Artificial insemination

Semen Collection and evaluation

Freezing

AI Preparation/ Execution

It's a Dairy Cow's Life






Birth → Milk Feeding 6 – 8 weeks → Group Housing → Heat Detection → AI 13-15 months → Transition 23 months



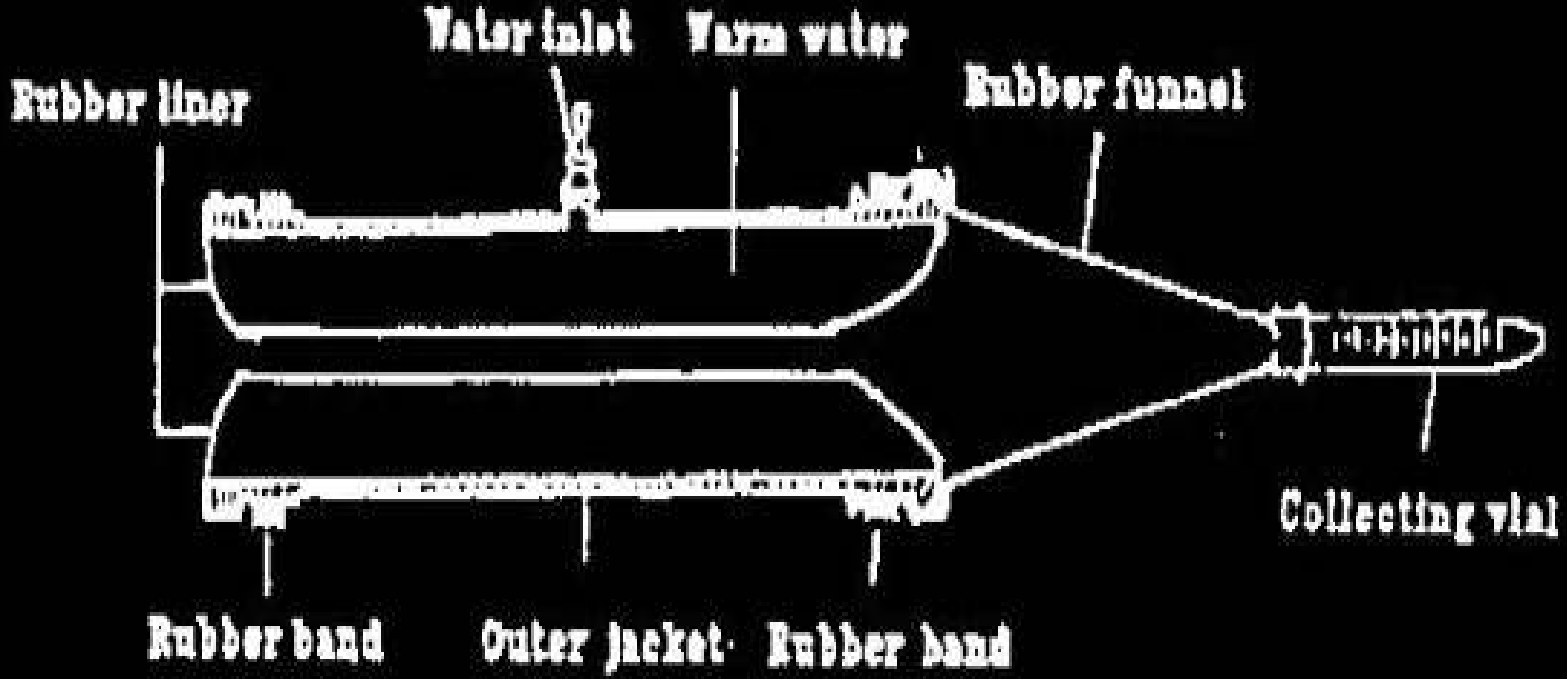



Transition 60 day Dry period ← Dry-Off 305 days Post calving ← PD 30 – 50 days Post-AI ← Heat Detection and AI 50 – 70 days Post-calving ← Milking Transition ← Calving 1st -24 mo Ideal- 365 d

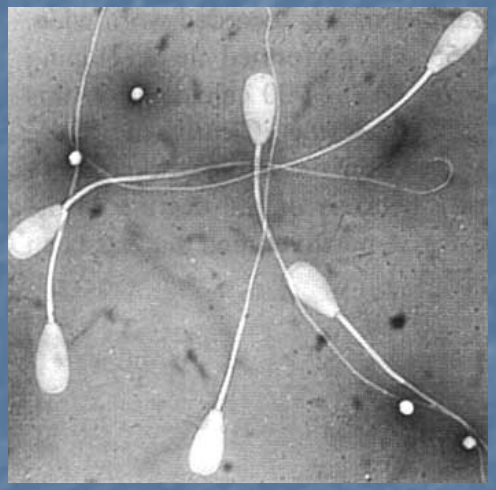
Semen Collection and Evaluation

- Bull mounts a "teaser" animal or a "dummy“
- Ejaculates into the artificial vagina
- The outer liner is filled with water at 42-48 degrees Celsius.

FALSE MOUNTING: Deviating penis to side during mount. Sexually stimulates the bull. Providing two false mounts with two minutes of active restraint and one additional false mount maximizes sperm cell numbers.


Water inlet
Warm water
Rubber liner
Rubber funnel
Collecting vial
Rubber band
Outer jacket
Rubber band

Semen Evaluation



- Evaluate semen quality

→ volume,

→ color,

→ consistency,

→ mass motility (overall movement observed in the microscopy, "waves"),

→ individual motility of sperm cells

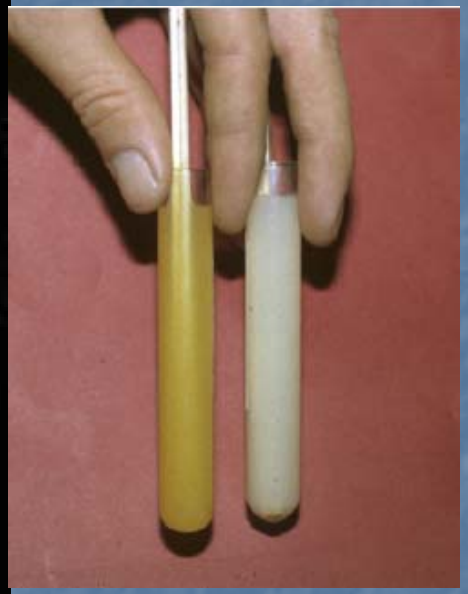
→ semen morphology (that is: normal/abnormal looking cells)

