Australian National University

COVID vaccines and MS

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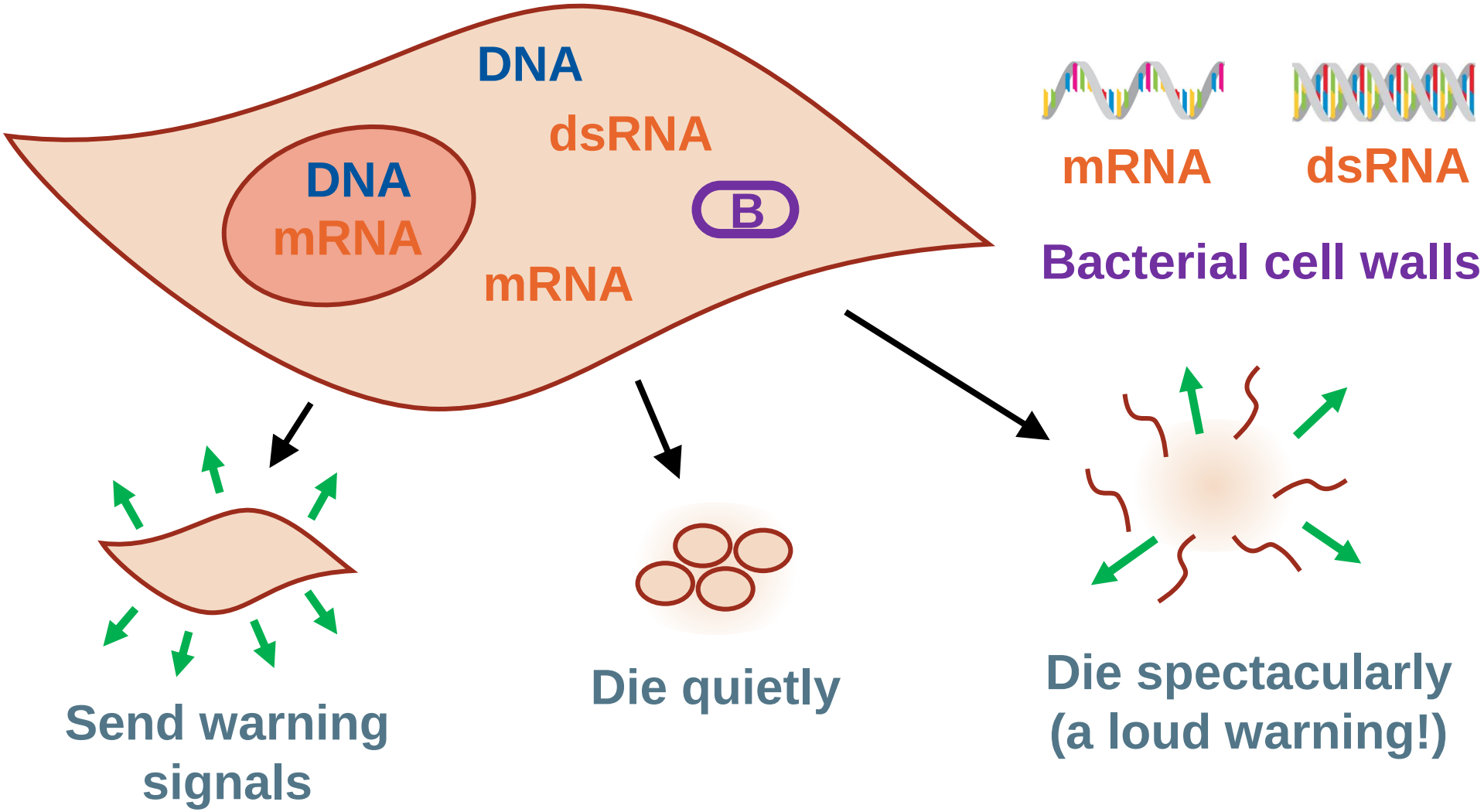
How the immune system works

- Blocks
  - Skin, mucous, anti-microbials
- Responds to danger and damage
  - Chemical warning signals
  - Activates cells
- Raises a pathogen-specific army
  - Several types of “lymphocyte”
- Stands down, cleans up
- Leaves a legacy of protection
  - Immunity / immune memory

Responding to danger and damage - 1

- Every cell can detect things out of place



Responding to danger and damage - 2

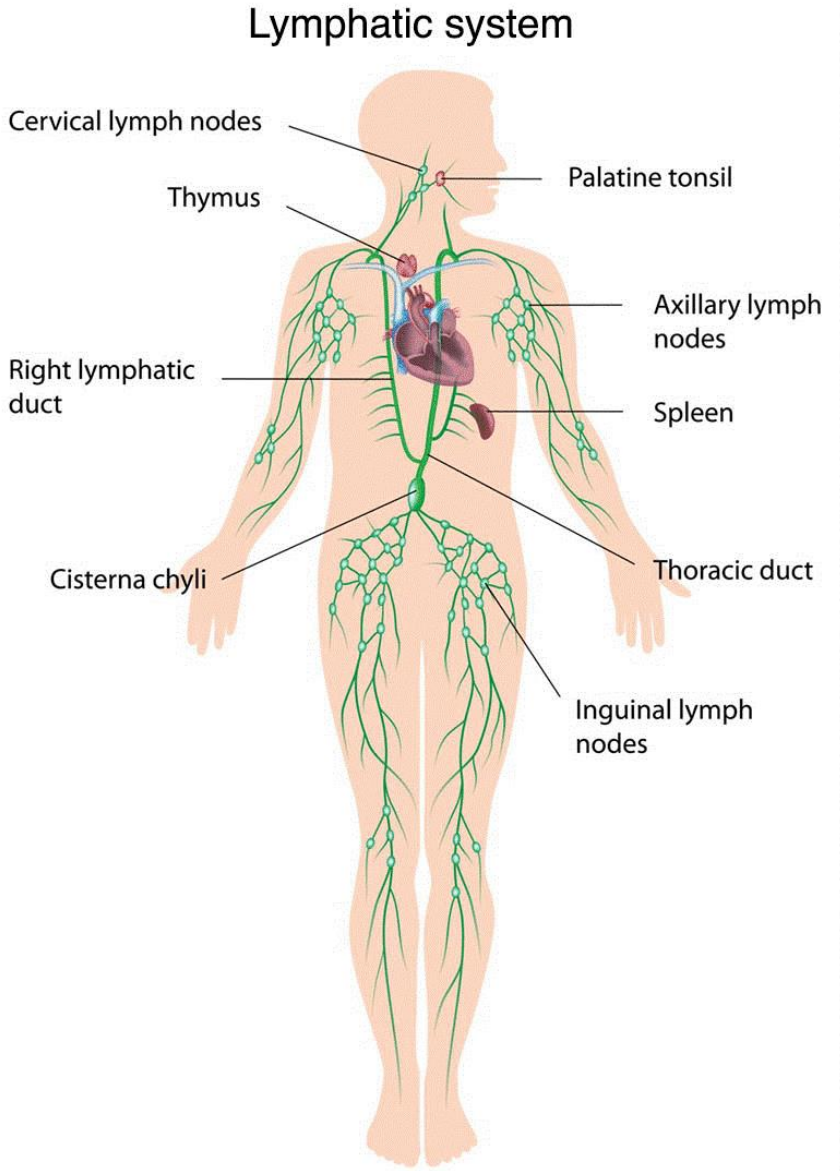
- "First responder" white blood cells arrive

