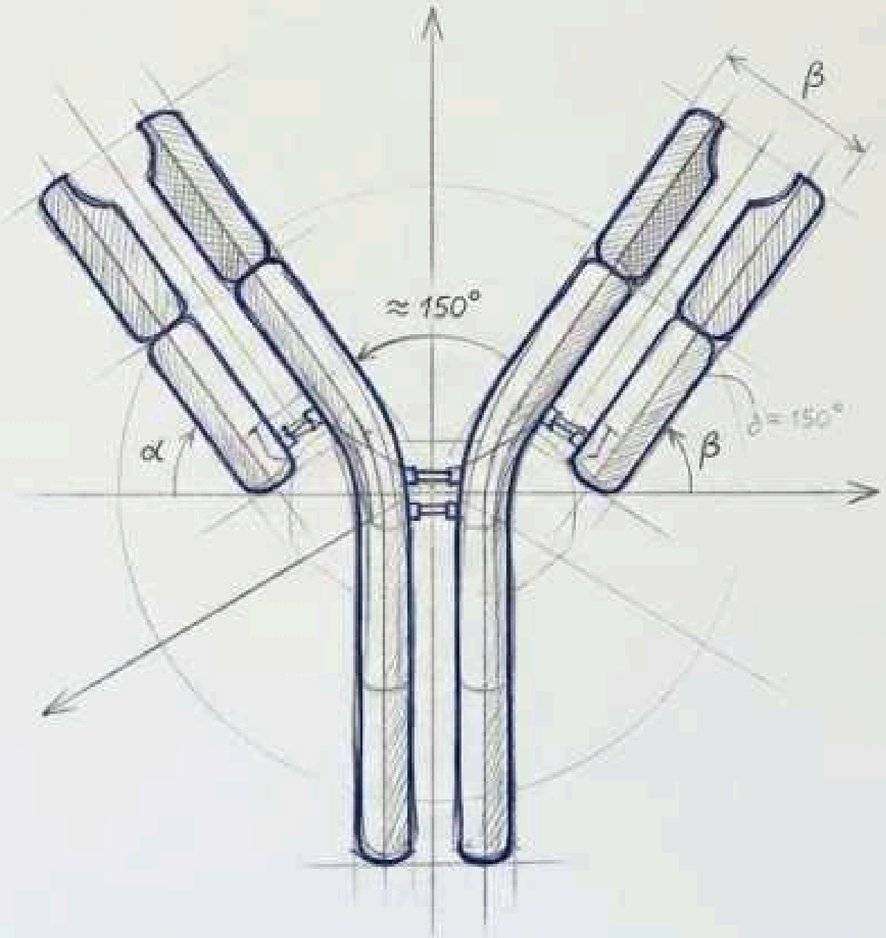
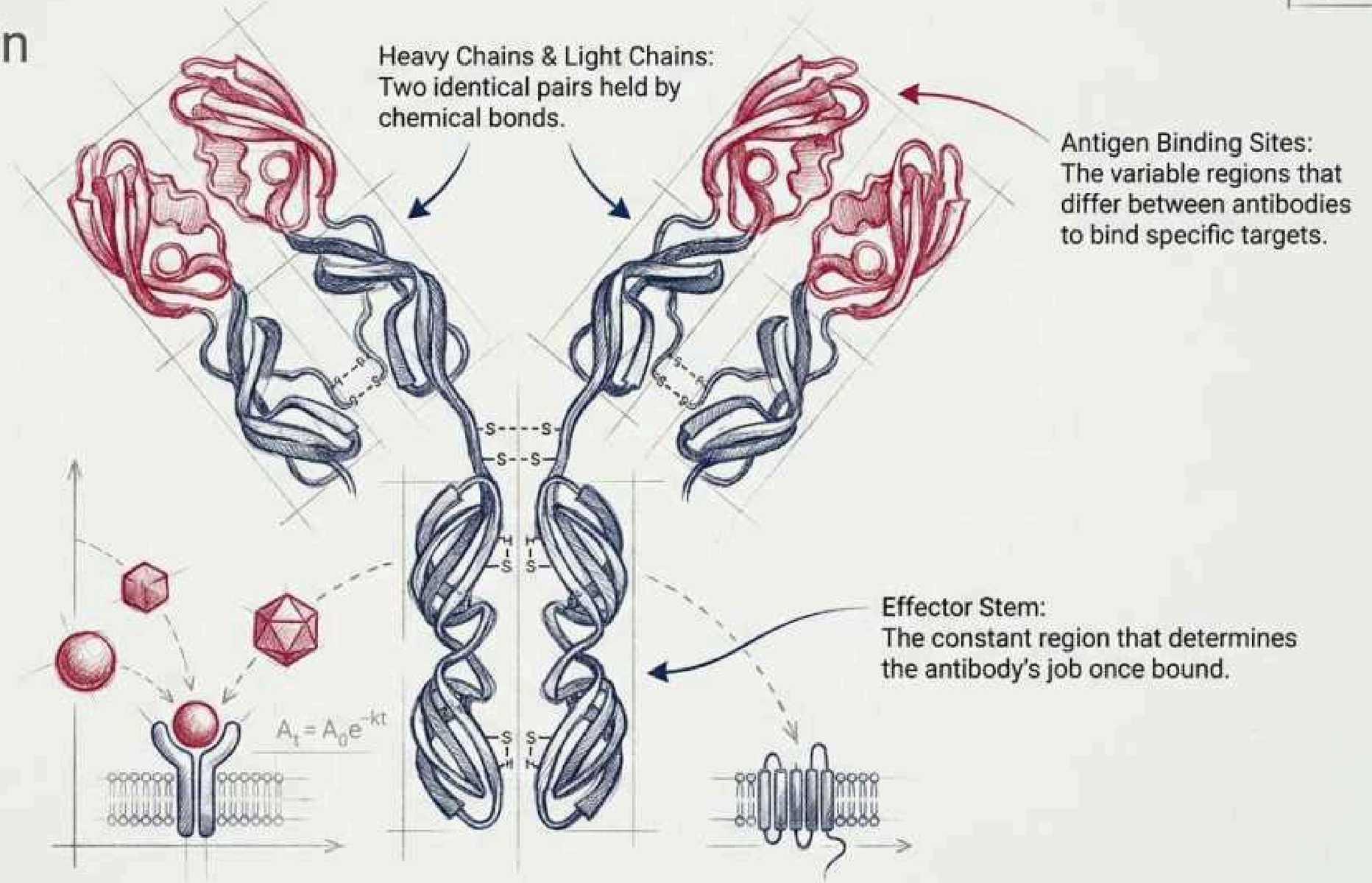


