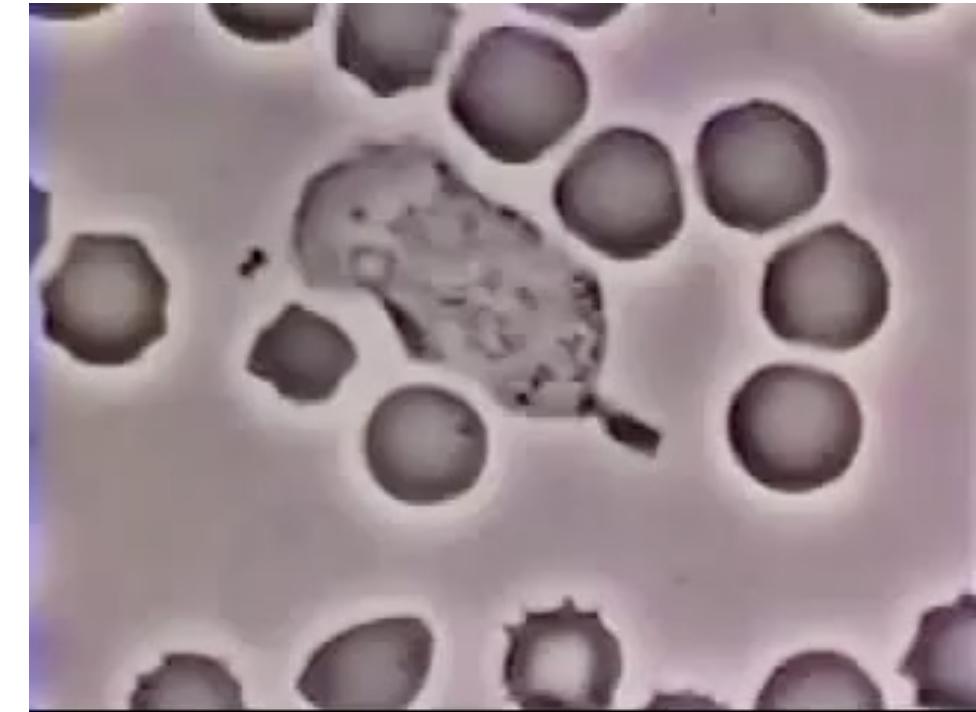
Toll like receptors (TLR)

- cell wall
- liposaccharides
- flagellin

Dangerous?

Things that should be inside cells
are now outside (DNA, IL-1b)

u^b Macrophages and Monocytes



Almost every tissue has its own version of macrophages.

Brain – Microglia

Liver – Kupffer cells

Lung – Alveolar macrophages

....

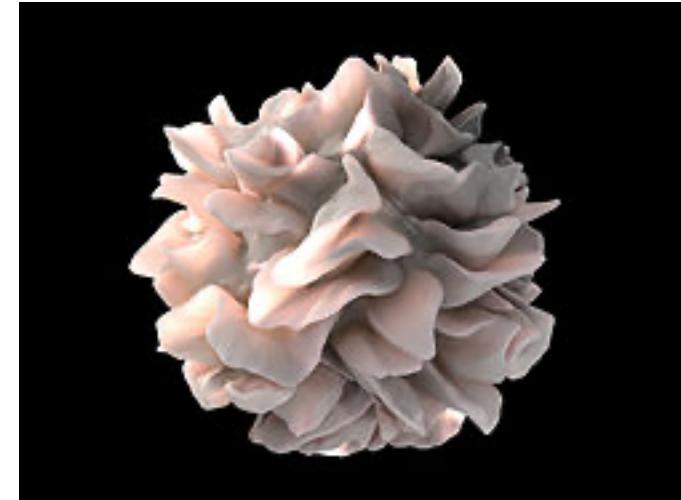
When macrophages die they get replaced by monocytes from the blood that become macrophages or DCs.
Monocyte derived MP or DCs are not as “good” as the OGs

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Dendritic cells (DCs)



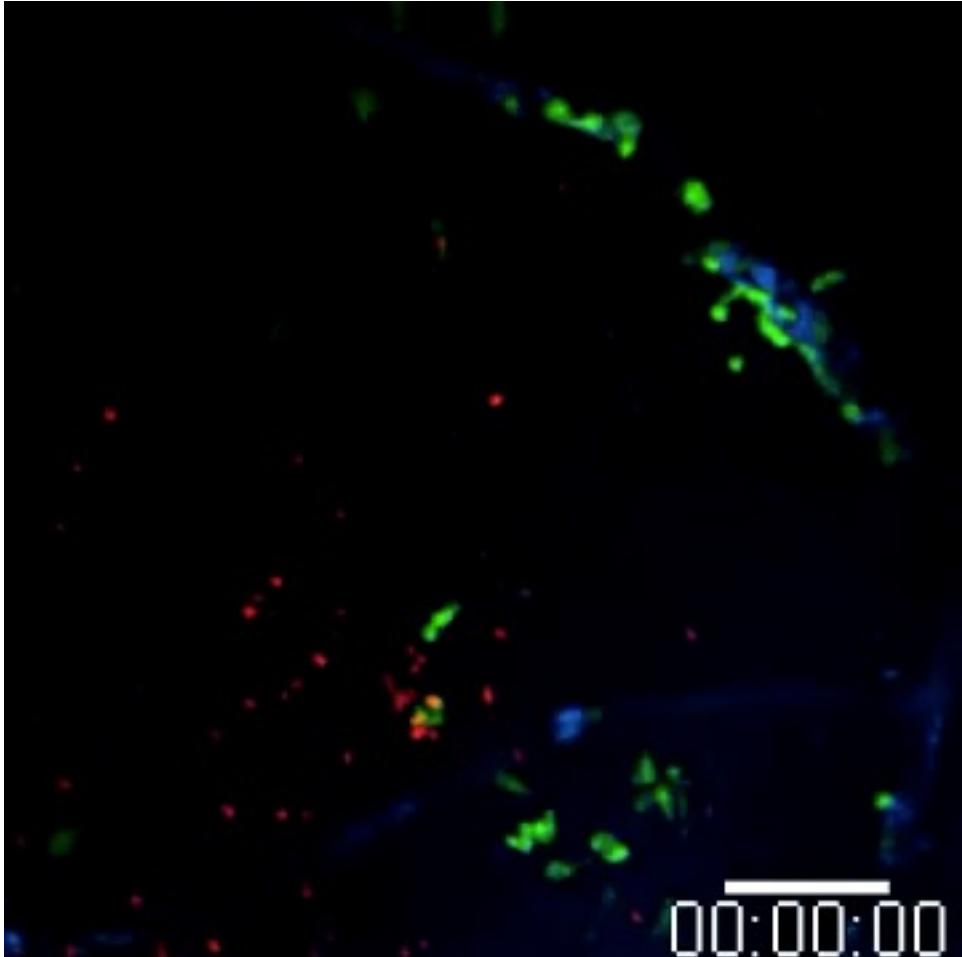
Eat bacteria and cell debris and travel via the lymph to the next lymph node



A lot of research is currently done to find out how many versions of DCs there are.
At least two: conventional DCs (cDC 1 and cDC 2) and pDCs
It is not always clear if a cell is a DC or a macrophage (eg. Langerhans cells in the skin) especially when it is monocyte derived.

