

# Breeding Soundness Examination

# BSE

- **Indications**

1. Diagnosis of infertility –identify and eliminate infertile males (Judgment depending on circumstance of breeding service)
2. To ascertain whether the animal will have a level of fertility that is adequate for breeding – AI or NM
  - 2<sup>nd</sup> purpose more relevant in food animals– pre-introduction
  - BSE estimates fertility levels to be expected from a given male for selection
  - These decisions are important to financial efficiency of the farm
  - Reduced costs and disease risk as well as increase selection intensity

# Cont ...

- **Basic Components:**

- } General clinical examination of the animal.
- } Examination of reproductive organs.
- } Measurement of scrotal size.
- } Evaluation of semen.

- **In addition, the following tests or procedures may be included in a breeding soundness evaluation:**

- 1) Mating ability: some assessment of the bull's desire (libido) and ability to breed a female in heat (termed serving capacity).
- 2) Pelvic measurement.
- 3) Trichomoniasis testing.

# Cont...

- **Outcomes/Judgment**

Depending on circumstances - Classification of the sire as -

1. **Satisfactory.** The animal is considered satisfactory in all components of the examination (or areas in which it is not satisfactory have been considered non-critical)
2. **Re-evaluate/Temporarily unsound.** The sire has Failed to meet a satisfactory standard in **critical Areas** (or were not evaluated.). Judgment confined to circumstances in which there is a **reasonable expectation of improvement with time**
3. **Unsatisfactory/unsound.** A sire that is not satisfactory in one or more **critical components** of the examination is 'unsatisfactory' of 'unsound'. Sterile or not
4. **Qualified pass.** Animals that are close to the 'cut point', in critical criteria between being classified as satisfactory or unsatisfactory, may possibly be considered as candidates for a qualified pass.

Judgment passed with strong reservation – apply carefully

# Cont...

## 1. General Clinical Examination

- **Identification**; Important for legal purposes – because certificates are given after BSE

- **Signalment**; Age, Breed

- **History** - Owner/attendant interview

- Management conditions such as; housing, nutrition, cleaning, handling , transport, service mgmt (needed to rule out problems)
- A history of recent illness is also important because semen quantity and/or quality may be reduced as a result of a prior illness.
- For a suspected infertile male animals - **Establish If infertility problem is truly due to male. If so determine the cause , the duration and onset of infertility**

How many females bred by male are affected

How was mating done – Eg male:female, synchronization, out of season breeding, male – female weight matching

Previous breeding performance (Virgin or experienced)

Female history and performances

# Cont...

- **General physical examination**

- The bull needs to be able to see, eat, smell, and move around to successfully breed his share of cows. Any factor that lowers the efficiency of these activities will have a negative effect on the bull's breeding ability.
- Therefore examination should cover; *BCS, Posture and Gait, Temperament, Eye and Nose, Teeth and Mouth, Feet and Legs*

## **2. Examination of the genital tract**

- How - depends upon species and circumstances

- **Penis and prepuce**

- Insect during coitus or while collecting semen
- Dog and boar - possible after manual stimulation
- Check for - externally visible lesion, erection, protrusion, orientation
- Palpation of the prepuce and of the more proximal parts of the penis (e.g. the sigmoid flexures of ruminants) for Adhesions, trauma and the presence of tumors

# Cont ...

- **Scrotum and Spermatic Cord Contents**

- Check scrotal skin for signs of trauma or ectoparasites
- palpation of scrotal structures (presence, size, texture, tone, evenness of the testes, its free immovability in scrotum, temperature, sensitivity)
- Tail of the epididymi turgidity – sperm reserve
- The ductus deferens should be palpated throughout the scrotal neck and (particularly in rams)
- The spermatic cord should be palpated up to the level of the inguinal ring for the presence of abdominal contents (scrotal hernia) or abnormalities of spermatic vasculature.