B Cells and Antibodies

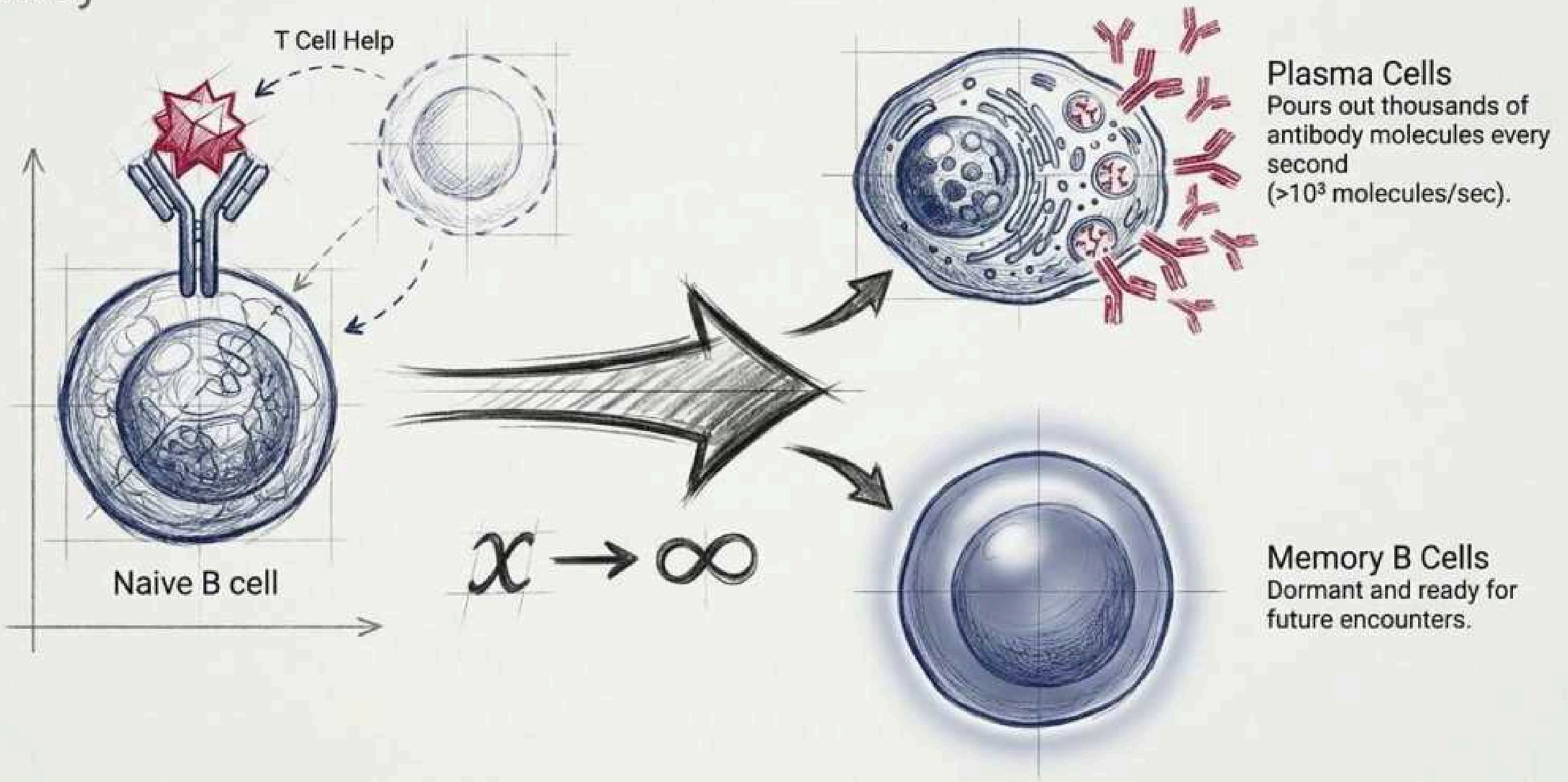
From nature's microscopic factories to the foundation of modern medicine.

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Anatomy of an Immunoglobulin



