

Andrology of the Bull



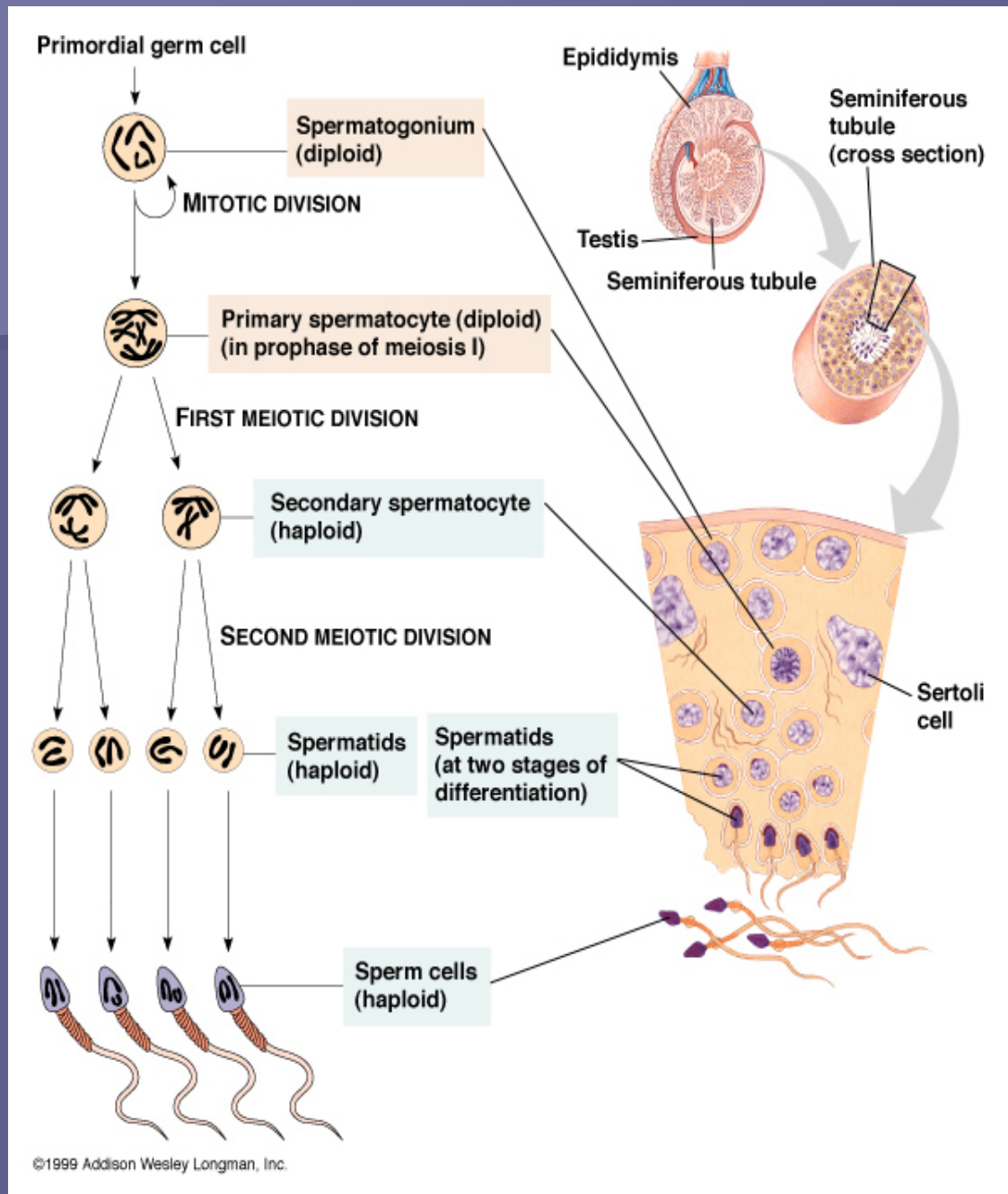
Spermatogenesis/ Hormones/ Breeding
Soundness

Spermatogenesis:

The process by which stem cells develop into mature spermatozoa.

There are three phases:

- (1) Spermatocytogenesis (Mitosis)
- (2) Meiosis
- (3) Spermiogenesis



Spermatogonium



1/ SPERMATOCYTOGENESIS



2/ MEIOSIS



Spermatids

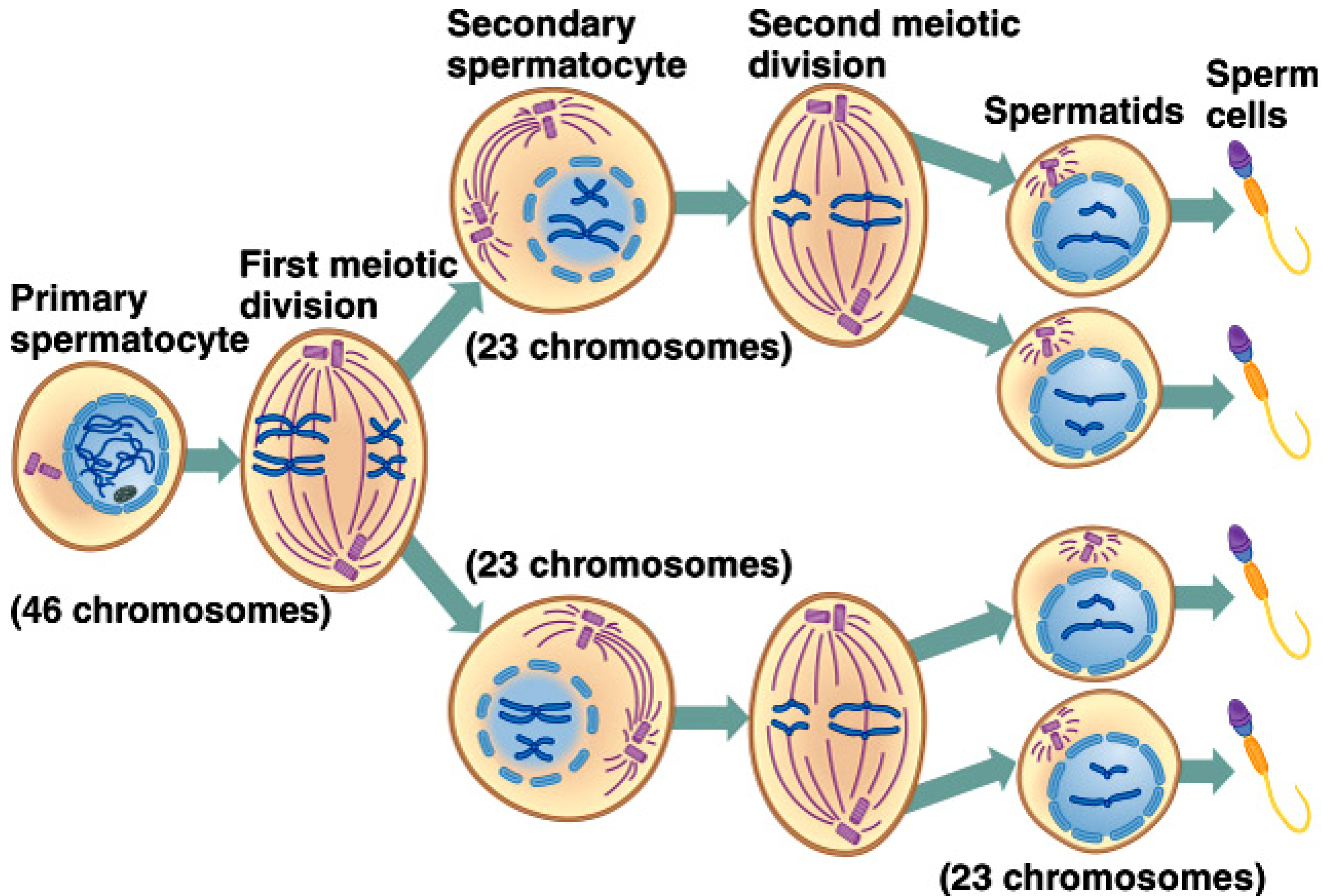


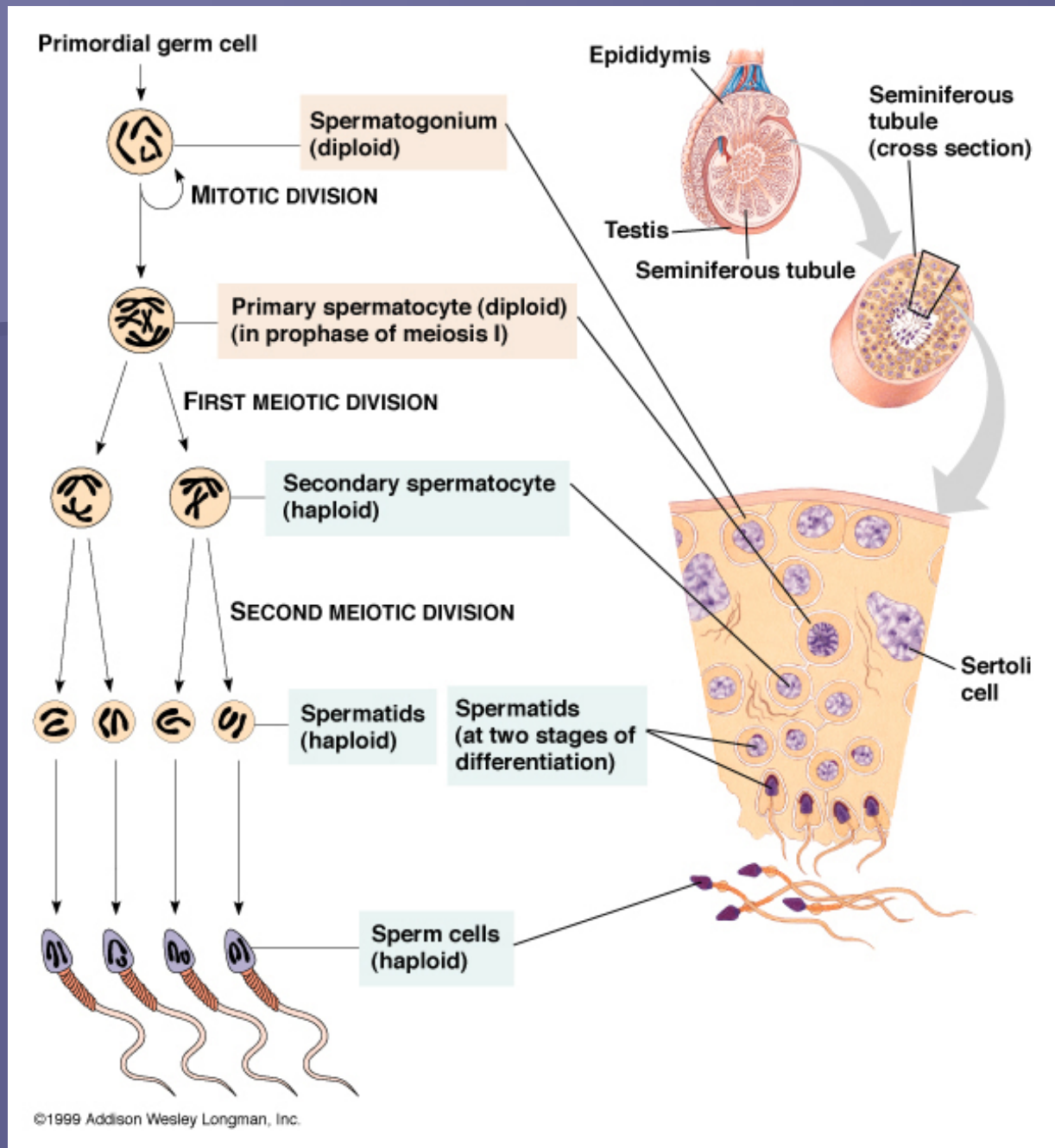
3/ SPERMIOGENESIS

Spermatozoa



Epididymal Maturation





Spermatogonium

Mitosis

Primary Spermatocyte

1st Meiosis

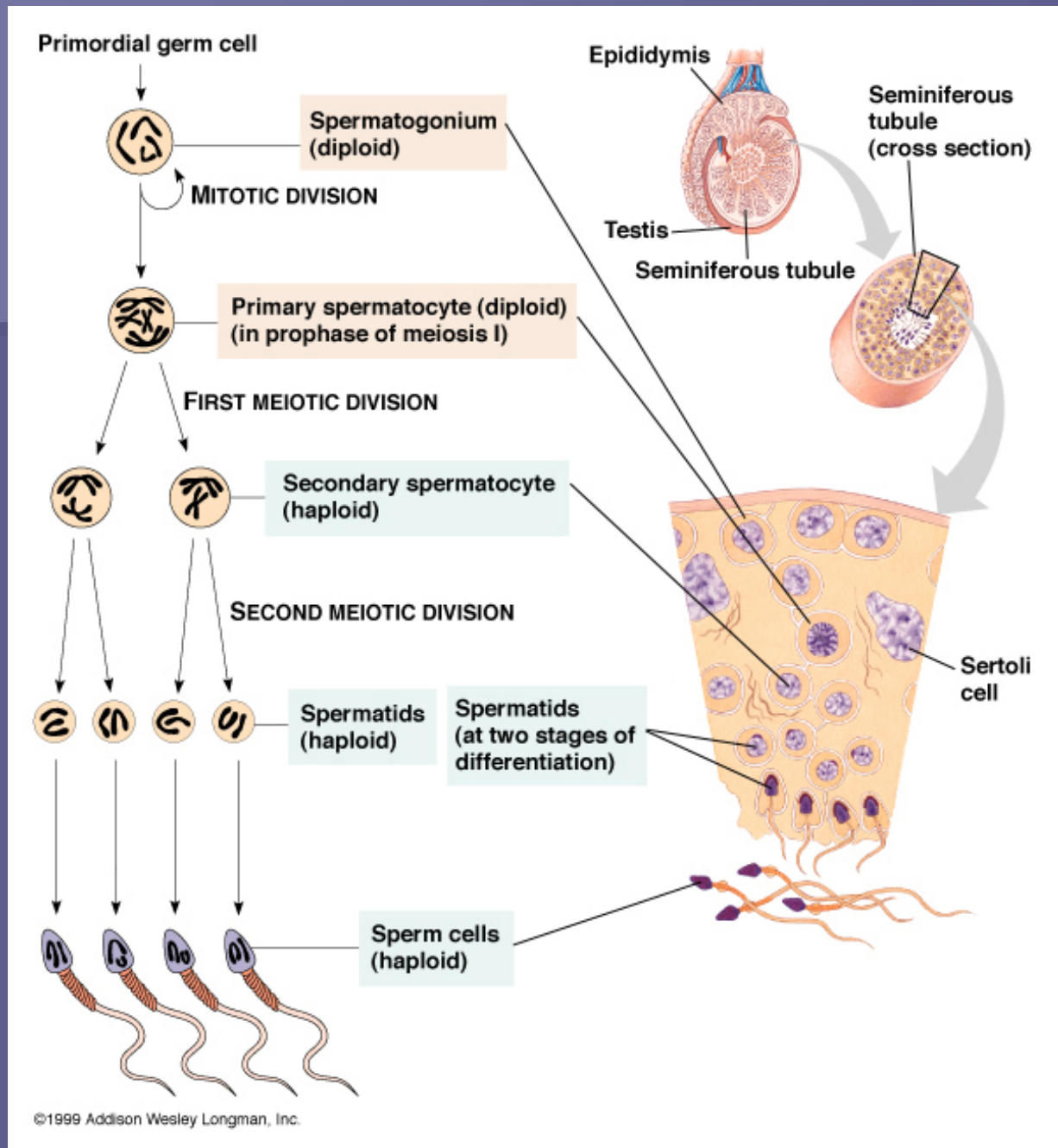
Secondary Spermatocyte

2nd Meiosis

Spermatids

Spermatozoa

Epididymal Maturation



Spermatogonium



15 Days

Primary Spermatocyte



15 days

Secondary Spermatocyte



1 - 2 Days

Spermatids



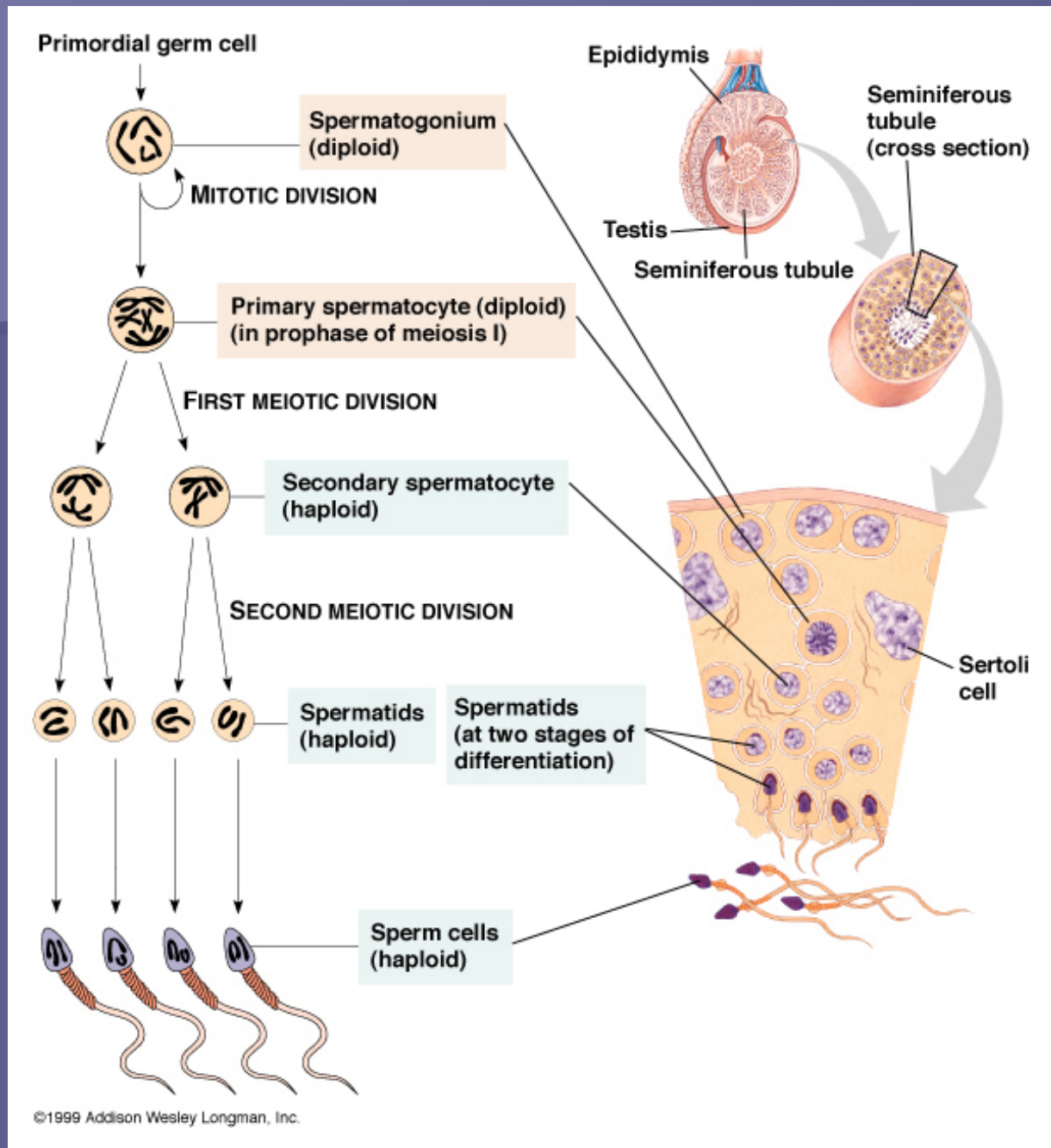
15 days

Spermatozoa