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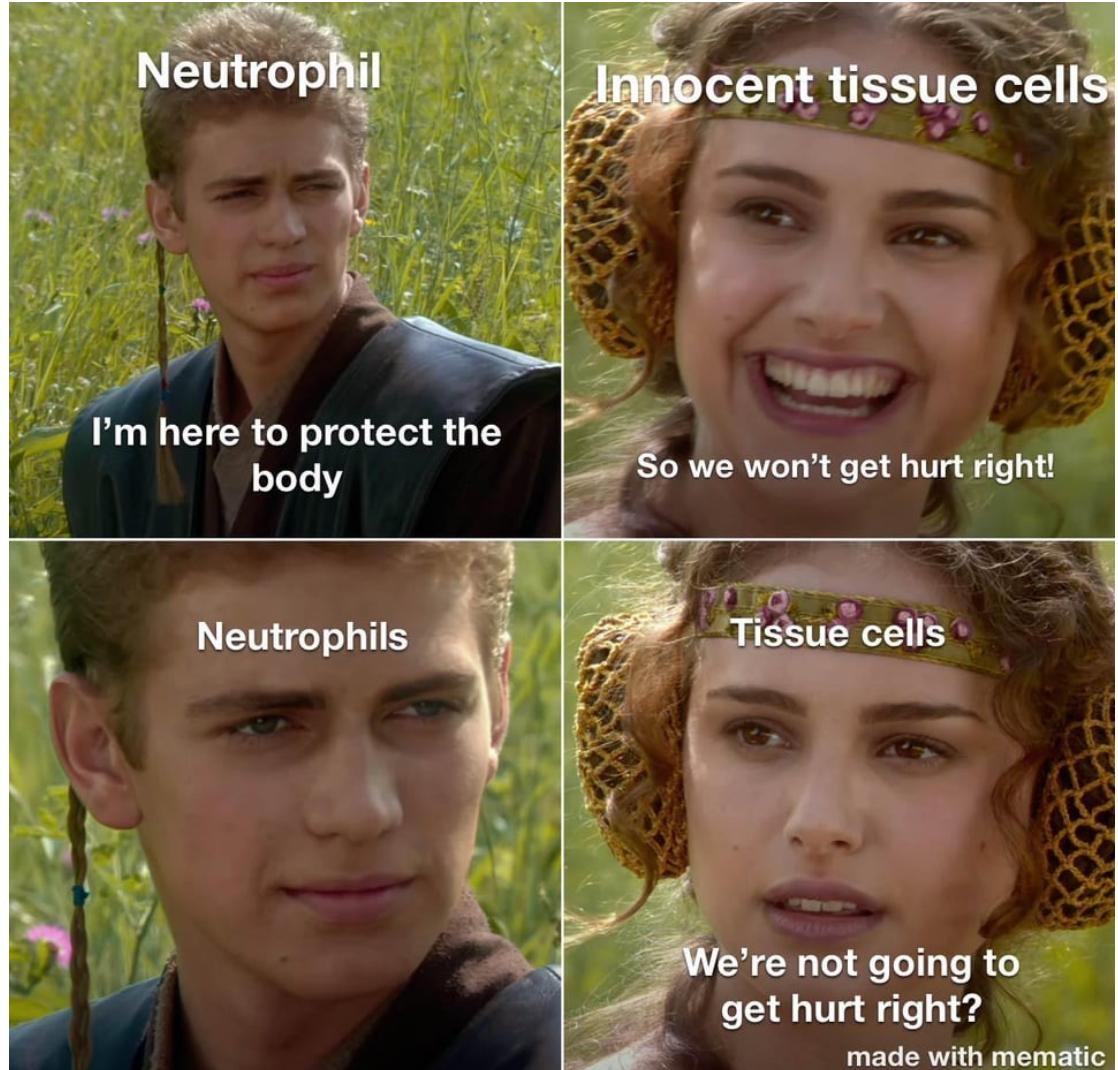
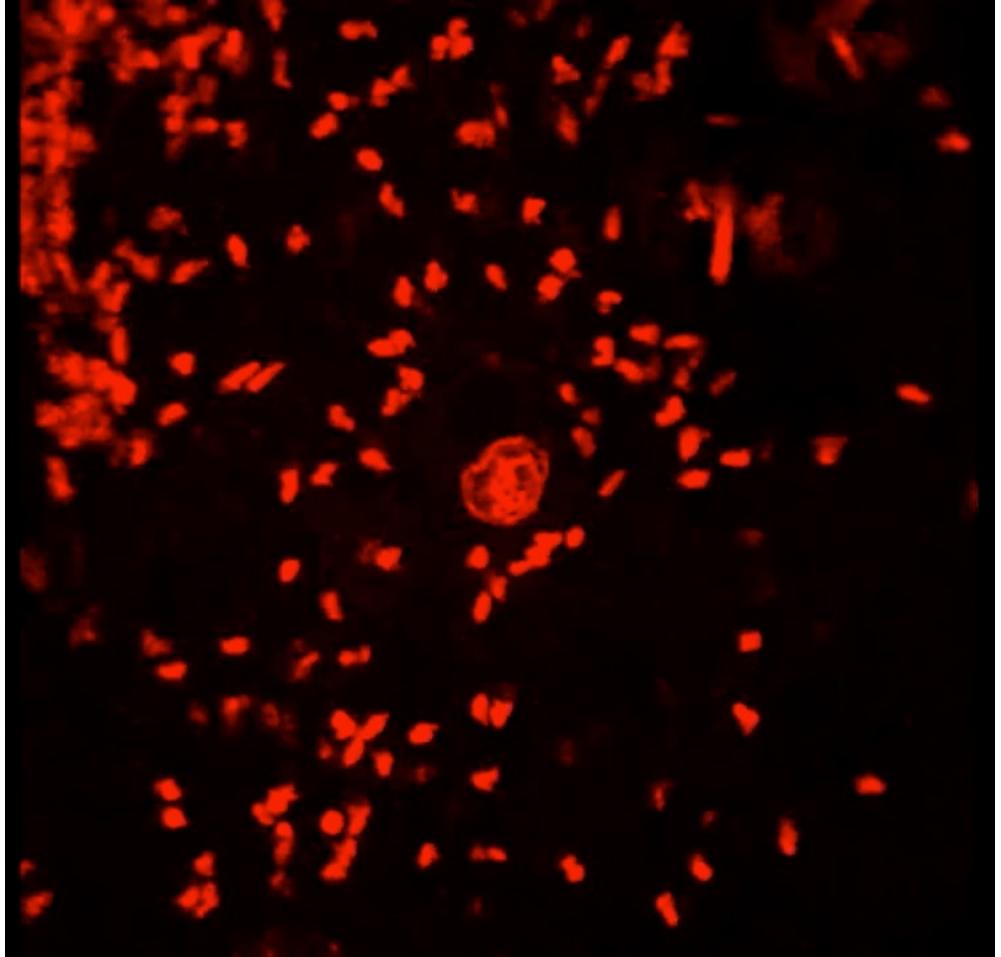
Neutrophils



