To Process an antigen ? Bustami

To modify it in some way, so that it can be "recognized" as foreign by a lymphocyte
B cell → T cell

Macrophage → Processing of antigen by macrophages involves phagocytosis and partial digestion of the antigens

Dendritic cells → some dendritic cells are NOT phagocytic
→ they process antigen on the surface of their plasma membranes !!

Antigen Presenting cells → Process both exogenous & endogenous antigens

A macrophage → Phagocytoses
- Bacteria which have exogenous antigens on their surfaces
- virus-infected cells
- cancer cells → have endogenous antigens on their surfaces

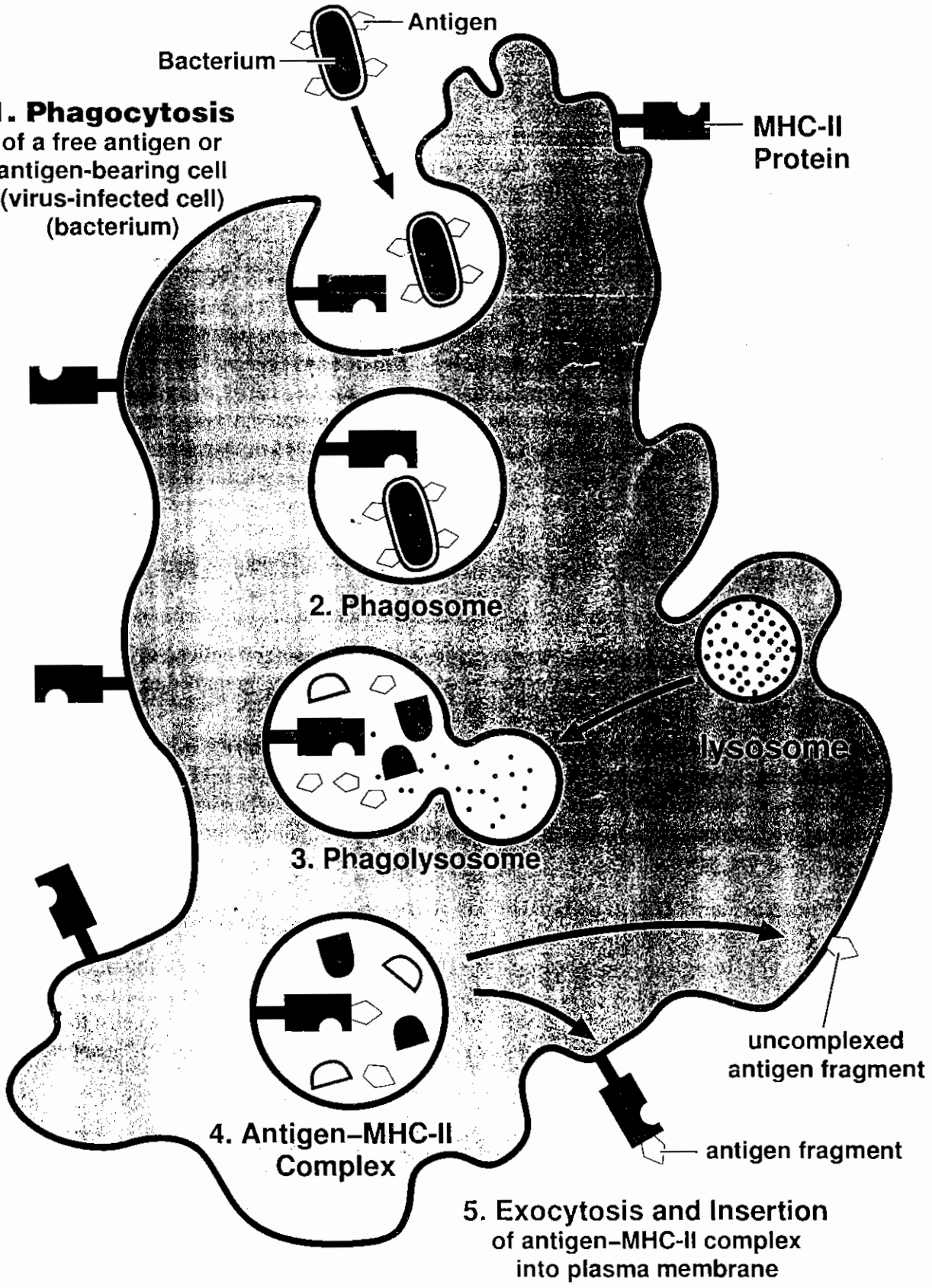
→ In order to be recognized as foreign by T cells →
- exogenous antigens must be processed & associated with MHC-II Proteins
- endogenous antigens must be processed & associated with MHC-I Proteins