- **Measurement of scrotal circumference**

This gives a good estimate of daily sperm producing ability which otherwise requires evaluation of serial semen samples

Scrotal circumference of mature depends on **body weight** and may fluctuate with **season**

Small rams >28 cm are acceptable; Large rams > 34cm acceptable

# Cont...

- **Accessory sex glands**
- In the bull and the stallion, the prostate, vesicular glands and ampullae can be palpated per rectum
- Small animals – US or X ray examination

Score	Description	Semen	Action
1	Firm and springy	Likely to be acceptable	Meets standard
2	Slightly softer	Adequate semen	Meets standard
3	Poor tone	Probably unacceptable	Evaluate semen
4	Flaccid/ atrophied	Unlikely to be adequate	Classify as unsound

Age	Minimum scrotal circumference
Yearling	32 cm
2-year-old	34 cm
> 2 years old	38 cm (clear pass)
	36 cm (provided testis tone and turgor of epididymal tail are normal)





# Cont...

## 3. Examination of mating behavior

- Assessment of **libido and serving ability** is widely used in the examination of bulls for breeding soundness in old days
- **Circumstances should be taken in to account**
  - Boars and Dairy bulls, will often be willing to mount females that are not in estrus, or even to mount other males, castrates or dummy animals
  - Rams and beef bulls, although usually of high inherent libido, commonly refuse to mount an estrous female in the presence of a human observer
  - Animals that are stressed by recent transport are also often unwilling to mount straight away
- **Libido test** - a single pre-stimulated bull is introduced to one restrained heifer. **Libido is scored according to the number and vigour of mating attempts (in 5 - 10 minutes & Scored 0 - 10 or other )**

# Cont...

- **Serving capacity test** - four to six bulls are admitted to restrained, estrogenized heifers and the numbers of mounts and effective services are recorded
- bulls' performance in the two tests is highly correlated, so they have now been combined into a single test:  
**Service test** – takes in to account the type and age of animals under examination

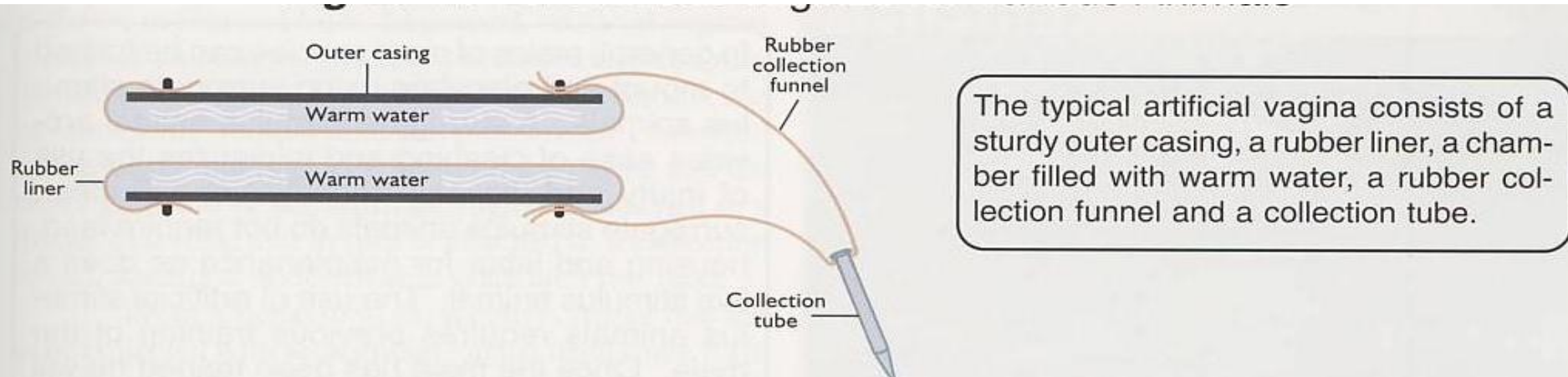
## 4. Collection and evaluation of semen

- The purpose of semen examination is to ascertain whether the **numbers** of **functionally** normal spermatozoa present in an ejaculate are sufficient **to cause pregnancy** and whether the sire has an adequate capacity to produce enough spermatozoa to achieve pregnancies among all the females he is required to service

