Biochemistry of semen

B.Sc. Part II, paper IV, Group B: Reproductive Biology

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Introduction

Semen is a substance produced by the male reproductive organs. It is white, opalescent slightly alkaline viscous fluid, having pH between 7.35 to 7.50. It is composed of spermatozoa with fluid ,known as seminal plasma . The Seminal plasma is a complex fluid originating from several glands which keeps the spermatozoa or sperm viable. Sperm cells constitute only 2 to5% of total seminal volume rest of the volume is constituted by fluids produced and secreted by the various tubules and glands of the reproductive system.

Structures involved in the production of semen

- Testis
- epididymis
- Prostate
- Seminal vesicle
- Bulbourethral gland

Semen is produced as a combination of secretions from the different regions of male reproductive tract

The component of semen-sperm and seminal plasma differ in their origin composition and function.

sperm

Spermatozoa or sperm originates in the testes from the germ cells of the seminiferous epithelium by the process of spermatogenesis. The human male ejaculates 200 to300million sperms during a coitus.

Sperm is a microscopic structure composed of a head, a middle piece and a tail.

Whole body of sperm is covered by plasma membrane.

The sperm head contains an elongated haploid nucleus.

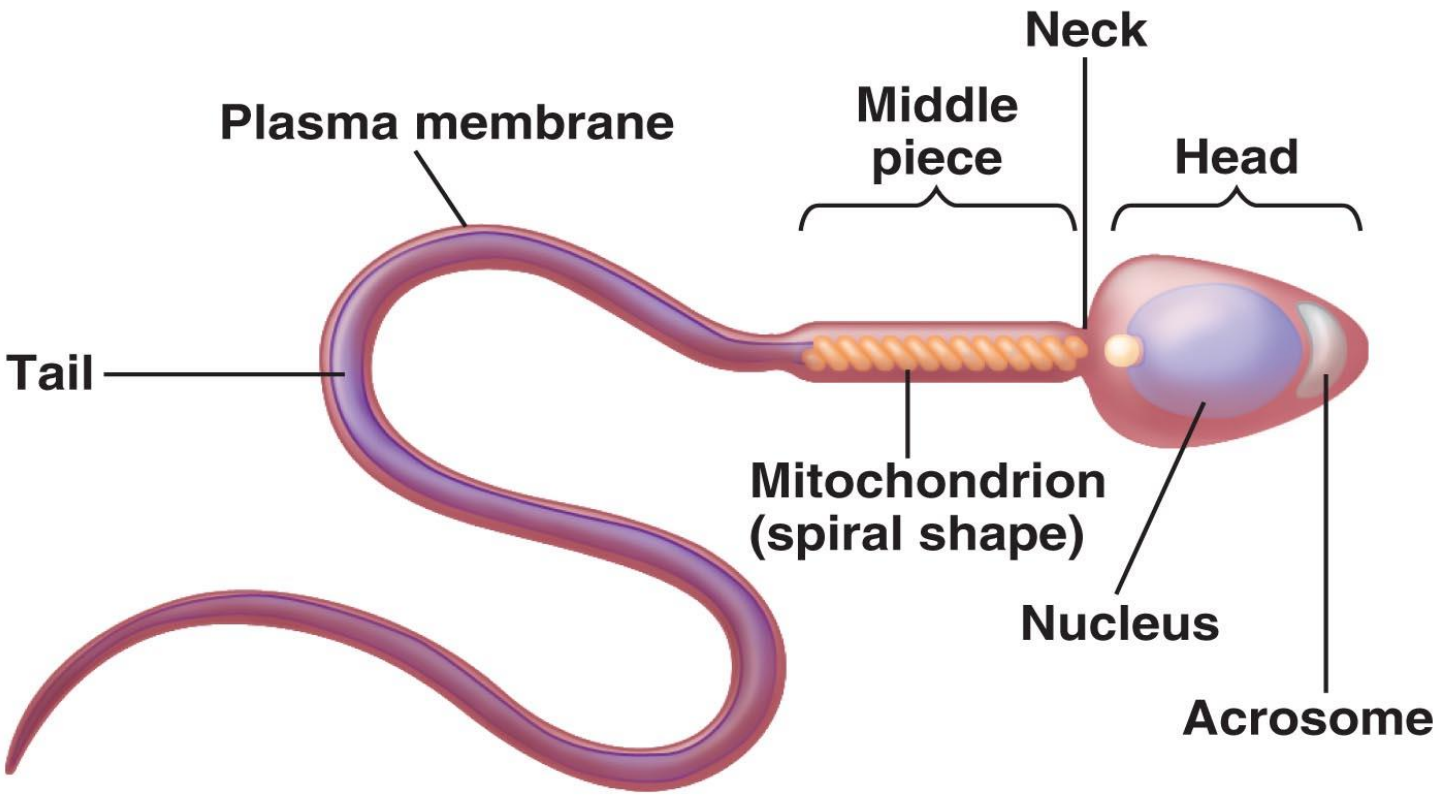
Anterior portion of the nucleus is covered by a cap like structure called acrosome.