The bacterial antigen fragments that associate with MHC-II proteins are presented to (recognized by) helper T cells (T4 cells), triggering activation of the helper T cells and the release of lymphokines such as interleukin-2 (IL-2), which helps to activate B cells. Uncomplexed antigen fragments are recognized by receptors on B cells, triggering their activation and transformation into antibody-secreting plasma cells.

Bustamante

ANTIGEN PROCESSING

Example: A Macrophage Processing Bacterial Antigens



Antibody-mediated immunity

Effective against

- Extracellular pathogens (Primarily Bacteria)
- Antigens dissolved in body fluids e.g bacterial toxins

Mechanism

Activation of B cells

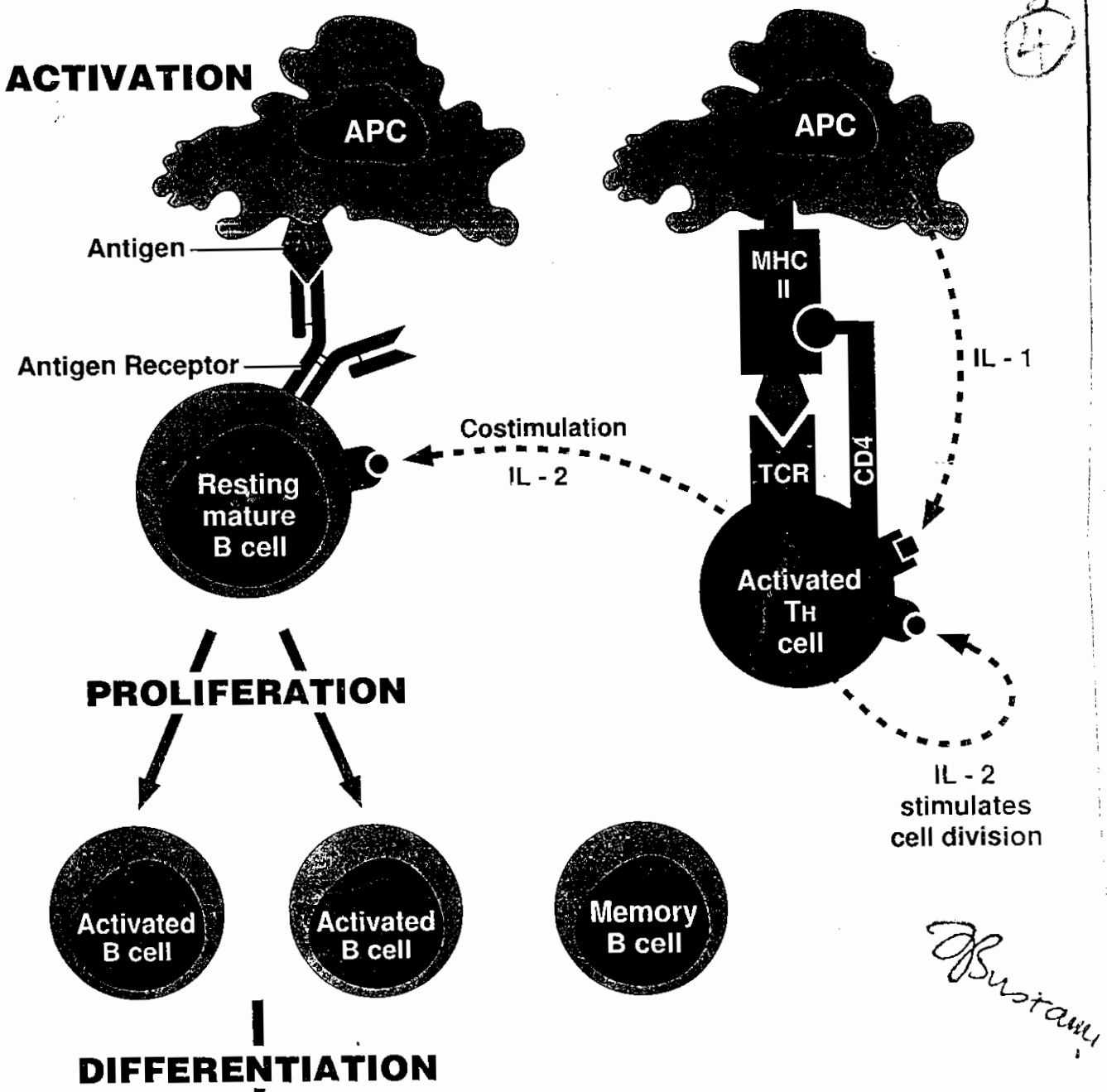
→ B cells can respond to unprocessed antigen in lymph or interstitial fluid but the response is much more intense if the antigens are processed by macrophages or dendritic cells } Antigen presenting cell (APC)