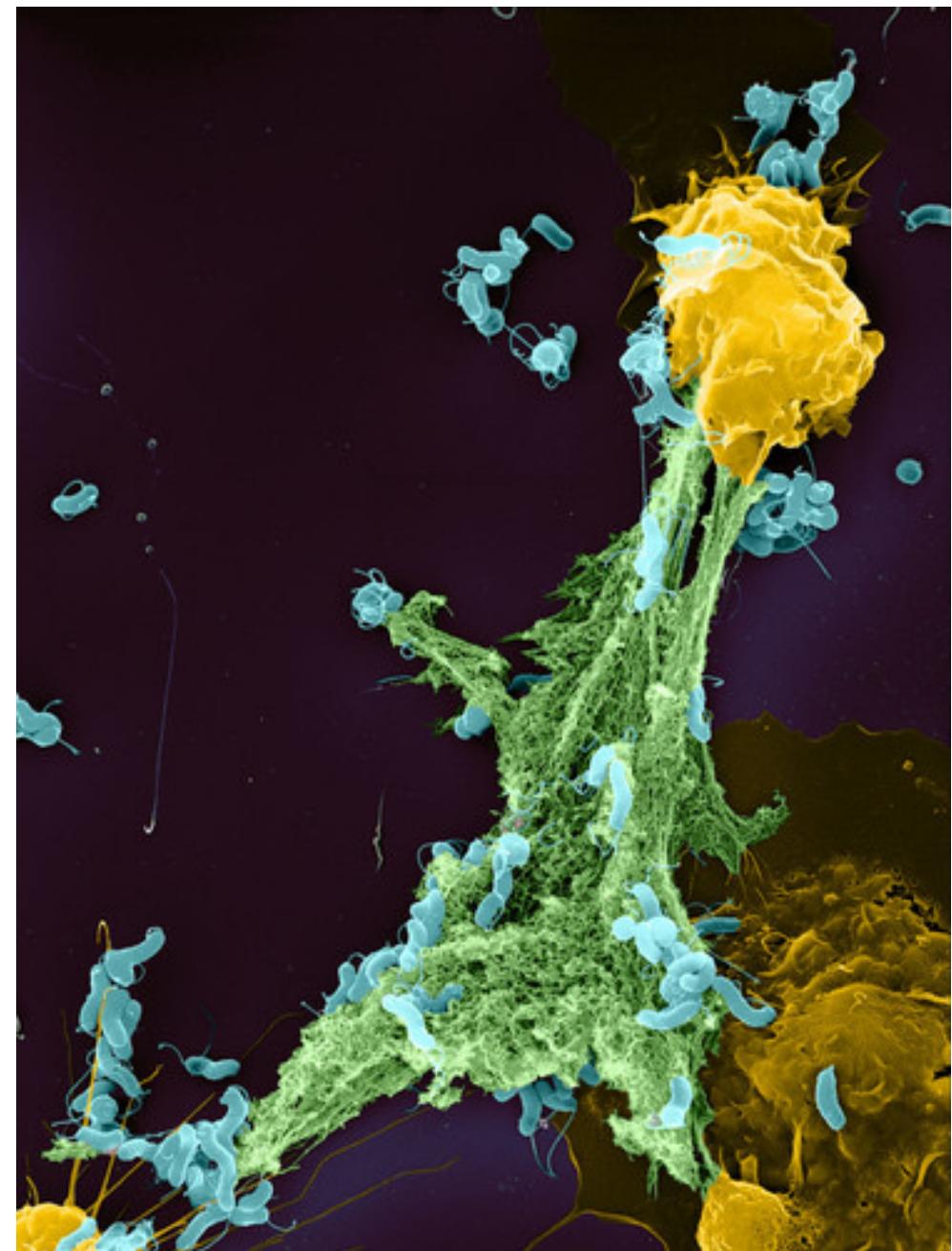
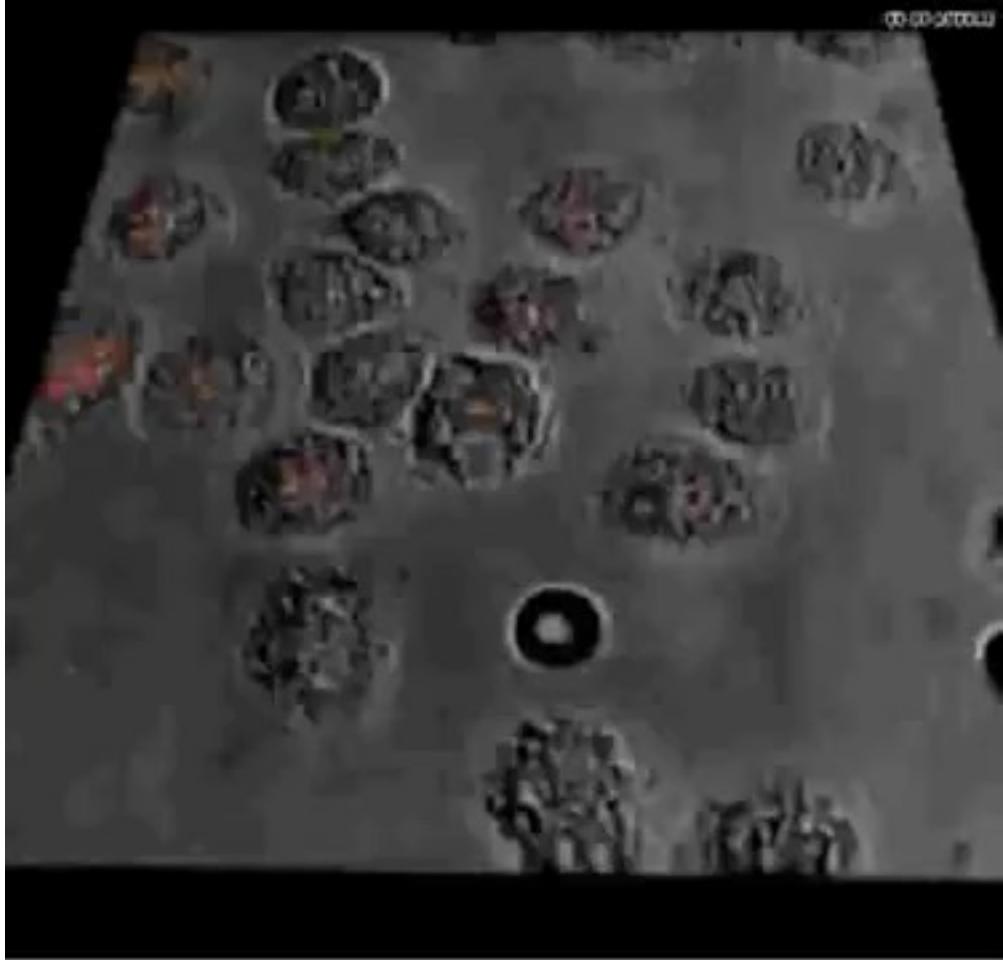
Blue – Blood vessels
Red – Bacteria
Green – Neutrophils

- Most common white blood cells (50 - 65%)
- Tasks: Identify and destroy microorganisms
- Every day the human body produces over 100 billion neutrophils in the bone marrow
- Neutrophile can „vomit out“ their DNA
- Pus is mostly dead neutrophils

u^b Neutrophils

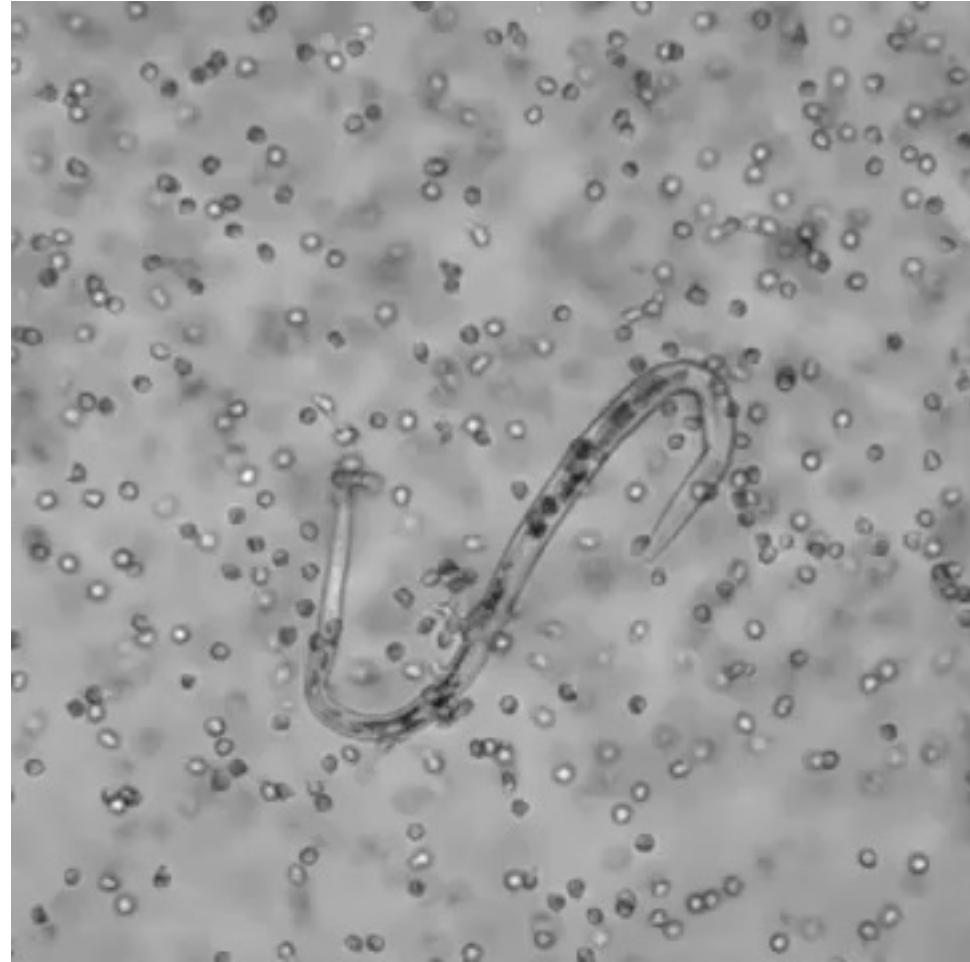


u^b NETs (Neutrophil extracellular traps)

