



**CHANDIGARH
UNIVERSITY**

Discover. Learn. Empower.

INSTITUTE-UNIVERSITY INSTITUTE OF ENGINEERING

ACADEMIC UNIT-II

Computer Science Engineering

Subject Name-Biology For Engineers

Subject Code- 20SZT148



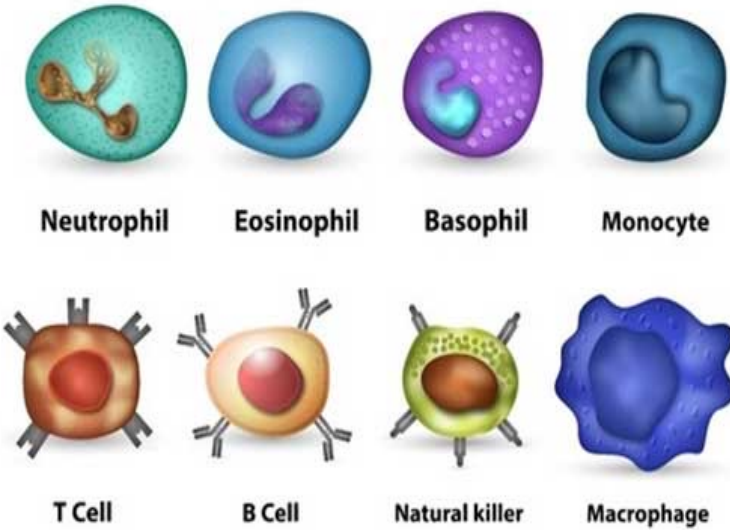
TYPES OF IMMUNE CELLS

DISCOVER . **LEARN** . EMPOWER

TYPES OF IMMUNE CELLS

Course Outcome

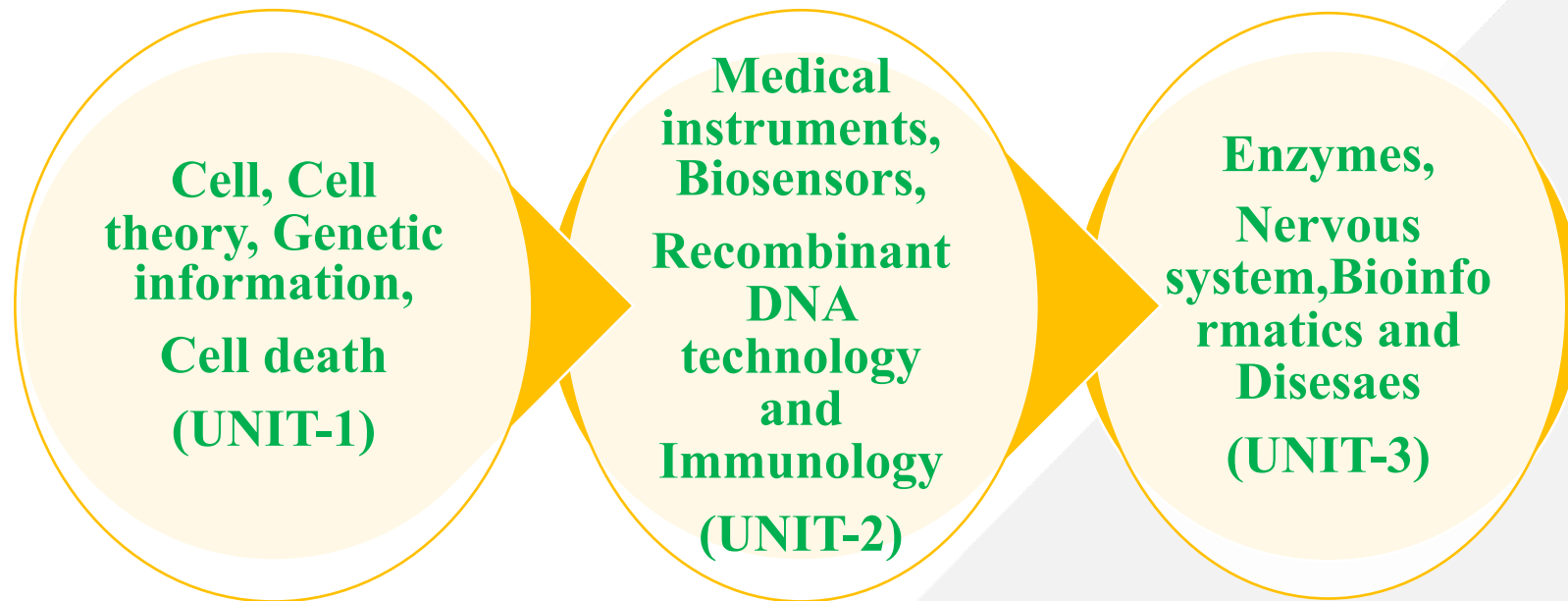
CO Number	Title	Level
CO1	It gives an idea about the about the basic cell biology.	Understanding
CO2	It deals with the idea of uses of biology in engineering.	Understanding
CO3	It provide knowledge about the uses of softwares in biology field.	Remembering