Antigen recognition ? → refers to the binding of an antigen to B cell receptors → Each specific type of antigen BINDS only to those B cells that are programmed to secrete antibodies that attack (bind to) that same type of antigen.

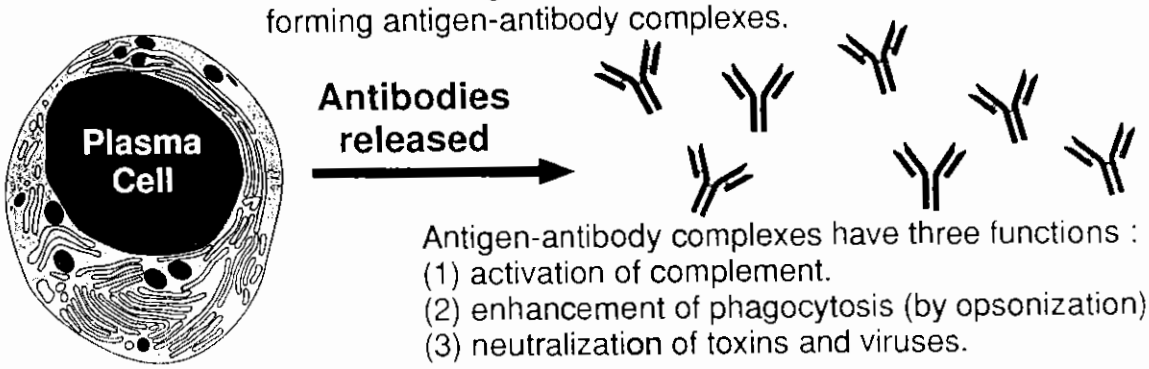
⊛ When B cells become activated → they enlarge divide & differentiate into a clone (population of identical cells) of plasma cells ⇒ plasma cells secrete specific antibodies that circulate in the lymph and blood to reach the site of invasion WHERE THEY BIND TO THEIR ANTIGENS.

Memory B cells → Some of the activated B cells do not differentiate into plasma cells, they remain as memory B cells ⇝ they respond more rapidly & forcefully should the same antigen appear at a future time

ANTIBODY-MEDIATED IMMUNITY



Antibodies travel via the blood to all regions of the body and bind to antigens of the kind that stimulated their production, forming antigen-antibody complexes.