METHODS OF SEMEN COLLECTION IN DOMESTIC ANIMALS			
Method	Species used for	Advantage	Disadvantage
Artificial vagina	<b>Bull; Stallion;</b> Ram; Boar; Camel; Buffalo	Most representative sample Close inspection penis possible	Risk to collector
Electroejaculator	Bull; Stallion; Camel <b>Ram</b>	Variable output volume, motility and density not always representative	Safer for operator
Digital stimulation of penis	<b>Boar; Dog;</b> Cat	Sample reasonably representative	
Manual stimulation of ampulla	Bull		No erection or protrusion of penis
Collect fresh ejaculate from vagina	Bull Ram/Buck (not recommended)	Possible to observe coitus	Semen mixed with mucus and contaminants Difficult to evaluate

# Cont...

- **Sperm collection by Artificial Vagina**



- The AV consists of a strong **outer rubber cylinder** containing a **latex liner**. At one end of the AV a **latex extension cone** carrying a **graduated collecting tube** is attached. The **length of the AV** should be adjusted so that the animal ejaculates into the extension cone, thereby producing semen that is as free as possible of particulate or bacterial contamination. The **space between the outer cylinder and latex liner** is filled with warm water, so that the temperature in the lumen of the AV is **between 45°C and 48°C. (bull)** The main stimulus to ejaculation are the temperature (bull, ram) of the AV and its pressure (stallion, boar) upon the penis. A little inert **non spermicidal**



The artificial vagina for the stallion consists of a leather outer casing (C) equipped with a port to drain water (arrow). The collection vessel (CV) and the protective covering (PC) are shown. Ideally, ejaculation takes place in the collection cone (CC) so that most of the semen will drain directly into the collection vessel. (Artificial vagina courtesy of Northwest Equine Reproduction Laboratory, University of Idaho, [www.avs.uidaho.edu/nerl/](http://www.avs.uidaho.edu/nerl/))



The artificial vagina for the bull consists of a black casing (C), a rubber liner (RL) a collection cone (CC) and a collection vessel (CV). Water is placed between the casing and the liner. The proper temperature is critical for successful ejaculation in the bull. While not shown in the photograph a protective covering is placed over the cone and collection vessel to prevent cold shock of the semen.



The artificial vagina for the boar consists of a bulb that can apply pressure to the artificial vagina. High pressure is obligatory for stimulation of the glans penis and ejaculation in the boar. The artificial vagina for the boar also consists of an outer casing (C), a liner (L) and a protective covering (PC) that houses the collection vessel. (Photograph courtesy of Minitüb Germany, [www.minitüb.de](http://www.minitüb.de))



The artificial vagina for collection of semen from rams and bucks consists of a rubber casing (C) with a valve (arrow) through which water can be added or emptied, a rubber liner and a collection vessel (CV). The protective covering (PC) is shown above the artificial vagina. (Photograph courtesy of Minitüb Germany, [www.minitüb.de](http://www.minitüb.de))



In general, males of most species can be trained to mount and ejaculate using surrogate stimulus animals. A surrogate stimulus animal provides ease of cleaning and minimizes the risk of injury and disease transmission. Further, surrogate stimulus animals do not require feed, housing and labor for maintenance as does a live stimulus animal. The use of artificial stimulus animals requires previous training of the male. Once the male has been trained he will generally mount the "dummy" readily. The size can be adjusted easily to accommodate various males. Mobile surrogate stimulus animals are used for collection of semen in bulls because the location can be changed with ease.



- **Procedure in bull - similar in other species**

1. Safely restrain the estrus female or dummy
  2. Lead bull to female/dummy but don't let it mount (repeat few times)-penis erection begins and dripping of accessory secretion - good semen
  3. Finally the bull is led up to the cow for mounting with the collector standing to the right of the shoulder of the bull
  4. Small preliminary thrusts occur as the bull locates the vulva and during this, **collector grasps prepuce (not penis) with the left hand and deflects the penis to the right of the hindquarters of the cow, allowing it to find the entrance to the AV.**
  5. The bull will then normally make the ejaculatory thrust into the AV
- The entire procedure must be carried out quietly and methodically, keeping the bull under continual careful observation