Will be covered in this lecture

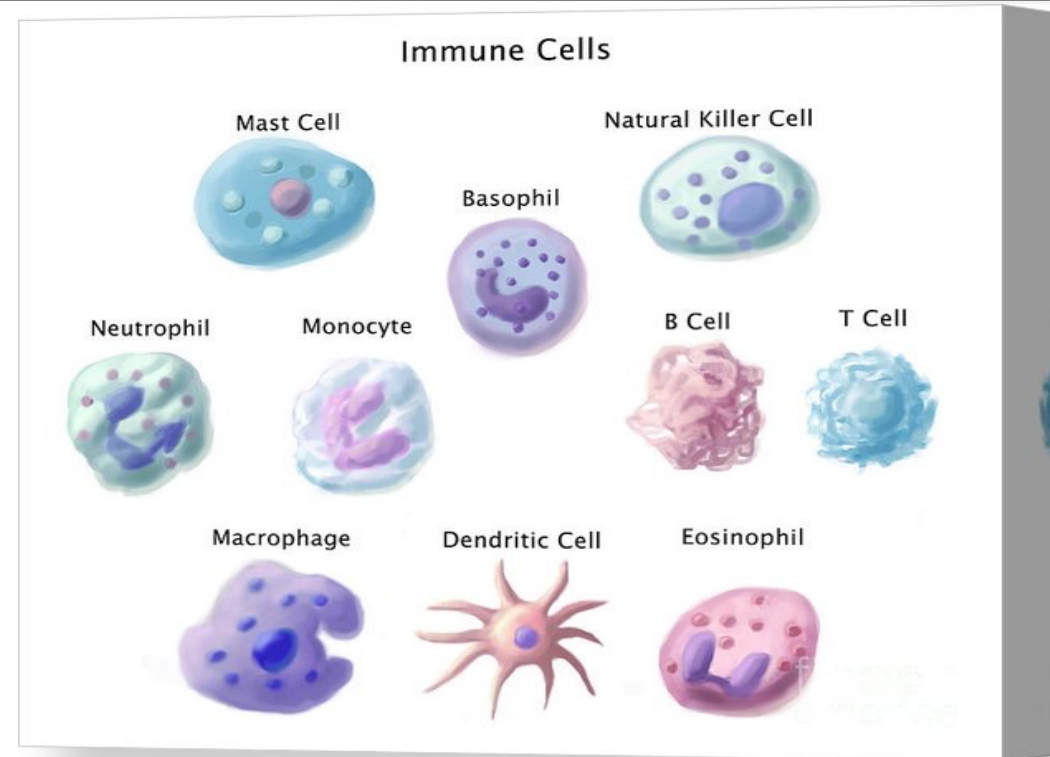
<https://microbenotes.com/cells-of-the-immune-system/>