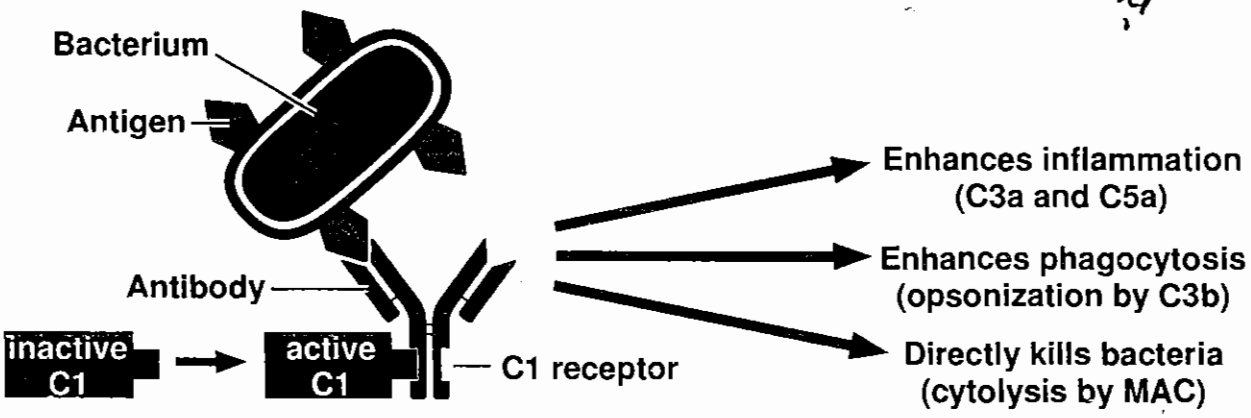


Antigen-antibody complexes have three functions :
(1) activation of complement.
(2) enhancement of phagocytosis (by opsonization).
(3) neutralization of toxins and viruses.

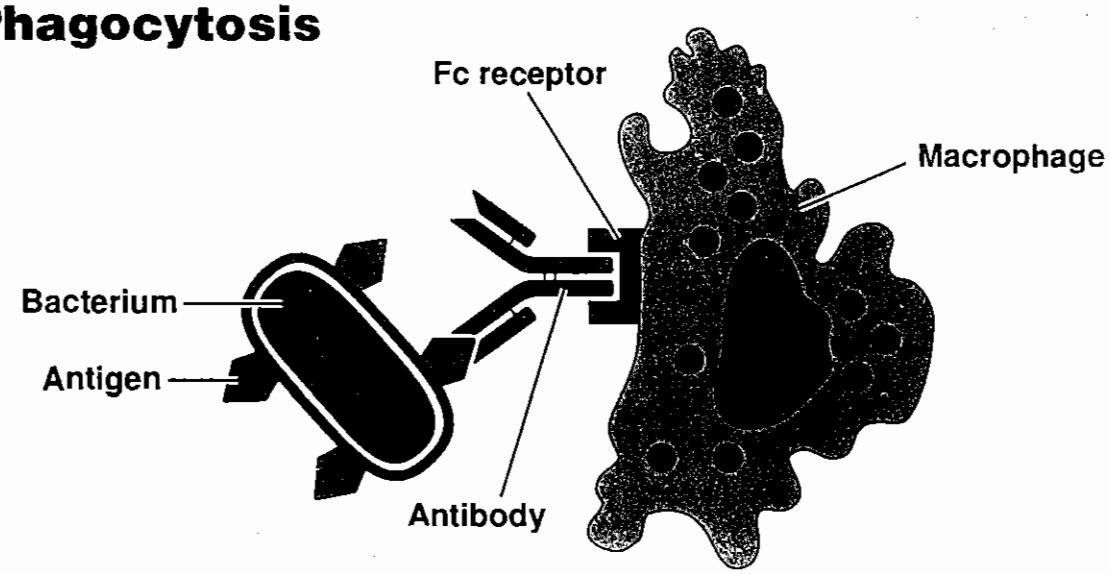
Costimulation Macrophages also present antigen to helper T cells. This stimulates the helper T cells to proliferate and secrete cytokines that costimulate the antigen-bound B cells. Helper T cells bind to the antigen–MHC-II complex and secrete IL-2 that acts as a costimulator to initiate B cell division and differentiation; IL-2 also acts as an autocrine, stimulating proliferation of the same helper T cells that secreted it.