21 days

Epididymal Maturation



Spermatogonium

4

15 Days

Primary Spermatocyte

15 days

1

Secondary Spermatocyte

1 - 2 Days

Spermatids

2

15 days

Spermatozoa

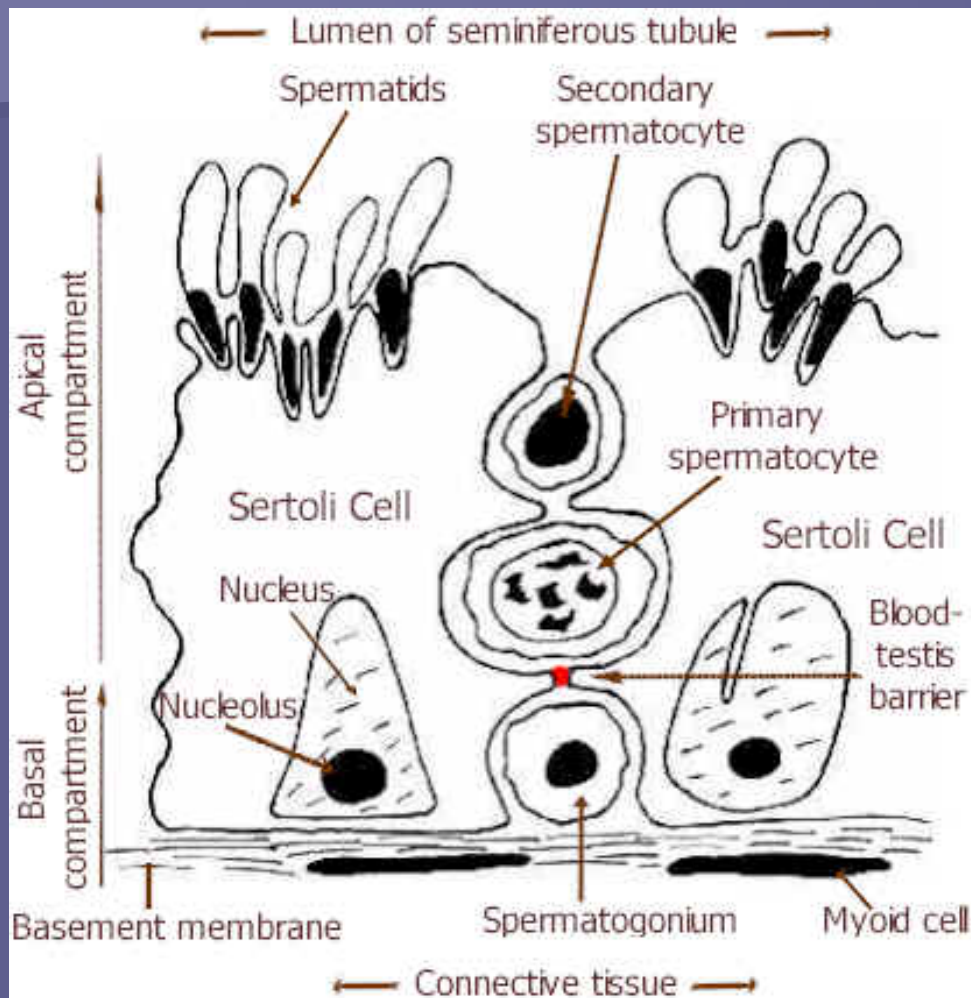
3

21 days

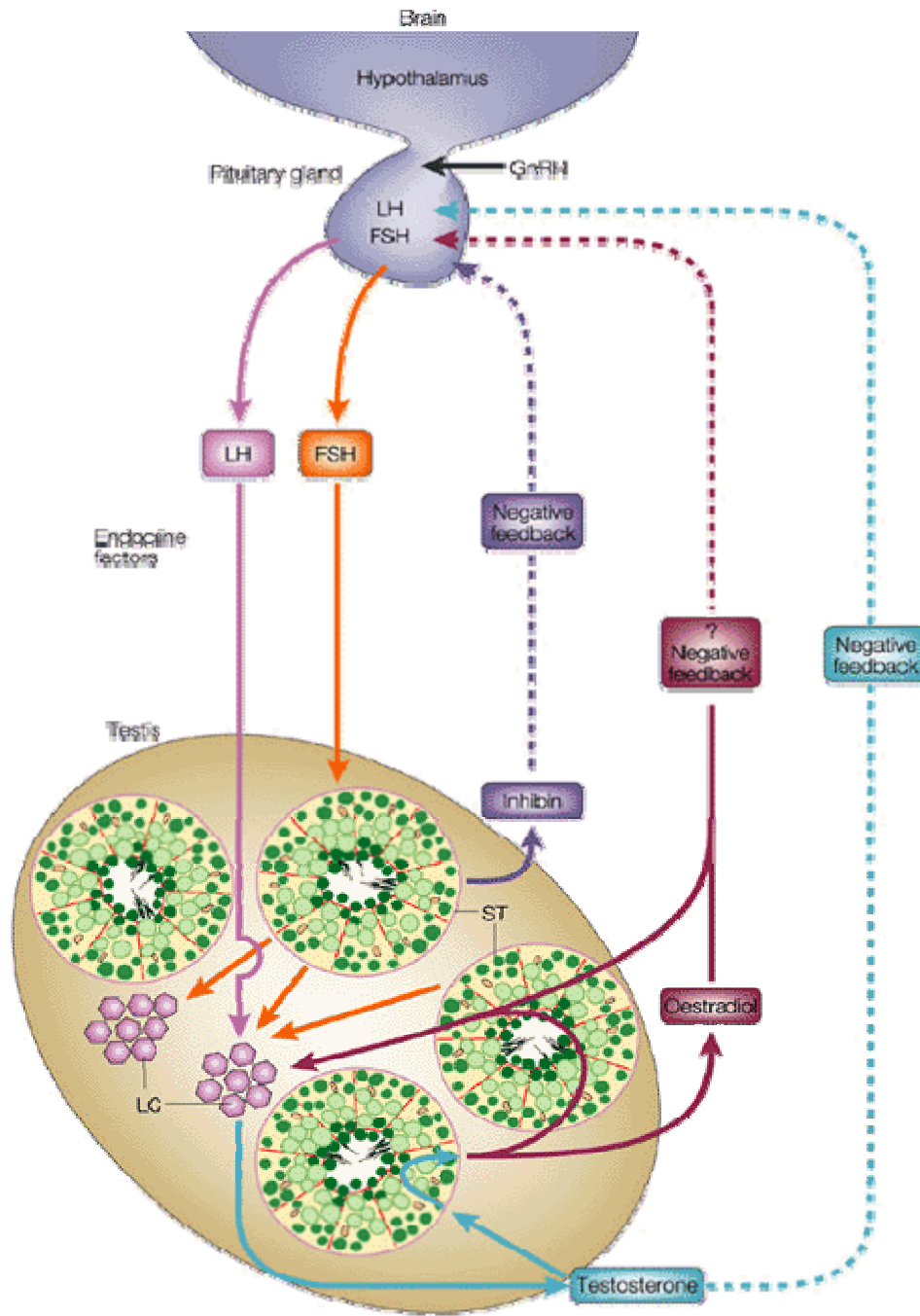
Epididymal Maturation

Sensitivity to Disruption- 1: Most sensitive/ 4: Least sensitive

Blood-Testes Barrier



- Tight junction between adjacent Sertoli cells.
- Large molecules cannot pass from the blood into the lumen of a seminiferous tubule
- The spermatogonia are in the basal compartment (deep to the level of the tight junctions)
- More mature forms are in the adluminal compartment.
