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Commentary

The Role of Human Sperm in Fertility and its Function

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DESCRIPTION

Sperm is the male reproductive cell, or gamete, in anisogamous modes of sexual reproduction (forms in which there is a larger, female reproductive cell and a smaller, male one). Red algae and fungi produce spermatia, which are non-motile sperm cells, whereas animals produce spermatozoa, which are motile sperm with a flagellum tail. Pollen from flowering plants includes non-motile sperm, but pollen from ferns and gymnosperms contains motile sperm.

Sperm cells are produced during spermatogenesis, which occurs in the seminiferous tubules of the testes in amniotes (reptiles and mammals). This process begins with spermatogonia and results in a sequence of sperm cell precursors that eventually mature into spermatocytes. The spermatocytes next go through meiosis, which reduces the number of chromosomes in half and generates spermatids. The spermatids then develop and form a tail, or flagellum, in animals, which gives rise to the mature, motile sperm cell. This entire procedure occurs on a continuous basis and takes around three months from start to end.

Sperm cells are unable to divide and have a short lifespan, but after fusing with egg cells during fertilization, a new creature emerges, beginning as a totipotent zygote. Human sperm cells are haploid, which means that their 23 chromosomes can unite with the 23 chromosomes of the female egg to generate a diploid cell with 46 paired chromosomes. In animals, sperm is kept in the epididymis and expelled from the penis in the form of semen after ejaculation.

STRUCTURE OF SPERM CELL

The sperm cell of a mammalian can be separated into two parts:

Head: The nucleus, which has densely coiled chromatin fibres, is encircled anteriorly by the acrosome, a narrow, flattened sac that carries enzymes for piercing the female egg. It also has vacuoles in it.

Tail: The longest component, also known as the flagellum, is capable of a wave-like action that drives sperm for swimming and assists in egg. Previously, it was considered that the tail moved in a helical pattern.

One conventional centriole and one atypical centriole, such as the proximal centriole-like, are found in the neck or connecting component. The midpiece includes a central filamentous core with multiple mitochondria spiraled around it, which is used to make ATP as the female cervix, uterus, and uterine tubes are passed through.

The sperm supplies three critical components to the oocyte during fertilization:

- A signaling or activation agent that induces the metabolically inactive oocyte to activate.
- The haploid paternal genome, and
- The centriole, which forms the centrosome and microtubule system.

FUNCTION

Sperm's primary function is to reach and fuse with the ovum, resulting in the production of two subcellular structures:

- The male pronucleus, which contains the genetic material, and
- The centrioles, which assist arrange the microtubule cytoskeleton.

The major characteristics of semen quality, which is a measure of the capacity of semen to fertilize, are sperm quantity and quality. As a result, in humans, it is a measure of a man's fertility. Sperm genetic quality, volume, and motility all tend to decline as people become older.

Damaged DNA found in sperm cells after meiosis but before fertilization can be repaired in the fertilized egg, but if not, it can have major consequences for fertility and the growing fetus. The development of oxidative DNA damage in human sperm cells is particularly sensitive to free radical attack.

Because male germ cells lose their ability to repair DNA damage as they grow into mature sperm, the post meiotic phase of mouse spermatogenesis is extremely vulnerable to environmental genotoxic chemicals. Irradiating male mice during late

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spermatogenesis damages fertilising sperm cells for at least 7 days, and altering maternal DNA double-strand break repair pathways improves sperm quality and cell-derived chromosomal abnormalities. Melphalan, a bifunctional alkylating drug often used in chemotherapy, causes DNA lesions in male mice during meiosis, which may remain in an unrepaired condition as germ cells move through DNA repair-competent phases of spermatogenic development. After conception, such unrepaired DNA lesions in sperm cells might results with a variety of defects in offspring.