ANTIBODY FUNCTIONS

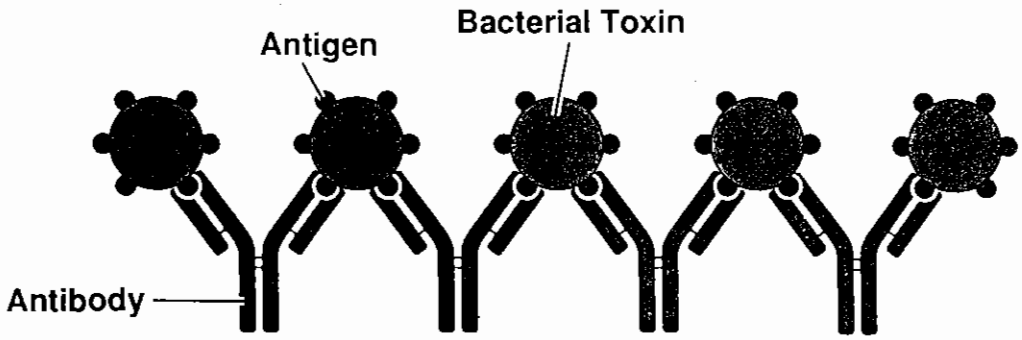
Activation of Complement



Phagocytosis



Neutralization



Antibody Functions

Antibodies destroy antigens by three basic mechanisms:

(1) Activation of Complement Complement kills bacteria by cytolysis and enhances phagocytosis.

(2) Phagocytosis Coating of bacteria with antibody (opsonization) enhances phagocytosis.

(3) Neutralization Antibodies link toxins or viruses, forming nonpathogenic substances.

Cell - Mediated immunity

Bustami #6

↓

Directly Kill specific < ABNORMAL cells or FOREIGN cells

↓ effective against

* Intracellular Pathogens — Fungi, Protozoa, viruses inside body cells
* Cancer cells
* cells of tissue transplantation

↓ Mechanism

→ **Activation of Cytotoxic T cells** ←

↓ e.g virus

→ viruses attack body cells by injecting their nucleic acids into the cytoplasm → viral nucleic acids alter the DNA of the host cell causing it to produce viral proteins which are used to produce new viruses

↓

SOME OF THE VIRAL PROTEINS ARE INSERTED IN THE PLASMA MEMBRANE OF THE HOST CELL **COMPLEXED** WITH MHC-I Proteins

↳ Since MHC-I proteins are present on all body cells this type of antigen-MHC-I complex can be formed by any virus-infected cell.

→ Tumour antigens → cancer cells result from genetic changes induced by viruses, chemicals or radiation

↓ genetically altered cancer cells produce UNUSUAL PROTEINS NOT FOUND IN NORMAL BODY CELLS