  - Neutrophils
    - rush in, burst open, make a mess
  - Macrophages
    - eat up debris, send warning signals

  - **Dendritic cells**
    - Collect debris
    - Get activated by warning signals
    - Go to lymph nodes

- **These signals and cells = inflammation**

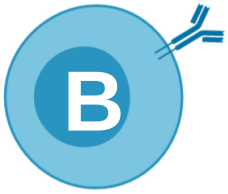
The lymph system is like a drain



- Fluid between cells is drained into lymph
  - Along with debris
- Some immune cells also follow lymph
- **Dendritic cells** are like outpost sentries
  - Their HQ is the nearest lymph node

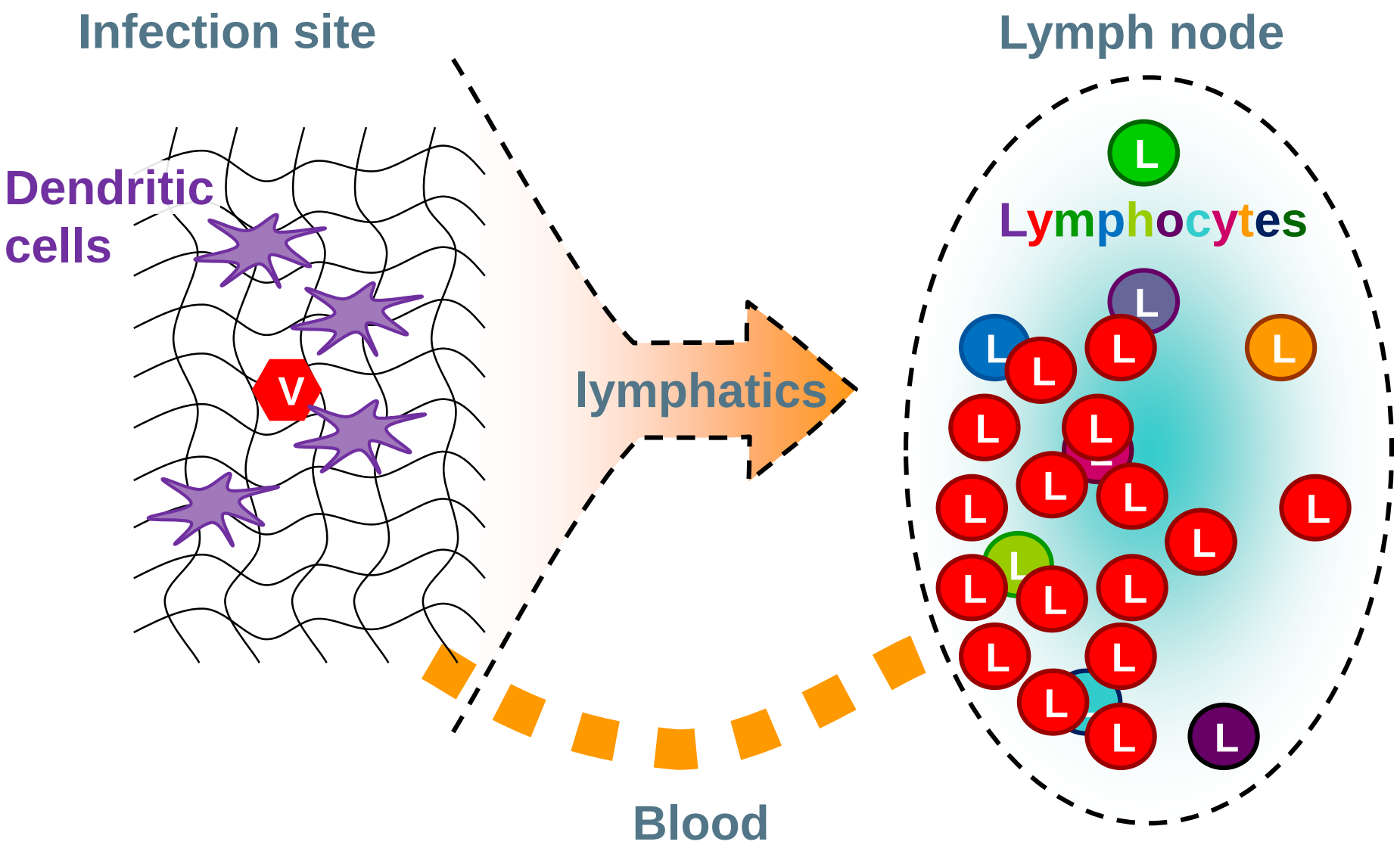
https://www.healthdirect.gov.au/lymph-nodes