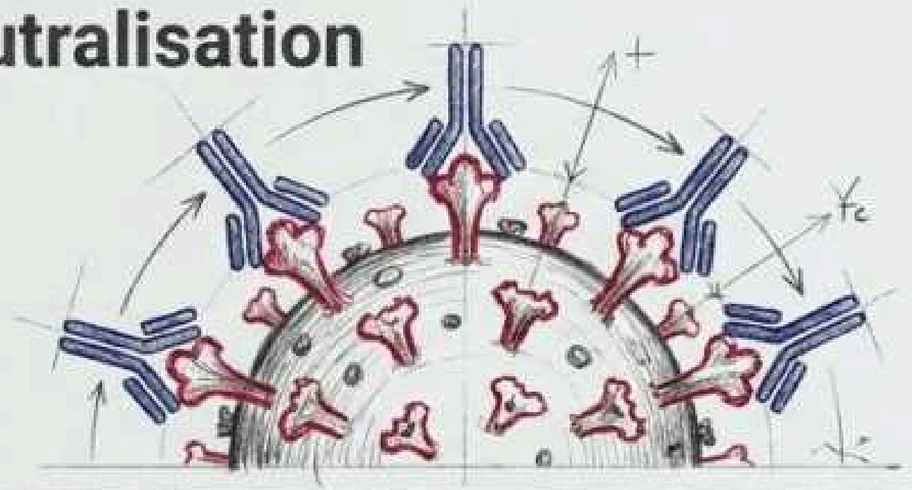
The B Cell Activation Pathway



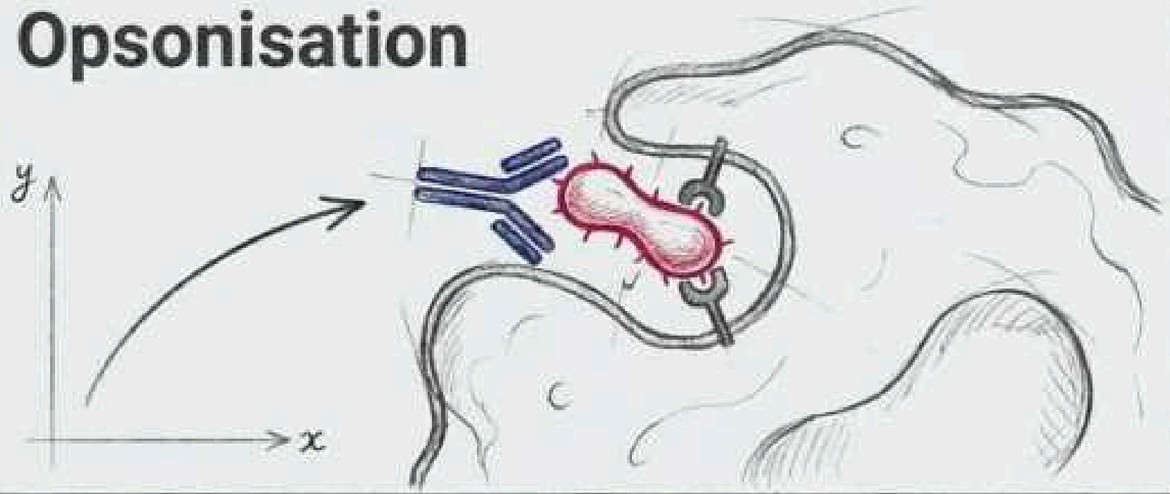
Mechanisms of Protection

¶ 3.3

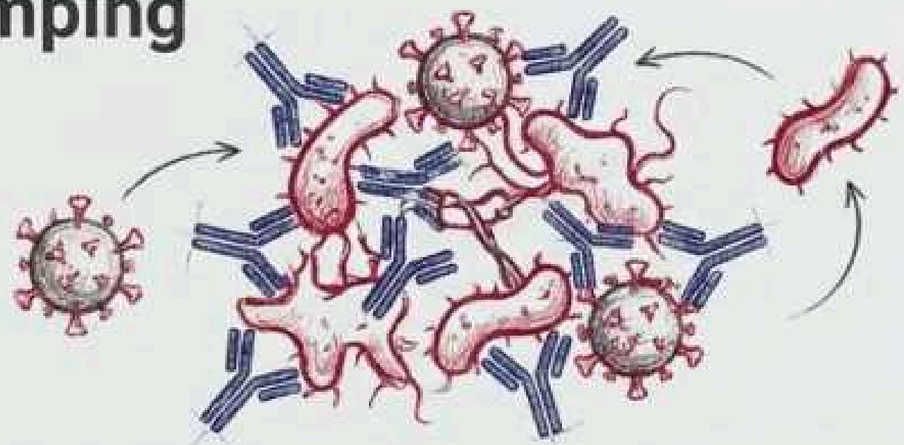
Neutralisation



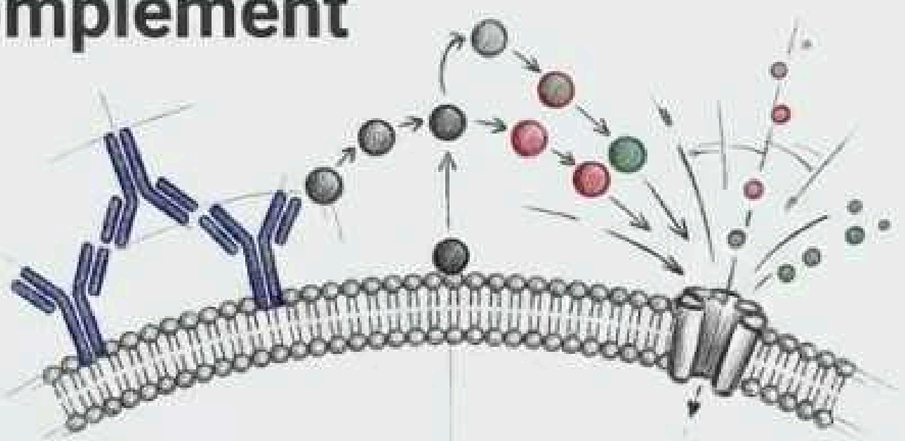
Opsonisation



Clumping



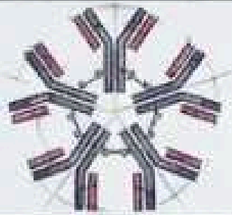
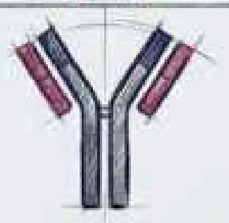
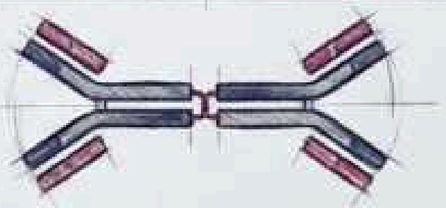
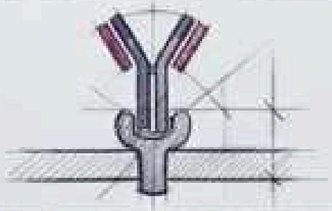
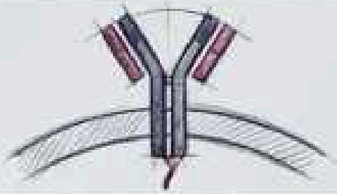
Complement



Notice: Antibodies rarely kill anything themselves. They mark targets and recruit other defences.

