IDENTIFICATION OF SERTOLI CELL REMANANTS IN SEMEN OF SQUALUS ACANTHIAS

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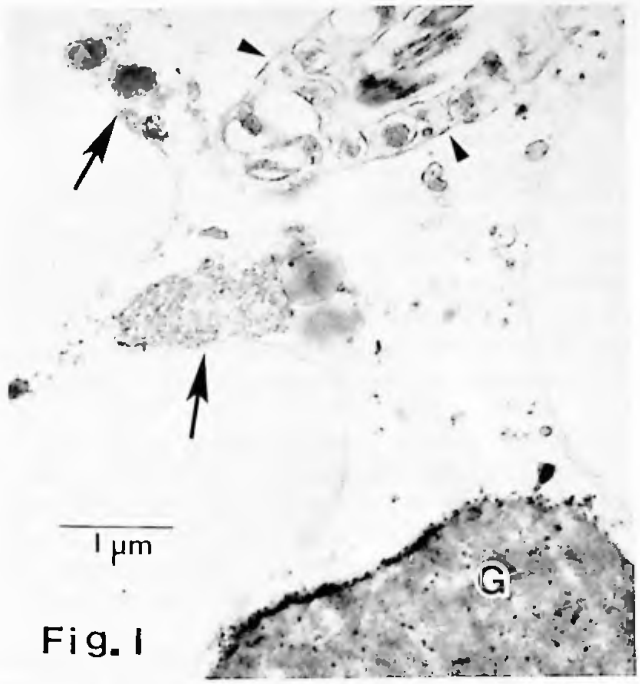

Fig. 1

Extracts of semen obtained from the sperm sacs of S. acanthias were found to contain a variety of steroids (Simpson et al. J. Endocrinol. 1963, 26:489-498). Further investigation using radiolabeled tracers demonstrated the presence of all enzymes (cholesterol cleavage enzyme, 5-ene-3β-hydroxysteroid dehydrogenase, 21-hydroxylase and 20β-oxidoreductase) necessary for the conversion of cholesterol to 11-deoxycorticosterone via pregnenolone and progesterone (Simpson et al. J. Endocrinol. 1964, 31:11-20). Whether spermatozoa themselves or another semen constituent were responsible for these conversions was not determined. Recently we have used S. acanthias as an animal model to study changes in activity of steroidogenic enzymes during successive stages of spermatogenesis (The Bulletin 21: 37-40,1981). We attributed steroid biosynthesis within the testis to Sertoli cells and showed that a direct relationship existed between increased androgen production and the proliferation of steroidogenic organelles in this cell type. In an effort to identify the source of steroidogenic enzymes in the seminal plasma of S. acanthias, the constituents of semen were examined by electron microscopy. Semen collected from the sperm sacs was fixed for 3 hr in a 2.5% solution of glutaraldehyde in elasmobranch Ringer, post-fixed in OsO_4 for 1 hr, and further processed using conventional techniques. The semen appeared highly structured (Fig. 1 x 15,700) and was comprised of the following elements: a) numerous remnants of Sertoli cytoplasm (arrows) bounded by a plasma membrane and containing lipid droplets, mitochondria and agranular reticulum; b) bundles of spermatozoa with individual sperm enveloped by sleeves of cytoplasm (arrowheads) containing dense structures enclosed in vacuoles; c) large granules (G) lacking a limiting membrane but often associated with remnant Sertoli cytoplasm and apparently undergoing dissolution. We conclude that Sertoli remnants are the primary source of steroidogenic enzymes and endogenous steroids in Squalus semen. This cytoplasm presumably is derived from the apical portions of the Sertoli cells which are shed at the time of sperm release, since only the basal, nucleated portions of these cells are seen within the testis following spermiation. The cytoplasm immediately surrounding each spermatozoan, on the other hand, has the characteristics of residual germ cell cytoplasm and thus is homologous to mammalian residual bodies. The dense granules may correspond to problematical bodies, large structures of unknown function, previously described in Squalus Sertoli cells. The persistence of functionally active steroidogenic elements in Squalus semen suggests that steroids may be essential for sperm maturation and survival and/or for maintenance of the excurrent ducts during sperm transit and storage. Although no portion of the Sertoli cytoplasm is lost during sperm release in mammals, it should be noted that mammalian Sertoli cells serve to maintain high levels of androgen in semen through the secretion of an androgen binding protein. (Supported by NICHD-16715)