

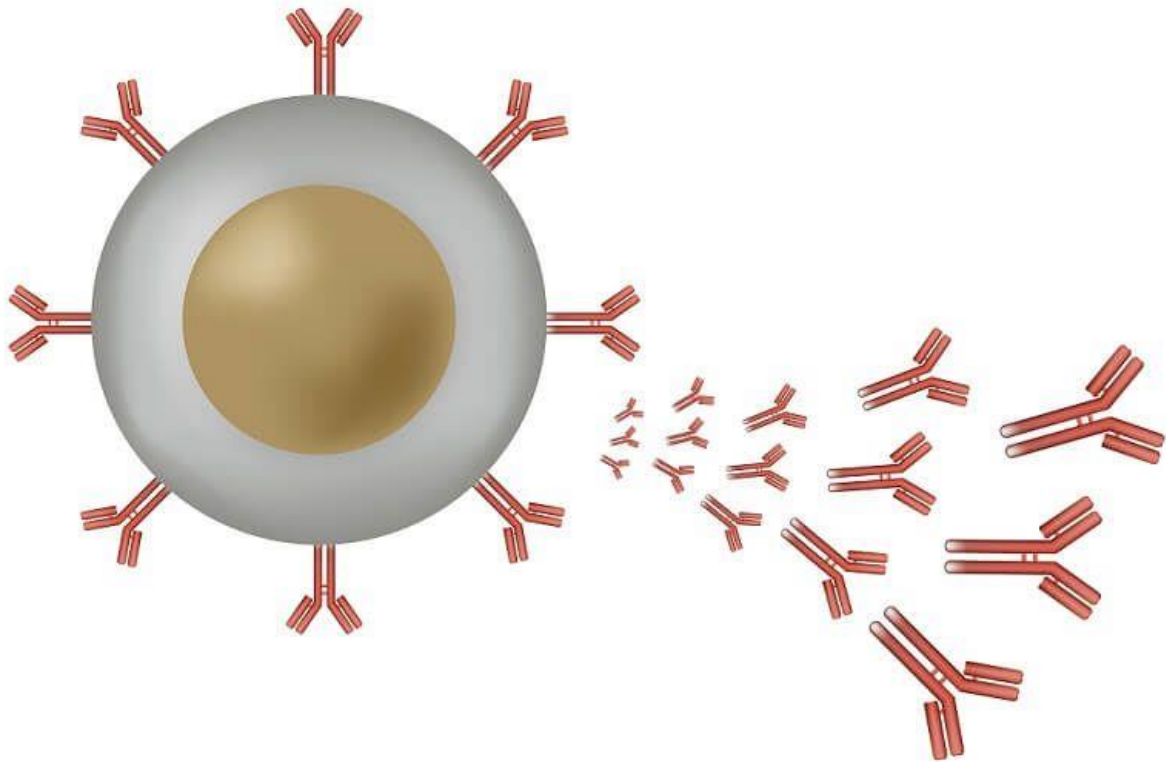
M.Sc ZOOLOGY
SEMESTER 3
PAPER CC 10
HUMORAL IMMUNITY:1

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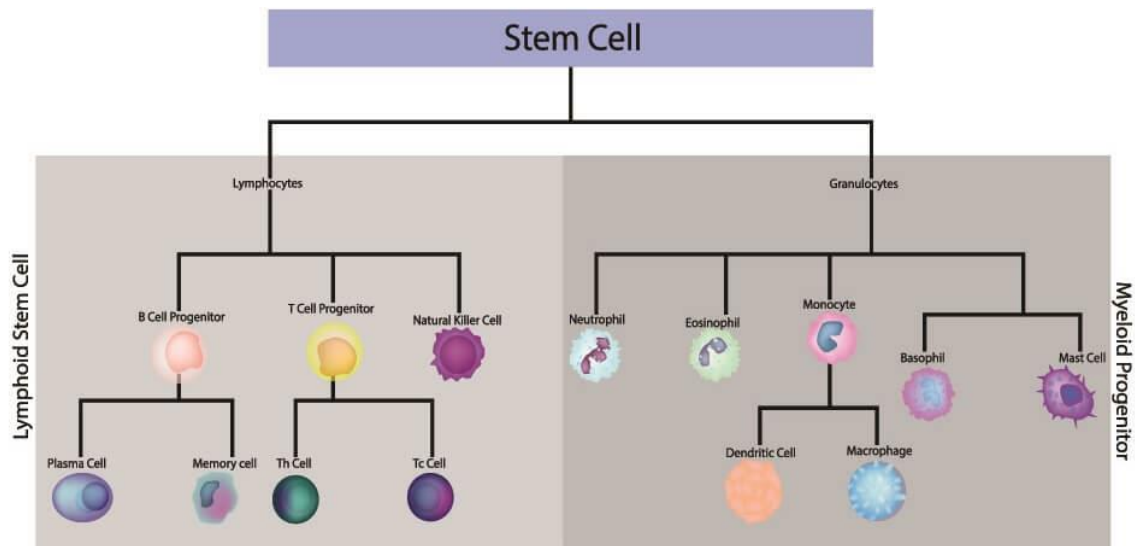
Humoral Immunity