Normal Parameters

Parameter	Normal Values
Ejaculate volume	5 ml (range 1-15 ml)
Sperm concentration	1200 million/ml (300-2500 million/ml)
Total sperm per ejaculate	Typically 4-5 billion
Progressive motility	Greater than 30%
Morphology	Greater than 70% normal

http://www.vivo.colostate.edu/hbooks/pathphys/reprod/semeneval/bull.html

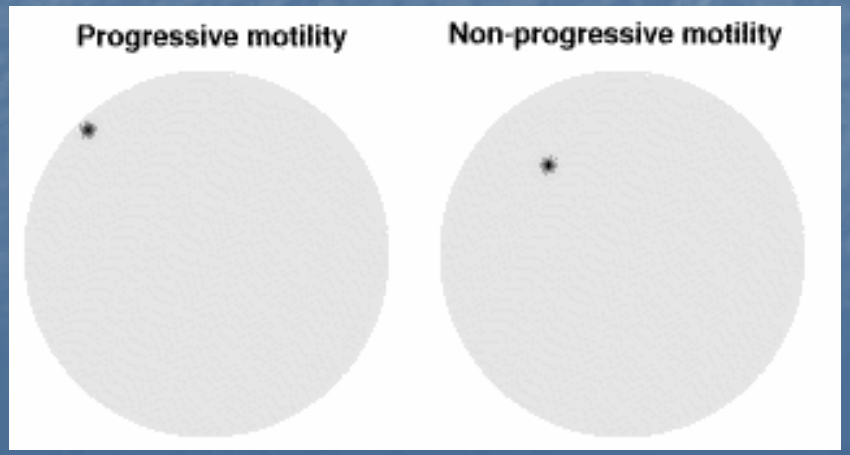
Color



- 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

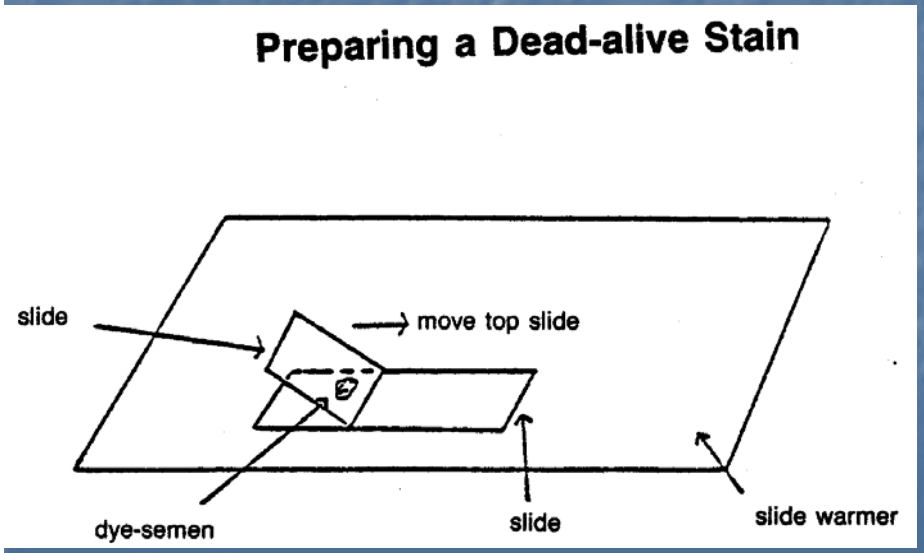
→ cold

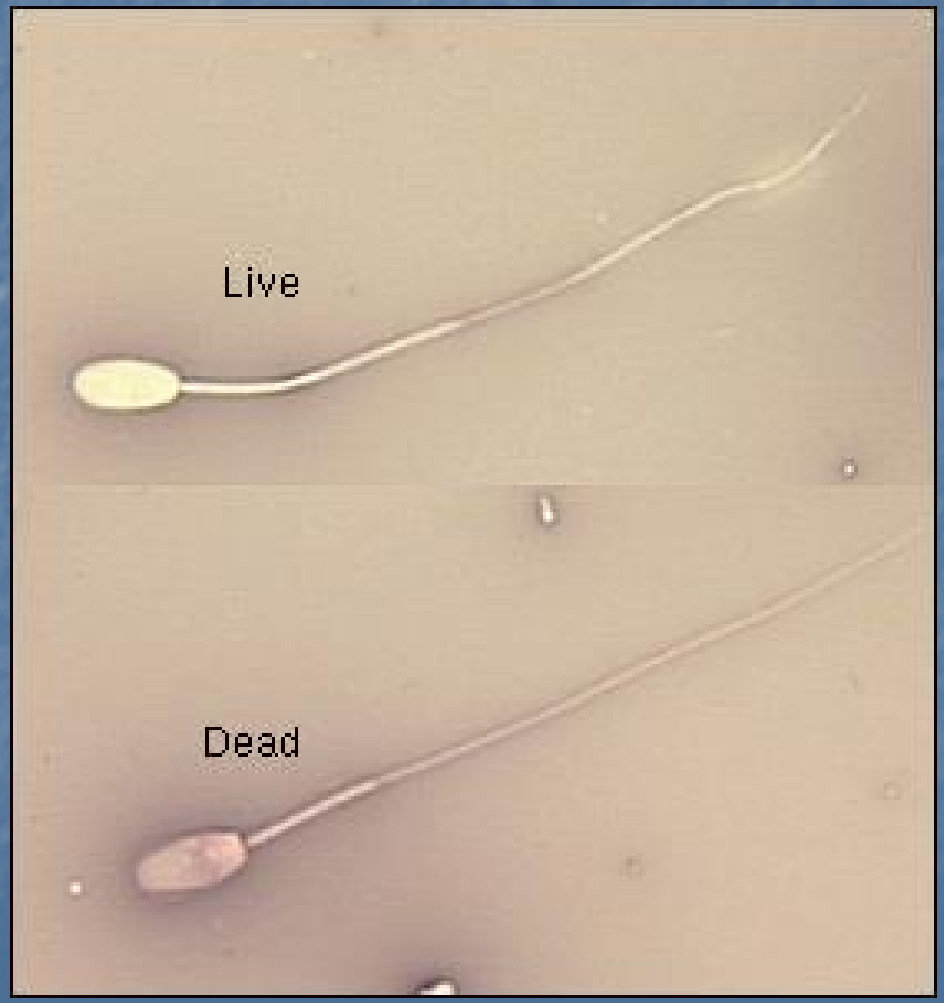
→ residue on collection equipment

