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Factors Facilitating The Movement of Sperm in the Female Reproductive Tract.

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.” The optimal pH for sperm viability is between 7.0 and 8.5 and a reduction in sperm motility is seen at a pH less than 6.0. Normal vaginal pH is only 3.5 to 4.0 and the acidic environment of the vagina is thus toxic to sperm. However, both seminal fluid and cervical mucus present within the posterior vagina are alkaline and act as buffers.

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, 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.

The Cervix

Production of mucus is perhaps the most important function of the cervix. Cervical pH is alkaline, with a peak pH during the periovulatory period. This environment is much more hospitable to spermatozoa than the acidic pH of the vagina. Cervical mucus is continuously secreted through exocytosis by the nonciliated epithelial cells that line the cervical canal. This biomaterial serves many important functions, including exclusion of seminal plasma, exclusion of morphologically abnormal sperm, and support of viable sperm for subsequent migration to the uterus and oviduct. It is a heterogeneous fluid with both high- and low-viscosity components. Sperm movement through the cervical mucus is primarily through the interstitial spaces between the mucin micelles, and the sperm's progression depends on the size of these spaces. The size of the interstices is usually smaller than the size of the sperm heads; thus, sperm must push their way through the mucus as they proceed through the lower female genital tract.

Spermatozoa entering the cervix are directed toward the cervical crypts, the site of mucus secretion that serves as a possible storage reservoir. Spermatozoa may retain their fertilizing capacity in human cervical mucus for up to 48 hours and their motility for as long as 120 hours. From their temporary storage location within the cervical crypts, sperm can be released gradually over time, thus enhancing the probability of fertilization.

Another important feature of human cervical mucus is that it is able to restrict migration of human spermatozoa with abnormal morphology.

Sperm Transport Through the Uterus

Little is known about sperm transport within the endometrial cavity. Sperm motility does not appear to be the only force directing the sperm toward the oviducts, because inert particles deposited within the uterus are transported to the Fallopian tubes. Uterine muscular contractions likely play a role in this process.

Fallopian Tube

Sperm movement through the Fallopian tube relies on a combination of forces:

intrinsic sperm motility, tubular muscular contraction, and fluid flow. Tubal fluid production is maximal at the time of ovulation, and this fluid sustains the sperm before fertilization. Tubal fluid may also facilitate both sperm capacitation and acrosomal reaction.