Definition

Humoral immunity is also called antibody-mediated immunity. This physiological mechanism protects the body from pathogens and foreign substances in extracellular fluids and is part of both the innate and adaptive immune systems. It involves a humoral immune response that occurs in two stages: primary and secondary. The primary phase is set into motion upon the body's first contact with an antigen (surface protein found on pathogen membranes); the secondary phase describes the immune-system reaction to subsequent contact with the same antigen.



Humoral immunity is provided by several immune cell types and occurs in specific stages. Older vaccines trigger the humoral immune response by introducing weakened or dead pathogens; newer vaccine developments use templates or mRNA sequences to set our humoral immunity response into motion. These newer vaccines are making headlines thanks to the COVID-19 pandemic.



All immune cells derive from a single stem cell

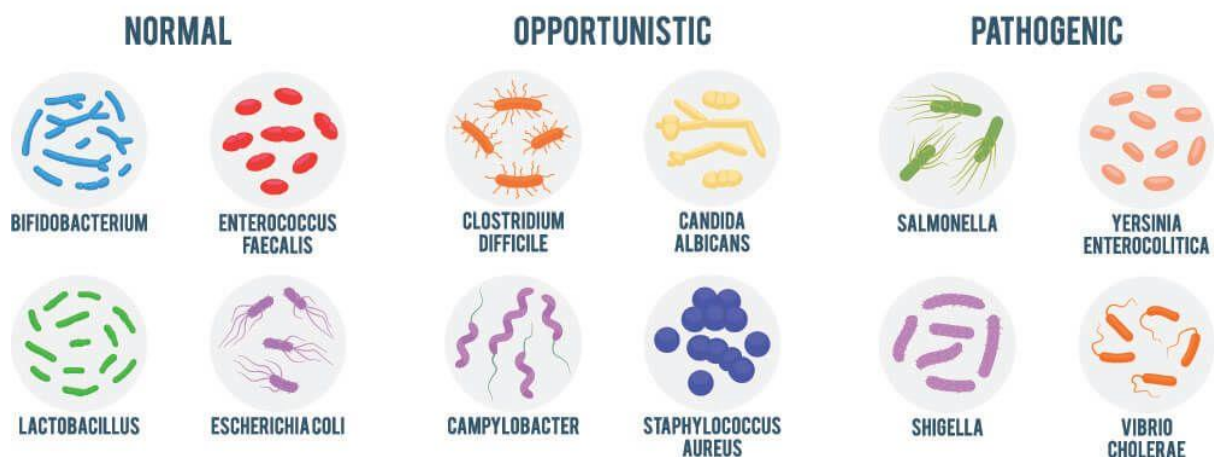
The majority of pathogens multiply in extracellular spaces, moving through this fluid environment. Some travel from cell to cell and use the extracellular space to move between cells.

Only extracellular space is associated with humoral immunity; this response is mediated by antibodies secreted by differentiated plasma cells. To understand the phases of the humoral immune response it is important to know more about its various components.

Pathogens

Pathogens are microorganisms that are not part of the normal body flora. While all of us play host to countless bacteria, many of these help rather than harm us. The word pathogen comes from the Greek word pathos which means suffering or disease.

INTESTINAL MICROFLORA



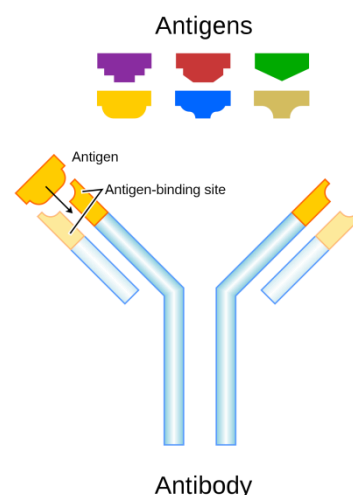
Not all bacteria are pathogenic

When a microorganism is harmful, it is known as a pathogen. If the normal body flora becomes imbalanced, certain non-harmful microorganisms may multiply and begin to cause unpleasant symptoms (opportunistic flora). For example, everyone's gut contains *E.Coli* bacteria. Only when these populations exceed normal levels do we suffer from diarrhoea. Pathogens are foreign organisms that do not form part of the normal flora.

