AVIAN IMMUNE SYSTEM AND ITS APPLICATION IN DISEASE CONTROL

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Attacking Infectious agent

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Physical barriers

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Innate immunity

Examples: Feathers, skin, thick mucus layer, cilia

Examples: Complement
Natural killer cells, Macrophages

Acquired immunity

Examples: Antibody production
Cell-mediated immunity

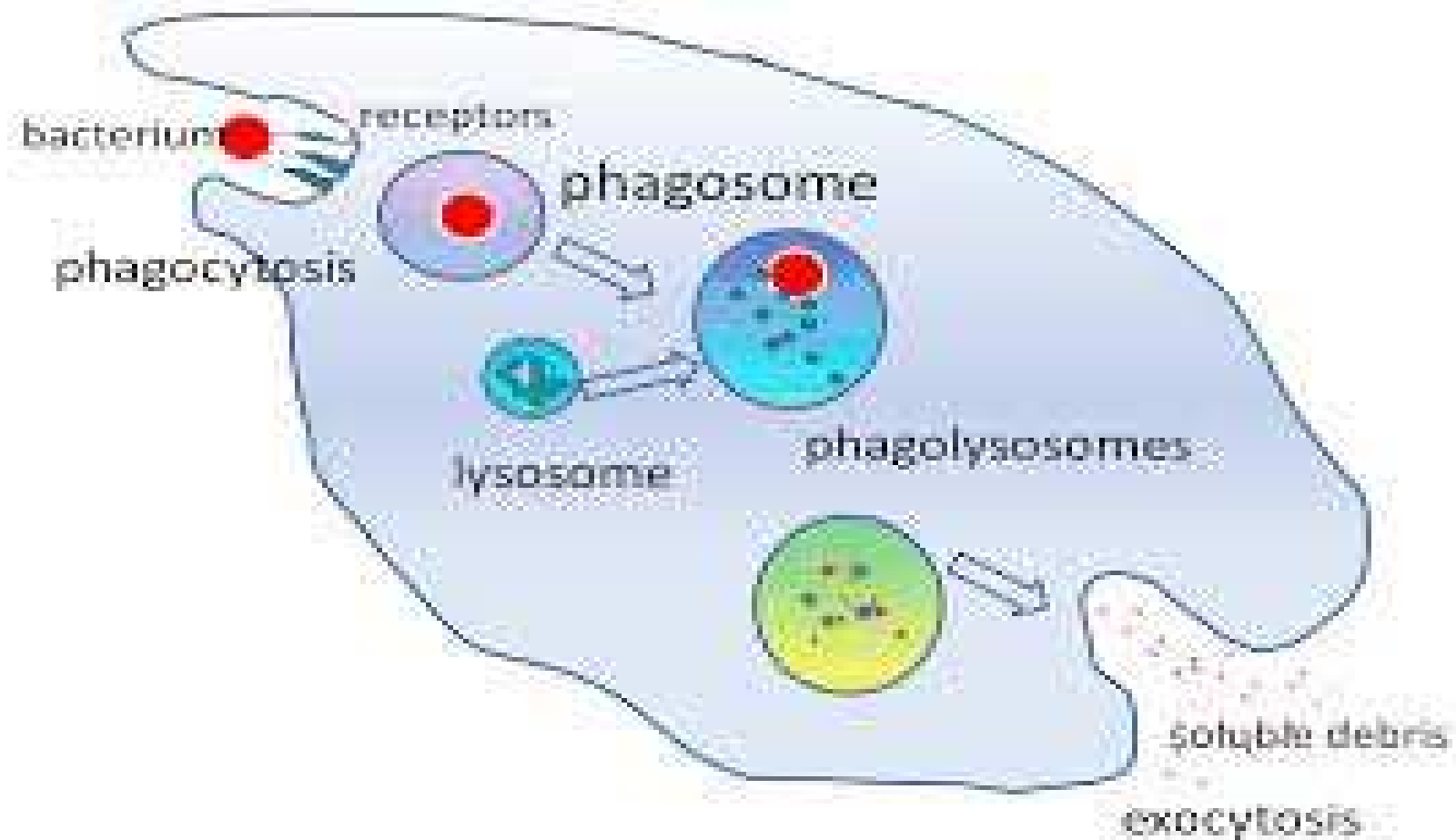**Fig. 1. The three ways by which the bird's body defends itself against infectious agents**