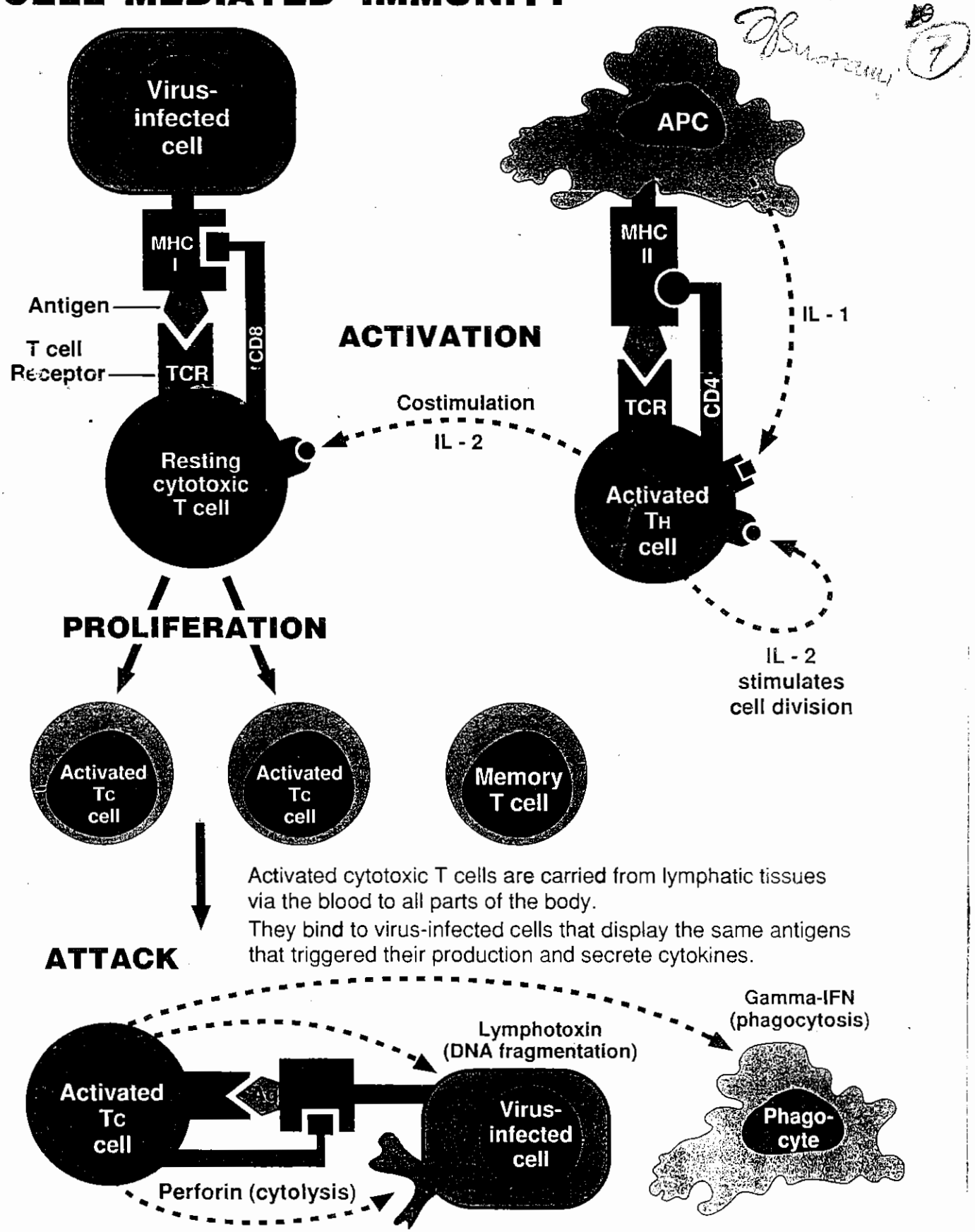
↓

SOME OF THESE CANCER-INDUCED PROTEINS CALLED TUMOR ANTIGENS ARE INSERTED IN THE PLASMA MEMBRANES OF TUMOR CELLS ASSOCIATED WITH MHC-I PROTEINS

↓

(*) THE ANTIGEN-MHC-I complexes serve as BINDING SITES for cytotoxic T cells

CELL-MEDIATED IMMUNITY



Activated cytotoxic T cells are carried from lymphatic tissues via the blood to all parts of the body.
They bind to virus-infected cells that display the same antigens that triggered their production and secrete cytokines.

SUPERFICIAL INGUINAL LYMPH NODES

The superficial inguinal lymph nodes are variable in their number and size. Their arrangement is 'T'-shaped, having a lower vertical group and an upper horizontal group. The upper nodes can be subdivided into the upper lateral and upper medial groups.

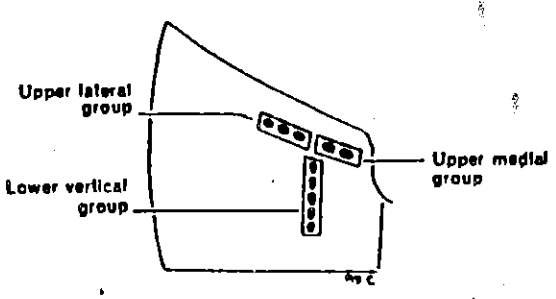


Fig. 5 Superficial inguinal lymph nodes.

1. The *lower vertical group* is placed along both sides of the upper part of great saphenous vein. It drains the skin and fasciae of the lower limb, except the buttock (to upper lateral group) and the short saphenous territory (to popliteal nodes).