- The function of the blood-testis barrier may be to prevent an auto-immune reaction.



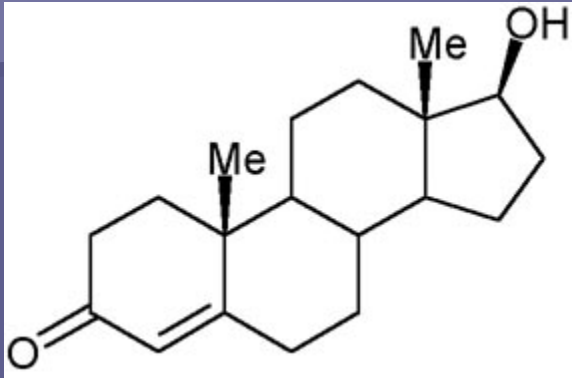
Leydig Cells

- Stimulated by LH
- Secrete **TESTOSTERONE**
- FSH increases number of LH receptors

Sertoli Cells

- Stimulated by FSH
- “Nurse” cells of the testes
- Secrete **ESTRADIOL** and **INHIBIN** → -ve Feedback
- Supports Spermatogenesis
- Forms Blood- Testes Barrier
- Requires FSH and testosterone
- Produces Androgen-binding protein (ABP)

Testosterone



■ Target Cells

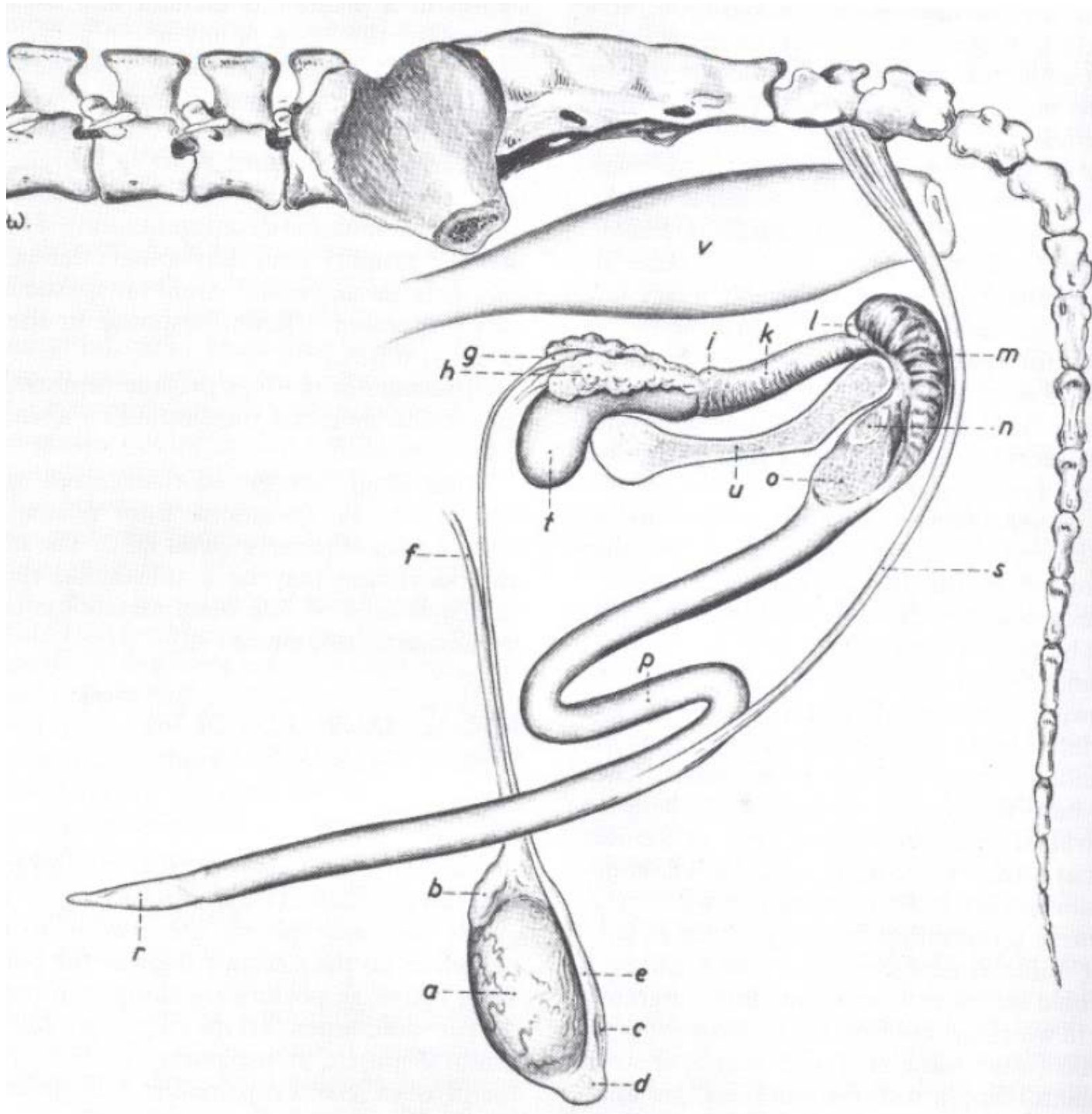
- Cells of Spermatogenesis
- Accessory Sex Glands
- Genitalia
- Anabolic effect (muscles)