Fig. 2. Different stages in the process of phagocytosis. Note after ingestion the bacterium in phagolysosomes is destroyed by enzymes and thrown out as soluble debris.
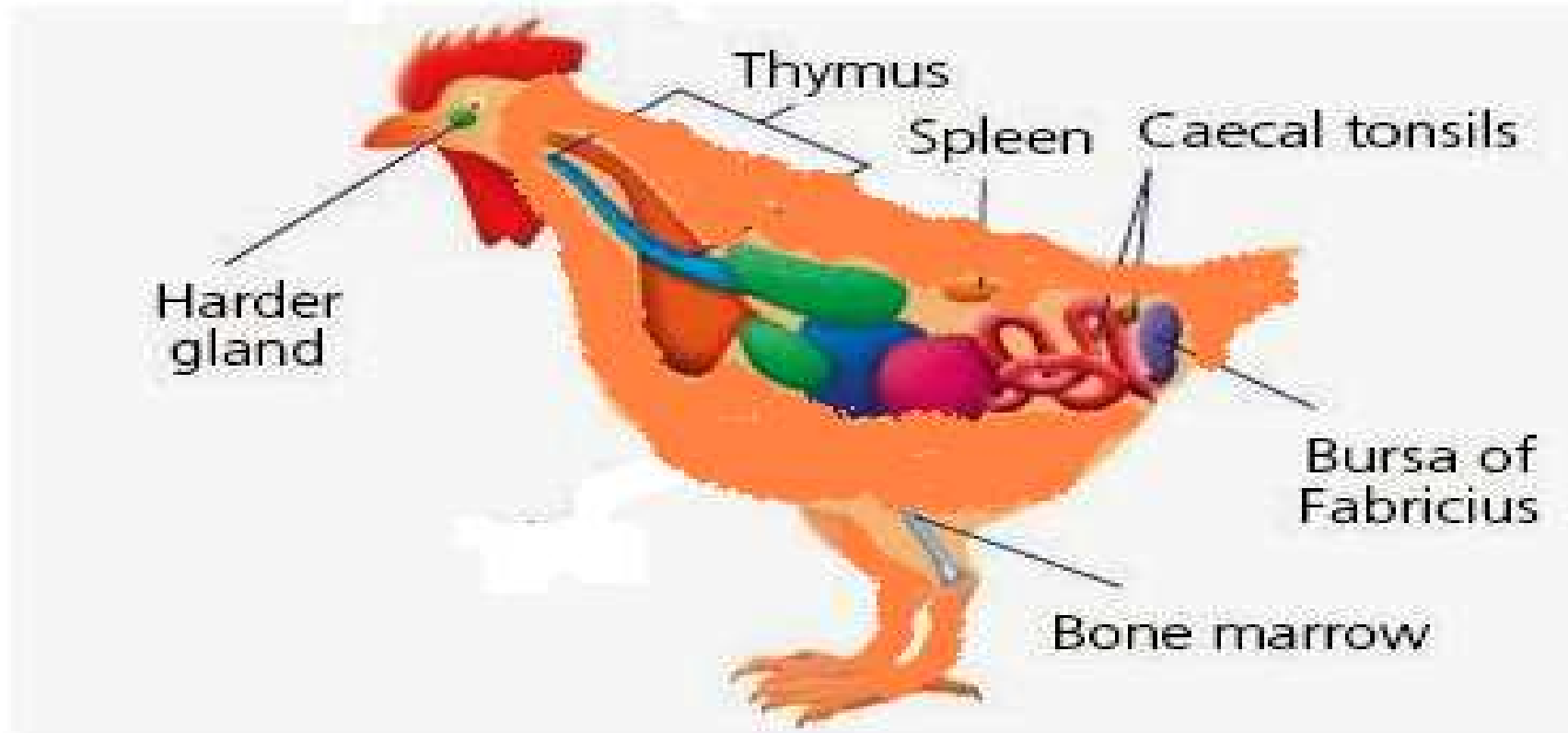
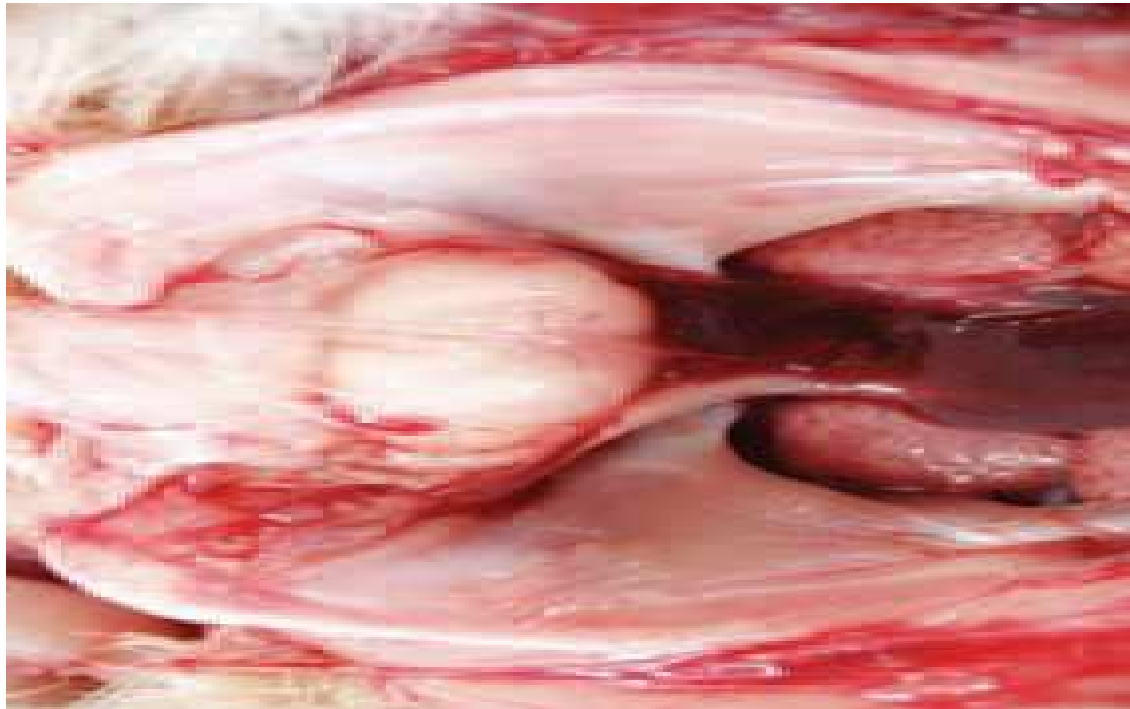**Fig. 3. Chicken's primary and secondary lymphoid organs**