→ wrong pH or osmolality

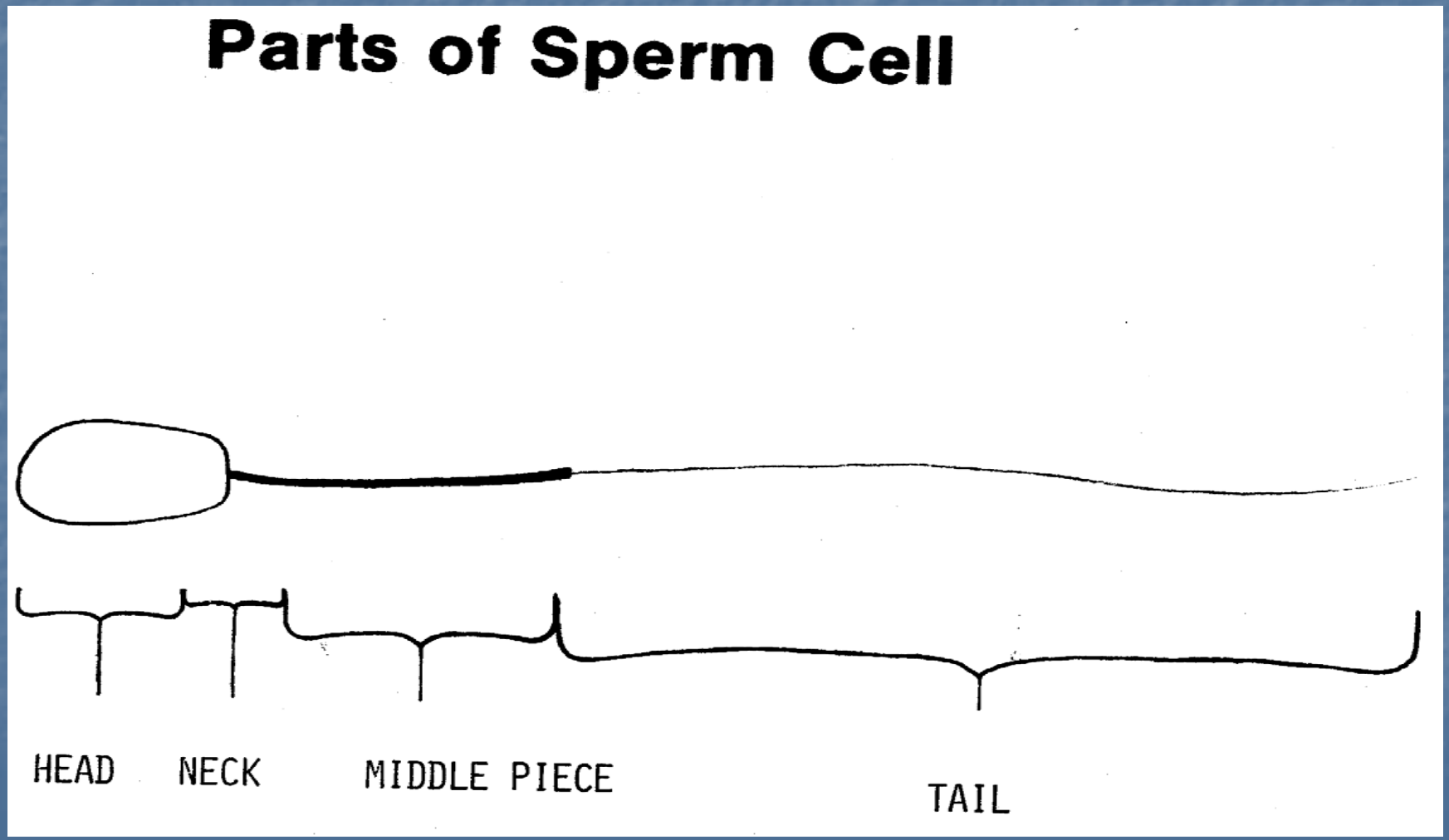
→ Sexual inactivity

Live/ Dead Staining

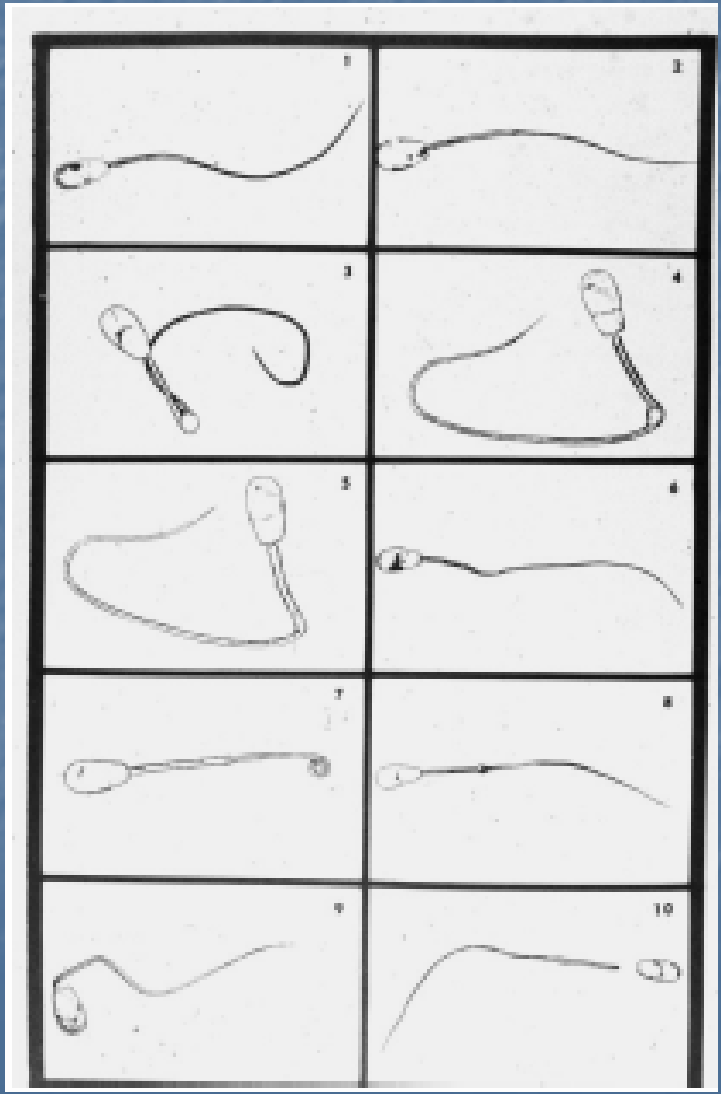


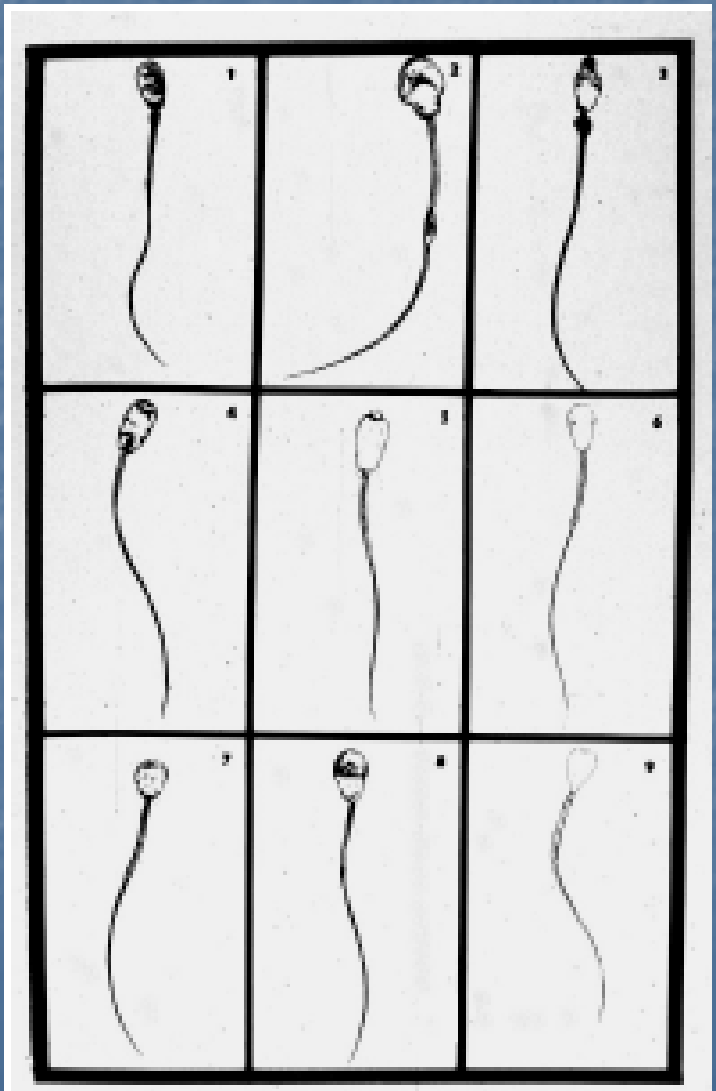


Morphology



Morphology





Sperm Morphology

Minimum Recommended Morphology is: 70% Normal Cells

<u>Primary sperm Abnormalities</u>

- Underdeveloped
- Double forms
- Acrosome defect (e.g. knobbed acrosome)
- Narrow heads
- Crater/Diadem defect
- Pear-shaped defect
- Abnormal contour
- Small abnormal heads
- Free abnormal heads
- Abnormal midpiece
