

SPERM FORM, FUNCTION AND FERTILITY: PATTERNS OF EVOLUTION AND SELECTIVE FORCES.

Dr. Eduardo Roldan

Grupo de Evolución y Biología de la Reproducción, Museo Nacional de Ciencias Naturales, Consejo Superior de Investigaciones Científicas (CSIC), Madrid, España.

Males exhibit an enormous diversity in reproductive traits. For example, they display wide variation in testes mass relative to body mass, in testis architecture and also in kinetics of the spermatogenic cycle. These differences translate into variations in relative sperm numbers. Males also show wide divergence in the morphology, size and function of spermatozoa. Sperm numbers and sperm design, which are key determinants of fertility, are likely to be under the influence of selective forces and modes of gamete transport and fertilization. Competition between spermatozoa from rival males takes place when females mate with two or more males in the same receptive period. Sperm competition to gain fertilizations has been shown to represent a powerful selective force influencing male's reproductive biology including sperm traits. A general response to sperm competition is an increase in the number of sperm produced and transferred to the female tract. An overall improvement of sperm quality (e.g., high percentages of motile and normal spermatozoa) is also widely observed. Sperm swimming velocity, which is crucial to negotiate barriers in the female tract, reach the site of fertilization and penetrate ovum vestments, is strongly related to the intensity of sperm competition. The velocity of spermatozoa is influenced by several factors, namely the morphology of the sperm head, sperm dimensions (the longer the sperm, the faster their speed) and ATP levels (required to fuel cell propulsion), all of which are influenced by sperm competition. Genes coding for proteins involved in reproduction are also under strong selective pressure. Among these genes, protamines are important for chromatin condensation and, thus, for determination of head morphology. Rodents and primates have two types of protamines (PRM1 and PRM2) and the proportion between them seems crucial for normal sperm formation. Sperm competition influences evolution and regulation of these genes but in a very complex way.