Fig. 4. Bursa of Fabricius in the chicken.

Fig. 5. Thymus in the chicken

Lymphoid Stem Cell

B Cell precursor

T Cell precursor

BURSA OF FABRCIUS

THYMUS

B Lymphocytes

Cytotoxic T Lymphocytes

(Helper T Lymphocytes)

Plasma cells

Direct cytotoxicity
(Apoptosis)

Antibodies

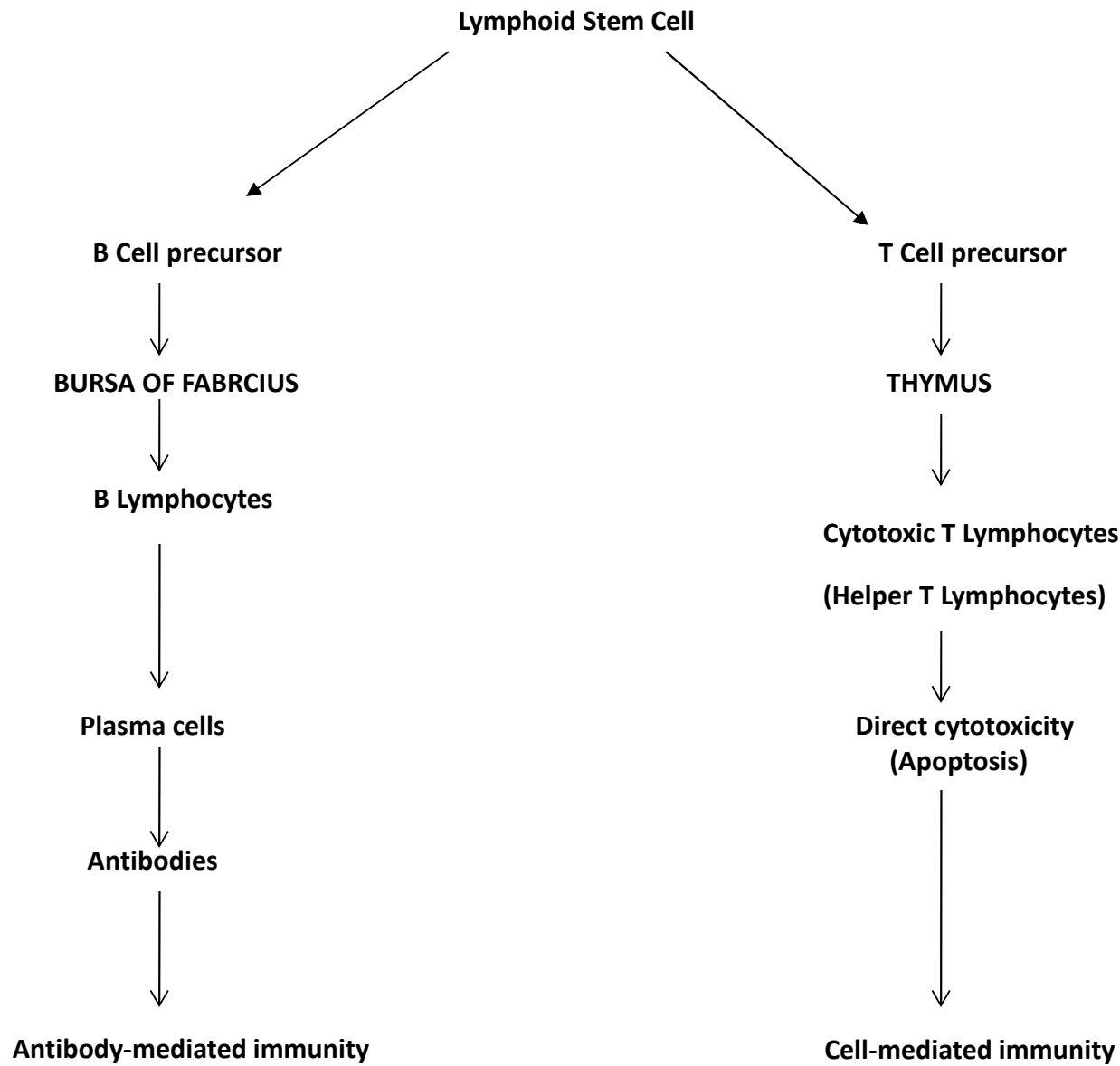Antibody-mediated immunity

Cell-mediated immunity

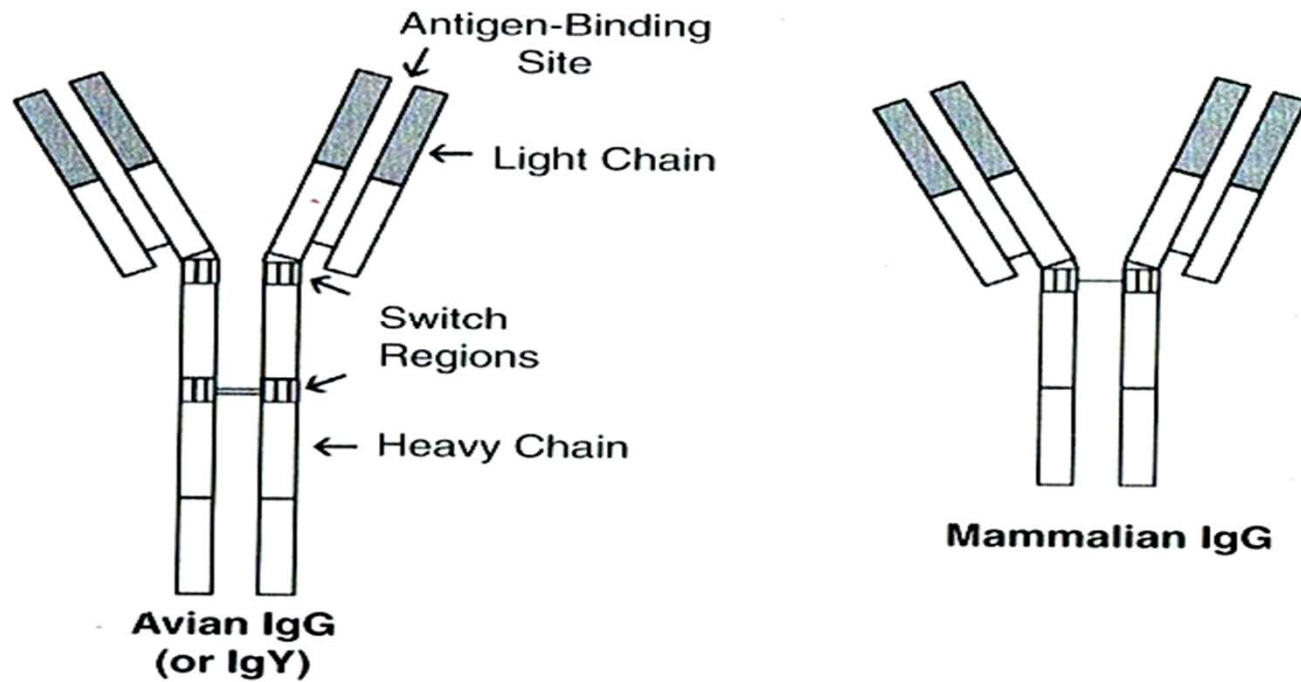Fig. 6. Origin of B and T Lymphocytes in the Chicken.