A pathogen-specific army

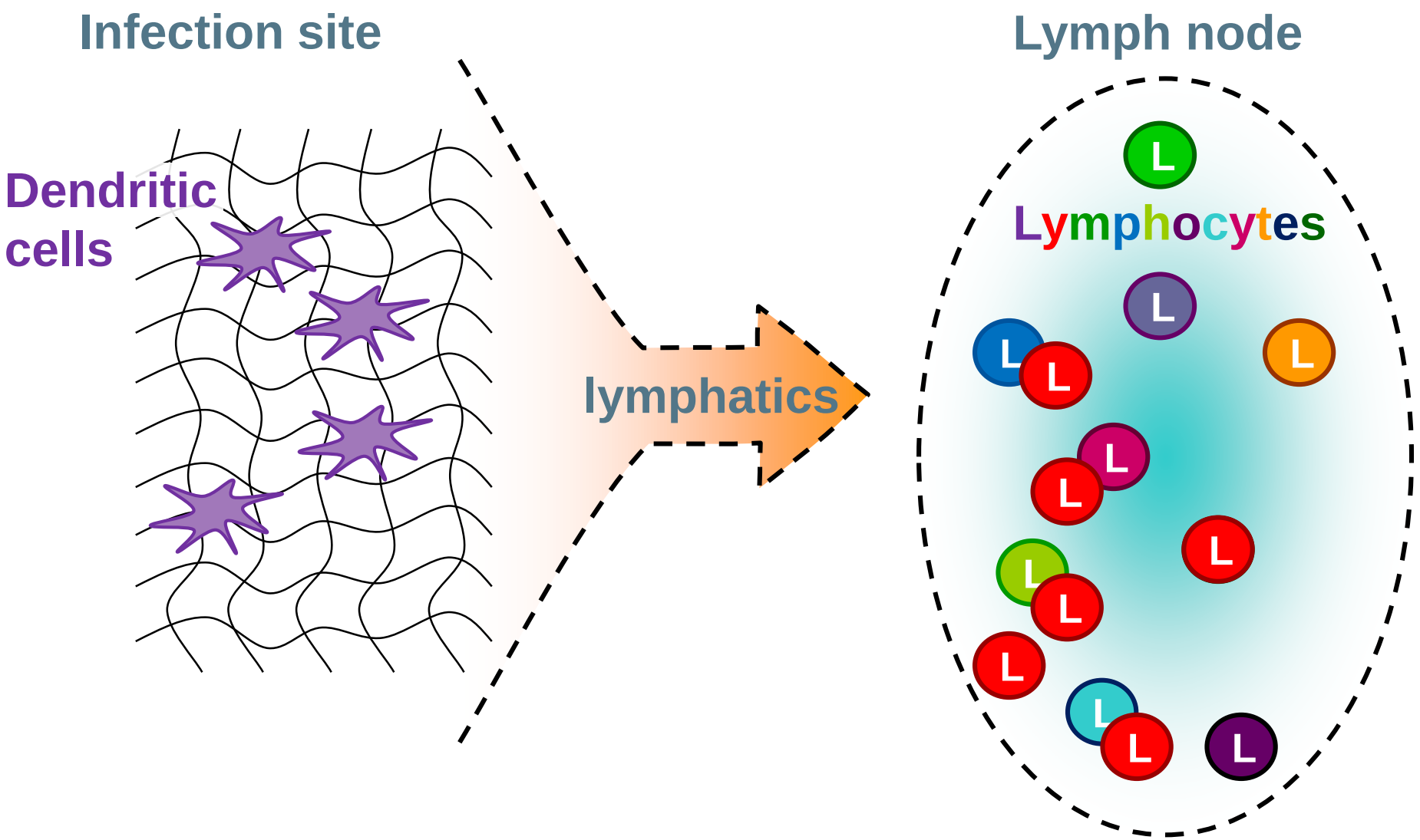


- Lymphocytes are also white blood cells
- Two main types:
  - T lymphocytes = **T cells** (killers or helpers)
  - B lymphocytes = **B cells** (make antibody)
- Each individual T or B cell responds to only one tiny shape (e.g. a small part of a microbe)
  - We have many millions of T and B cells
  - Only a few respond to any particular microbe