- Proximal droplet
- Strongly folded or coiled tail
- Accessory tails

<u>Secondary sperm Abnormalities</u>

- Small normal heads
- Giant and short broad heads
- Free normal heads
- Detached, Folded, Loose acrosomal membranes
- Abaxial implantation
- Distal droplet
- Simple bent tail
- Terminally coiled tail

<u>Other cells</u>

- Epithelial cells
- Erythrocytes
- Medusa formations
- Sperm precursor cells
- Round cells
- White blood cells

Semen Handling

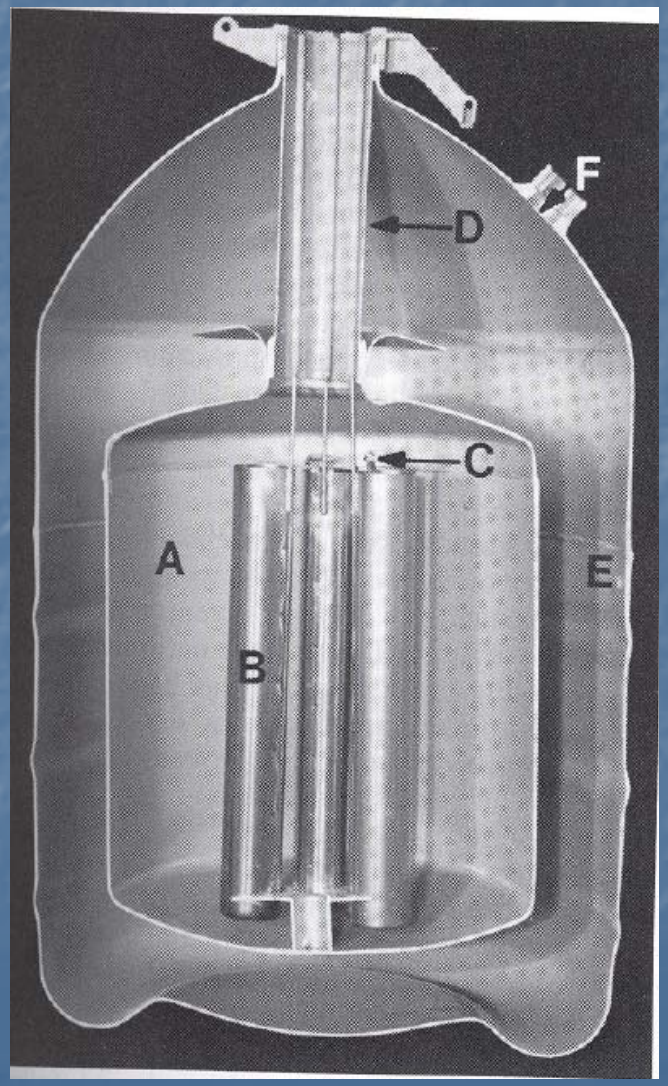
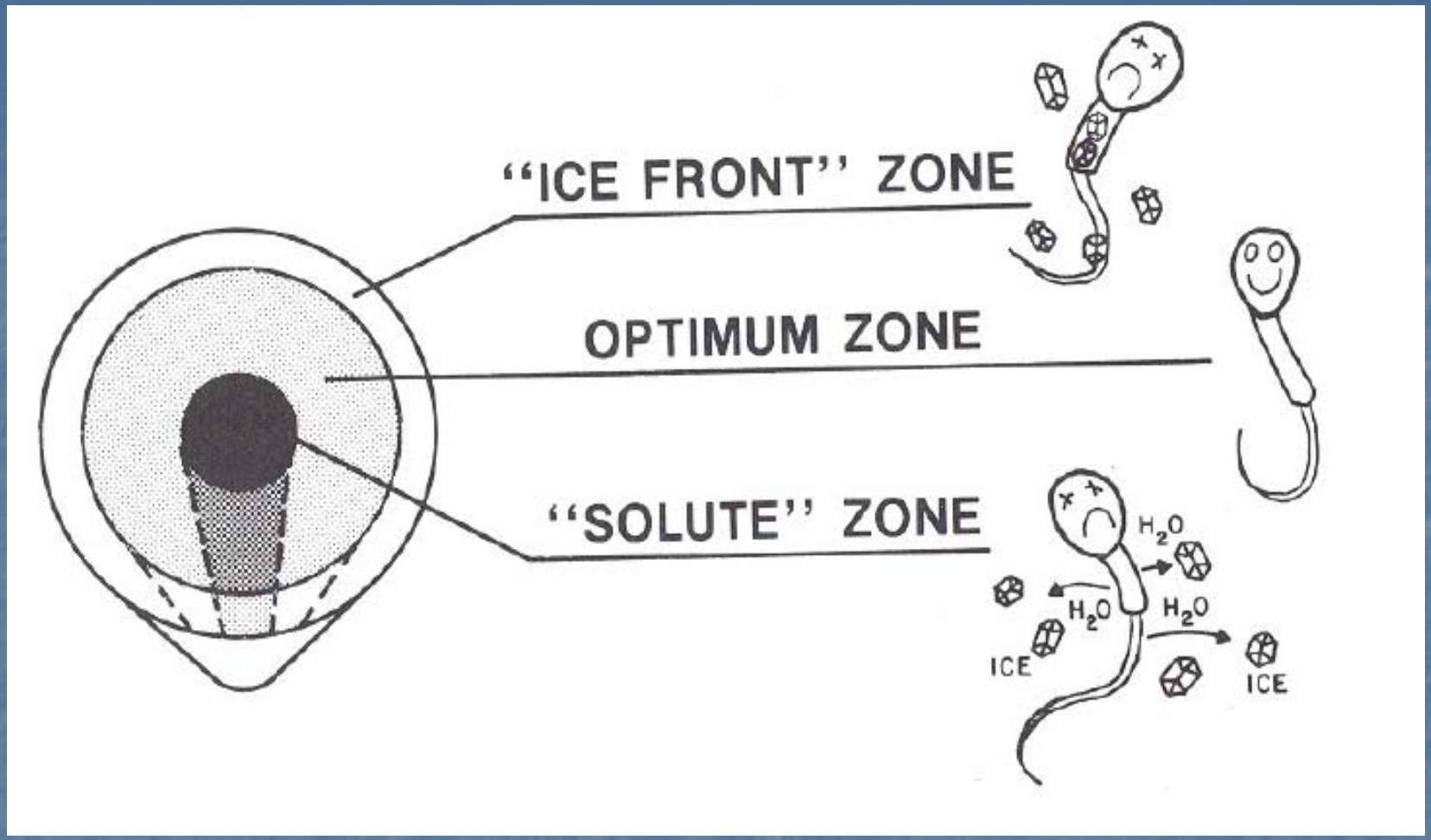


