12.5D: Immune Complex Autoimmune Reactions

An immune complex is formed from the integral binding of an antibody to a soluble antigen and can function as an epitope.

Learning Objectives

- Describe how immune complex autoimmune reactions arise

Key Points

- After an antigen–antibody reaction, the immune complexes can be subject to any of a number of responses including complement deposition, opsonization, phagocytosis, or processing by proteases.
- Immune complexes may cause disease when they are deposited in organs.
- The Arthus reaction involves the in situ formation of antigen/antibody complexes after the intradermal injection of an antigen (as seen in passive immunity).

Key Terms

- **epitope**: That part of a biomolecule (such as a protein) that is the target of an immune response.
- **immune complex**: An immune complex is formed from the integral binding of an antibody to a soluble antigen. The bound antigen acting as a specific epitope, bound to an antibody is referred to as a singular immune complex.

An immune complex is formed from the integral binding of an antibody to a soluble antigen. The bound antigen acting as a specific epitope, bound to an antibody is referred to as a singular immune complex. After an antigen-antibody reaction,
the immune complexes can be subject to any of a number of responses, including complement deposition, opsonization, phagocytosis, or processing by proteases. Red blood cells carrying CR1-receptors on their surface may bind C3b-decorated immune complexes and transport them to phagocytes, mostly in liver and spleen, and return back to the general circulation. Immune complexes may cause disease when they are deposited in organs, e.g. in certain forms of vasculitis. This is the third form of hypersensitivity in the Gell-Coombs classification, called Type III hypersensitivity. Immune complex deposition is a prominent feature of several autoimmune diseases, including systemic lupus erythematosus, cryoglobulinemia, rheumatoid arthritis, scleroderma, and Sjögren’s syndrome.

Figure: **Immune Complex Diseases**: An immune complex is formed from the integral binding of an antibody to a soluble antigen. The bound antigen acting as a specific epitope, bound to an antibody is referred to as a singular immune complex.

In immunology, the Arthus reaction is a type of local type III hypersensitivity reaction. Type III hypersensitivity reactions are immune complex-mediated. They involve the deposition of antigen/antibody complexes mainly in the vascular walls, serosa (pleura, pericardium, synovium), and glomeruli. The Arthus reaction involves the in situformation of antigen/antibody complexes after the intradermal injection of an antigen (as seen in passive immunity). If the animal/patient was previously sensitized (has circulating antibody), an Arthus reaction occurs. Typical of most mechanisms of the type III hypersensitivity, Arthus manifests as local vasculitis due to deposition of IgG-based immune complexes in dermal blood vessels. Activation of complement primarily results in cleavage of soluble complement proteins forming C5a and C3a, which activate recruitment of PMNs and local mast cell degranulation (requiring the binding of the immune complex onto FcγRIII), resulting in an inflammatory response. Further aggregation of immune complex-related processes induces a local fibrinoid necrosis with ischemia-aggravating thrombosis in the tissue vessel walls. The end result is a localized area of redness and induration that typically lasts a day or so. Arthus reactions have been infrequently reported after vaccination against diphtheria and tetanus.