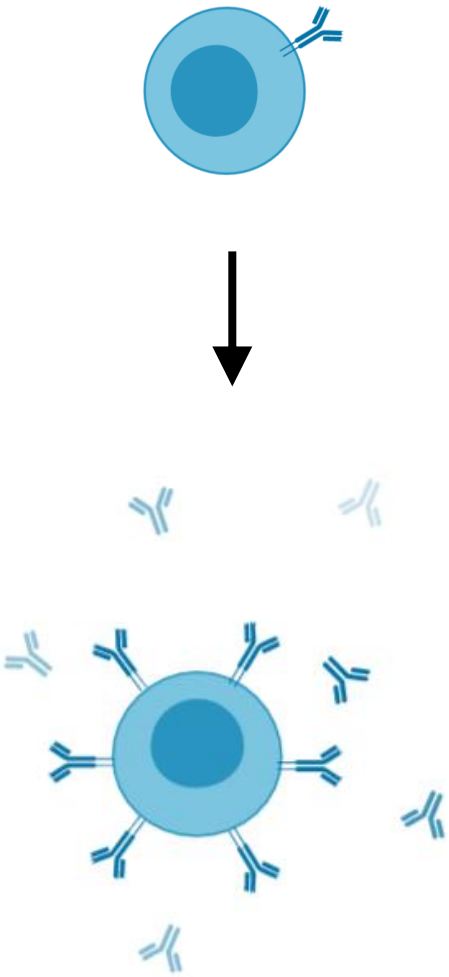
Growing a pathogen-specific army



Growing a pathogen-specific army



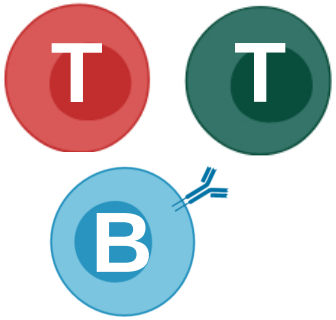
B cells and antibody



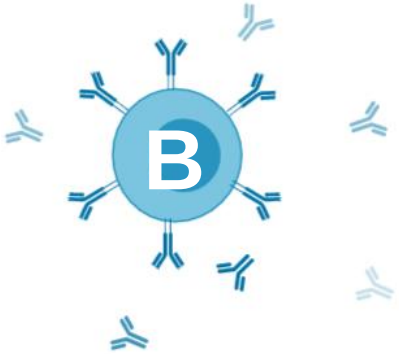
- B cells ‘see’ a microbe with a receptor protein on their surface
- When B cells are activated they start shedding their receptor
- This is **antibody** (or immunoglobulin)
- Some then go to the bone marrow
  - These cells make most of the antibodies in blood

At the end…

- Most extra immune cells die off
  - The inflammation subsides
  - Some cell types help in the clean-up



- Some T and B cells remain at greater number = memory
  - To respond faster next time



- B cells in bone marrow just keep on making their antibodies

How do vaccines work?

- Makes the immune system think it is under attack
- All immune processes are engaged
  - But without risk of infection
  - Directed at the ‘fake’ invader
- Immune memory is built
  - Antibodies
  - Memory T and B cells

How do vaccines work?

