

Acrosomal Proteases in Mammalian Spermatozoa

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Fertilization is the process in which sperm and egg unite to form a zygote. For successful fertilization, sperm must undergo preparatory events, namely capacitation and acrosomal reaction. Acrosomal reaction is the exocytotic event in which outer portion of the acrosomal membrane fuses with the plasma membrane, vesiculates and disappears. The acrosome, a unique vesicle surrounding the anterior part of the sperm head, contains various hydrolytic enzymes. The most prominent proteases in the acrosome are proacrosin/acrosin system and sperminogen. These proteases are exposed and gradually released during acrosomal reaction.

Acrosin is one of the hydrolases in the acrosome and is initially present as an enzymatically inactive zymogen, proacrosin. Proacrosin has trypsin-like specificity and is purified from the acid extracts of spermatozoa, which is sequentially converted into enzymatically active -, -, -acrosin by autoactivation. The proteolytic activity of acrosin is believed to be responsible for the sperm penetration by the proteolysis of the glycoprotein matrix of the egg zona pellucida. Proacrosin/acrosin also possesses the capacity to bind carbohydrate groups of the glycoprotein in the zona pellucida, which suggests an important role for proacrosin/acrosin in sperm-egg recognition and binding during the initial stages of fertilization. Lately, the findings that sperm produced from the mouse whose proacrosin gene is knocked out, however, could penetrate and fertilize the egg imply that proacrosin/acrosin system might not be the sole protease involved in the fertilization process.

Sperminogen is another prominent acrosomal protease with trypsin-like specificity. Sperminogen was originally detected in human spermatozoa as a characteristic low-molecular, non-proacrosin zymogen. Sperminogen was shown to autoactive into spermin, with marked differences in enzyme activation kinetics from that of proacrosin/acrosin system. The novelty of this enzyme, however, draws controversy lately since some researchers believe that this enzyme belongs to the proacrosin/acrosin system.

The main interests of my laboratory include molecular characterization of proacrosin/acrosin system and sperminogen from the perspective of the structure/function relationship, and elucidating the physiological importance of these enzyme systems in the fertilization process.