BIOLOGY FOR ENGINEERS



TYPES OF IMMUNE CELLS

The cells that serve specialized roles in innate and adaptive immune responses are phagocytes, dendritic cells, antigen-specific lymphocytes, and various other leukocytes that function to eliminate antigens. Most of these cells are found in the blood, their responses to microbes usually occur in lymphoid org



<https://fineartamerica.com/featured/1-immune-cells-illustration-spencer-sutton.html?product=canvas-print>

TYPES OF IMMUNE CELLS

Phagocytes

- Phagocytes, including neutrophils and macrophages, are cells whose primary function is to ingest and destroy microbes and get rid of damaged tissues.
- The functional responses of phagocytes in host defense consist of sequential steps: recruitment of the cells to the sites of infection, recognition of and activation by microbes, ingestion of the microbes by the process of phagocytosis, and destruction of ingested microbes.

Dendritic Cells

- Dendritic cells are the most important activating naive T cells, and they play major roles in innate responses to infections and in linking innate and adaptive immune responses. They have phagocytic capabilities and are widely distributed in lymphoid tissues.

TYPES OF IMMUNE CELLS

Lymphocytes

- Lymphocytes are the principal cell players in the adaptive immune response. They represent 20% to 40% of circulating white blood cells and 99% of cells in the lymph. Lymphocytes can be broadly subdivided into three major populations on the basis of functional and phenotypic differences:
- B lymphocytes (B cells)
- T lymphocytes (T cells)
- Natural killer (NK) cells.
- Each B or T cell also expresses an antigen-specific receptor (the B cell receptor (BCR) or the T cell receptor (TCR), respectively) on its surface.

TYPES OF IMMUNE CELLS

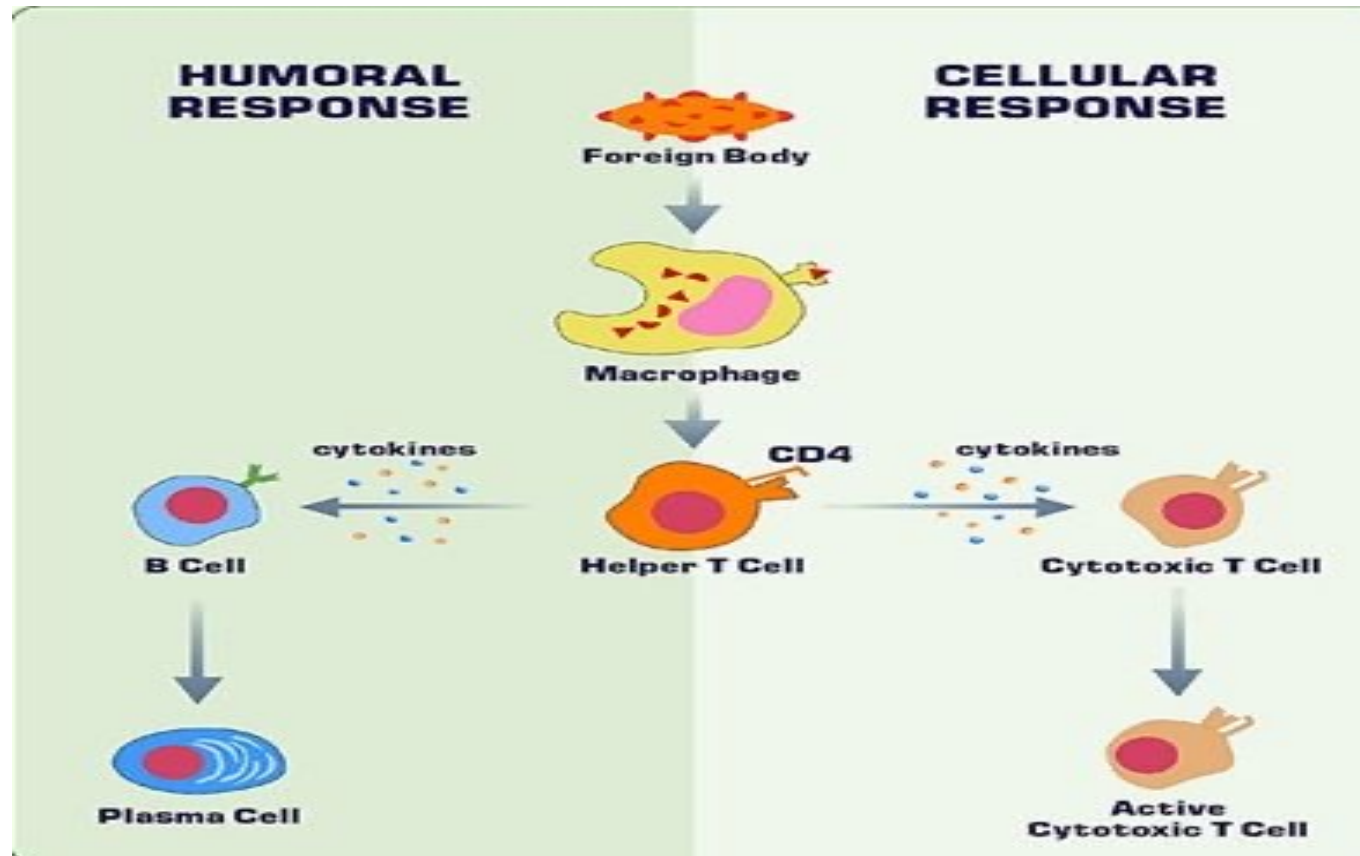
1. B-Lymphocytes or B-Cells:

- B-lymphocytes or B-cells derive their name from their site of maturation.
- They are so named since they were first detected in the bursa of Fabricius of birds and later from bone marrow of a number of mammalian species, including humans and mice.
- B-lymphocytes do not have the ability to synthesize antibody molecule during undifferentiated stage.
- During differentiation, each lymphocyte acquires the ability to synthesize antibody molecules when provoked by antigens.

TYPES OF IMMUNE CELLS

- **Humoral Immune Response:**
- Humoral immune response is also called B-cell mediated immunity because B-lymphocytes are involved in this response. Humoral immune response is to defend the body against pathogens that may invade body fluids or humor. B cells are antigen specific.
- During immune response, B cells, specific for the antigen, enlarge to become lymphoblasts that further differentiate to form plasma cells. The mature plasma cells produce gamma globulins or immunoglobulins called antibodies at a rapid rate of about 2000 molecules per second for each plasma cell.
- The antibodies secreted into the lymph eventually enter the blood.

TYPES OF IMMUNE CELLS



<https://www.pinterest.com/pin/356417757982739912/>

TYPES OF IMMUNE CELLS

2. T-Lymphocytes or T-Cells:

- T-Lymphocytes or T-cells derive their name from their site of maturation in the thymus. They are major players in the cell-mediated immune response and also have an important role in B-cell activation. T-cells themselves do not secrete antibodies (immunoglobulin) like B-cells.
- They are immunologically specific and are directly involved in cell-mediated immune responses, can carry a vast repertoire of immunologic memory, and can function in a variety of effector and regulatory way.
- The main effector functions include tuberculin reaction (delay-ed hypersensitivity response), destruction of tissue grafts, secretion of soluble chemical mediators called lymphokines and their ability to perform killer functions of other cells.

TYPES OF IMMUNE CELLS

- The regulatory functions involve their cooperation with B-lymphocytes to produce antibodies. In additions to these functions, some subpopulations of T-cells contribute immune responses such as cytotoxicity, suppression, and killer properties.
- **Cell Mediated Immune Response:**
- Cell mediated immune response is carried out by the T-cells or T lymphocytes. So, it is also called T-cell immunity. This type of immune response is to defend against pathogens that may invade host cells.
- The surface of the T-cell has receptor molecule that can bind with antigens. These receptor molecules are made of a variable unit similar to the variable portion of the humoral antibody. A single T-cell has about 100,000 receptor sites.