Figure 1. Cutaway view of a typical field liquid nitrogen (LN) refrigerator. *A*, Inner chamber containing LN. *B*, Canister containing racks (canes) of frozen semen. *C*, Racks holding goblets of semen. *D*, Neck tube. *E*, Outer chamber. *F*, Evacuation port.


"ICE FRONT" ZONE
OPTIMUM ZONE
"SOLUTE" ZONE
H_2O
H_2O
H_2O
ICE
ICE

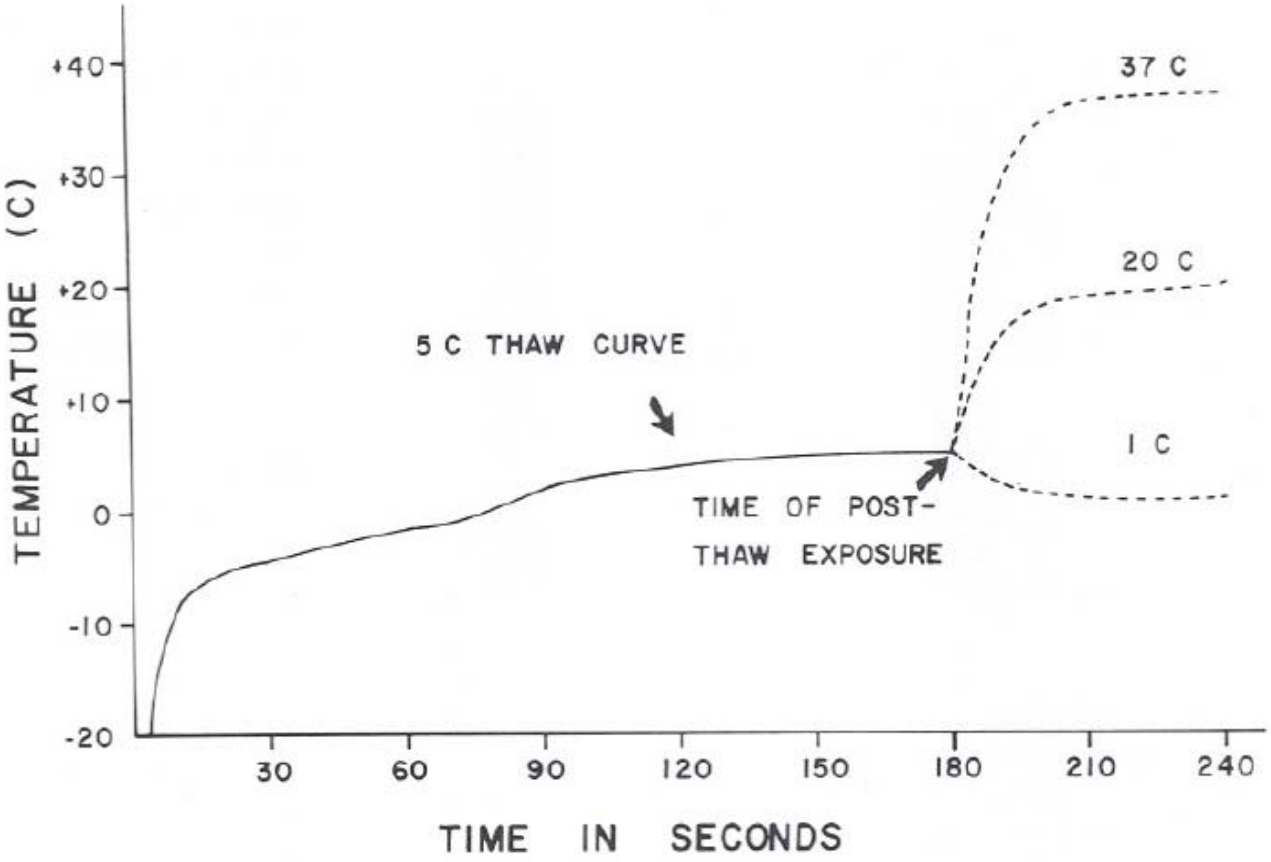


Figure 6. Temperature changes within the French straw during the 5°C thaw and during immediate post-thaw exposure to 1°C, 20°C and 37°C (10 replications). (From Senger et al.: J Anim Sci 42:932, 1976.)