# Cont...

- **Sperm collection by Electroejaculation**

- 1) Ram semen is most commonly collected by this method
- 2) EE is placed into the rectum and is used to stimulate the **sacral plexus, hypogastric nerve and parasympathetic outflow via the pudendal nerve**
- 3) Apply **low initial voltages and progressively increase up to the threshold needed for ejaculation**
- 4) Risk of hind limb stiffening due to stimulation of the sciatic and obturator nerves







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[../videos/Semen Collection of Horse at Writtle College.mp4](#)

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# Cont...

- **Semen evaluation**
- Main purpose is to identify males with low fertility
- Value findings – Handling – Spermatozoa are very sensitive to cooling, so temperature control of semen during its evaluation is critical
- Evaluate immediately after collection and always hold sample between **30° and 37 °C**
- **Gross inspection** of volume, color, consistency and odor for contamination (with urine, blood or puss)
- **Wet smear** – place a drop of semen on warm slide and examine under microscope
- At low power (x100) – **Mass Activity** – swirling or waves motion of semen scored as strong medium or poor
- At high power (x400) – **Individual Motility** – calculate

# Cont...

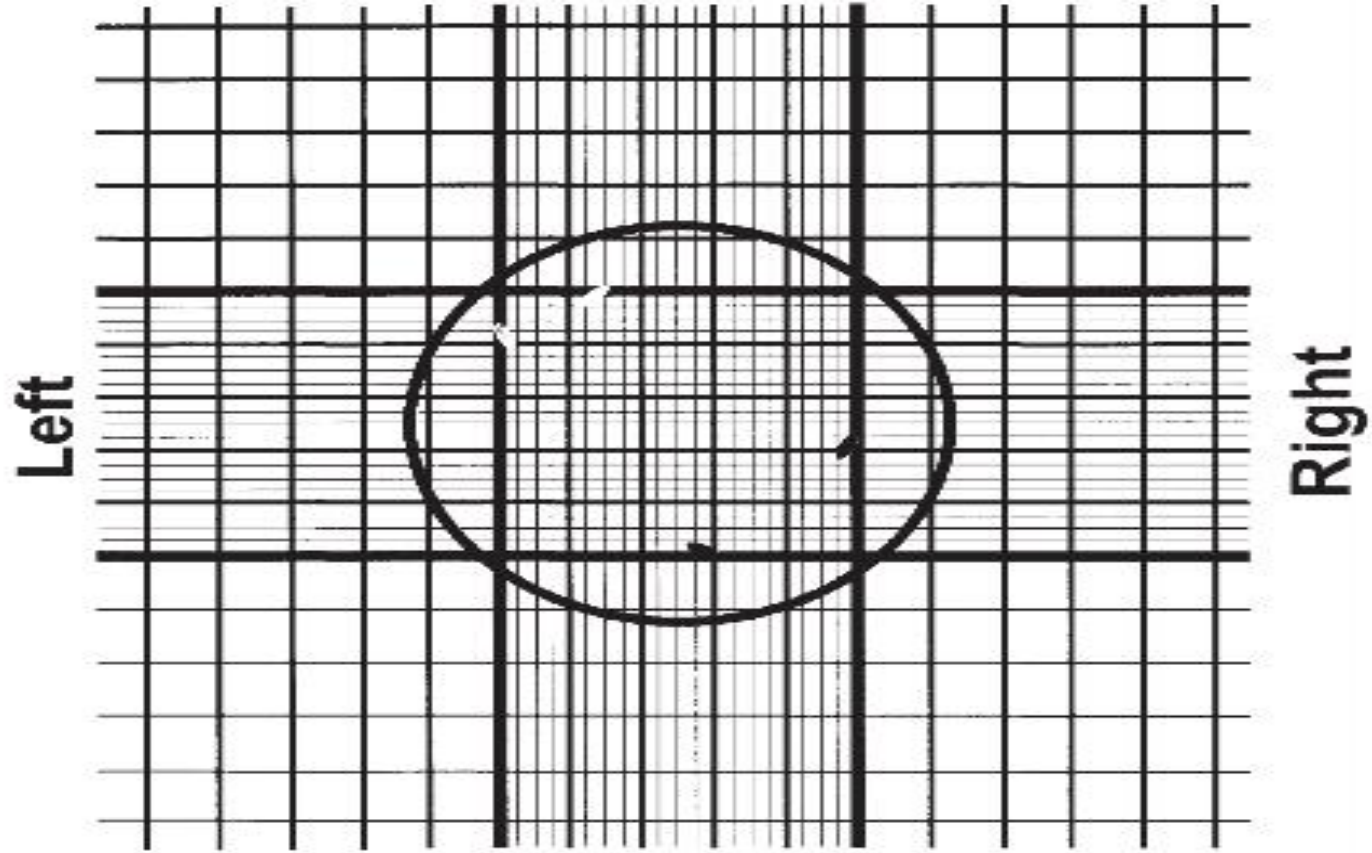
1) **Morphological smear** - a drop of semen mixed with 2 drops of vital stain (Nigrosin, India ink) on warm slide. Mix, smear and air dry. Smears are examined under 400 X and then at 1000 X oil emersion. 100-200 sperm cells classified according to their morphology