Fig. 7. Typical structure of an IgG molecule. It looks like letter 'Y'. IgG contains only one 'Y', whereas IgM consists of five 'Ys" (see Fig. 8). Figure 7 also shows comparison between avian and mammalian IgG molecule.
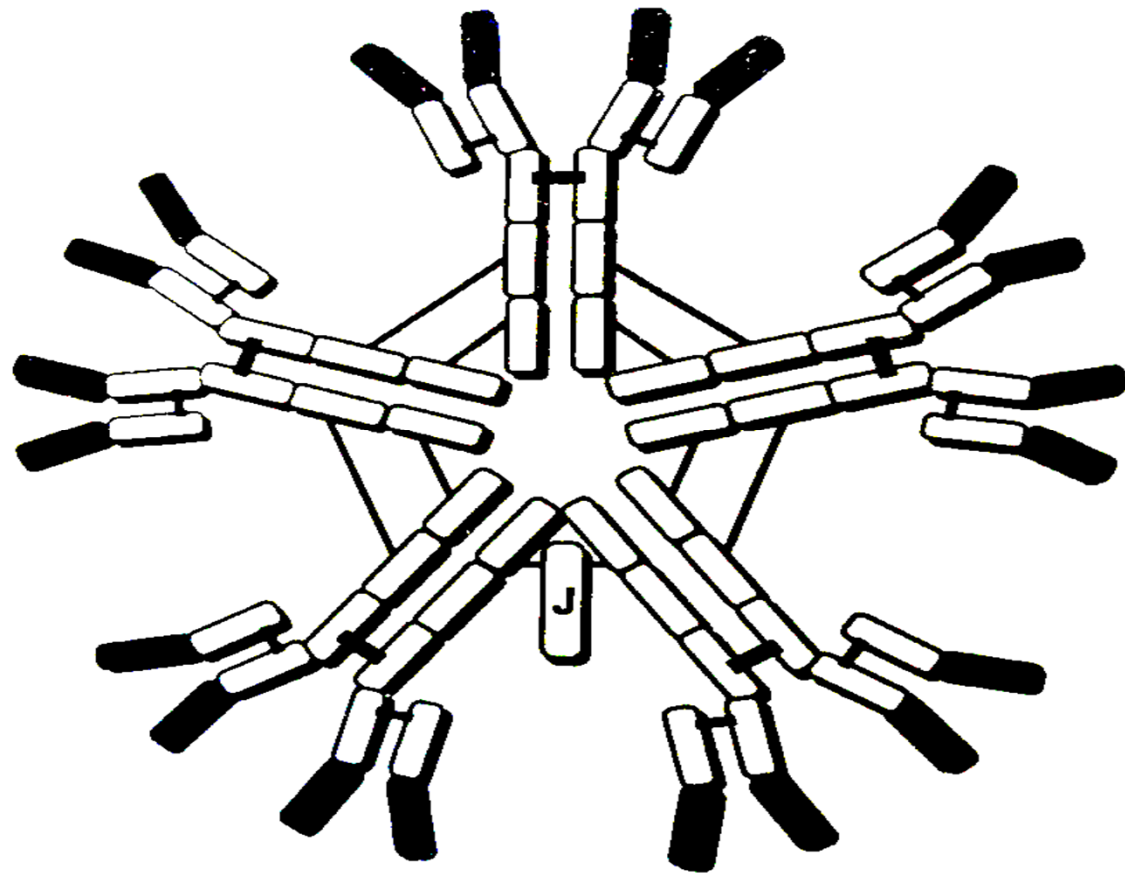
Fig. 8. Structure of immunoglobulin M (IgM). It consists of five IgGs.
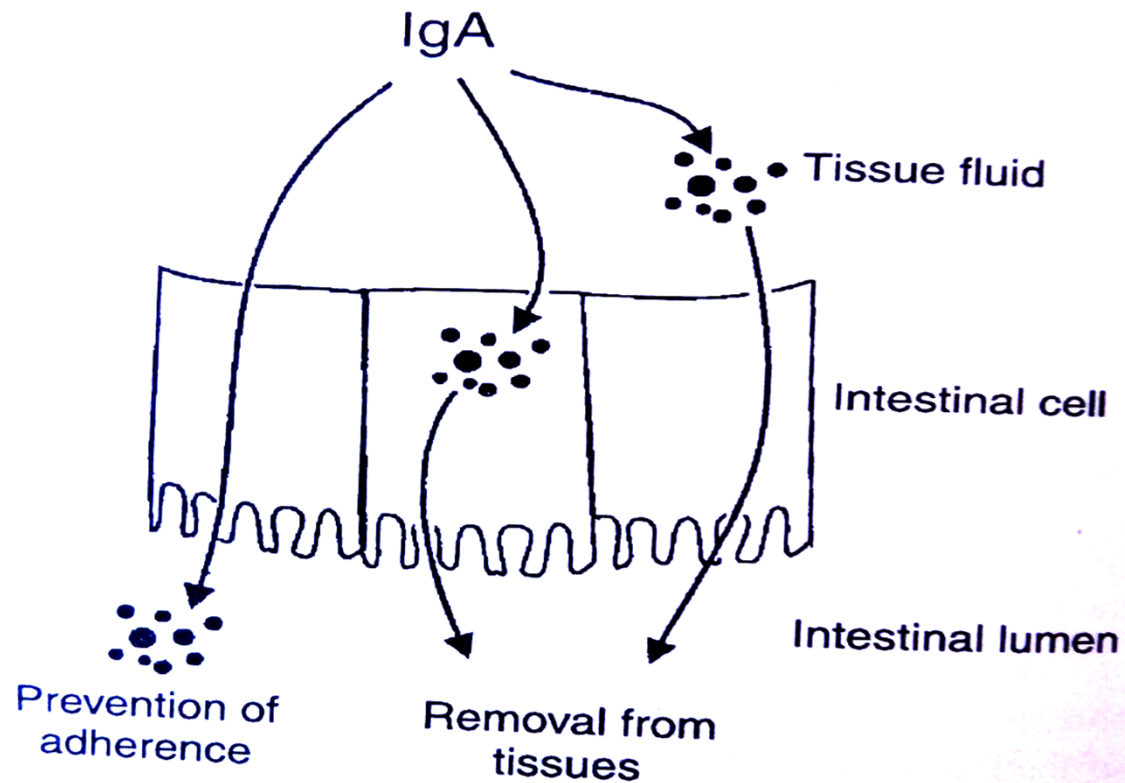
Fig. 9. Immunoglobulin A (IgA) is unique in that it acts at three places. It can bind infectious agent in tissue fluid, inside the intestinal cell, and also in the intestinal lumen. The bound infectious agent in tissue fluid or from the intestinal cell is carried to the intestinal lumen and expelled without causing any harm.