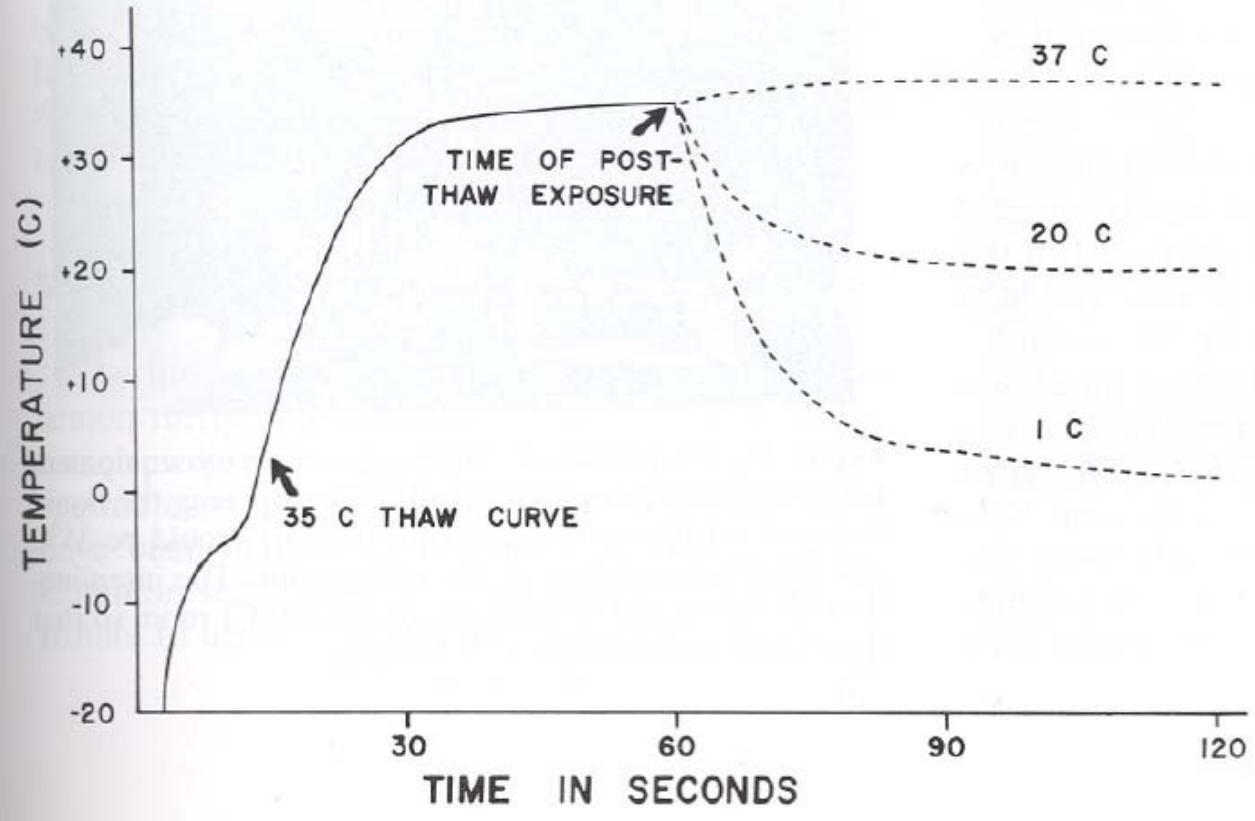


Figure 7. Temperature changes within the French straw during the 35°C thaw and during immediate post-thaw exposure to 1°C, 20°C, and 37°C (10 replications). (From Senger et al.: J Anim Sci 42:932 1976.)