TYPES OF IMMUNE CELLS

- When an antigen enters the body, the macrophages first attack the antigen and fragment it into pieces. It then presents a piece of antigen to the T-helper cells. The T helper cells recognize the antigen and trigger off a series of cell mediated response. A clone of T-lymphocytes is first formed after being activated by the T-helper cells. There are different kinds of T-cells, which are morphologically similar but differ functionally.
- **The actions of the different types of T-cell are summarised below:**
 - a. Helper cells react by producing small peptide molecules called lymphokines. The lymphokines promote proliferation of more T-cells, stimulate B cells to produce antibodies and also help in accumulating macrophages in the inflamed tissues and by promoting phagocytosis.

TYPES OF IMMUNE CELLS

- b. Cytotoxic cells or Killer cells kill cells infected by viruses, cancerous cells and transplants.
- c. Suppressor cells, the third type of T-cells produce lymphokines that suppress the action of the phagocytes and the different types of WBC cells.

https://www.biologydiscussion.com/wp-content/uploads/2017/07/clip_image013_thumb2-1.png

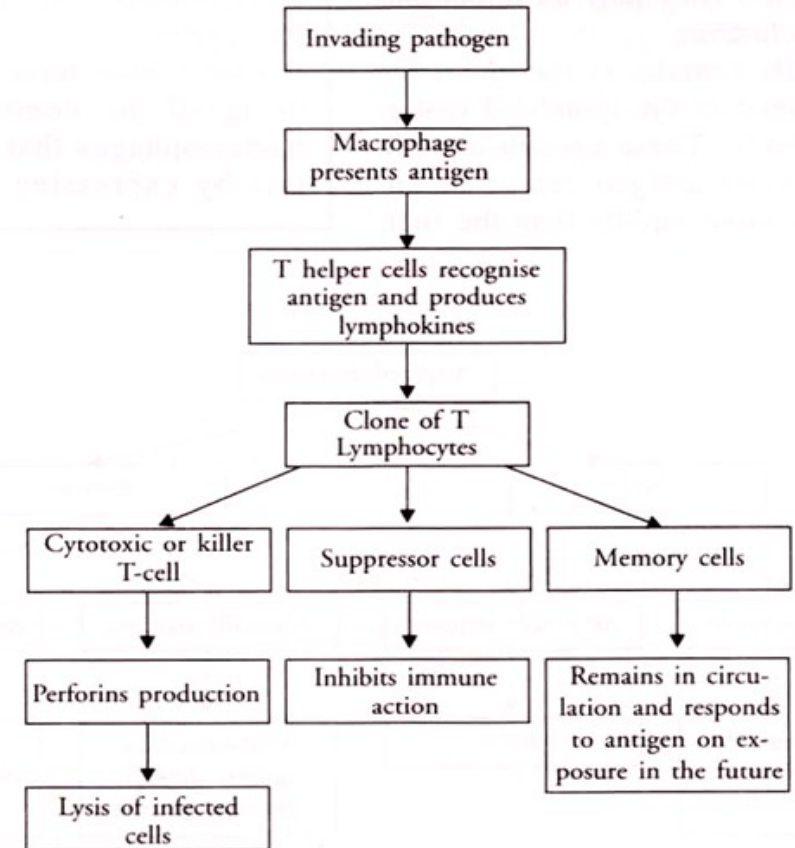


Fig. 11 Flow chart of cell mediated immune response.

TYPES OF IMMUNE CELLS

Mast Cells:

- Mast cell precursors originate in the bone marrow and are released into the blood as undifferentiated cells. Mast cells are not differentiated from their precursors until the latter leave the blood and enter the tissues. Mast cells are found in a variety of tissues including the skin, connective tissues of various organs, and mucosal epithelial tissue of the respiratory, genitourinary, and digestive tracts.
- These cells, like basophils, possess large numbers of granules in cytoplasmic matrix. The granules in cytoplasm contain histamine and other pharmacologically active substances that contribute to the inflammatory response. Mast cells, together with basophils, play an important role in the development of allergies and hypersensitivities.