■ Maintain Target Concentrations

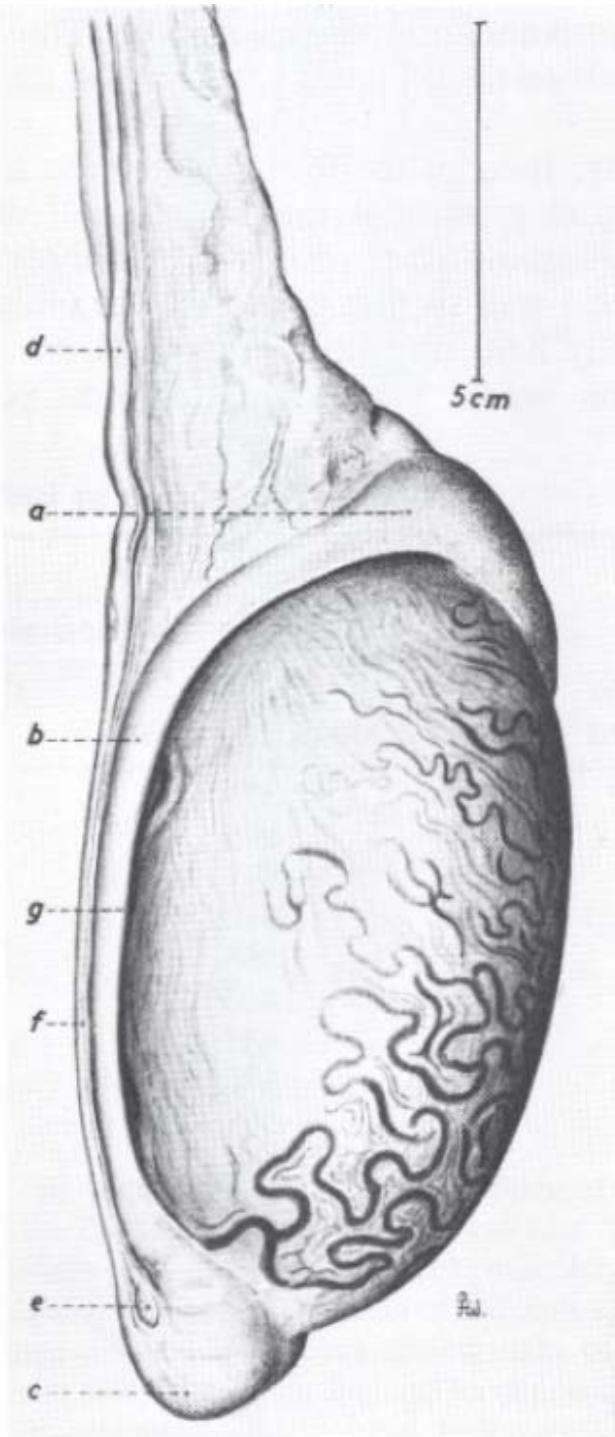
- -ve Feedback: Estradiol & inhibin
- Autoregulation → -ve feedback

Maintained in Testes:

- ABP binding testosterone
- Pampiniform Plexus



- A- Testicle
- B- Epididymis (head)
- C- Epididymis (body)
- D- Epididymis (tail)
- E- Ductus deferens
- F- Mesorchium
- G- Ampulla
- H- Vesicular Gland
- I- Prostate
- K- Urethra
- L- Bulbourethral gl
- M- Bulbospongiosus
- N- Crus penis
- O- Ischiocavernosus
- P- Penis
- R- Glans Penis
- S- Retractor penis
- T- Urinary bladder
- U- Pelvic symphysis
- V- Rectum



A- Head of Epididymis

B- Body of Epididymis

C- Tail of Epididymis

D- Ductus Deferens

E- Epididymal Ligament

F- Mesorchium

G- Testicular bursa

Function of the Epididymis

- 1/ Concentration of Sperm (head and body)-
 - Absorption of excess fluid
 - Increase storage capacity
- 2/ Maturation of Spermatozoa
 - Chemical changes within sperm
- 3/ Storage of Sperm (tail)
 - Sperm can age in epidydimis

Breeding Soundness Examination

1/ History

2/ Physical examination

→ General Examination

→ Genital Examination

→ External Genitalia

→ Internal Genitalia

3/ Semen Evaluation

History

- Age of first service
- Date of last service
- Previous Examinations
- Disease & Vaccination History
- Transport
- Breeding system- Ratio of bulls to cows
- Herd health history/ Conception rates

General Physical Examination



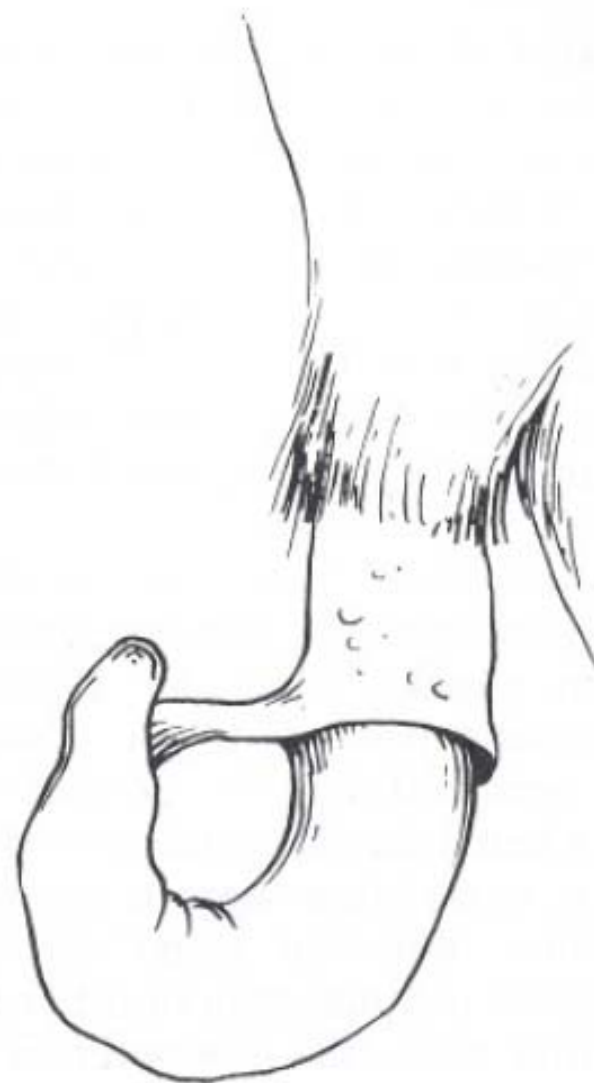
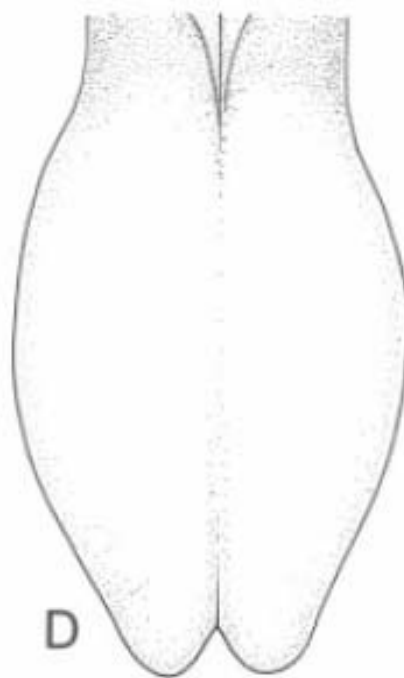
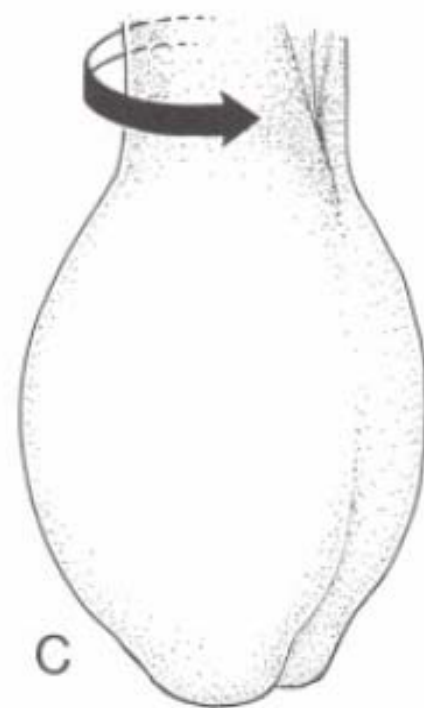
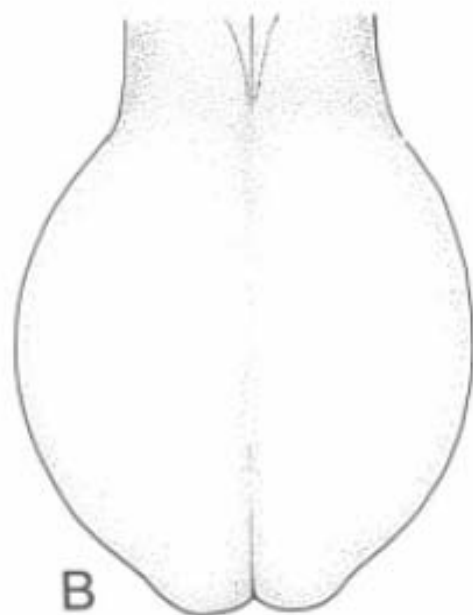
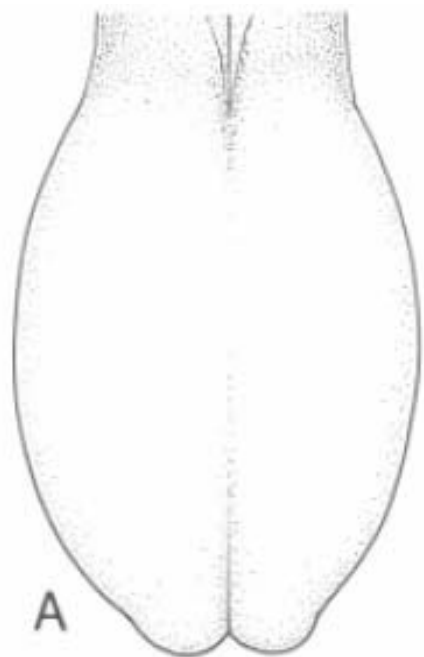
- General Conformation Defects
- Eyesight
- Mastication problems
- Locomotory problems
- Hereditary Defects
- Body Condition