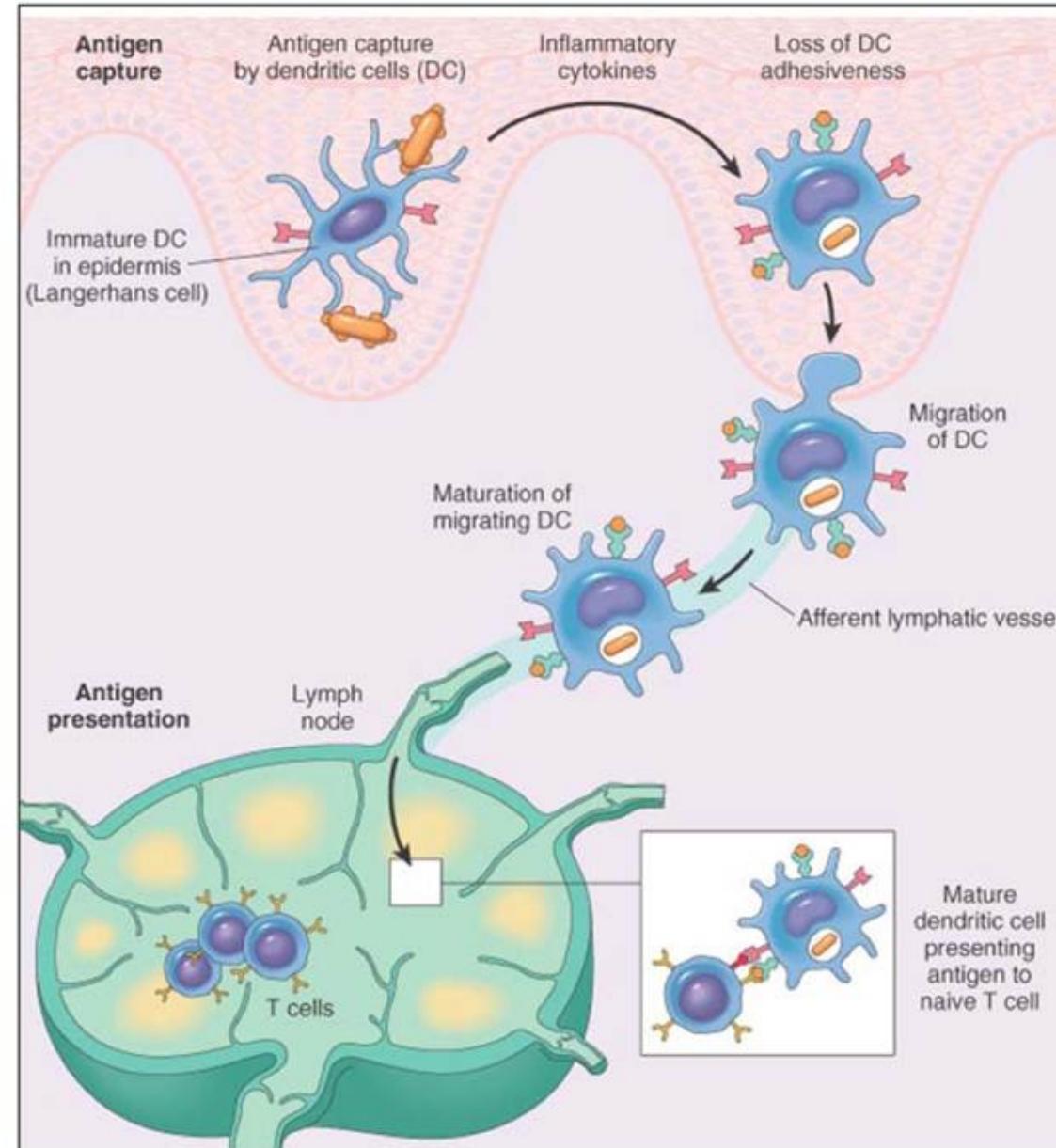


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Eosinophil vs. worm

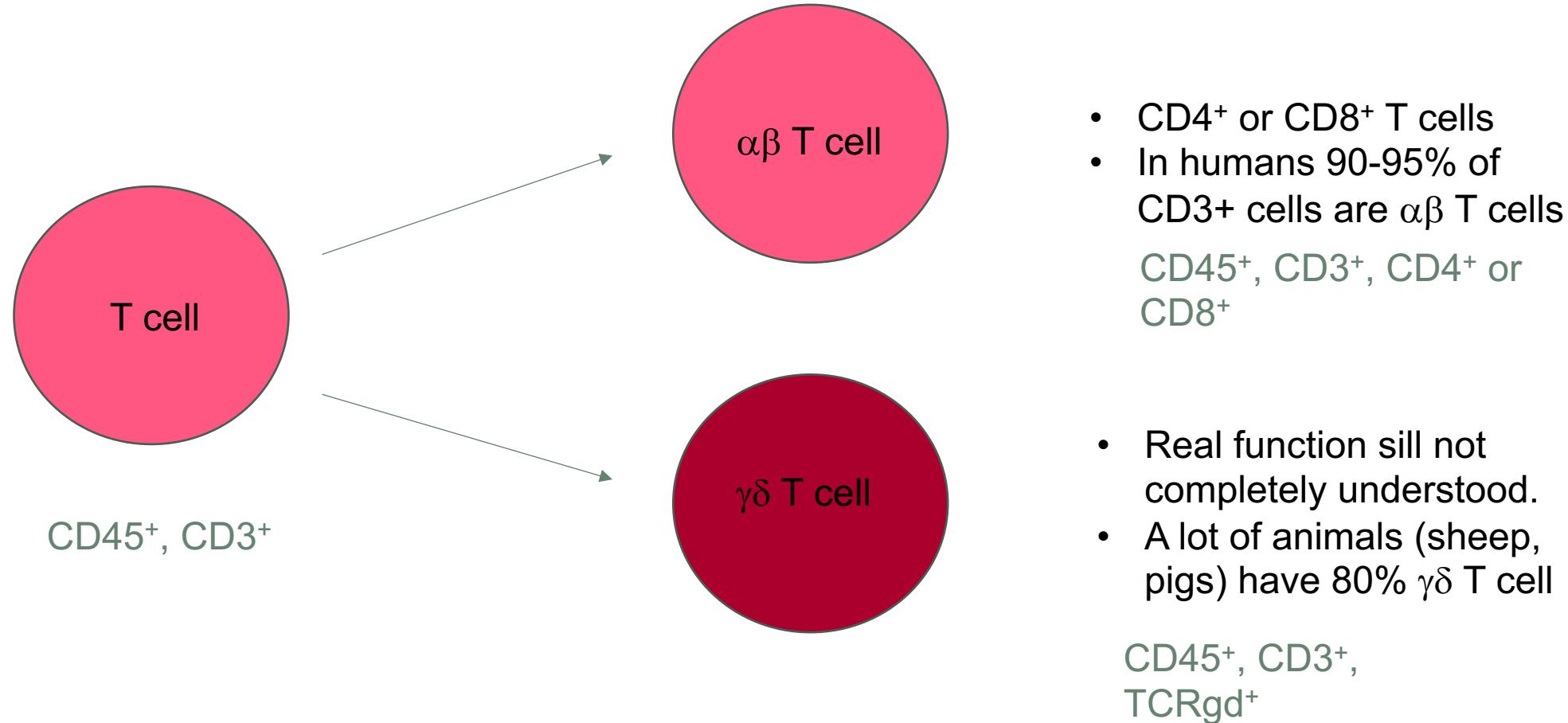


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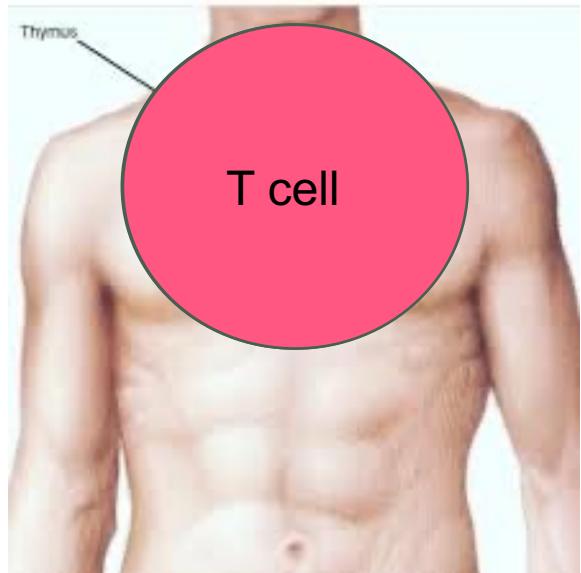
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What are T cells