- Makes the immune system think it is under attack

Immunity from vaccination
IS
natural immunity

re

on

der

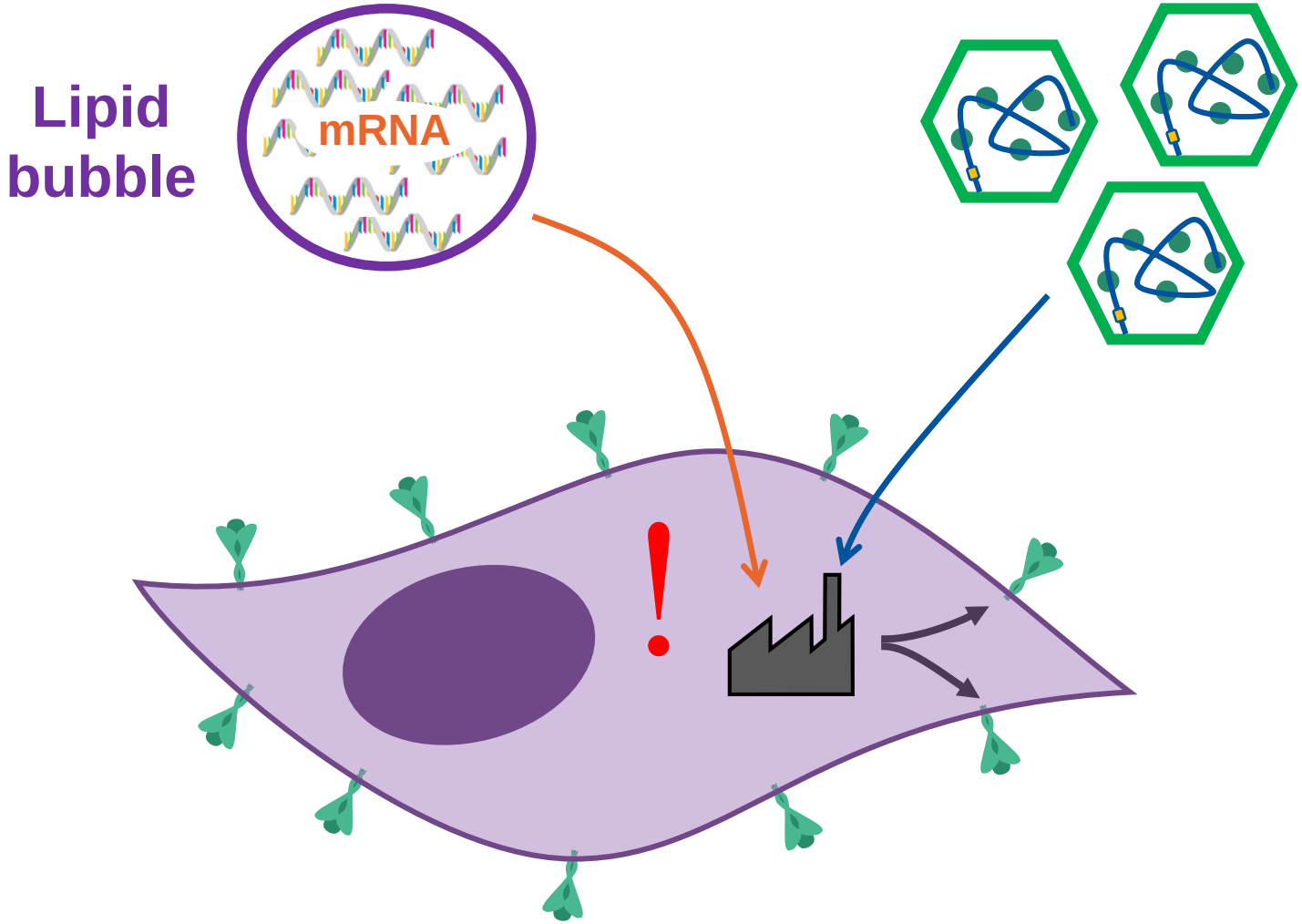
– Antibodies
– Memory T and B cells


WANTED
NEUTRALISED
SARS-COV-2
$10,000
REWARD


WANTED
NEUTRALISED
SARS-COV-2
SPIKE
$10,000
REWARD

The two types of COVID vaccines

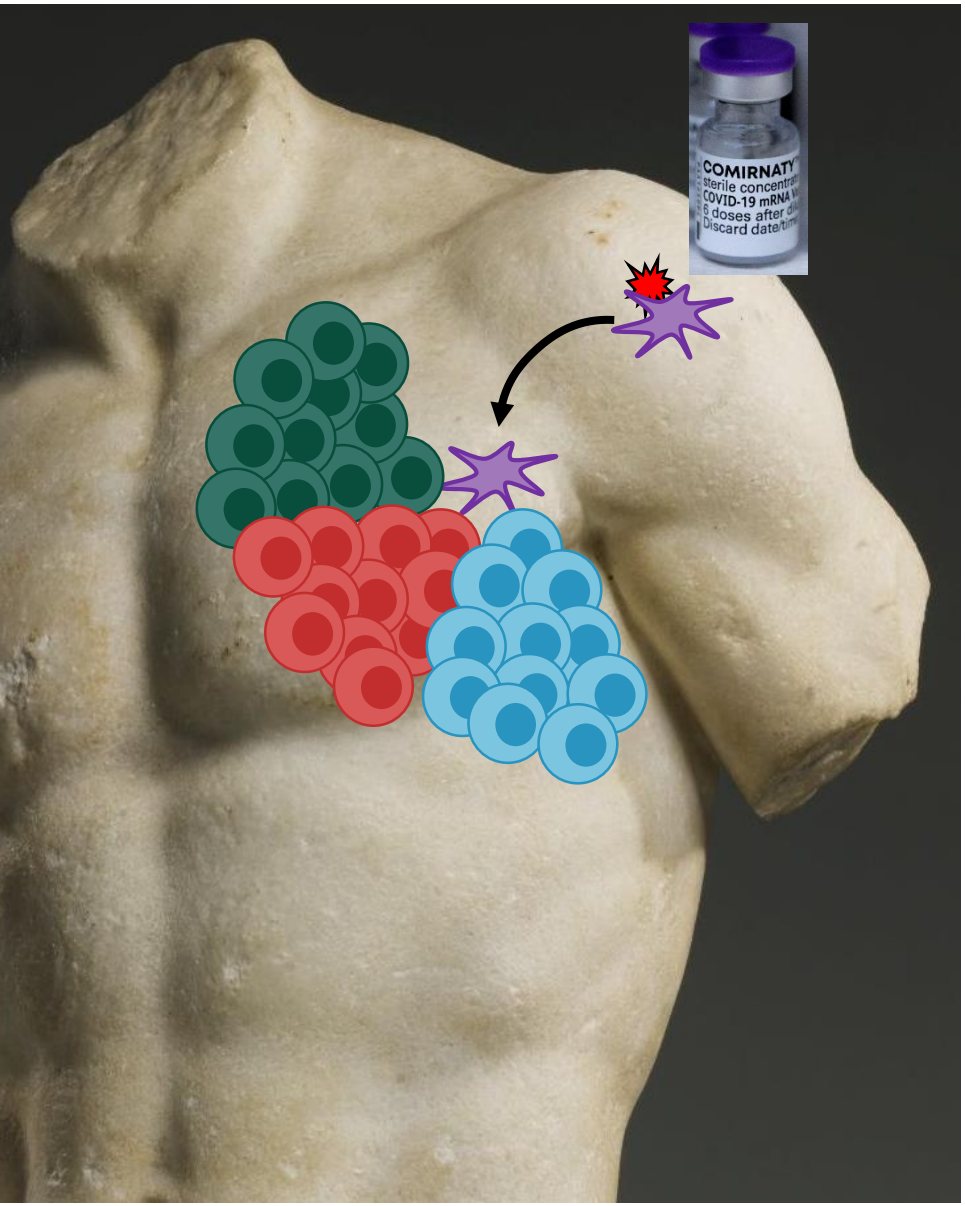
- Pfizer/Moderna and AZ have genetic code for the spike



How do COVID vaccines work?

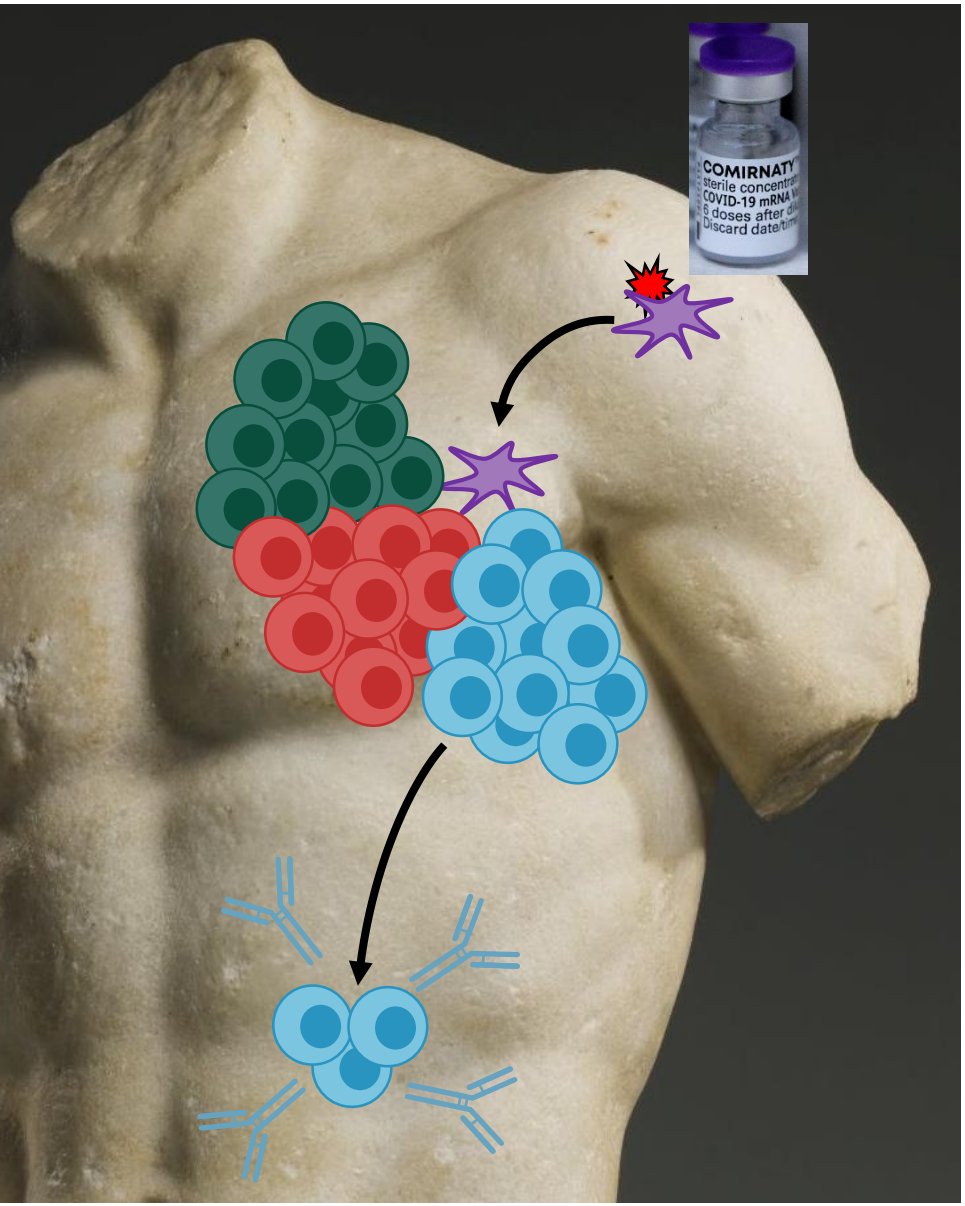
- Damage/danger at the vaccination site + **Spike**
  - Spike made by the body
    - Looks to the body like an infection BUT
      - Cannot spread in the body
      - Cannot spread to others
  - May cause side effects
    - Sore arm
    - Fatigue, fever, etc