2) **Live : dead smear** - a drop of each semen mixed with drops of eosin-negrossin stain on warm slide. The mixture is then gently spread over slide surface and allowed to air dry. Smears are then examined under 1000 X magnification to count sperm with red staining cytoplasm (dead) out of a 100

3) Sperm concetration - **spetrophotometric** assessment of semen optical density or **haemocytometer** cell count

4) **Interpretation - good indication for sub-fertility, but not reliable prognostic markers of in vitro**





**Illustration of the hemacytometer grid used for counting sperm.**

Nine large squares are present, with additional crosshatched dividing lines within the center and central squares.

All sperm present within the large center square are counted.

Characteristic	Bull	Ram	Stallion	Boar	Dog
Volume (ml)	4 (2–10)	1.0 (0.5–2.0)	60 (30–250)	250 (125–500)	10 (2–19)
Fractionated	N	N	Y	Y	Y
Density ( $\times 10^6/\text{ml}$ )	1250 (600–2800)	2000 (1250–3000)	120 (30–600)	100 (25–1000)	125 (20–540)
Motile sperm (%)	>70	>90	>60	>60	>85
Normal spermatozoa (%)	>75	>85	>60	>60	>90

### Head Abnormalities

Crater Defect  
(Nuclear Vacuoles)



Tapered Heads



Ruffled Acrosome



Knobbed Acrosome



### Tail Abnormalities

Coiled Tail



Double Midpiece



Folded Tail



Detached Head



### Compensable defects

Distal midpiece reflex

Flag defect

Abnormalities of the  
mitochondrial sheath

Tail-stump defect

Tail defects

Knobbed acrosome

Swollen acrosome

Close/detached heads

### Uncompensable defects

Proximal cytoplasmic droplets

Pyriform heads

Chromatin defects

Sperm head vacuoles

Macro- and microcephalic heads

Nuclear crest

## Major abnormalities (group I)

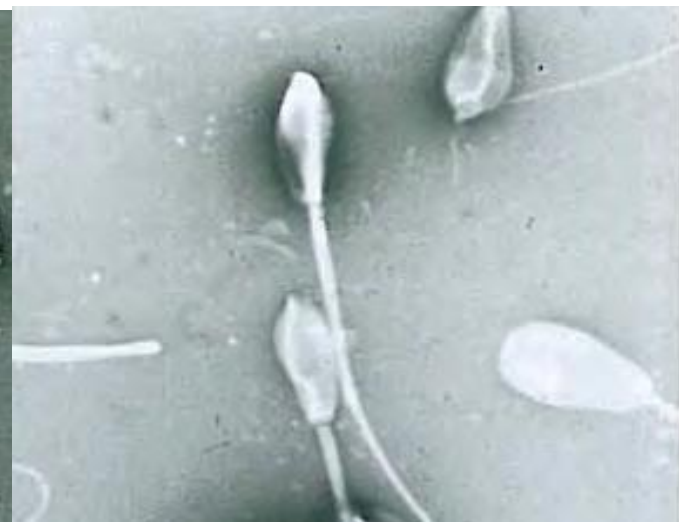
1	Underdeveloped cells	9	Small abnormal heads
2	Double forms	10	Detached abnormal heads
3	Acrosome (knobbed acrosome) defects	11	Corkscrew midpiece defect
4	Diadem defects	12	Other midpiece defects (incl. tail-stump defect)
5	Decapitated sperm (active tails)	13	Proximal cytoplasmic droplet
6	Pear-shaped head	14	Other thickened midpieces
7	Head narrow at the base	15	Coiled tails and Dag defect
8	Head abnormal contour		Looped tail, enclosed droplet (= distal midpiece reflex) (not illustrated)