External Genitalia



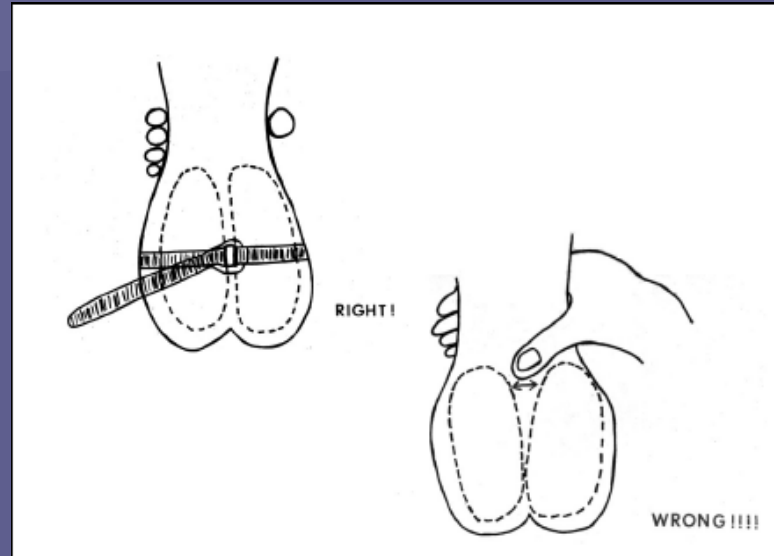
- Scrotum
- Testicles
- Spermatic cord
- Epididymides
- Sheath
- Penis
- Scrotal Circumference



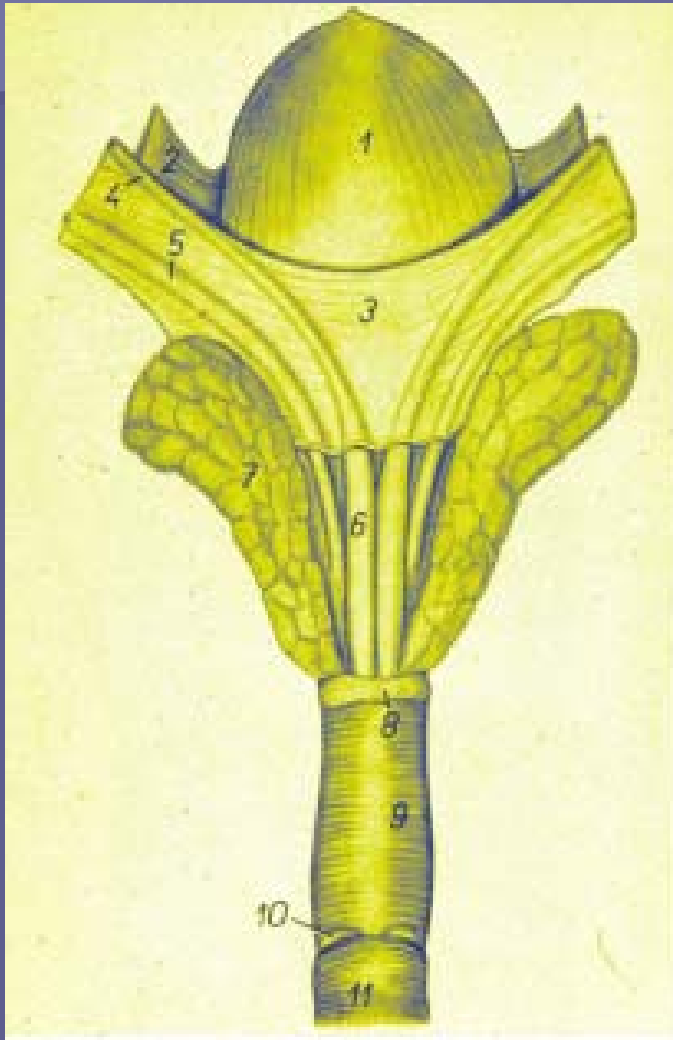


Scrotal Circumference

Minimum Recommended Scrotal Circumference	
Age	SC (CM)
≤ 15 MO	30
$> 15 \leq 18$ MO	31
$> 18 \leq 21$ MO	32
$> 21 \leq 24$ MO	33
> 24 MO	34



Internal genitalia



Rectal Examination:

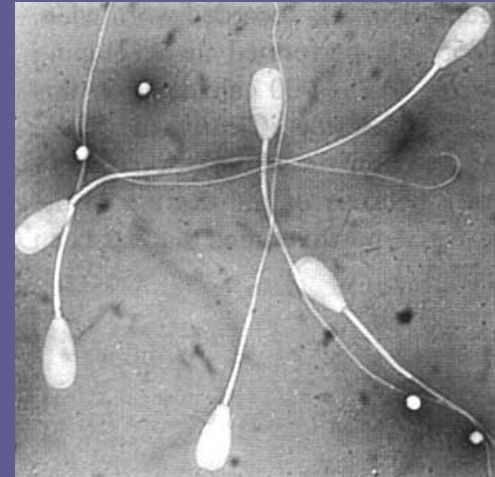
- Prostate Gland (8)
- Seminal vesicles (7)
- Cowper's Gland (10)
- Ampulla (6)
- Size
- Symmetry
- Width
- Consistency
- Pain on palpation
- Inguinal Rings

Semen Collection



Semen Evaluation

- Evaluate semen quality
 - volume,
 - color,
 - consistency,
 - mass motility (overall movement observed in the microscopy, "waves"),
 - individual motility of sperm cells
 - semen morphology (that is: normal/abnormal looking cells)



Normal Parameters

Parameter

- Ejaculate volume
- Sperm concentration
- Total sperm per ejaculate
- Progressive motility
- Morphology

Normal Values

5 ml (range 1-15 ml)

1200 million/ml

(300-2500 million/ml)

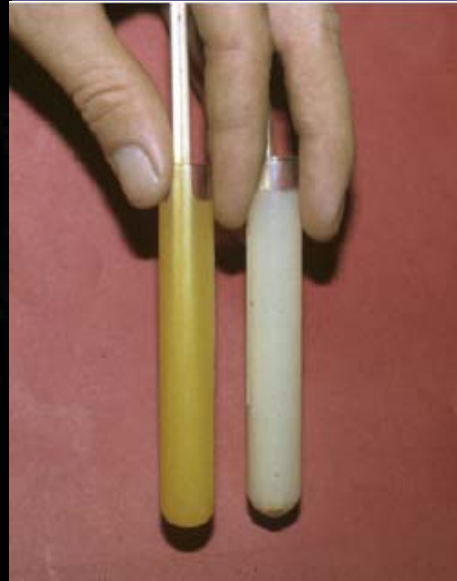
Typically 4-5 billion

Greater than 30%

Greater than 70% normal



Color

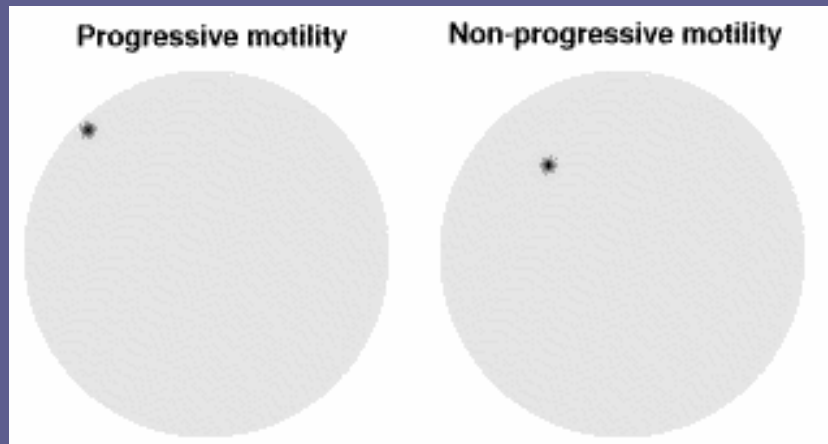


- Opacity:- Indication of concentration
- Color--acceptable color ranges from milky to creamy
- (Note: This indicates sperm per cubic millimeter of 500,000 or above.
- Other colors indicating less than 500,000 sperm/cu mm would be opalescent (cloudy) to watery.)