Fig. 10. The passive transfer of maternal antibodies from hen to the chick.

INFECTIOUS AGENT
(Foreign Antigen)

B- Cell   **T- Cell**
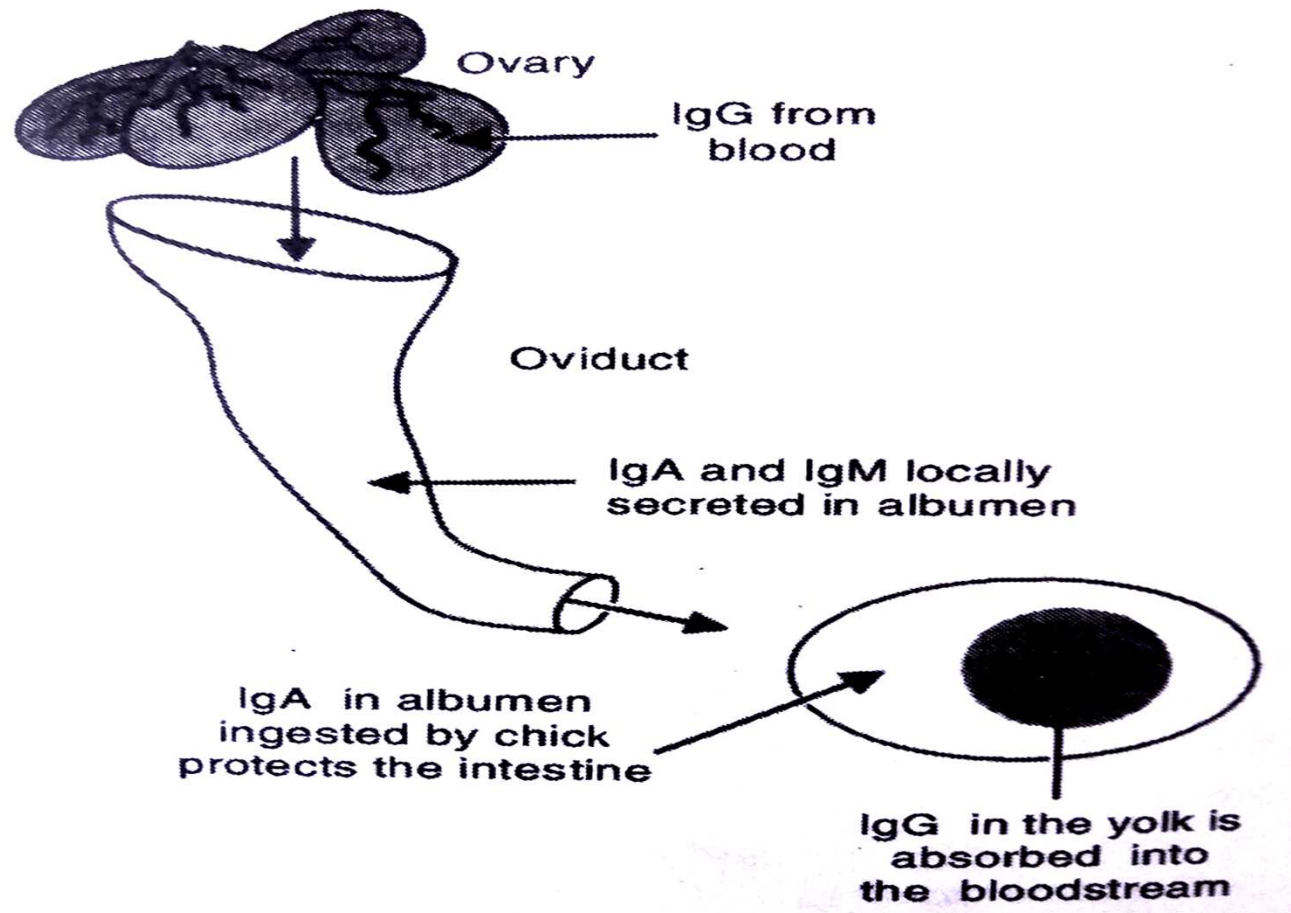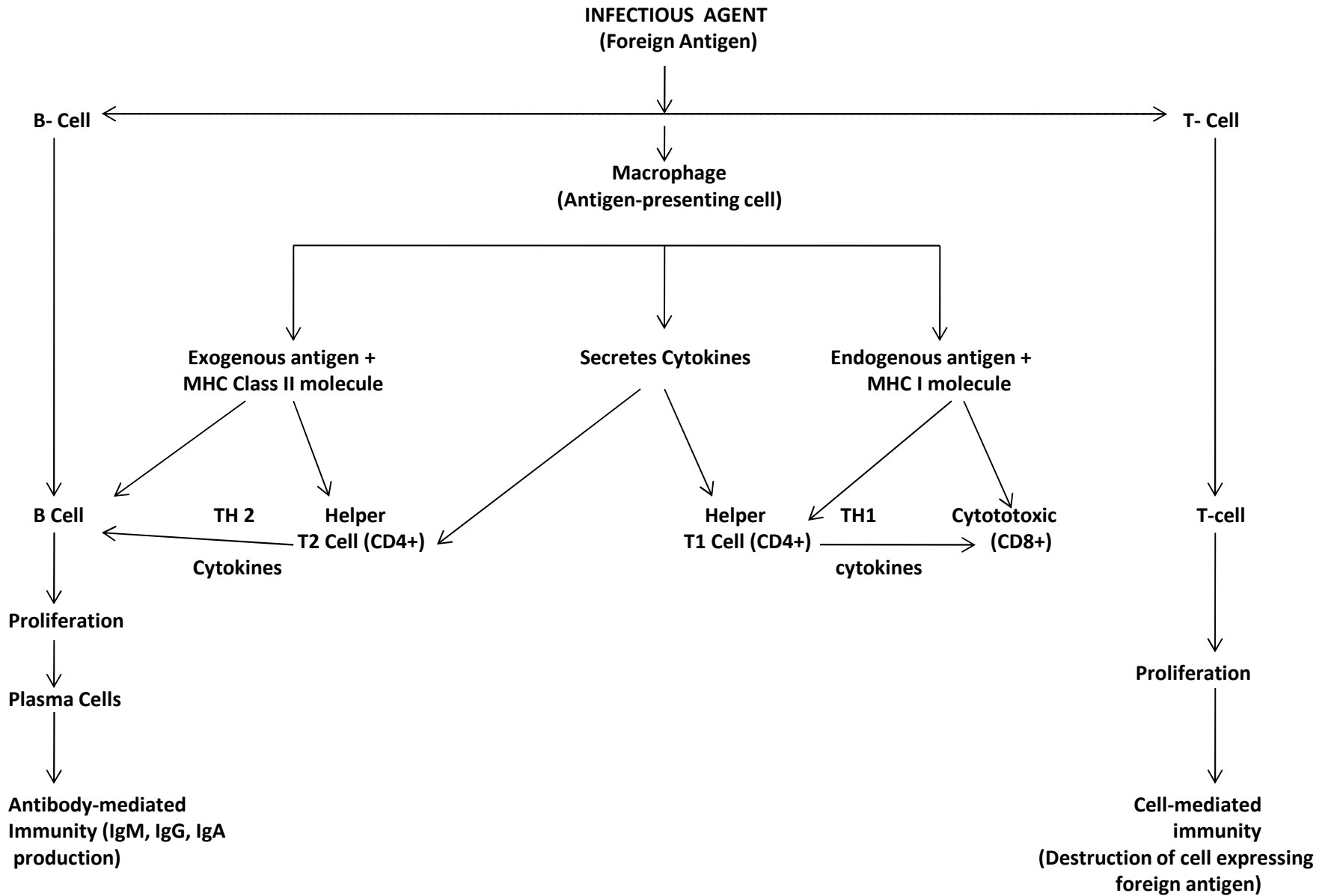
Macrophage
(Antigen-presenting cell)