## Minor abnormalities (group II)

16	Narrow heads
17	Small normal heads
18	Giant or broad heads
19	Detached normal heads
20	Detached acrosomal membranes
21	Abaxial tails
22	Distal cytoplasmic droplets
23	Simple bent tail
24	Terminally looped tails

## Other cells (group III)

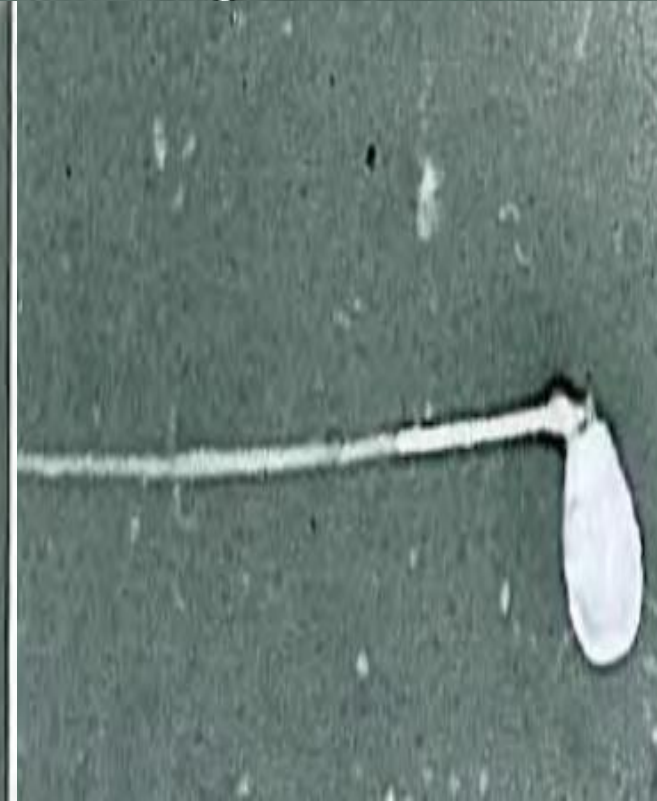
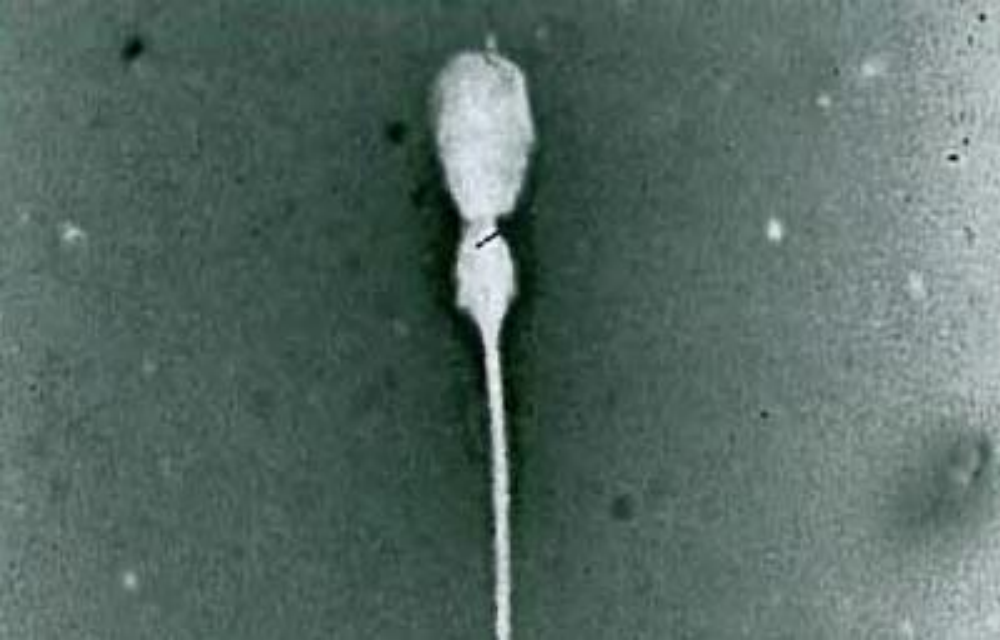
a	Epithelial cells
b	Erythrocytes
c	Medusa formations
d	Boat cells
e	Mononuclear cells
f	Neutrophil



