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QUESTION

Discuss the factors facilitating the movement of sperm in the female reproductive tract

**ANSWER**

**SPERM TRANSPORT**

At coitus, human sperm are deposited into the anterior vagina, where, to avoid vaginal acid and immune responses, they quickly contact cervical mucus and enter the cervix. Cervical mucus filters out sperm with poor morphology and motility and as such only a minority of ejaculated sperm actually enter the cervix. In the uterus, muscular contractions may enhance passage of sperm through the uterine cavity. A few thousand sperm swim through the uterotubal junctions to reach the Fallopian tubes (uterine tubes, oviducts) where sperm are stored in a reservoir, or at least maintained in a fertile state, by interacting with endosalpingeal (oviductal) epithelium. As the time of ovulation approaches, sperm become capacitated and hyperactivated, which enables them to proceed towards the tubal ampulla. Sperm may be guided to the oocyte by a combination of thermotaxis and chemotaxis. Motility hyperactivation assists sperm in penetrating mucus in the tubes and the cumulus oophorus and zona pellucida of the oocyte, so that they may finally fuse with the oocyte plasma membrane. Knowledge of the biology of sperm transport can inspire improvements in artificial insemination, IVF, the diagnosis of infertility and the development of contraceptives.

**TRANSPORT**

Vaginal Insemination

The complex process of sperm transport through the female reproductive tract begins at the time of ejaculation. During coitus, 1.5- to 5.0-ml of semen containing between 200 and 500 million sperm is deposited at the posterior vaginal fornix, leaving the external cervical os partially submerged in this pool of fluid.1 At this time, some sperm may be passively taken up by the cervix in a process described as “rapid transport;” otherwise, sperm undergo “delayed transport.” Both of these are discussed at length in this chapter.

Within about 1 minute after coitus, the ejaculate undergoes coagulation. This coagulum temporarily restricts movement of sperm out of the seminal clot, thus preventing their passage into the cervical mucus and ascension up the female reproductive tract. Over the next 20 to 30 minutes, however, a seminal-fluid proteolytic enzyme produced by the prostate gland gradually liquefies the clot. At this time, motile sperm may then enter the cervical mucus, leaving behind the seminal plasma. Although there are reports of motile sperm persisting within the vagina for up to 12 hours after ejaculation,11 motility of most vaginal sperm is diminished within about 30 minutes, and after 2 hours almost all sperm motility in the vagina has been lost.

**RAPID SPERM TRANSPORT**

Sperm may begin to undergo the process of rapid sperm transport within seconds after ejaculation. This type of sperm movement is thought to be predominantly passive, resulting from coordinated vaginal, cervical, and uterine contractions. Although these contractions are of short duration, they are believed to be the primary force responsible for the rapid progression of sperm to the upper female reproductive tract—the oviduct. Within 5 minutes after insemination, sperm were present within the Fallopian tubes, and the number of sperm found there was proportional to the number inseminated.12 Similar results demonstrating this rapid transport process have also been documented in numerous animal studies

**Essential Factors Regulating Sperm Migration Through The Utj**

More than 10 factors have been reported to be essential for sperm migration through the UTJ and to be involved in ADAM3 maturation; however, there is no direct evidence that ADAM3 functions on the sperm surface during UTJ migration. Considering that ADAM3 is a pseudogene in humans, the contribution of undiscovered novel factors should be taken into account. This idea is also supported by the fact that ADAM3 localized normally in migration-defective Ly6k and Pgap1 KO spermatozoa. Because both LY6K and PGAP1 disappear during epididymal sperm maturation, these molecules do not directly function during UTJ migration. Although many molecules have proven to be essential for sperm migration through the UTJ, the sperm migration mechanism per se is still unclear. Interestingly, migration-defective spermatozoa also show impaired binding to the zona pellucida (ZP). It is also reported that Adam3 KO spermatozoa are less adhesive than wild-type spermatozoa. Although control wild-type spermatozoa could pass through the uterotubal junction, the mixed wild-type spermatozoa could not compensate for the inability of Clgn KO spermatozoa to migrate into the oviduct.