Pathogens can be recognized by immune cells. This is because all microorganisms have specific proteins on their membrane surfaces. Sometimes, textbooks refer to pathogens as antigens. This is not correct. The aforementioned surface proteins are distinguishing features and it is these surface proteins that we call antigens.

Antigens

Surface-membrane antigens can be pure proteins, glycoproteins, lipoproteins, polysaccharides, lipopolysaccharides, nucleic acids, or lipids. Not all generate an immune response – this is important. If the body reacted with an immune response to every antigen, we could not survive. In people with auto-immune disorders – where the body wrongly attacks its own cells – immune responses are excessive and damaging. Any antigen that produces an immune response is referred to as an immunogen. Most immunogens are proteins and polysaccharides.



An antigen has active areas able to bind to **white blood cells** and antibody receptors. This area is the epitope or antigenic determinant.

There are three classes of antigen:

- **Exogenous:** foreign antigens that enter the body from the external environment. These are recognized by antigen-presenting cells (see below).
- **Endogenous:** normal body cells that signal to cytotoxic **T cells** (cellular immunity) when infected by a **virus** or cancer.
- **Autoantigens:** the primary cause of auto-immune disorders, autoantigens are parts of our tissue that cause immune responses.

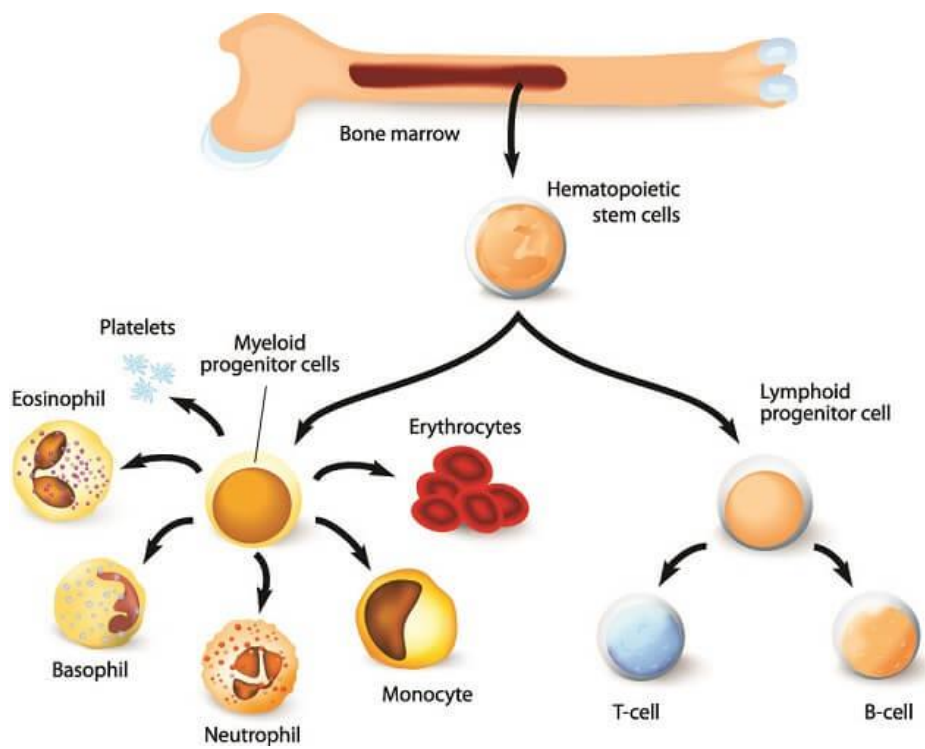
Haptens

Sometimes, smaller molecules enter the body that do not present complete antigens. If you touch poison ivy, your skin absorbs haptens in the form of a chemical called urushiol. Urushiol is not a harmful molecule. If the immune system did not recognize it, there would be no effect. To create an immune response, the hapten must bind to skin proteins like keratin. Only as a combined molecule do they cause an ill effect and only in this state can immune cells see them as hazardous. A hapten needs a carrier protein to make its antigen complete.

Lymphoid Organs

Lymphoid organs are components of our extracellular system and it is here that lymph (a fluid made of the same products as extracellular or interstitial fluid) is produced. Our lymphoid system is a drainage network that also transports lipids and cells of the immune system. We have three classes of lymphoid organs:

- **Primary lymphoid organs:** red bone marrow, thymus gland.
- **Secondary lymphoid organs:** lymph nodes, spleen, tonsils, Peyer's patches in the small intestine, and some mucous membranes (mucosa-associated lymphoid tissue or MALT).
- **Tertiary lymphoid organs:** found in areas where chronic inflammation exists due to autoimmune disease or cancer. TLOs are abnormalities that consist of lymphocyte groups and resemble lymph nodes.



Red bone marrow – essential for so many reasons
