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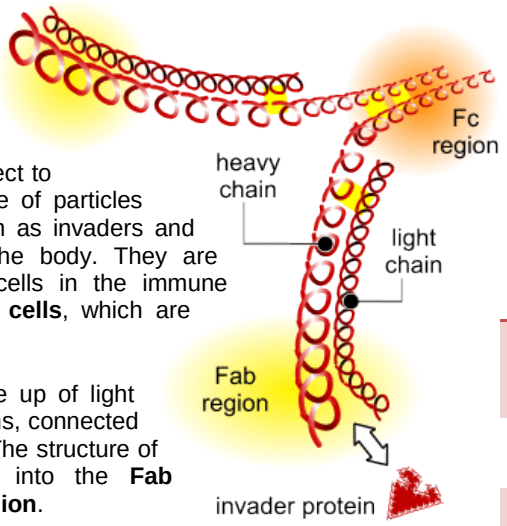
Antibodies

Introduction

The body has a number of ways of fighting off invaders like bacteria and viruses. Sometimes it uses chemicals that kill them off randomly. However, a really clever system has been designed to target them very specifically. Antibodies are the body's clever labels for marking out these invaders.

What is an antibody?



Antibodies are groups of proteins which connect to proteins on the surface of particles and cells to label them as invaders and stop them attacking the body. They are produced by special cells in the immune system called **plasma cells**, which are mature B lymphocytes.

Each antibody is made up of light chains and heavy chains, connected by a disulphide bond. The structure of the antibody is split into the **Fab regions** and the **Fc region**.

The Fab regions are the *fragment antigen-binding regions*, which are the bits which connect to enemy proteins and which are different in different antibodies.

The Fc region is the *fragment crystallisable region*, which is the bit which connects to normal human immune cells, so that lymphocytes can connect to the antibody and recognise that it has found an invader.

What do antibodies do?

You can split the body's immune response into **cellular** immunity (i.e. fighting enemies off using cells) and **humoral** immunity (i.e. fighting them off using antibodies). Because antibodies are so cleverly designed, they help in three main ways:

Neutralisation

When the Fab region connects to a protein on the surface of a particle or cell, it stops that protein from having any effect. Like shooting an enemy in the leg, it does not kill the enemy but it stops it from causing any further harm.

Flag

When an antibody connects to a protein with the Fab region, it leaves the Fc region free. If this is recognised by any cells with an Fc receptor, the cell will realise there's an enemy nearby and release perforin and granzymes to destroy it. The antibody acts like a flag to the presence of a nearby invader.

Opsonisation

When cells like macrophages 'eat' another cell, it is called phagocytosis. They need something to trigger this – to alert the macrophage that the cell is worth eating. This is called opsonisation. Some molecules that are normally found on the surface of bacteria can do this. Antibodies aren't great at it, but they can stimulate it – or they can cause C3b (part of the *complement pathway*) to stimulate it.

Antibody Isotypes

IgA	Acts wherever there's mucus to fight infection (e.g. gut, lungs, genitourinary tract)	Dimer (goes around in a pair)
IgD	Forms a receptor on the surface of B-lymphocytes	Monomer (goes around on its own)
IgE	Responds to things that the body is allergic to (e.g. pollen)	Monomer
IgG	This is the main antibody needed to fight infection, causing autoimmunity, and recognising re-infection	Monomer
IgM	The antibody used mostly in the 'acute phase' immediate response, before a rise in IgG	Pentamer (goes around in a group of 5)

Further Reading

1. **DeFranco AL, Locksley RM, Roberston M (2007) Immunity: The Immune Response in Infectious and Inflammatory Disease. 5th Ed. Oxford University Press**
2. **Frank SA. (2002) Immunology and Evolution of Infectious Disease. Princeton University Press**
3. **Janeway CA Jr. (1993) How the immune system recognizes invaders. Scientific American. 269(3):72-79**