TYPES OF IMMUNE CELLS

Granulocytes: Granulocytes are those white blood cells (leucocytes) which have irregular-shaped nuclei with two to five lobes and granulated cytoplasmic matrix. Three types of granulocytes are recognised in the body and they are: basophils, eosinophils, and neutrophils.

1. Basophils:

- Basophils (G. basis = base; philein = to love). These granulocytes are non-phagocytic cell that function by releasing pharmacologically active substances (e.g., histamine, prostaglandins, serotonin, and leucotrienes) from their cytoplasmic granules upon appropriate stimulation. Basophils possess high-affinity receptors for immunoglobulin-E (IgE) antibody and thereby become coated with these antibodies. Once coated, antigens trigger the basophil cells to secrete vasoactive mediators which are inflammatory and play a major role in certain allergic responses

TYPES OF IMMUNE CELLS

2. Eosinophils:

- Eosinophils (G. eos = dawn; philein = to love) have a bi-lobed nucleus connected by a slender thread of chromatin and prominent acidophilic granules in cytoplasmic matrix. Eosinophils, like neutrophils, are motile cells that migrate from bloodstream into tissue spaces.
- These granulocytes are considered to play a role in the defence against parasitic organisms (protozoans and helminth parasites) by phagocytosis.
- They release mainly cationic proteins and reactive oxygen metabolites into the extracellular fluid. These substances damage the plasma membrane of the parasite. Eosinophils constitute only 3-5% of the white blood cells and their acidophilic granules stain red with acidic dyes.

TYPES OF IMMUNE CELLS

3. Neutrophils:

- Neutrophils (L. neuter – neither; philein = to love) . Neutrophils, like eosinophils, are motile cells that migrate from bloodstream into the tissue. Phagocytosis by neutrophils is similar to that operated by macrophages except that the lytic enzymes and bactericidal substances in neutrophils are contained within primary and secondary granules instead of lysosomes in macrophages. The primary granules are larger and denser and contain peroxidase, lysozyme, and various hydrolytic enzymes.
- The secondary granules are smaller and contain collagenase, lactoferrin, and lysozyme. Both primary and secondary granules fuse with phagosome, whose contents are then digested and the remains excreted much as they are in macrophages.

CONCLUSION

- The cells of the immune system can be categorized as lymphocytes (T-cells, B-cells and NK cells), neutrophils, and monocytes/macrophages. These are all types of white blood cells.
- The major proteins of the immune system are predominantly signaling proteins (often called cytokines), antibodies, and complement proteins.
- One of the functions of specialized cells (located in the thymus and bone marrow) is to present young lymphocytes with self antigens produced throughout the body and to eliminate those cells that recognize self-antigens, preventing autoimmunity.

ASSESSMENT PATTERN

Assessment Pattern	Total Marks
1st Hourly Test	36
2nd Hourly Test	36
Surprise Test	12
Assignment (3)	10
Quiz	4
End Semester Examination	60

REFERENCES

- C.B.Powar, 2010.Cell Biology.5th Ed,Himalyan Publishing House.
- Leshie Cromwell, Fred.J. Weibell and Erich.A.Pfeiffer. 2003. Biomedical instrumentation and measurements. 2nd edition, PHI.
- John G. Webster 1998. Medical Instrumentation: Applications and Design, 3rd edition, Jon Wiley and Sons, New York.
- Jeremy M. Berg, John L. Tymoczko and Lubert Stryer. 2006. “Biochemistry,” 6th Ed. W.H. Freeman and Co. Ltd.
- Robert Weaver. 2012 “Molecular Biology,” 5th Edition, MCGraw-Hill.
- Jon Cooper, , 2004. “Biosensors A Practical Approach” Bellwether Books.
- Martin Alexander, 1994 “Biodegradation and Bioremediation,” Academic Press.



THANK YOU

For queries
Email: subject_code_2020@gmail.com