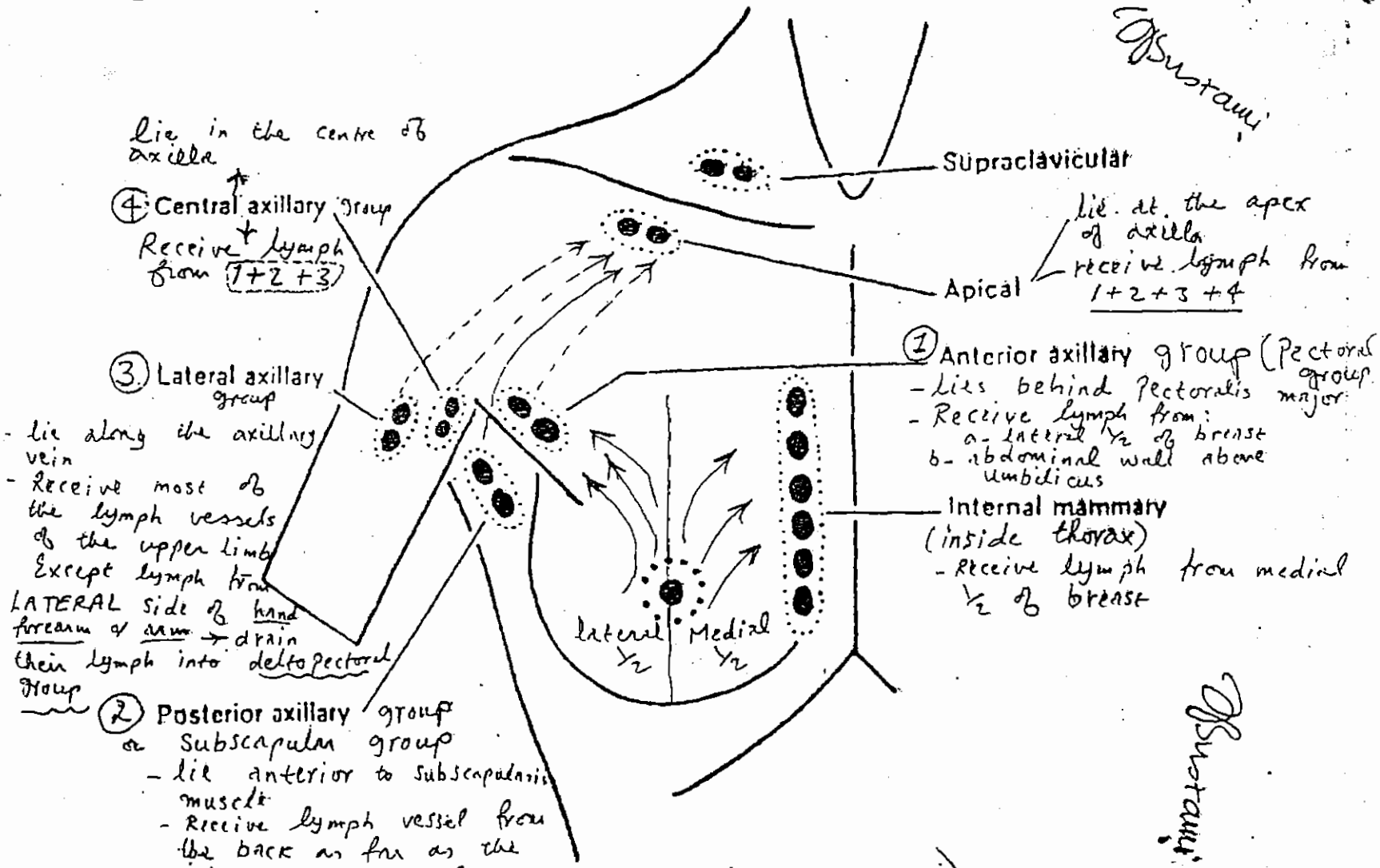
2. The *upper lateral group* is placed below the lateral part of inguinal ligament. It drains the buttock, flank and the back below the waist.

3. The *upper medial group* is placed below the medial end of the inguinal ligament; one or two nodes may lie above the inguinal ligament on the course of the superficial epigastric vessels. They drain anterior abdominal wall below the umbilicus, and the perineum.

* The *efferents* from all superficial nodes pierce the cribriform fascia, and terminate into the deep inguinal lymph nodes which lie along the upper part of the femoral vessels.

Painful enlargement of the superficial inguinal lymph nodes may therefore indicate a disease of the superficial parts of the lower limb including the buttock, infraumbilical part of anterior abdomial wall, perineum, external genitalia, anus, vagina and round ligament of uterus.

{Superficial lymphatics follow veins
deep " " arteries}



Lymph nodes draining the breast

- The apical lymph nodes drain into the subclavian lymph trunk
- on the left this trunk drains into thoracic duct → venous circulation
- " " right " " " " Rt-lymph trunk → " "

LYMPH TRUNKS AND LYMPHATIC DUCTS