Complement Encyclopedia Article

Complement

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Complement

Complement refers to a series of some 30 proteins that enhance the bacterial killing effect of antibodies. This complementation involves facilitating the engulfing of **bacteria** by immune cells in the process known as **phagocytosis**, or by the puncturing of the bacterial membrane. Additionally, complement helps dispose of antigen-antibody complexes that form in the body.

The various complement proteins circulate throughout the bloodstream in an inactive form. When one of the proteins is converted to an active form upon interaction with an antigen-antibody complex, a series of reactions is triggered. The activation step involves the cleaving, or precise cutting, of the particular complement protein. The cleavage turns the complement protein into a protease, a protein that is itself capable of cleaving other proteins. In turn, cleavage of a second complement protein makes that protein a protease. The resulting cleavage reaction generates a series of active complement proteins. These reactions, known as the complement cascade, occur in an orderly sequence and are under precise regulation.

The reactions involve two pathways. One is known as the classical complement activation pathway. The end result is an enzyme that can degrade a protein called C3. The other pathway is known as the alternative pathway. The second pathway does not require the presence of **antibody** for the activation of complement. Both pathways result in the formation of an entity that is called the membrane attack complex. The complex is actually a channel that forms in the bacterial membrane. Under the magnification of the **electron microscope**, a bacterial membrane that is a target of the complement system appears riddled with holes.

The channels that form in a membrane allow the free entry and exit of fluids and molecules. Because the concentration of various ions is higher inside the bacterium than outside, fluid will flow inward to attempt to balance the concentrations. As a result, the bacterium swells and bursts.

Other reaction products of the complement cascade trigger an inflammatory immune response. In addition, the invading bacteria are coated with an immune molecule (C3b) that makes the bacteria more recognizable to phagocytes. This process is called **opsonization**. The phagocytes then engulf the bacteria and degrade them.

Tight control over the activity of the complement system is essential. At least 12 proteins are involved in the regulation of complement activation. Defects in this control, or the operation of the pathways, result in frequent bacterial infections.