How do COVID vaccines work?



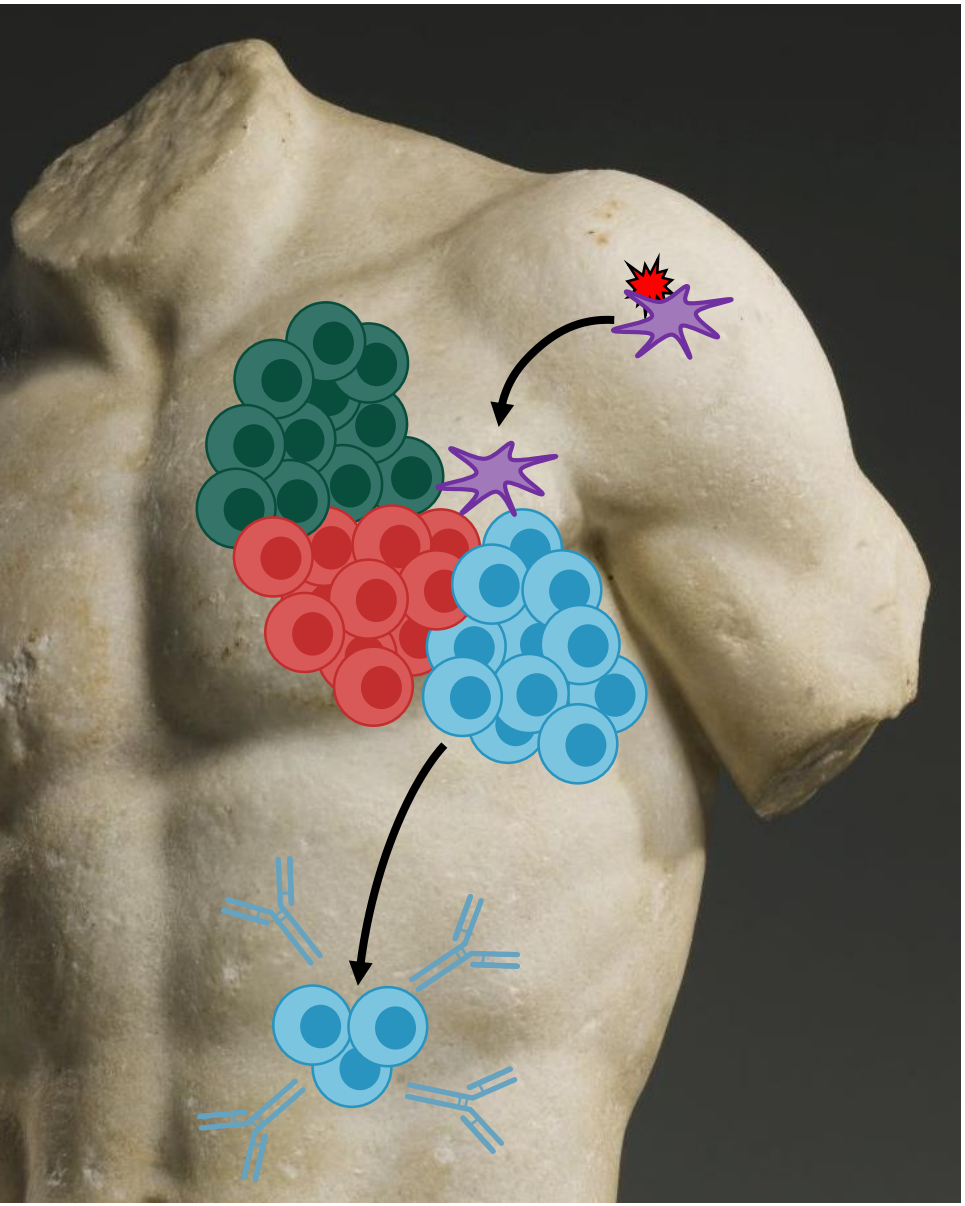
- Damage/danger at the vaccination site + **Spike**
  - **Spike made by the body**
- Dendritic cell “sentries”
  - **pick up (or make) spike**
  - **activated → lymph node**
- **Anti-spike** B and T cells activated and expanded

How do COVID vaccines work?



