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Gamete activation: basic knowledge and clinical applications

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BACKGROUND: The first clues to the process of gamete activation date back to nearly 60 years ago. The mutual activation of gametes is a crucial event during fertilization. In the testis and ovaries, spermatozoa and oocytes are in a state of meiotic and metabolic quiescence and require reciprocal signals in order to undergo functional changes that lead to competence for fertilization. First, the oocyte activates sperm by triggering motility, chemoattraction, binding and the acrosome reaction, culminating with the fusion of the two plasma membranes. At the end of this cascade of events, collectively known as sperm capacitation, sperm-induced oocyte activation occurs, generating electrical, morphological and metabolic modifications in the oocyte.

OBJECTIVE AND RATIONALE: The aim of this review is to provide the current state of knowledge regarding the entire process of gamete activation in selected specific animal models that have contributed to our understanding of fertilization in mammals, including humans. Here we describe in detail the reciprocal induction of the two activation processes, the molecules involved and the mechanisms of cell interaction and signal transduction that ultimately result in successful embryo development and creation of a new individual.

SEARCH METHODS: We carried out a literature survey with no restrictions on publication date (from the early 1950s to March 2016) using PubMed/Medline, Google Scholar and Web of Knowledge by utilizing common keywords applied in the field of fertilization and