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CD4⁺ T-cells and CD8⁺ T-cells



T-helper cells (Th)
CD4⁺ T-cells
CD45⁺, CD3⁺, CD4⁺

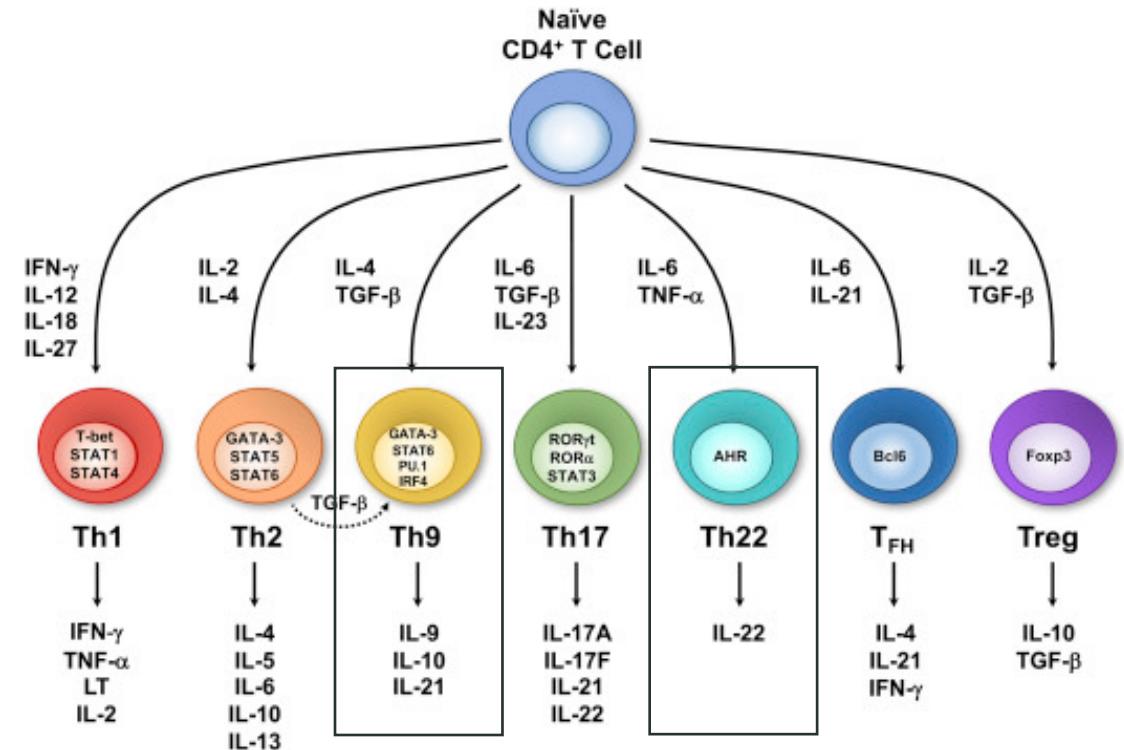
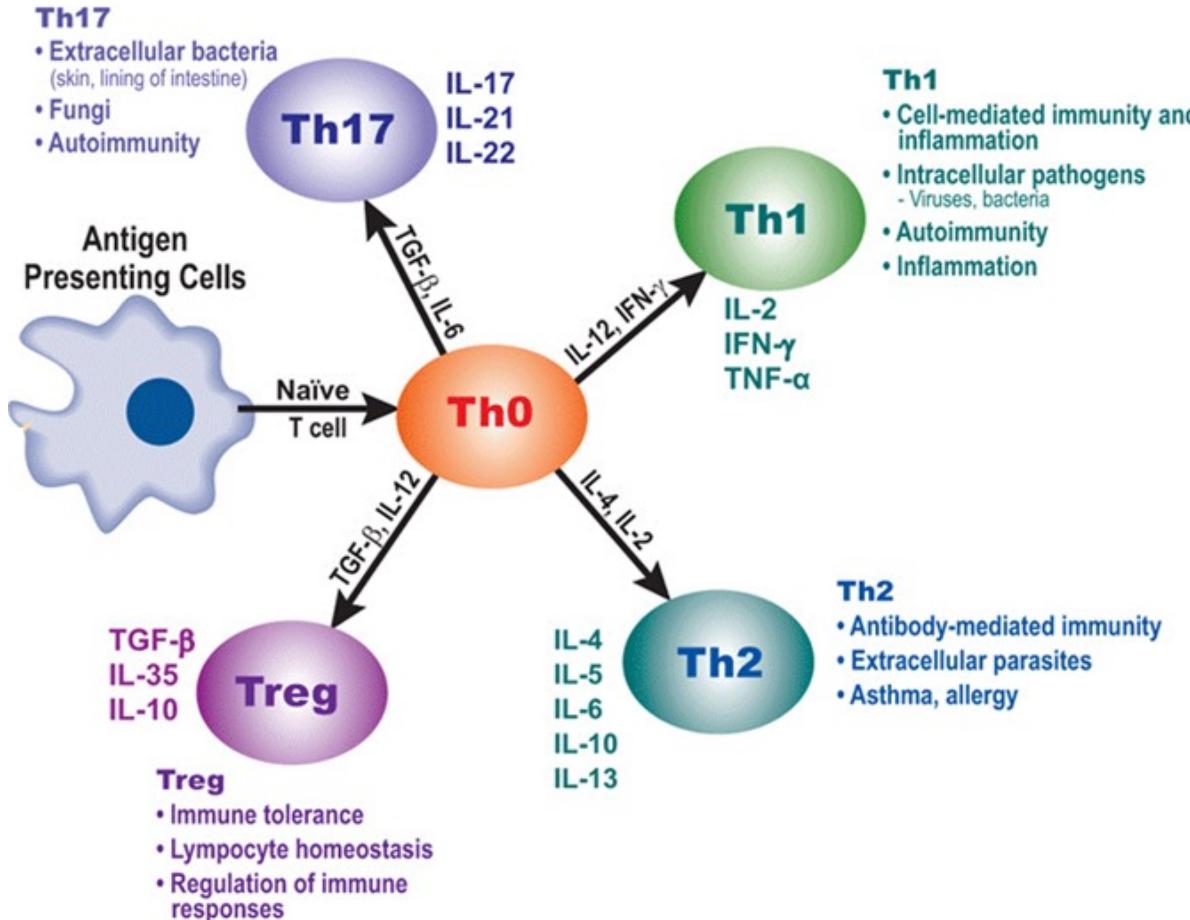


Regulatory T cells
 T_{regs}
CD45⁺, CD3⁺, CD4⁺, CD25⁺,
Foxp3⁺



T-killer cells
Cytotoxic T cells
CD8⁺ T-cells
CD45⁺, CD3⁺, CD8⁺

Th^b_1 , Th2, Th17, ... or more



Th1:

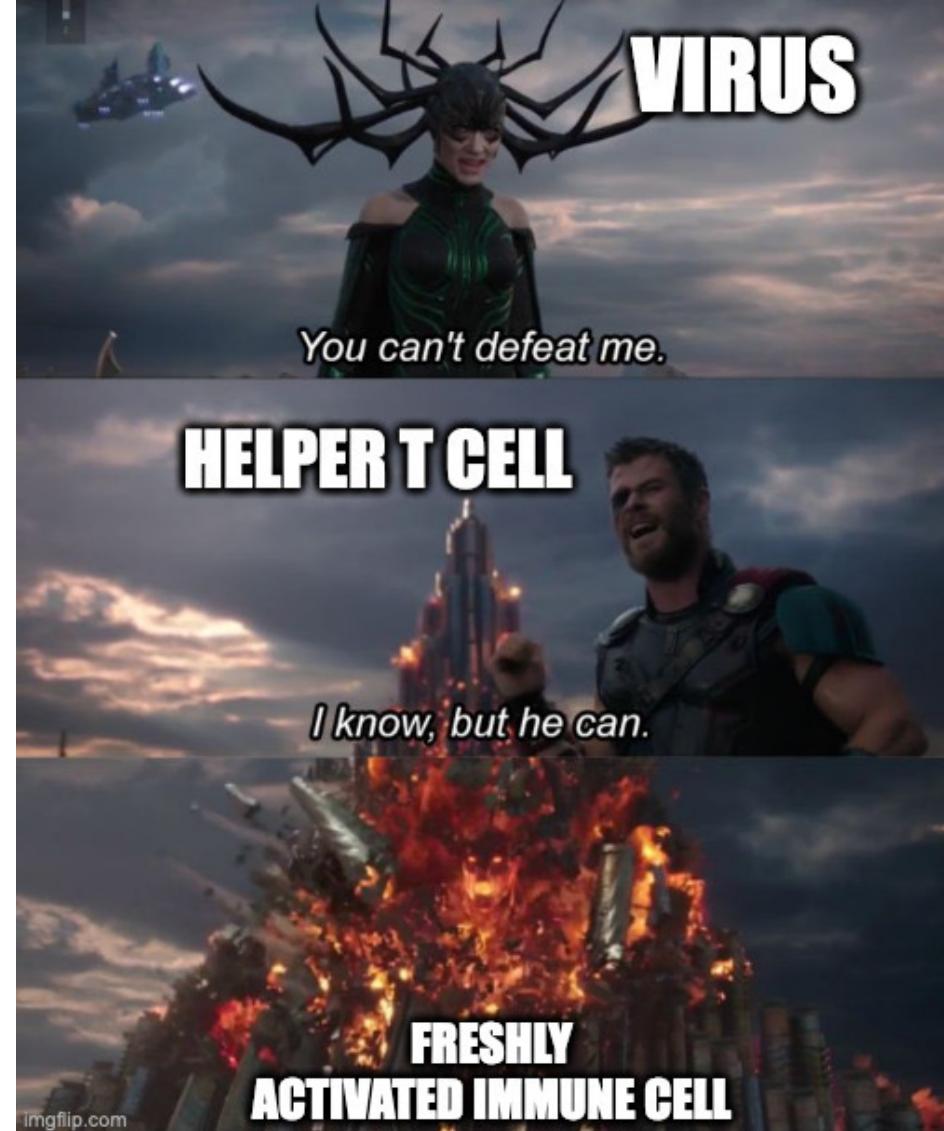
- Fight against intracellular Bacteria as well as viral infections
- Activation of **macrophages**
- Stimulates **natural killer cells** und **cytotoxic T cells**

Th2:

- Fight against microorganisms and worms
- Stimulates **mast cells** and **basophils** as well as **eosinophils**

Th17:

- Fight against bacterial- and fungal infections
- Over activation leads to Autoimmune diseases
- Activation of **macrophages**
- Recruitment of additional **neutrophils**



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Tregs (regulatory T cells)

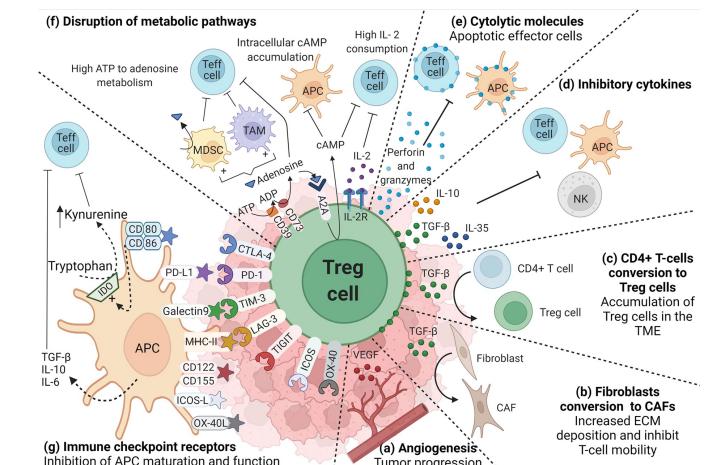
Tregs control the immune response to self and foreign particles (antigens)

- They and help prevent autoimmune disease.
- Protect the fetus from the immune system
 - Mice without T regs have a near 100% abortion rate
- Some cancers recruit Tregs and are protected from anti-cancer immune response

Published: 01 February 2004
Regulatory T cells mediate maternal tolerance to the fetus
 Varuna R Aluvihare  Marinos Kallikourdis & Alexander G Betz 
Nature Immunology 5, 266–271 (2004) | [Cite this article](#)

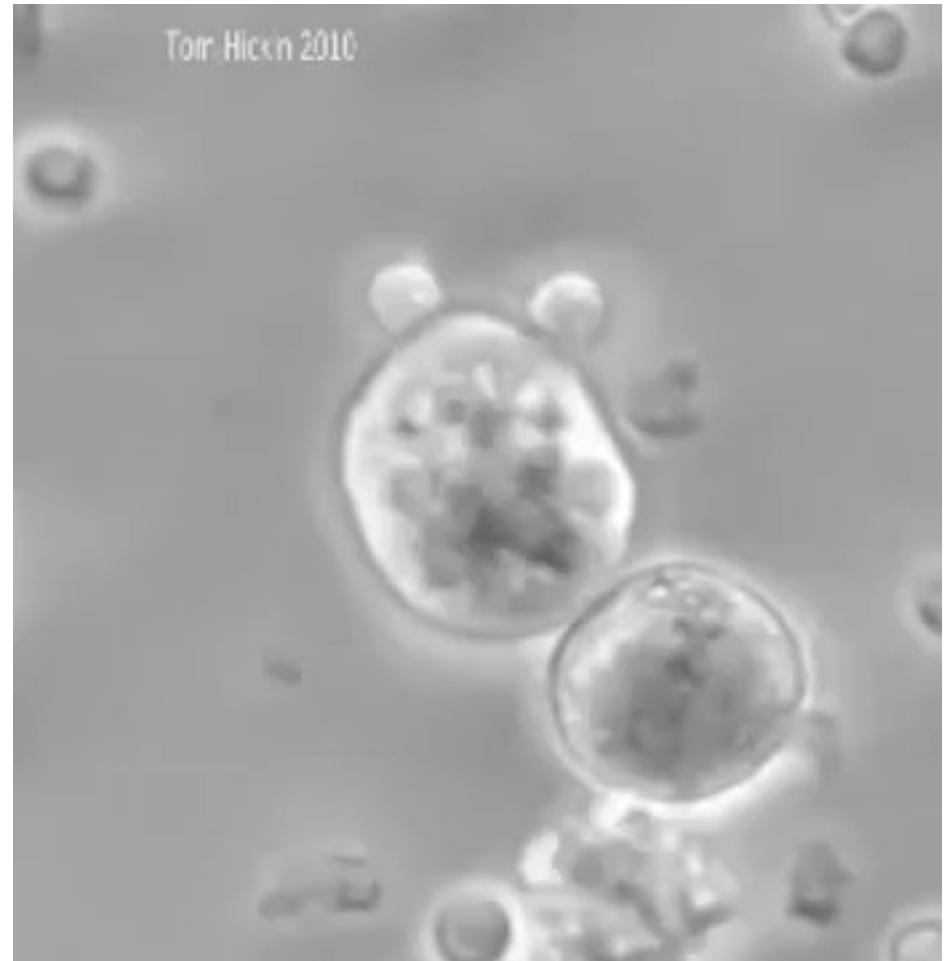
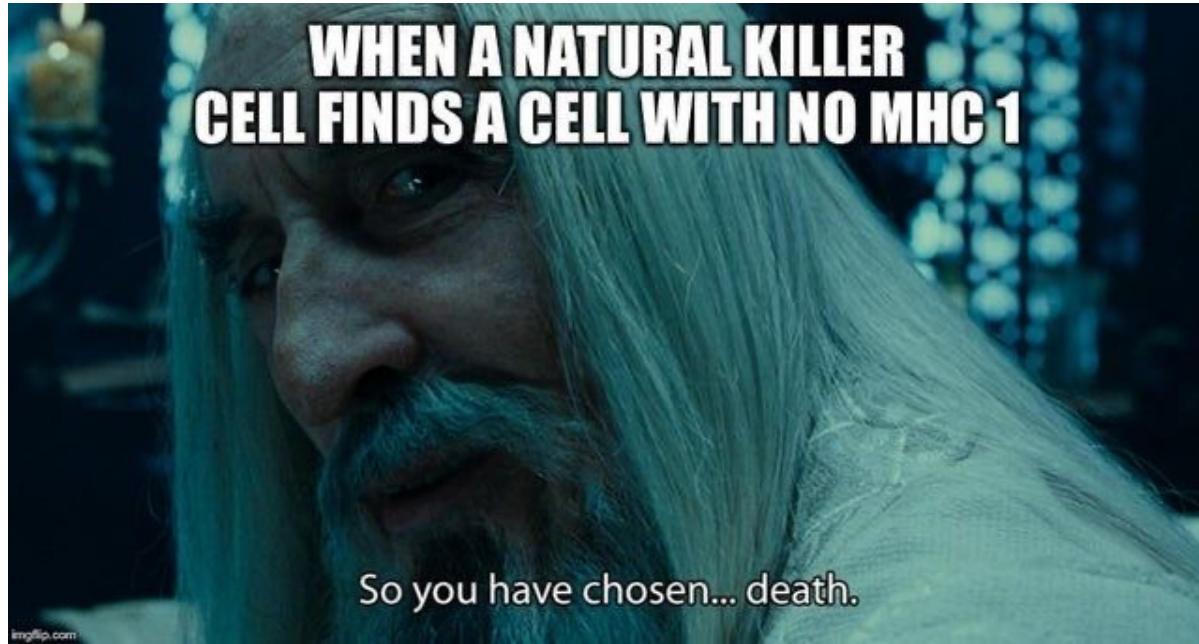
Colorectal Cancer-Infiltrating Regulatory T Cells: Functional Heterogeneity, Metabolic Adaptation, and Therapeutic Targeting