The Five Immunoglobulin Classes

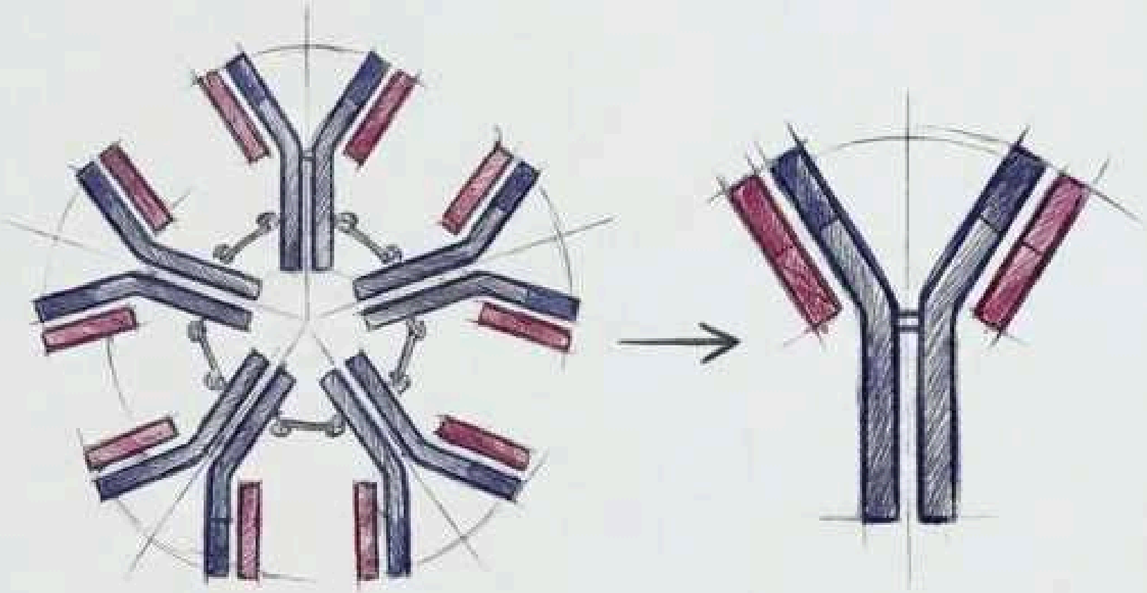
¶ 3.4

Class	Structure	Primary Location	Specialized Job
IgM_M		Blood	First made in primary response; activates complement.
IgG_G		Blood / Tissues	Most abundant; main secondary response; crosses placenta to protect babies.
IgA_A		Mucus, tears, saliva, breast milk	Guards body surfaces.
IgE_E		Tissues	Defence against parasites and allergy.
IgD_D		Surface of B cells	Receptor function.

Refining the Response

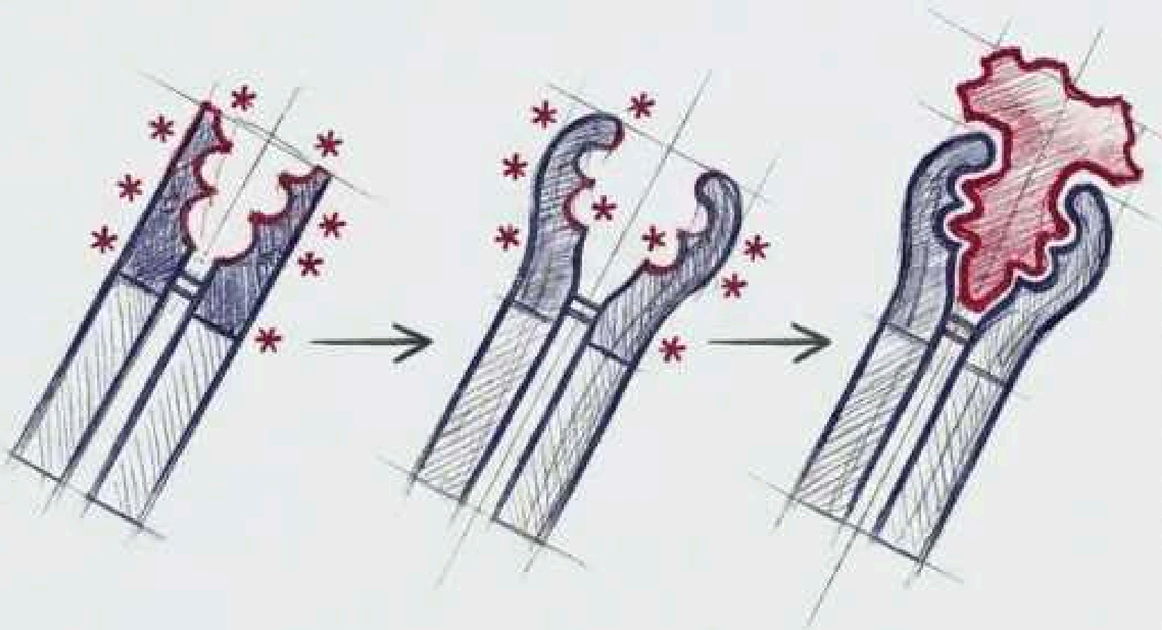
¶ 3.5

Class Switching



Activated B cells change their constant region—
keeping the same binding site but changing the job.