Mass/ Individual Motility

Minimum Recommended Motility is: 30% or FAIR (F)		
Mass Activity (Gross)	Rating	Individual
Rapid Swirling	Very Good (VG)	≥ 70%
Slower Swirling	Good (G)	50 - 69%
Generalized Oscillation	Fair (F)	30 - 49%
Sporadic Oscillation	Poor (P)	< 30%

- Bulls: > 30% progressively motile sperm
- Adversely affected by;
 - heat
 - cold
 - residue on collection equipment
 - wrong pH or osmolality
 - Sexual inactivity



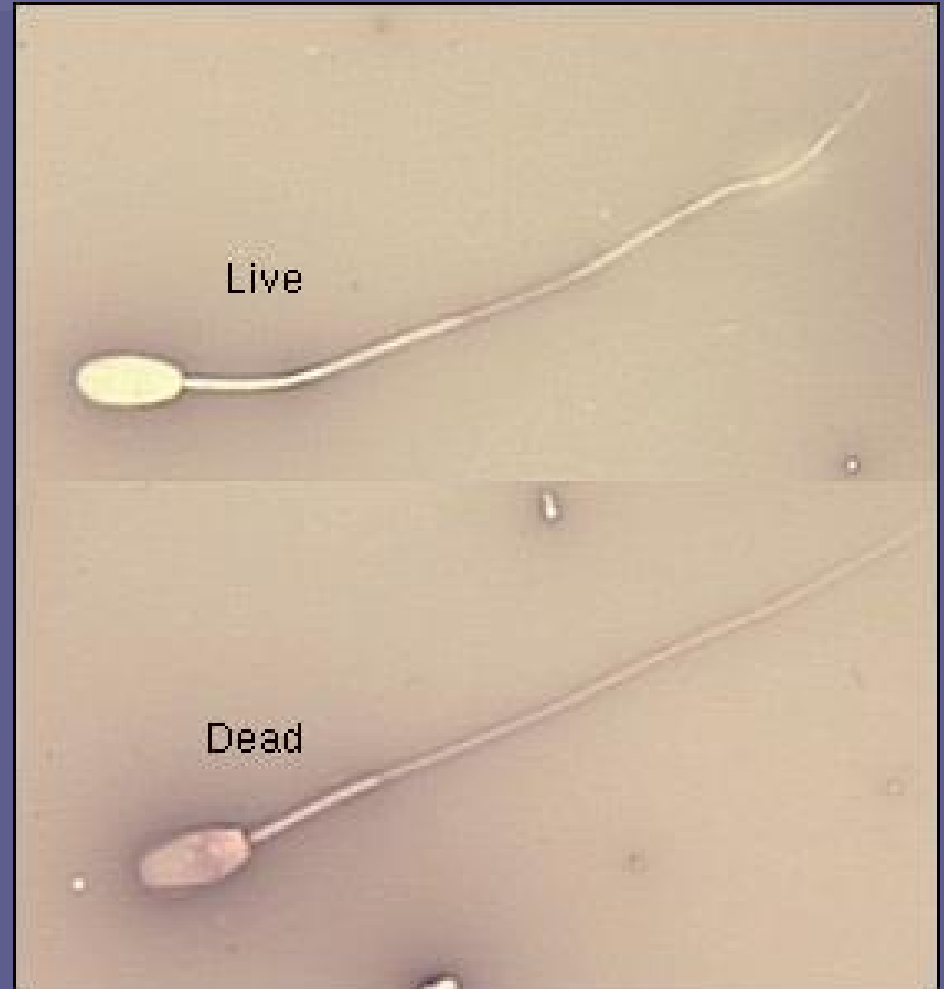
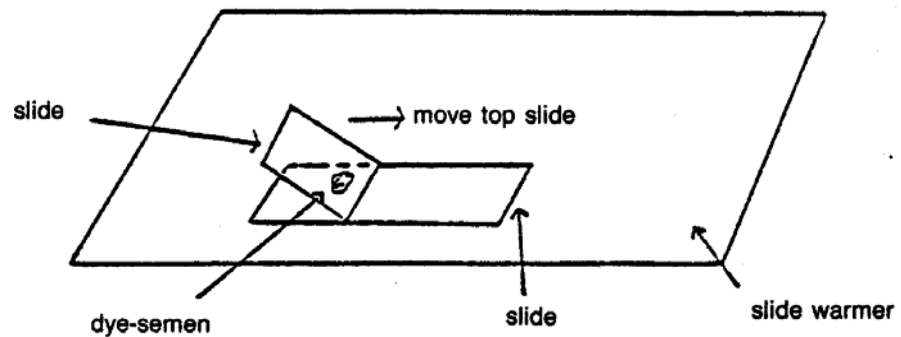
Live/ Dead Staining