Sonia Aristin Revilla^{1,2,3} Onno Krakenburg⁵ Paul J. Coffer^{1,2*}



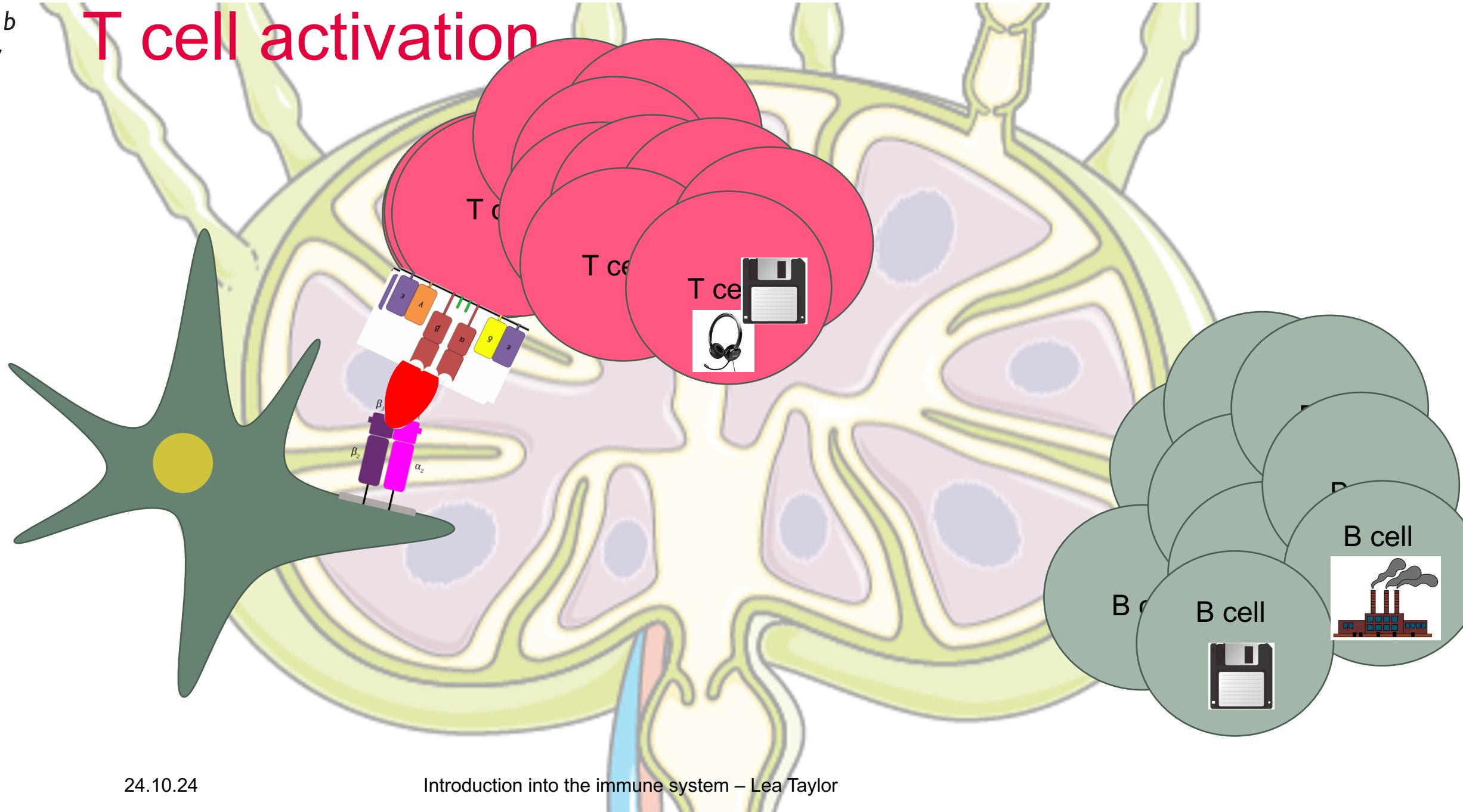
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CD8⁺ T cells and NK -> the serial killers



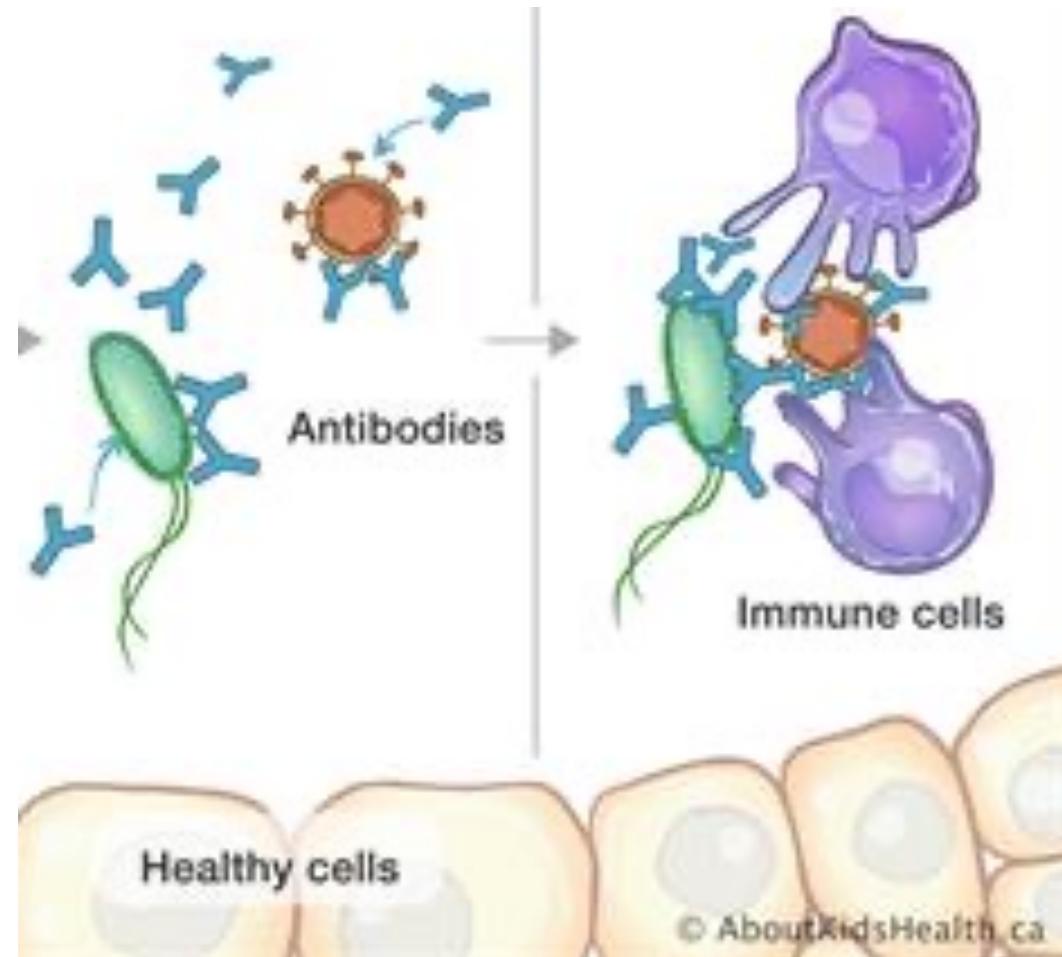
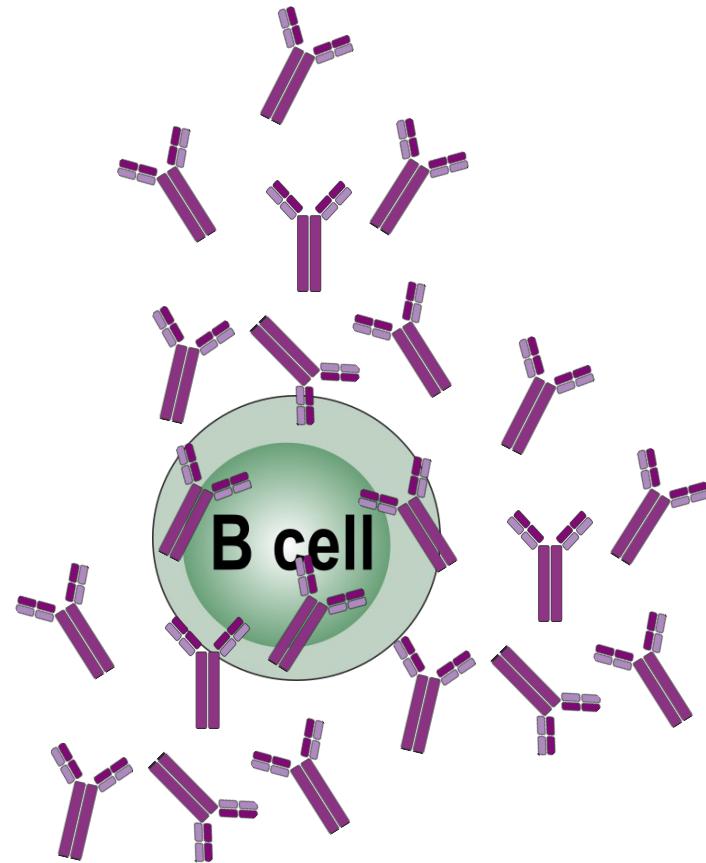
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T cell activation



