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# Ultrastructural Observations on the Penetration of Human Sperm into the Zona Pellucida of the Human Egg *In Vitro*

A. HENRY SATHANANTHAN <sup>1</sup>, A. O. TROUNSON <sup>1</sup>, CARL WOOD <sup>1</sup>, AND J. F. LEETON <sup>1</sup>

<sup>1</sup> *Department of Obstetrics and Gynecology, Queen Victoria Medical Centre, Monash University, Melbourne, Australia*

Sperm penetration into the zona of 46 human eggs was examined by electron microscopy. Preovulatory oocytes were aspirated at laparoscopy and inseminated by methods which produced normal pregnancies. These were routinely fixed 3-72 hours after insemination and examined for zona penetration.

The mechanism of zona penetration was similar in the non-activated oocytes, fertilized ova, and embryos obtained, and resembled that which was reported in most mammals. Sperm were tightly bound to the zona by their plasma membranes. Both acrosome-reacted and unreacted sperm were seen in the cumulus and entering the zona. The acrosome reaction involved multiple fusions and vesiculation of the plasma and outer acrosome membranes. Fine and coarse vesiculation was observed, and the sperm digested a clear pathway through the zona. Sperm were rarely seen in the inner zona and never seen in the perivitelline space of monospermic ova, but freely penetrated these regions in polyspermic ova. A block to polyspermy seemed to operate at the level of the inner zona. Morphologic evidence for the involvement of the inner acrosome membrane in the acrosome reaction and a possible sequence of events in zona penetration is presented. The findings confirm most of late Professor Pierre Soupart's work on zona penetration.

Key words: ultrastructure, zona pellucida, human ova, acrosome reaction, monospermy, polyspermy, sperm penetration, *in vitro* fertilization

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