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On ejaculation, the spermatozoa rapidly pass through the ductus deferens and become mixed with fluid secretions from the seminal vesicles and prostate gland. Prostatic fluid is rich in citric acid, acid phosphatase, zinc, and magnesium ions, whereas fluid of the seminal vesicle is rich in fructose (the principal energy source of spermatozoa) and prostaglandins. The 2–6 ml of ejaculate (semen, or seminal fluid) typically consists of 40–250 million spermatozoa mixed with alkaline fluid from the seminal vesicles (60% of the total) and acid secretion (pH 6.5) from the prostate (30% of the total). The pH of normal semen ranges from 7.2 to 7.8.

In the female reproductive tract, sperm transport begins in the upper vagina and ends in the ampulla of the uterine tube, where the spermatozoa make contact with the ovulated egg. During copulation, the seminal fluid is normally deposited in the upper vagina, where its composition and buffering capacity immediately protect the spermatozoa from the acid fluid found in the upper vaginal area. The acidic vaginal fluid normally serves a bactericidal function in protecting the cervical canal from pathogenic organisms. Within about 10 seconds, the pH of the upper vagina is increased from 4.3 to as much as 7.2. The buffering effect lasts only a few minutes in humans, but it provides enough time for the spermatozoa to approach the cervix in an environment (pH 6.0–6.5) optimal for sperm motility.

The next barriers that the sperm cells must overcome are the cervical canal and the cervical mucus that blocks it. Changes in intravaginal pressure may suck spermatozoa into the cervical os, but swimming movements also seem to be important for most spermatozoa in penetrating the cervical mucus.

The composition and viscosity of cervical mucus vary considerably throughout the menstrual cycle. Composed of cervical mucin (a glycoprotein with a high carbohydrate composition) and soluble components, cervical mucus is not readily penetrable. Between days 9 and 16 of the cycle, however, its water content increases, and this change facilitates the passage of sperm through the cervix around the time of ovulation; such mucus is sometimes called E mucus. After ovulation, under the influence of

progesterone, the production of watery cervical mucus ceases, and a new type of sticky mucus, which has a much decreased water content, is produced. This progestational mucus, sometimes called G mucus, is almost completely resistant to sperm penetration.

There are two main modes of sperm transport through the cervix. One is a phase of initial rapid transport, by which some spermatozoa can reach the uterine tubes within 5–20 min of ejaculation. Such rapid transport relies more on muscular movements of the female reproductive tract than on the motility of the spermatozoa themselves. These early-arriving sperm, however, appear not to be as capable of fertilizing an egg as do those that have spent more time in the female reproductive tract. The second, slow phase of sperm transport involves the swimming of spermatozoa through the cervical mucus (traveling at a rate of 2–3 mm h, their storage in cervical crypts, and their final passage through the cervical canal as much as 2–4 days later.

Relatively little is known about the passage of spermatozoa through the uterine cavity, but the contraction of uterine smooth muscle, rather than sperm motility, seems to be the main intrauterine transport mechanism. At this point, the spermatozoa enter one of the uterine tubes. According to some more recent estimates, only several hundred spermatozoa enter the uterine tubes, and most enter the tube containing the ovulated egg.

Once inside the uterine tube, the spermatozoa collect in the isthmus and bind to the epithelium for about 24 h. During this time, they are influenced by secretions of the tube to undergo the capacitation reaction. One phase of capacitation is the removal of cholesterol from the surface of the sperm. Cholesterol is a component of semen and acts to inhibit premature capacitation. The next phase of capacitation consists of removal of many of the glycoproteins that were deposited on the surface of the spermatozoa during their tenure in the epididymis. Capacitation is required for spermatozoa to be able to fertilize an egg (specifically, to undergo the acrosome reaction). After the capacitation reaction, the spermatozoa undergo a period of hyperactivity and detach from the tubal epithelium. Hyperactivation helps the spermatozoa to break free of the bonds that held them to the tubal epithelium. It also assists the sperm in penetrating isthmic mucus, as well as the corona radiata and the zona pellucida, which surround the ovum. Only small numbers of sperm are released at a given time.

On their release from the isthmus, the spermatozoa make their way up the tube through a combination of muscular movements of the tube and some swimming movements. The simultaneous transport of an egg down and spermatozoa up the tube is currently explained on the basis of peristaltic contractions of the uterine tube muscles. These

contractions subdivide the tube into compartments. Within a given compartment, the gametes are caught up in churning movements that over 1 or 2 days bring the egg and spermatozoa together. Fertilization of the egg normally occurs in the ampullary portion (upper third) of the uterine tube. Estimates suggest that spermatozoa retain their function in the female reproductive tract for about 80h.