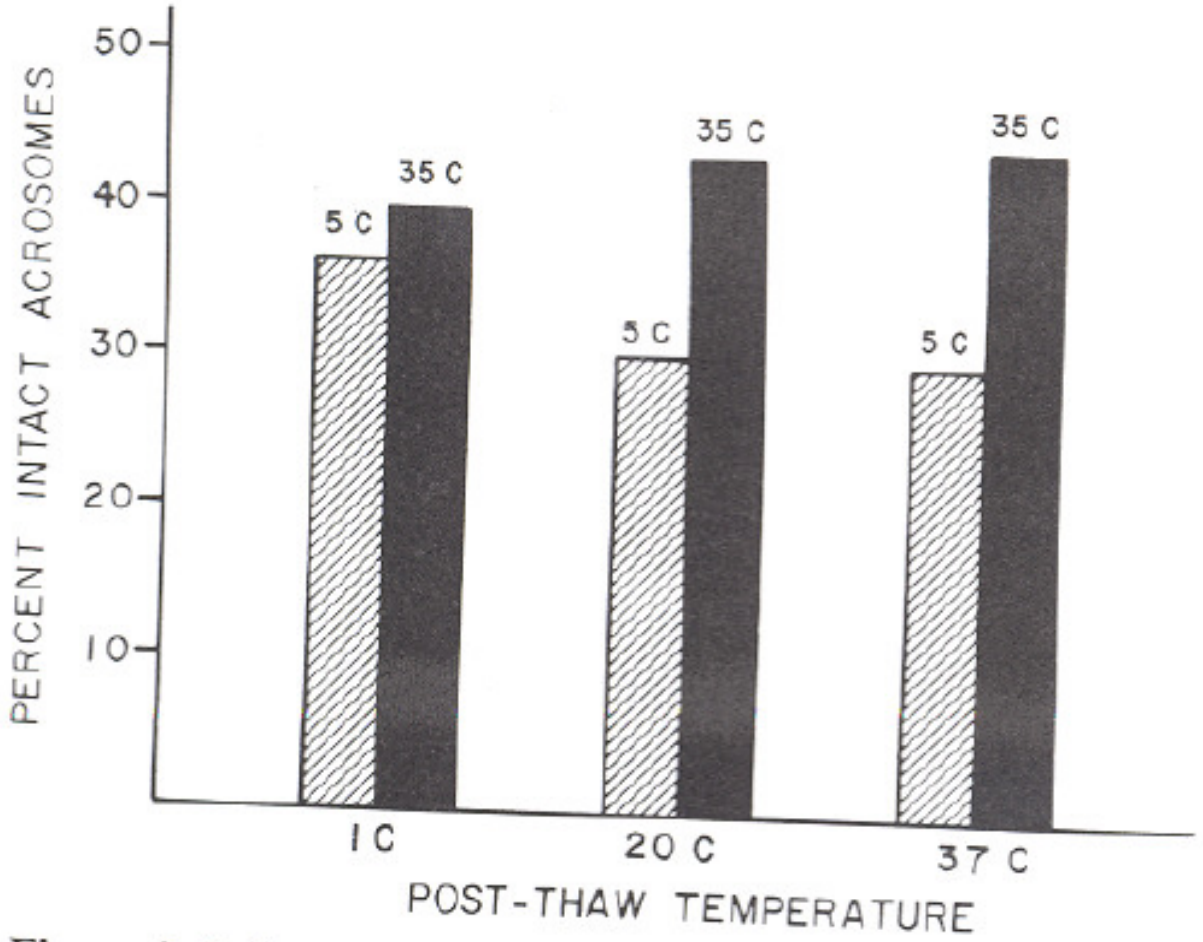


Figure 8. Influence of thawing rate (5°C or 35°C) and post-thaw temperature (1, 20, 37°C) on acrosomal maintenance. Values depicted by each bar are the overall means for 0-, 4- and 8-hour post-thaw incubations (37°C) for one ejaculate from each of 13 bulls. (Adapted from Senger et al.: J Anim Sci 42:932, 1976.)

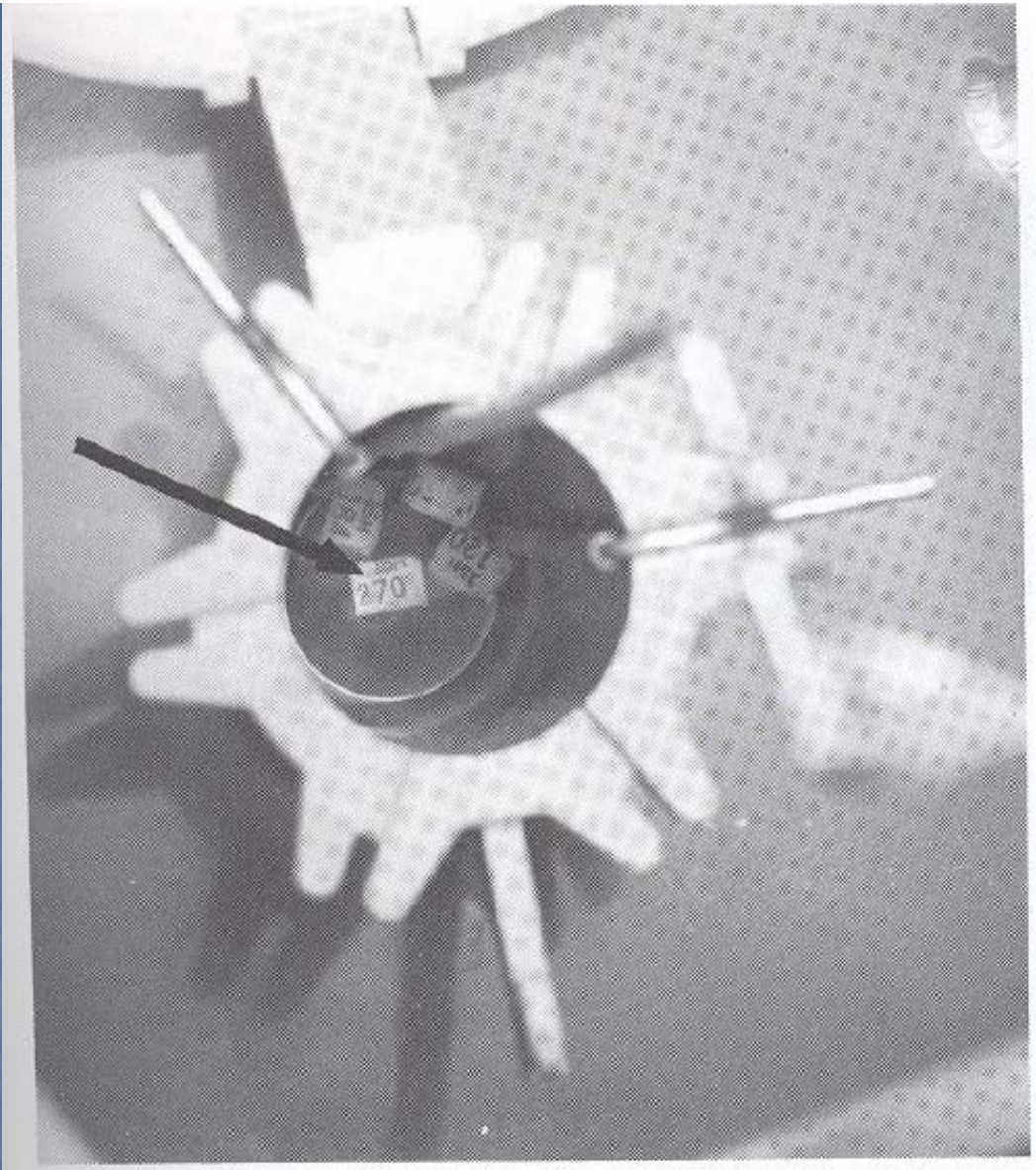


Figure 10. Identify the semen from the desired bull by the number on the top of each rack (arrow). Be sure that the canister containing the semen is well below the top of the refrigerator neck (see Fig. 11).