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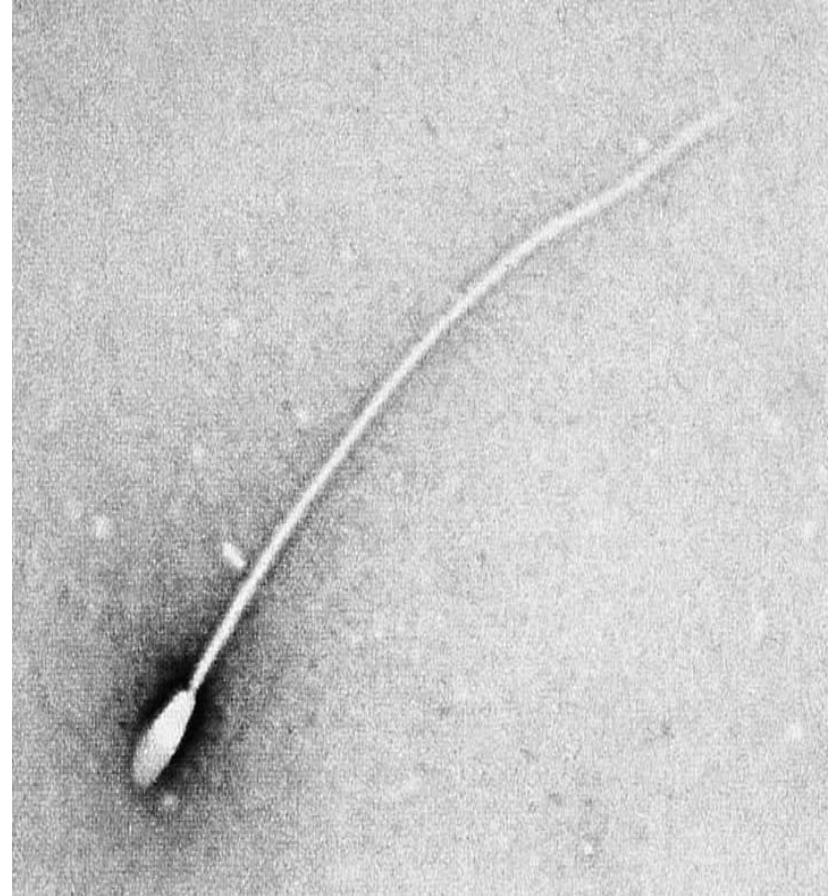
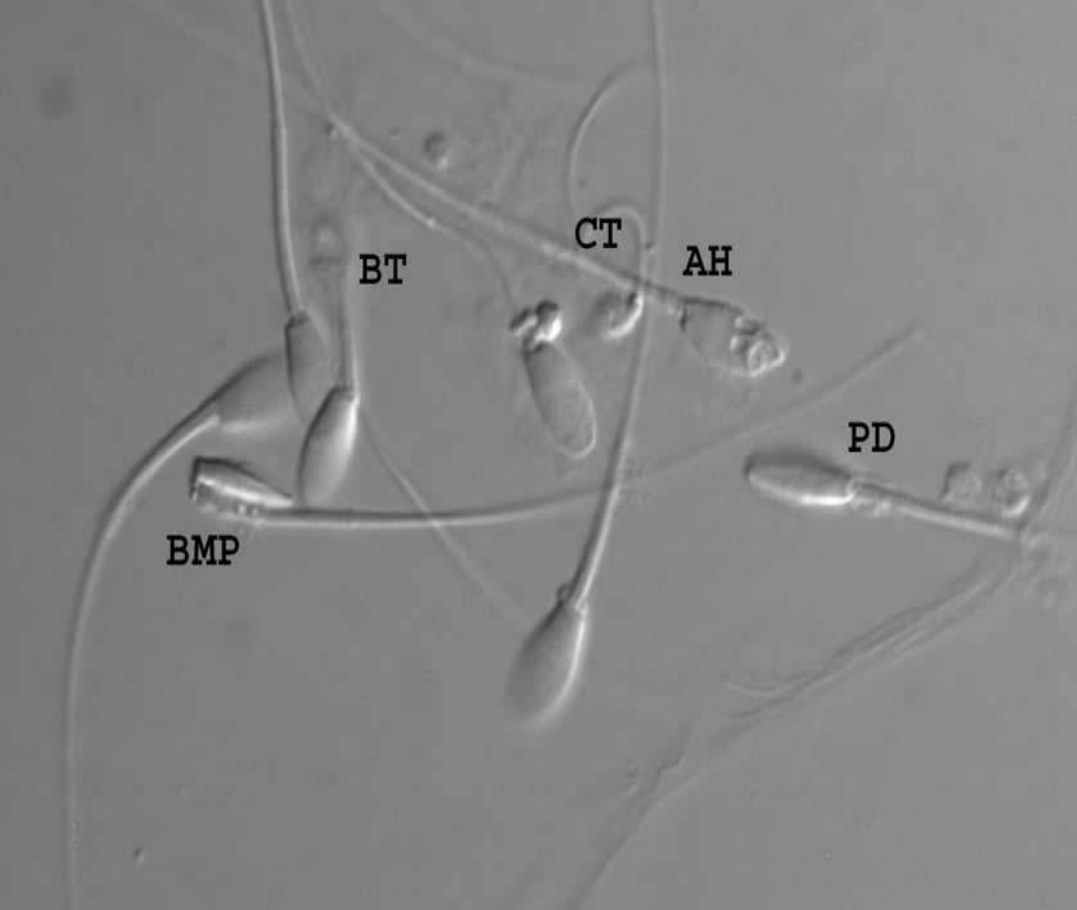