Affinity Maturation

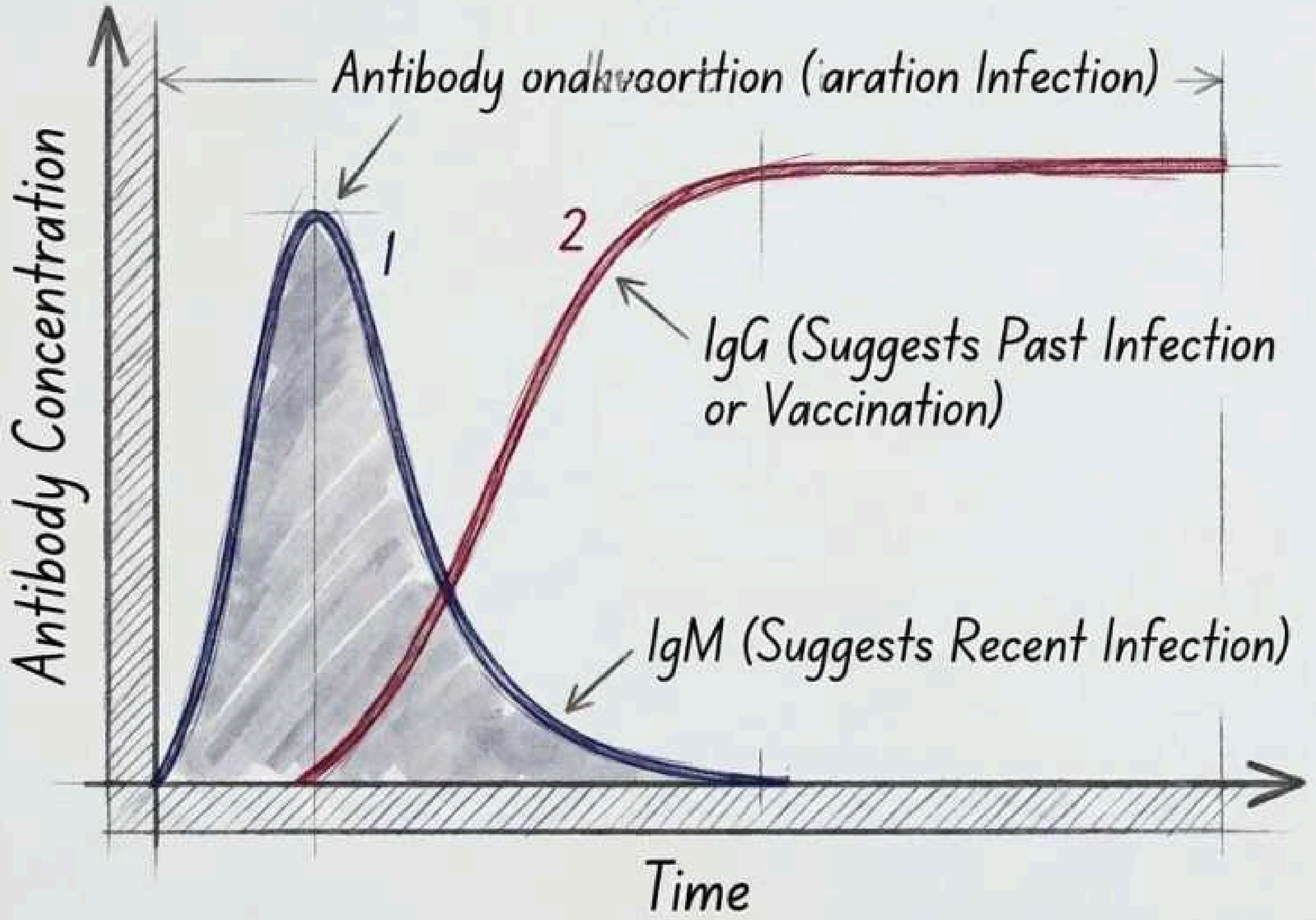


Lymph nodes introduce small mutations.
The tightest binders are selected to survive.