- Damage/danger at the vaccination site + Spike
- Dendritic cell “sentries” take spike → lymph node
- Anti-spike T and B cells activated and expanded
- B cells go to bone marrow
  - Anti-spike antibody (IgG)

How do COVID vaccines work?



- Damage/danger + Spike all dissipate
- Dendritic cell “sentries” and spike cleared
- Anti-spike T and B cell
  - Only memory cells persist
- B cells and Anti-spike antibody production persist in bone marrow

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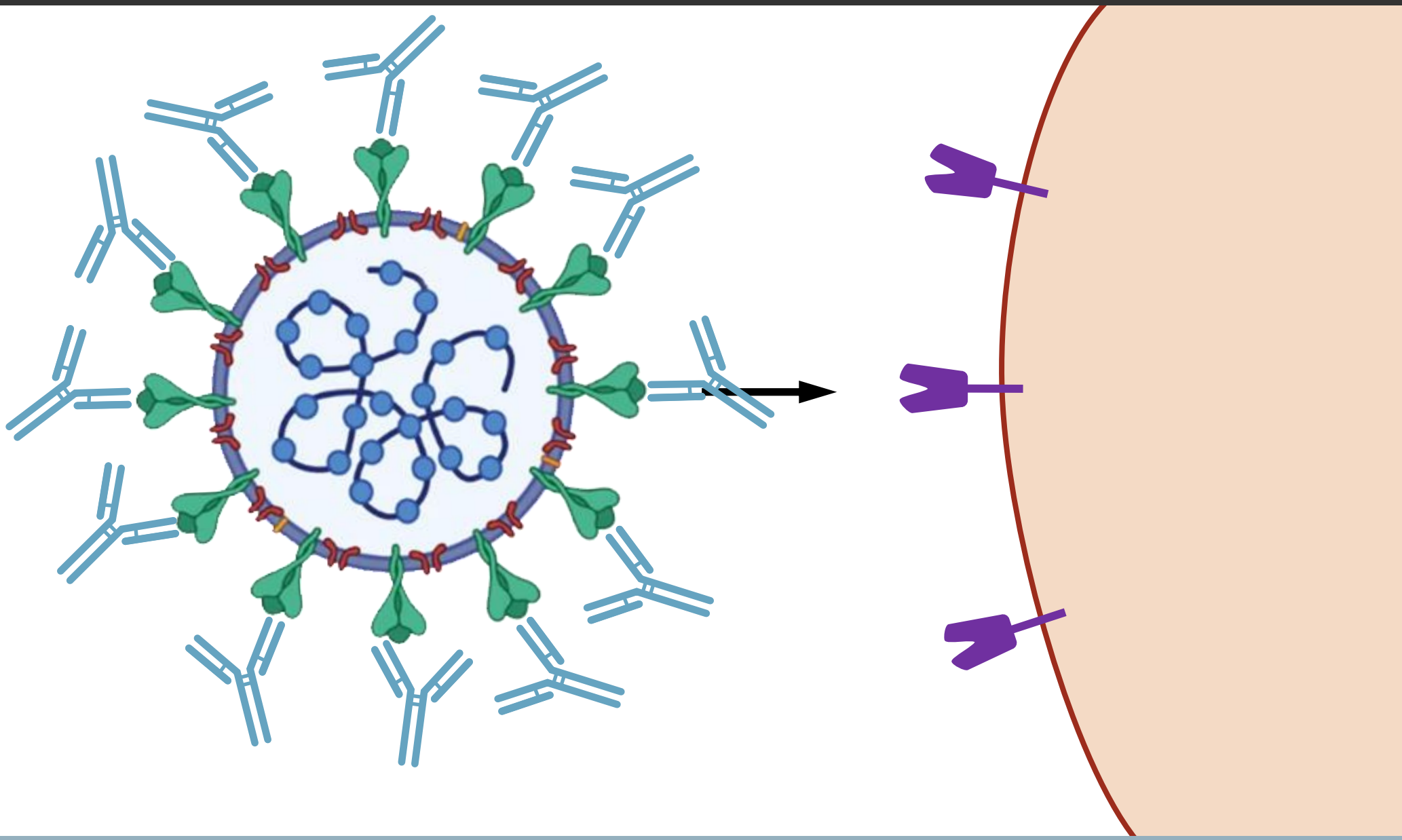
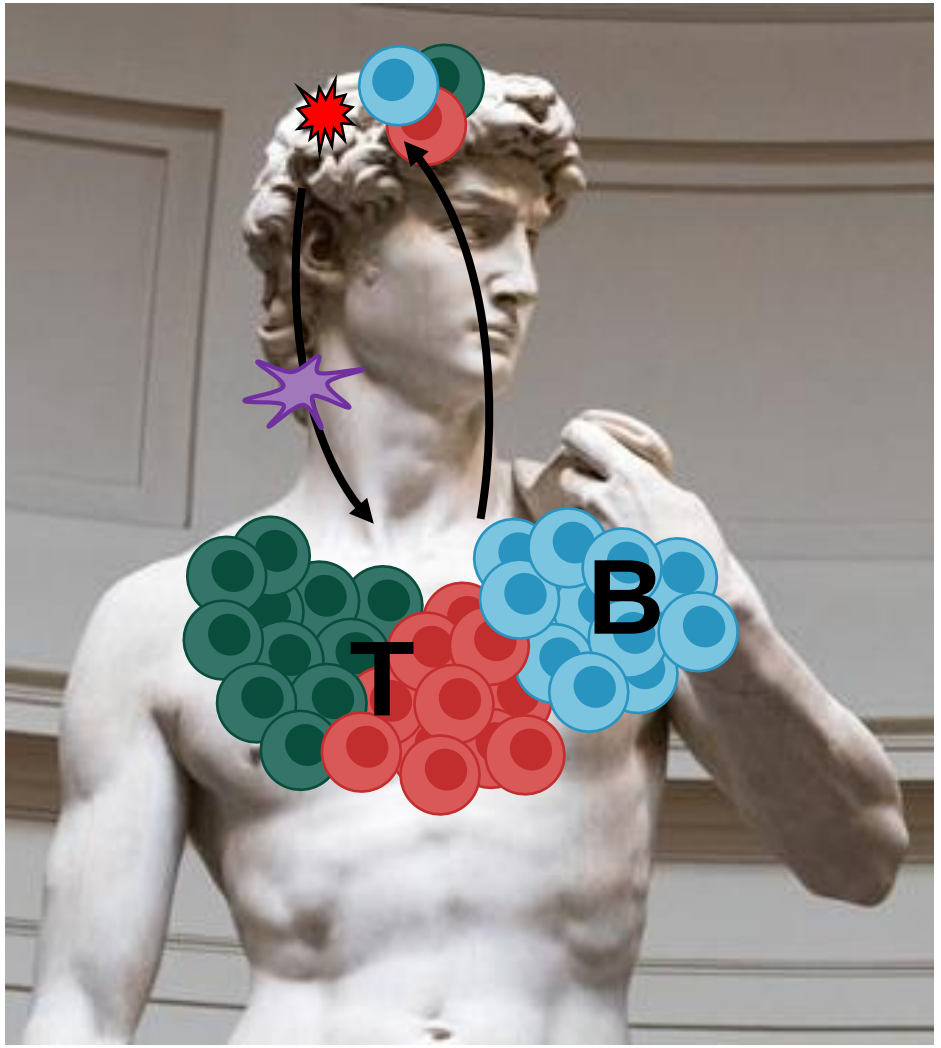
When SARS-CoV-2 comes knocking…



