INVITED SYMPOSIUM XII

Comparative Hemostatic Mechanisms of Animals.

BLOOD COAGULATION IN THE HORSESHOE CRAB (Limulus polyphemus): A MODEL FOR MAMMALIAN COAGULATION AND HEMOSTASIS. Jack Levin. Johns Hopkins Univ. School of Medicine, Baltimore, Md., USA

The amebocyte is the only type of circulating cell in the blood of Limulus. It is a nucleated cell, the cytoplasm of which is packed with granules. The coagulation system of Limulus is contained exclusively within the amebocytes. Furthermore, factors necessary for blood coagulation are localized within their cytoplasmic granules. Cell-free plasma does not clot and is not required for coagulation. Aggregation and disruption of cells follow exposure of amebocytes to foreign surfaces. Endotoxin produces similar changes and in addition, results in coagulation of the blood, following release from amebocytes of the components of the coagulation mechanism. Coagulation, produced by endotoxin, is the result of activation by endotoxin of an enzyme (or series of enzymes) that in turn reacts with the clotting protein. Endotoxin does not react directly with the clotting protein. The rate of the reaction depends upon the concentration of endotoxin.

In both Limulus and mammals, disruption of the integrity of the circulatory system or exposure of blood to foreign surfaces results in aggregation of amebocytes or platelets, with subsequent changes in shape, disruption of granules, and release of cellular constituents into the surrounding environment. Both cells are necessary for hemostasis but in addition, amebocytes are necessary for the coagulation of blood. The presence of the entire coagulation system in amebocytes provides the basis for suggesting that coagulation in animals was initially a cellularly based function. The role of the amebocytes in controlling infection and its reaction to endotoxin suggest that the response of platelets and the blood coagulation system in various mammals to gram-negative infection or endotoxin is a remnant of this mechanism.