Exogenous antigen +   **Secretes Cytokines**   **Endogenous antigen +**
MHC Class II molecule   **MHC I molecule**

B Cell   **TH 2**   **Helper**   **Helper**   **TH1**   **Cytototoxic**   **T-cell**
                               T2 Cell (CD4+)   **T1 Cell (CD4+)**   **(CD8+)**
            Cytokines   **cytokines**

Proliferation   **Proliferation**

Plasma Cells

Antibody-mediated   **Cell-mediated**
Immunity (IgM, IgG, IgA   **immunity**
production)   **(Destruction of cell expressing**
                                                                      foreign antigen)

Fig. 11. Immunological mechanisms of defence against infectious agents in birds.

DISEASE	ANTIBODY	CELLULAR
RANIKHET DISEASE	√	
INFECTIOUS BURSAL DISEASE	√	
AVIAN INFLUENZA	√	
CHICKEN INFECTIOUS ANAEMA	√	
AVIAN ENCEPHALOMYELITIS	√	
INFECTIOUS CORYZA	√	
INFECTIOUS BRONCHITIS	√	√
REOVIRUS INFECTION	√	√
FOWL POX	√	√
INCLUSION BODY HEPATITIS	√	√
SALMONELLOSIS	√	√
COLIBACILLOSIS	√	√
MAREK'S DISEASE		√
INFECTIOUS LARYNGOTRACHEITIS		√
MYCOPLASMOSIS		√

Fig. 12. Disease protection dependent on antibody versus cellular immunity.

Thank you