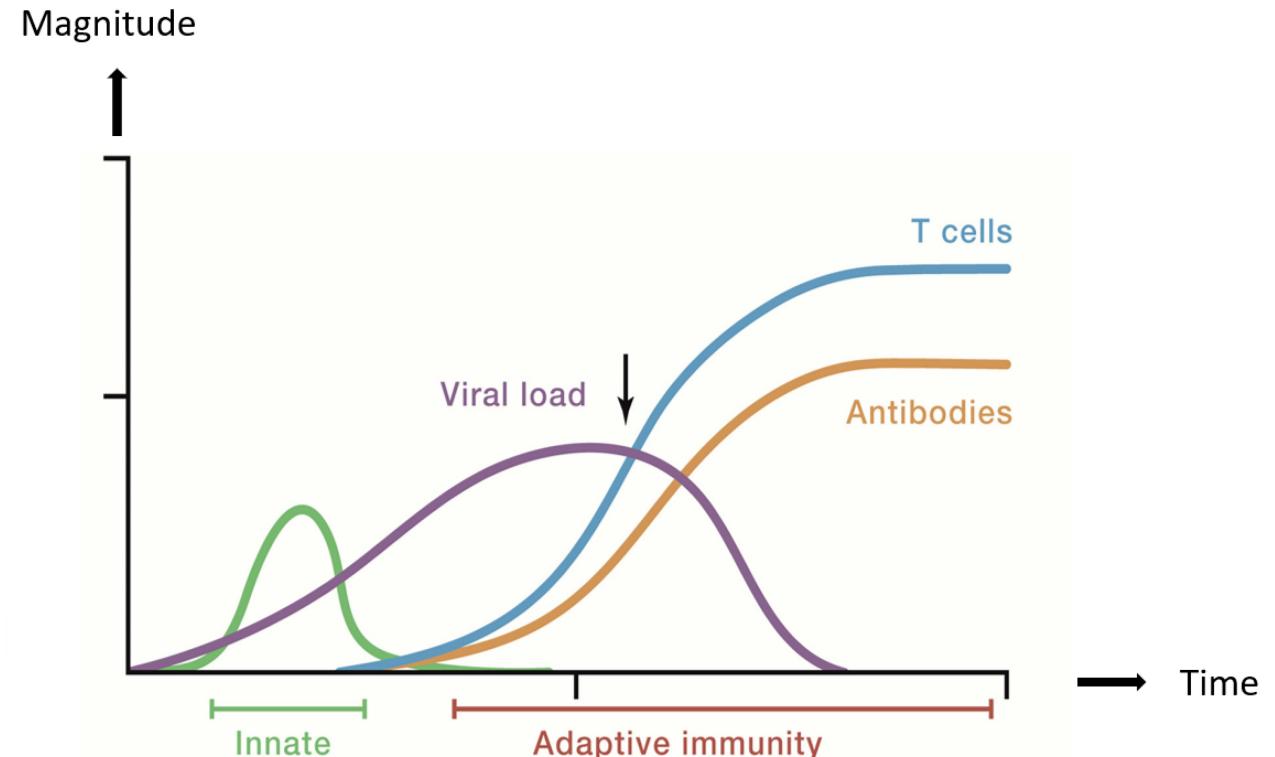
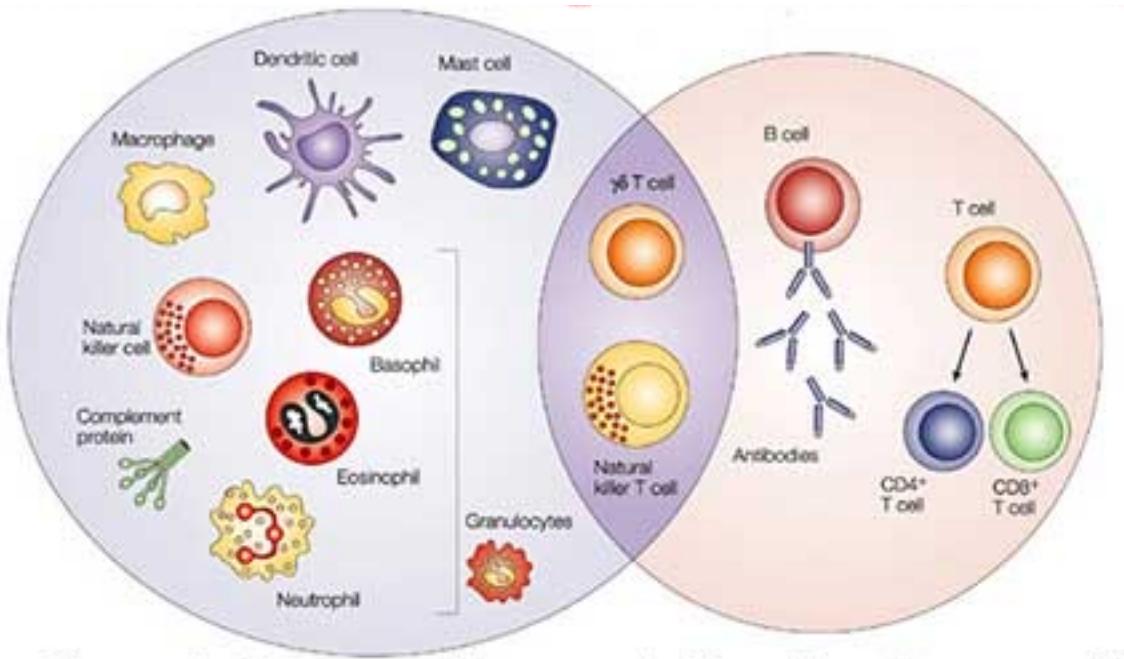
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Antibody production



Why does a cold take 7 days?

u^b Why does a cold take 7 days.



Innate immune response Adaptive immune response

u^b Second exposure to antigen