Weeks: Steady Improvement →

Clinical Diagnostics: Reading the Record

¶ 3.6

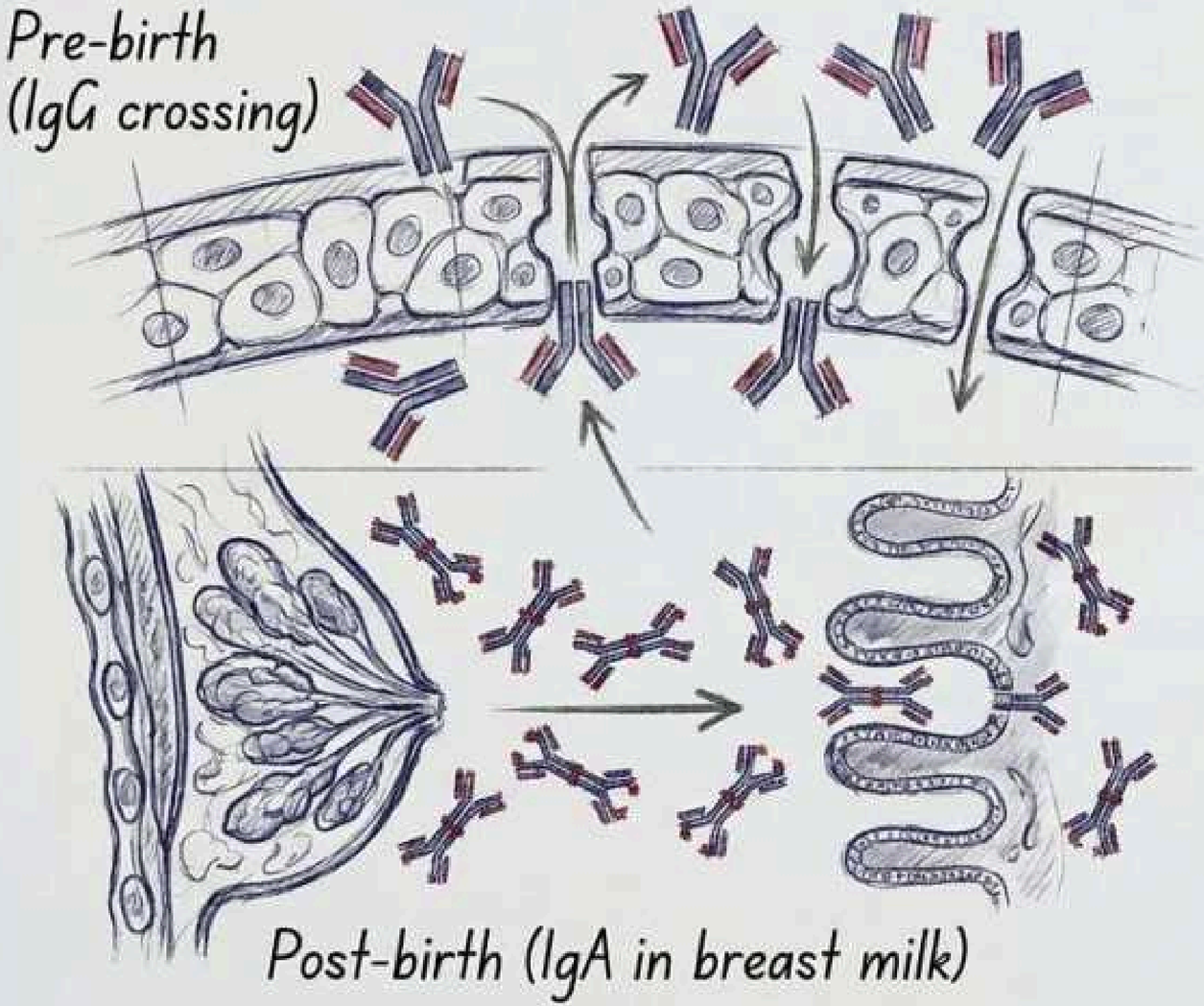


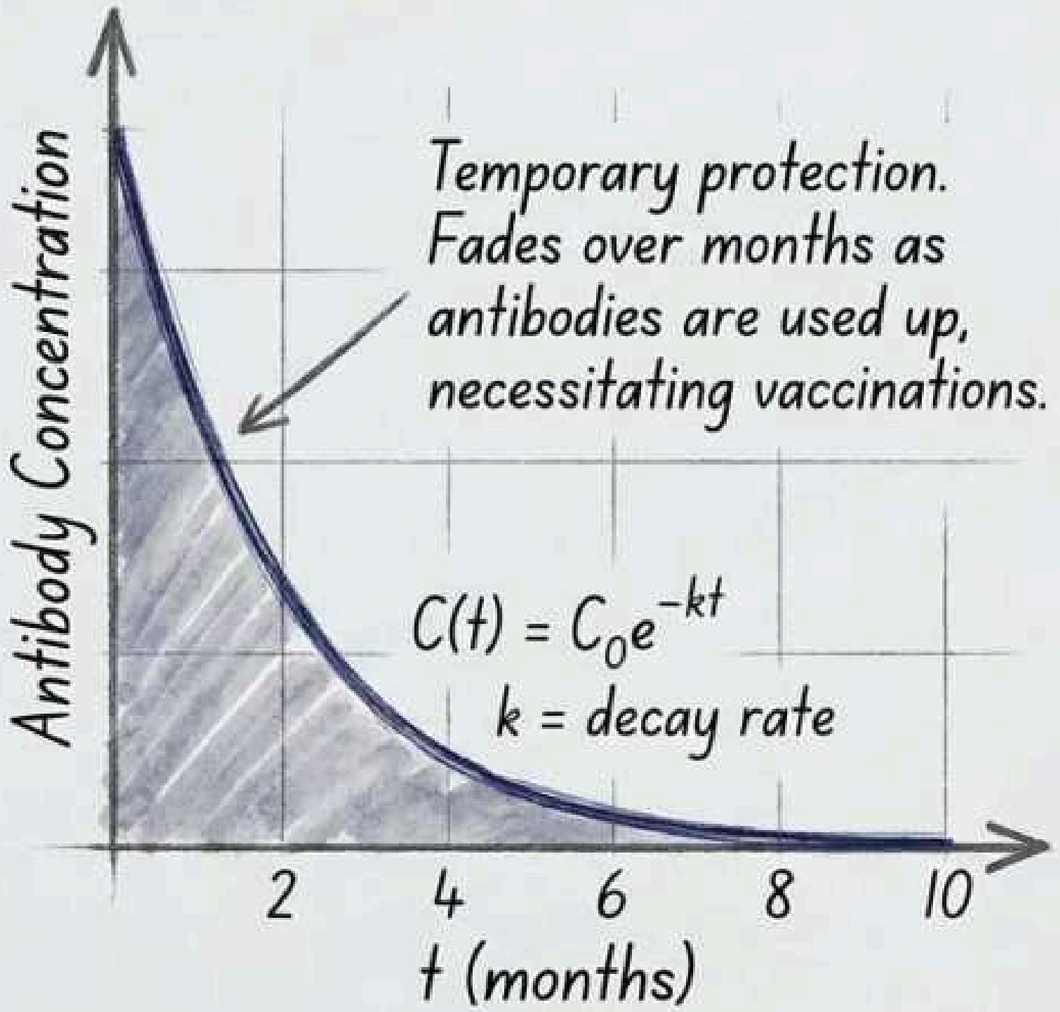
- Blood tests utilize this timeline to check immunity (e.g., measles).
- Diagnose ongoing infections.
- Identify autoimmune conditions.

Natural Passive Immunity

¶ 3.7

Passive immunity: Receiving ready-made antibodies rather than making them.





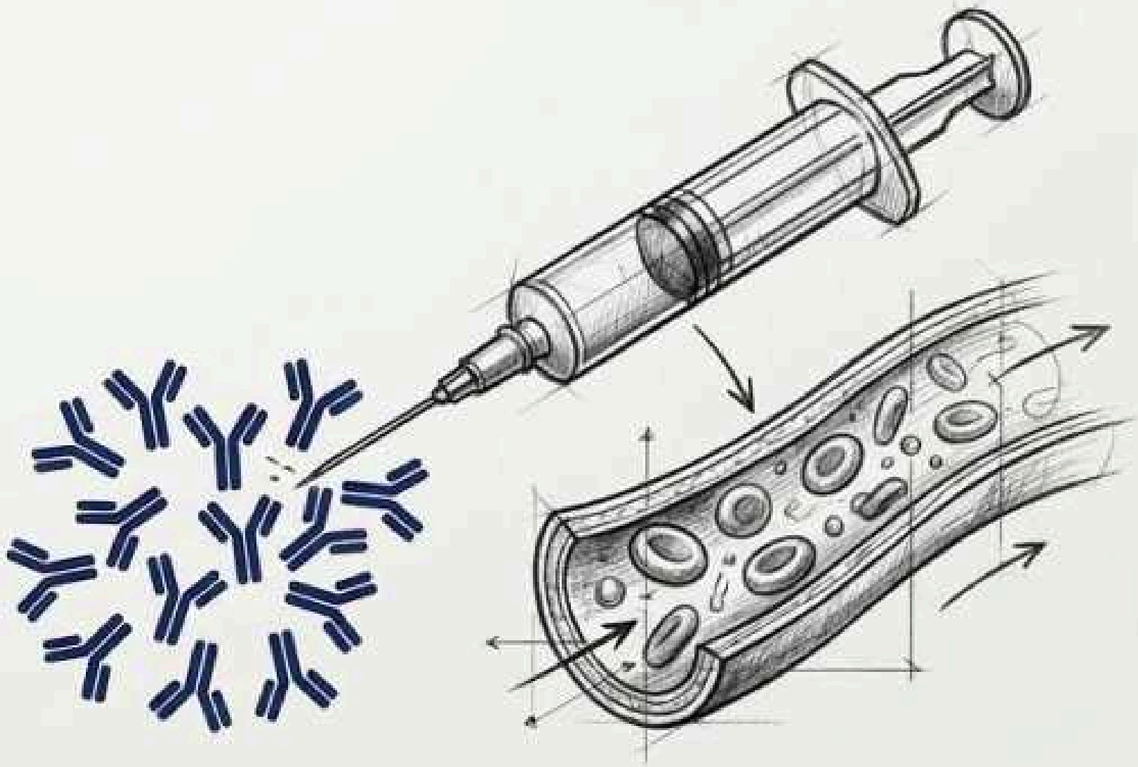
Therapeutic Passive Immunity

¶ 3.8





1890s: Emil von Behring uses serum from immunised animals to treat diphtheria. Awarded the first Nobel Prize in Medicine in 1901.