Live/ Dead Staining



Preparing a Dead-alive Stain



Major defects

A-Proximal Cytoplasmic Droplet

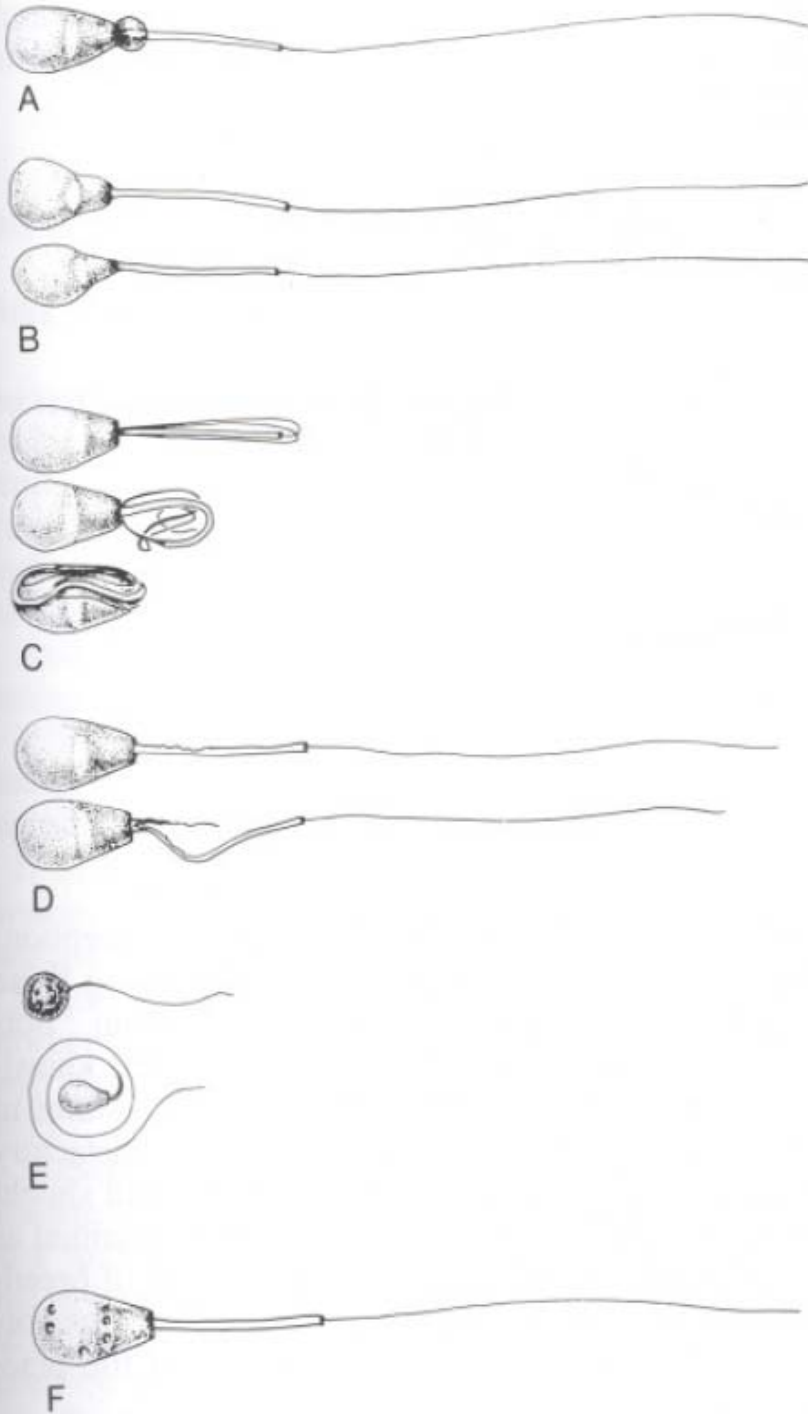
B- Pyriform heads

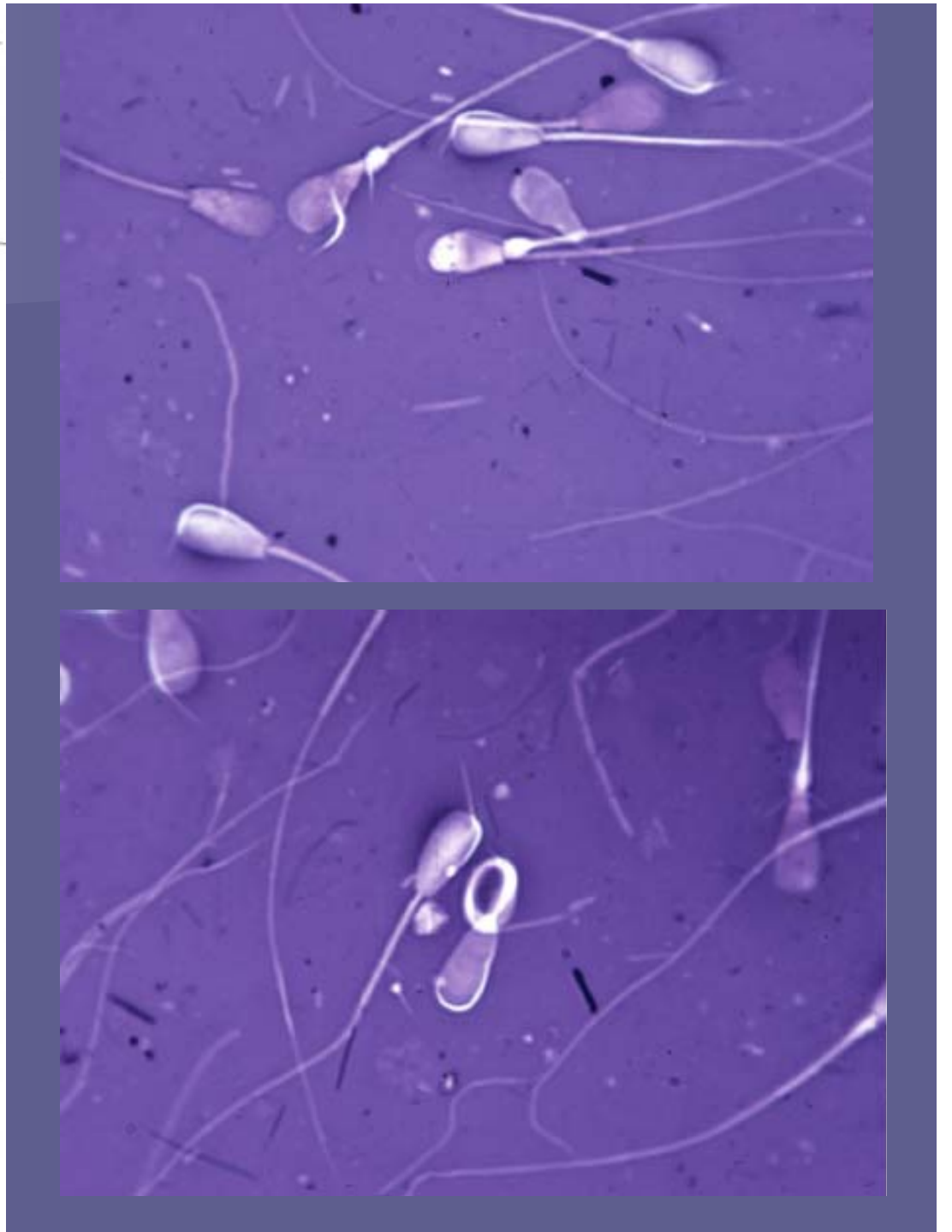
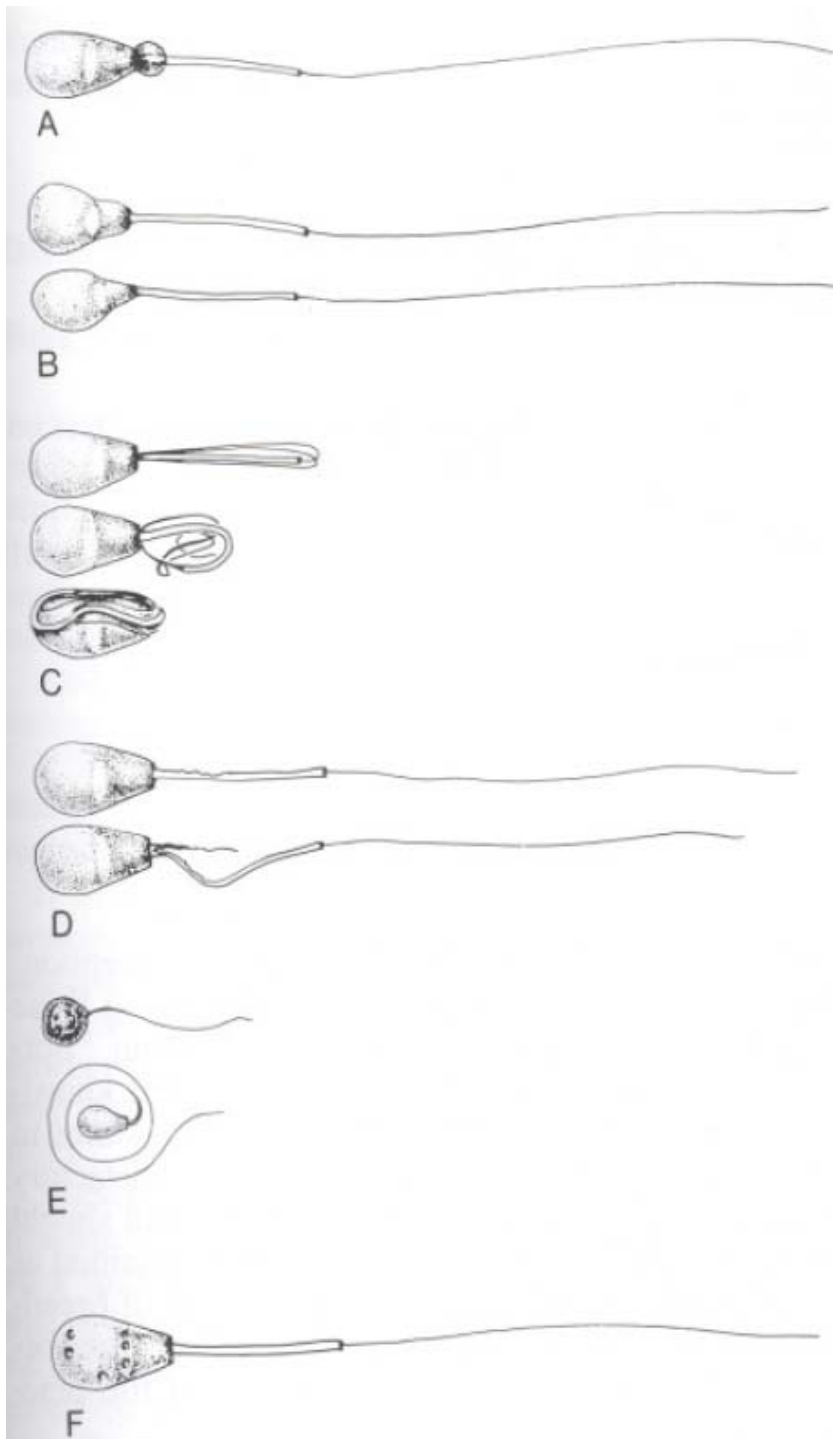
C- Folded/ Coiled Tails

D- Middle piece Defects

E- Maldeveloped

F- Craters





Minor defects

- A- Distal cytoplasmic droplets
- B- Tailless normal heads
- C- Simple bend, terminally coiled tail
- D- narrow, small or giant heads
- E- Abaxial implantation
- F- Abnormal Acrosomes