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Equine spermatozoa fixed in 2% buffered formolsaline solution and examined on a wet mount slide preparation under oil immersion using a differential interference contrast microscope. The morphologic defects of these sperm include proximal protoplasmic droplets (*PD*), reversed or bent tails (*BT*), coiled tails (*CT*), bent midpiece (*BMP*), and abnormal heads (*AH*).



Scoring	Criteria	Ver. Good	Good	Fair	Poor
Scrotal Circum. by Age	12-14 mos.	>34 cm	30-34	<30	<30
	15-20 mos.	>36 cm	31-36	<31	<31
	21-30 mos.	>38 cm	32-38	<32	<32
	over 31 mos.	>39 cm	34-39	<34	<34
SCORE FOR SCROTAL CIRCUMFERENCE:		40	24	10	10
<b>Semen Morphology</b>					
-- Primary Abnormalities		<10	10-19	20-29	> 29
-- Total Abnormalities		<25	26-39	40-59	> 59
-- SCORE FOR -- MORPHOLOGY		40	24	10	3
Gross Motility	Rapid Swirling	Slower Swirling	Generalized Oscillation	Sporadic Oscillation	
Individual	Rapid Linear	Moderate Linear	Slow Linear to Erratic	Very Slow Erratic	
SCORE FOR MOTILITY:	20	12	10	3	