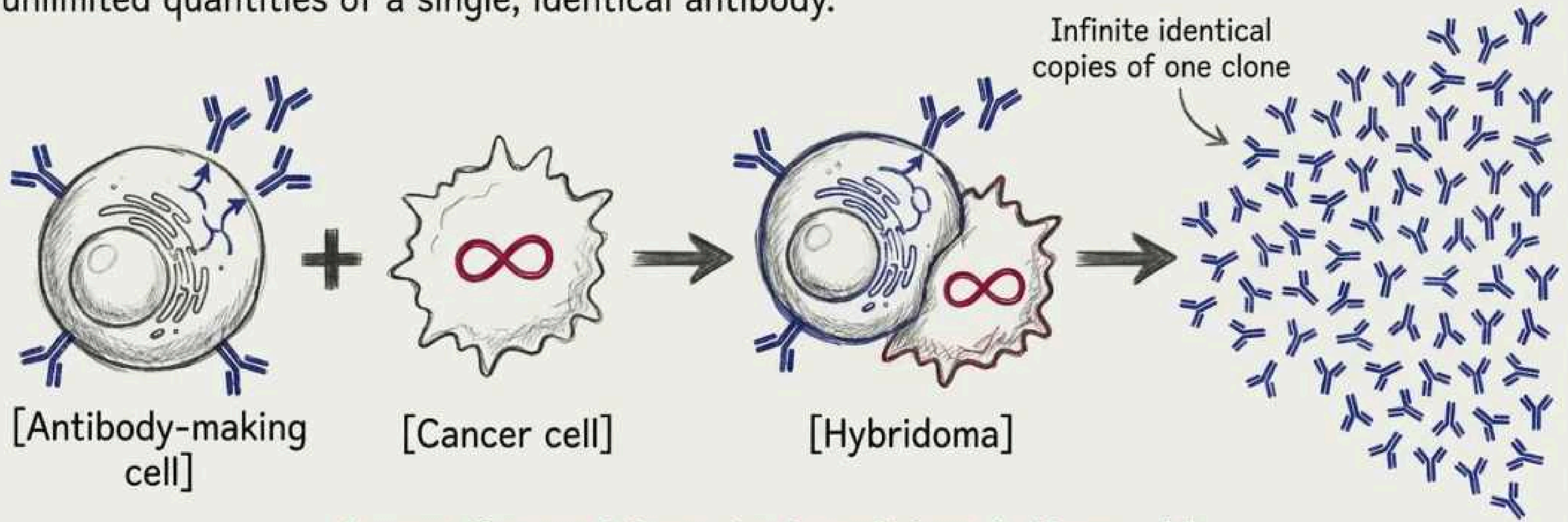


Injected for immediate protection against acute threats, such as rabies exposure or snake bites.

The Monoclonal Revolution (1975)

¶ 3.9

César Milstein and Georges Köhler discover how to manufacture unlimited quantities of a single, identical antibody.

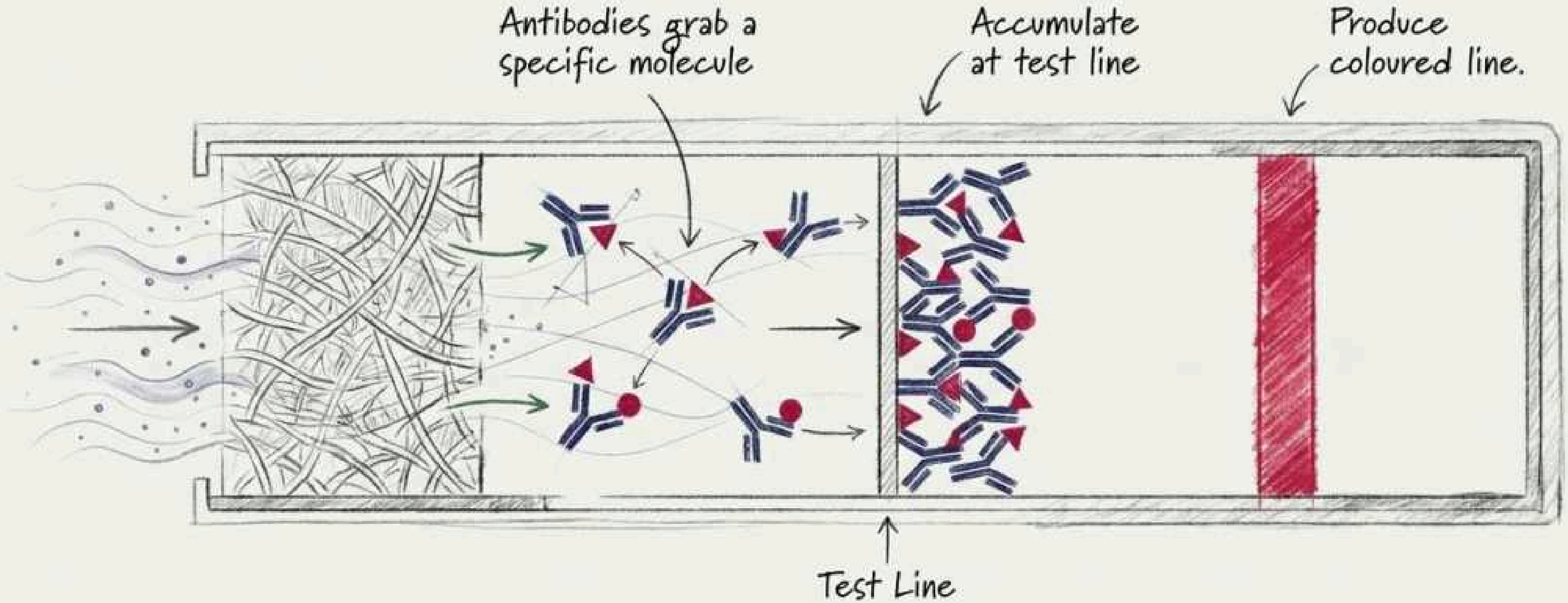


Among the most important medicines in the world.
Used to treat cancers, autoimmune diseases, and infections.

