

## Unit II – Problem 3 – Immunology: Antibody Production

### - Antibody production:

- Antibodies are produced by plasma cells which develop from B-lymphocytes following antigenic stimulation. Each individual has a pool of B-lymphocytes each of which has a different antigen receptor on its surface. B-lymphocyte antigen receptors are truncated immunoglobulins which are embedded in the plasma membrane, and which mediate signaling in the B-lymphocyte when it binds an antigen (by definition, an antigen is a substance -usually protein polysaccharide or the like- which is immunologically “foreign” to the person responding, and which stimulates a specific immune response against it). As this pool of B-lymphocytes consists of “clones” (collection of lymphocytes with identical receptor) each (clone) possessing a different antigen-specific receptor. Only that clone which possesses a receptor complementary (fits the shape) to an antigen is stimulated when a person is exposed to the antigen, in addition to the direct stimulation of the B-lymphocyte by the antigen, a second stimulus is delivered to the B-lymphocyte by specialized T-lymphocytes known as helper T-lymphocytes.
- Following stimulation, the majority of the cells of the clone differentiate into plasma cells and start secreting antibodies of a similar antigen specificity as those which were on the surface of the B-lymphocyte. Few of the B-lymphocytes in the clone do not differentiate into plasma cells, but instead develop into a new clone of “memory” B-lymphocytes which replace the original clone of “naïve” (unexposed to antigen) B-lymphocytes. These memory lymphocytes have a longer half-life than original cells, thus insuring our protection against future exposure to the same antigen many years (often a lifetime). Plasma cells are short-lived cells that die when their job, of producing antibodies, ends.

### - Control of antibody production:

- Following the initiation of an antibody response, various mechanisms are involved in controlling this ongoing response, and in ending the response, once the need for additional antibodies is no longer required. The first of the control factors is the availability of antigen. As antibodies are produced they bind to the antigen and clear it from the body. This results in gradual decrease in antigen concentration, which when it reaches a critical low, will no longer stimulate additional B-lymphocytes and thus the response terminate, a second factor is the concentration of the antibody itself. As the concentration of IgG increases, it exerts feedback inhibition on antibody synthesis. Additional mechanisms include effects exerted by helper T-lymphocytes and by anti-idiotypic antibodies (specific antibodies which bind to the antigen-binding region of antibodies) and certain hormones.