Acrosome contains the enzymes needed for the fertilization of the ovum.

Middle piece contains numerous mitochondria, which supply energy.

Sperm tail thin elongated structure making 80% of the entire length of the sperm, helps in motility.

This forms about 2-5% of the semen composition.



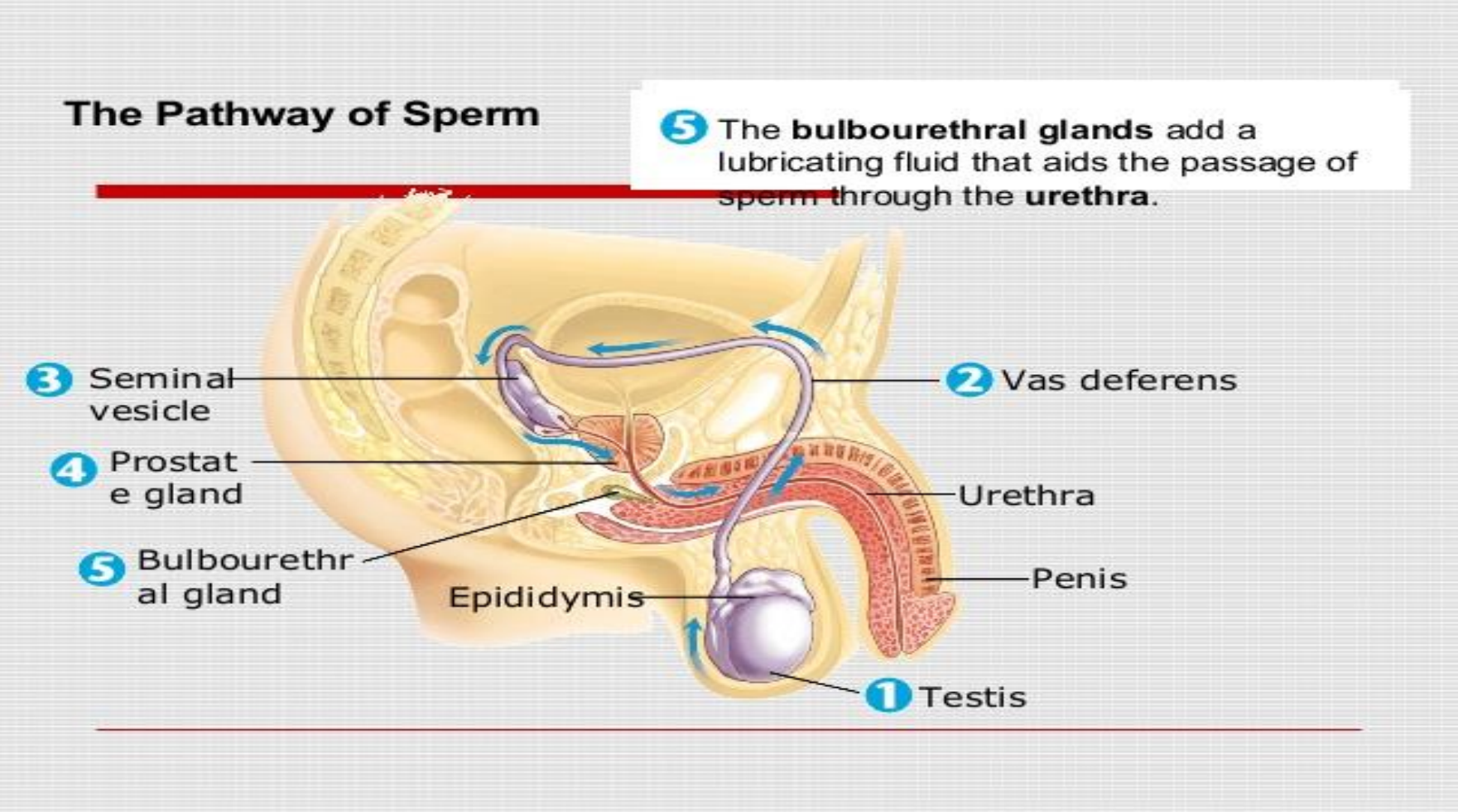
The seminal plasma

- The Seminal plasma is the fluid portion of semen.
- It is a complex fluid, which serve as the vehicle for transporting ejaculated spermatozoa.
- It provides protection and nutrition to the spermatozoa during their onward movement in the female reproductive tract.
- The secretions of the seminal tract and seminal glands contribute the main portion of the seminal plasma.

Process of semen formation

- From testis the sperms are transferred and stored in the epididymis. In epididymis secretions of potassium, sodium and glyceryl phosphorylcholine(an energy source for sperm) are added to the sperm cells. Constitute about 5% of the total semen volume.
- In epididymis sperm matures and pass to another storage area ampulla part of vas or ductus deferens.
- The ampulla secretes a yellowish fluid ,ergothioneine, a substance that removes oxygen also secrete fructose which nourishes the sperm.
- During the ejaculation liquid from the prostate gland and seminal vesicles are added .these dilute the semen concentration and provide suitable environment for them.
- The seminal fluid (fluid from the seminal vesicle constitute the 50-65% 0f seminal volume .these fluid contains fructose, amino acids, citric acids phosphorus, potassium and hormones like prostaglandin.