Naming convention: Always ends in **-mab**.

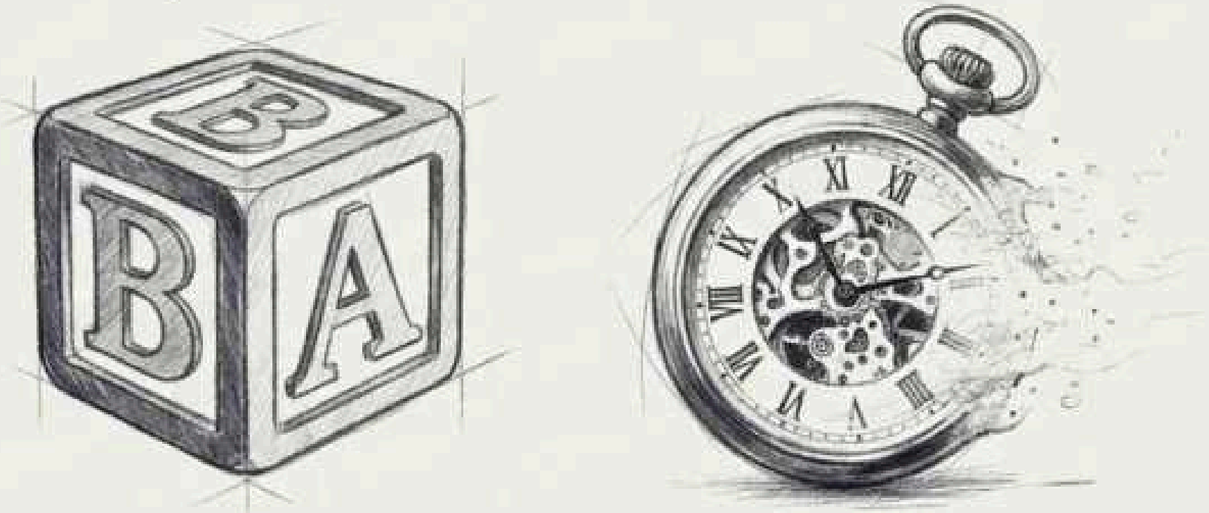
Powering Laboratory Diagnostics

¶ 3.10



The extreme precision with which an antibody recognises and grave raich math erase molecule. | its target makes rapid, at-home testing possible.

Why does a baby have some protection against infections in its first few months, and why does that protection fade?

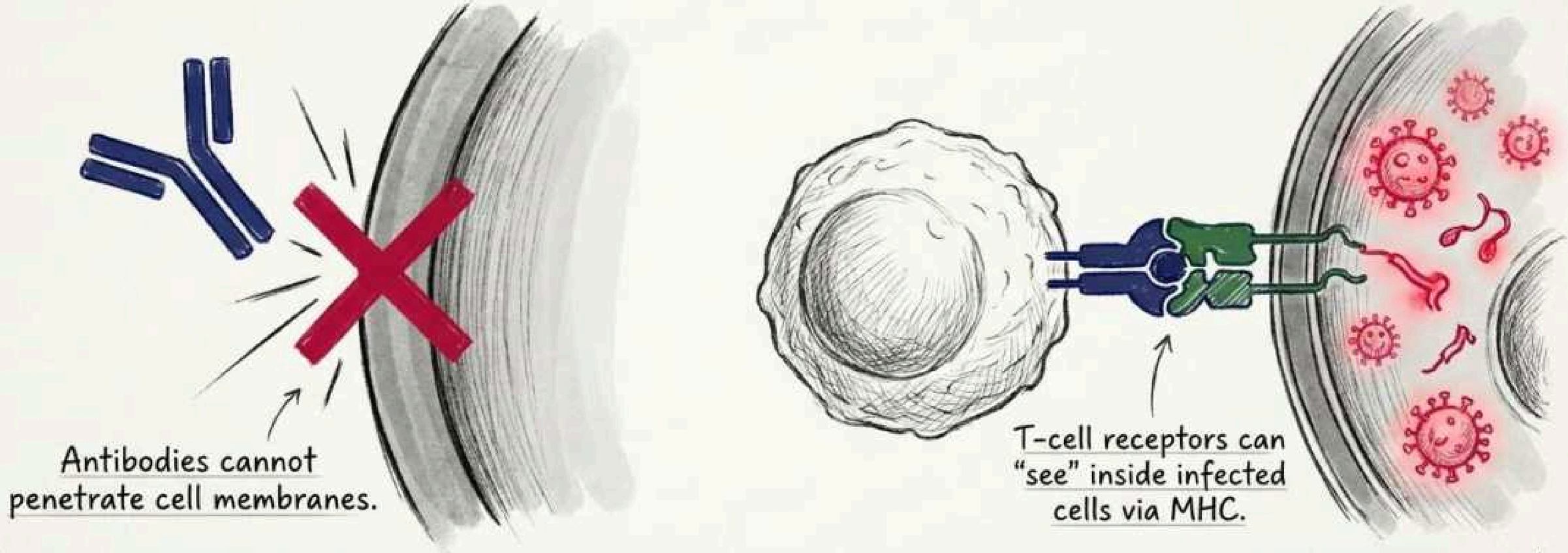


Requirement: You must use specific antibody classes (IgG, IgA) in your answer to explain the mechanism.

The Limitation of Antibodies

¶ 3.12

Antibodies are remarkable, but they cannot look inside our cells to find hidden threats.



Next in Lecture 4: T Cells and the molecules that let them look inside.