In MS immunity goes wrong

- Myelin is recognised as ‘foreign’ and attacked
- We do not really know why, or how this starts
  - Lots of theories
  - I am showing a general concept
- The disease modifying treatments (DMTs) modify or suppress immunity



DMTs modify or suppress immunity

No (general) immunosuppression

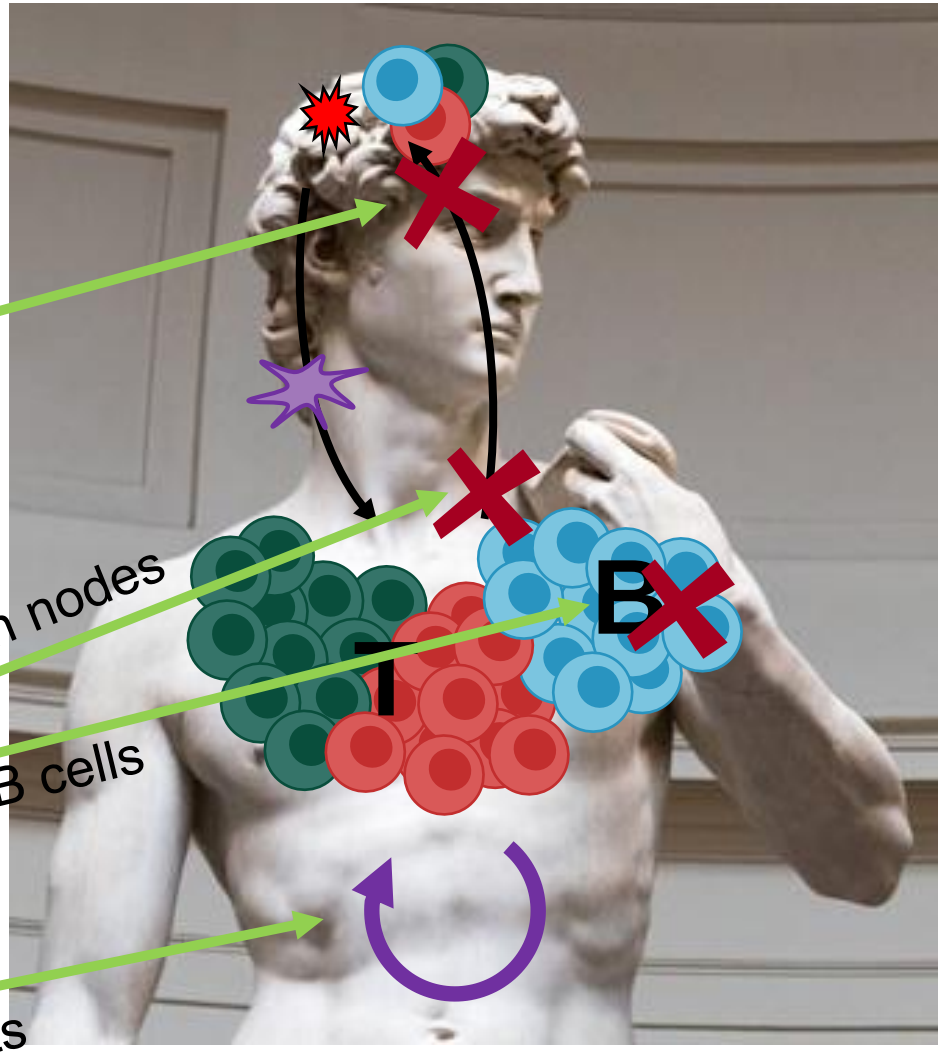
- Interferons
- Copaxone
- Aubagio
- Tecfidera
- Tysabri

Immunosuppresive

- Gilenya, Mayzent, Zeposia
- Ocrevus, Kesimpta

Immune Reconstituting

- Mavenclad
- Lemtrada



Summary

- Infection and vaccines give “natural” immunity
  - Fundamental process is the same
  - There are differences in quality and quantity
- The autoimmune attack in MS can be understood in a similar way
- Treatments for MS that reduce general immunity expected to reduce responses to vaccines
  - We need data to be sure
- Resist vaccine misinformation
  - Be wary of science words, but a message that contradicts medical / official advice