- The prostate gland contribute 20-30% of the semen volume and it adds acid phosphatase, calcium,sodium,zinc,potassium, proteolytic enzymes and fibrolysin(an enzyme that reduces blood and tissue fibres).
- These helps in coagulation and subsequent liquification of semen.
- Most of the IgA(immunoglobulin A) present in the semen are produced by prostate.
- The bulbourethral gland produces
- mucoproteins, a thick ,clear lubricating protein commonly known as mucus. These make up to 5% of the volume of the semen
- The seminal plasma along with the sperm finally forms the semen.

Structure involved in the production and transport of semen



Physical properties

Colour:

- White or opalescent

Specific gravity:

- 1.028

pH:

- 7.25 to 7.50

Volume:

- 2 to 3 ml

Composition of semen

gland	Volume of ejaculate	Substance addedt
Testes/epididymis	0.15 ml	Sperm
Seminal vesicle	1.5 to 2ml 50 to 65%	Fructose, phosphoryl choline, ascorbic acid, prostaglandins, bicarbonates
Prostate	20 to 30%	Acid phosphatase, calcium, sodium, zinc, potassium, proteolytic enzymes, fibrinolysin
Bulbourethral gland	5%	mucoproteins

Functions:

- Semen carries sperm or the spermatozoa.
- Contains fructose and other enzymes that help the sperm to survive.
- Creation of alkaline buffered medium in the vagina.
- Coagulation of the sperm cells .
- Coating the sperm cells with capacitation inhibitors.
- Activation and motility of the sperm cells.
- Promote successful fertilization.