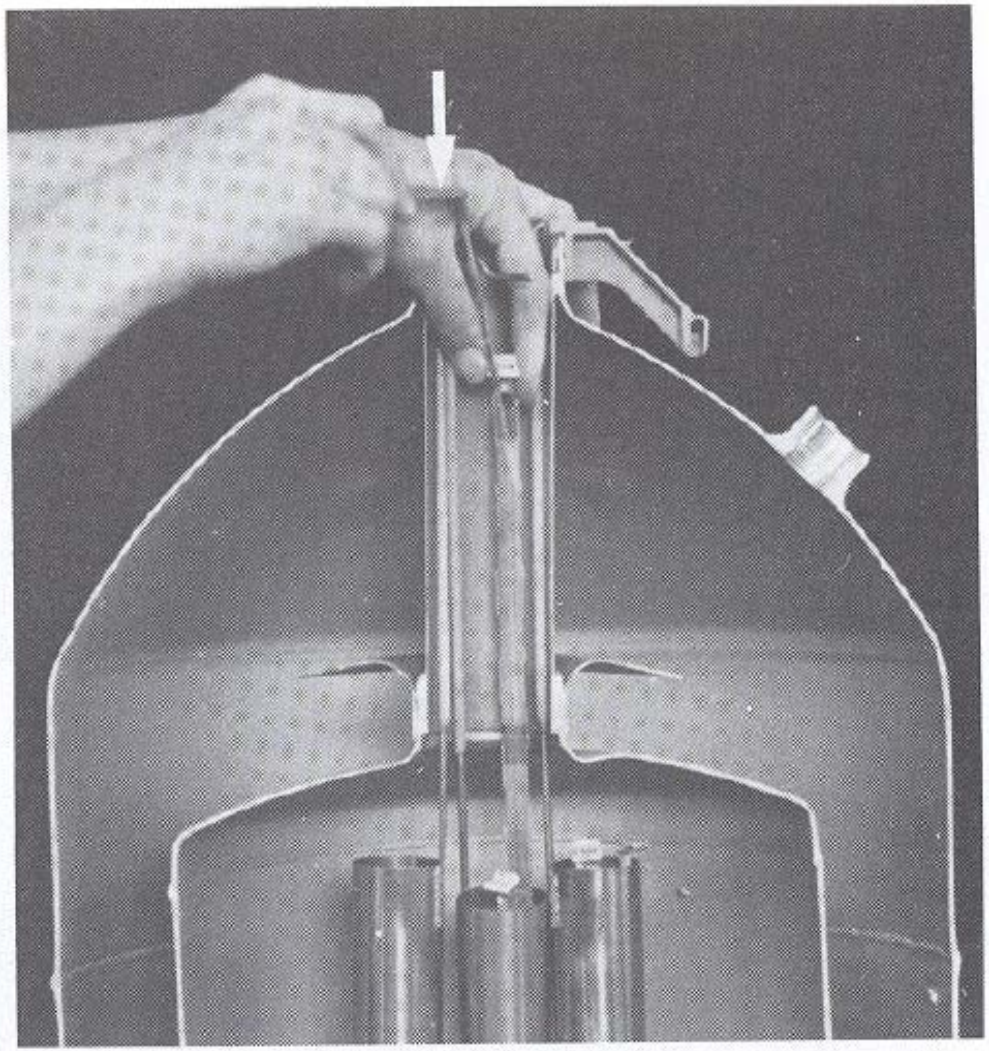


Figure 11. *This step takes practice*. Reach within the semen tank neck to grasp the top of the rack. Remove the straw using tweezers as shown (arrow). When properly elevated, the bottom end of the rack does not come out of the canister. Therefore, when the straw is removed, the rack may be released, and it will drop inside the canister. (See Fig. 23 for an additional method of straw removal.)

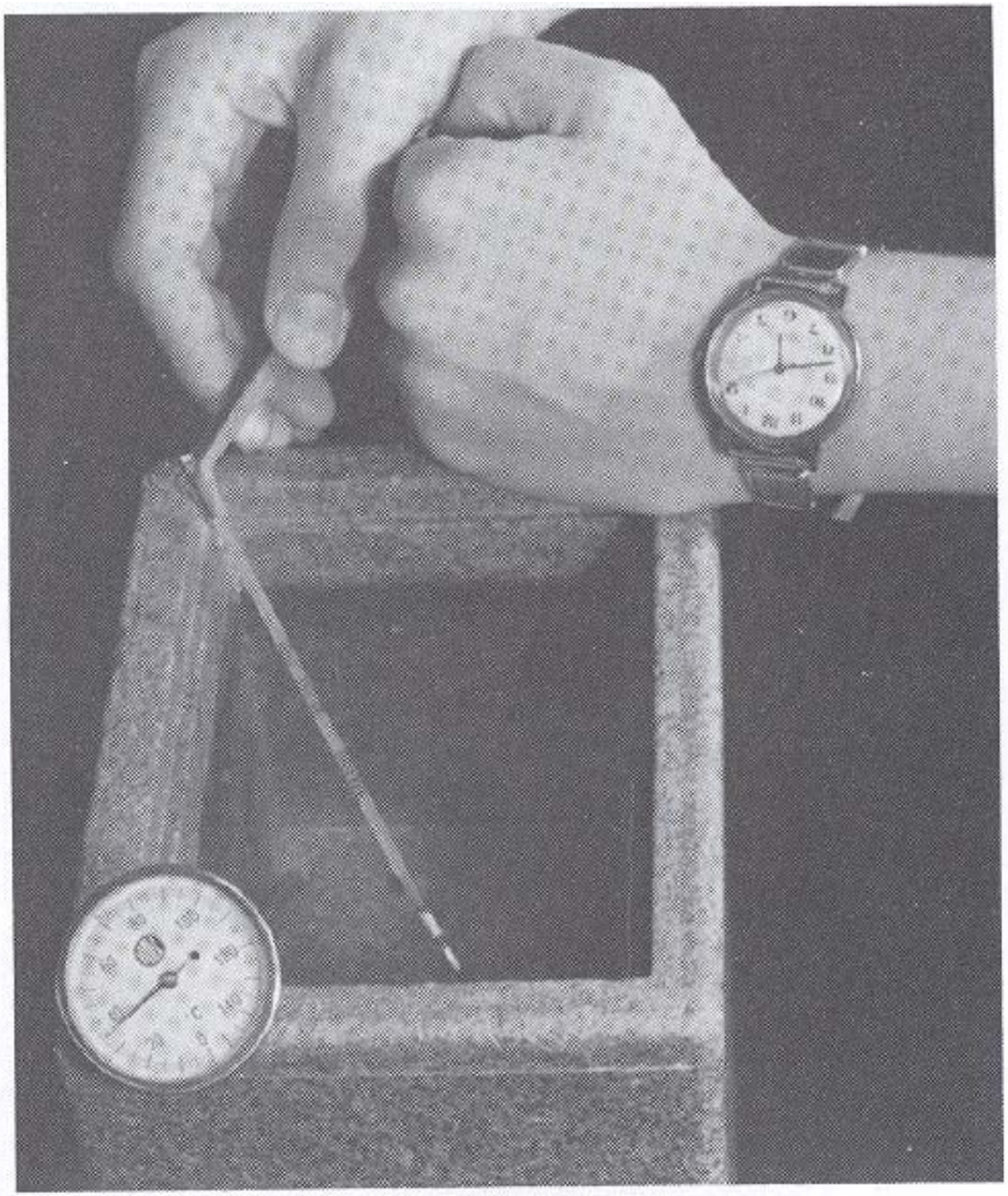


Figure 12. Immediately place the straw into the water bath at 35°C. Thaw time should be no less than 30 seconds and no longer than 1 minute.

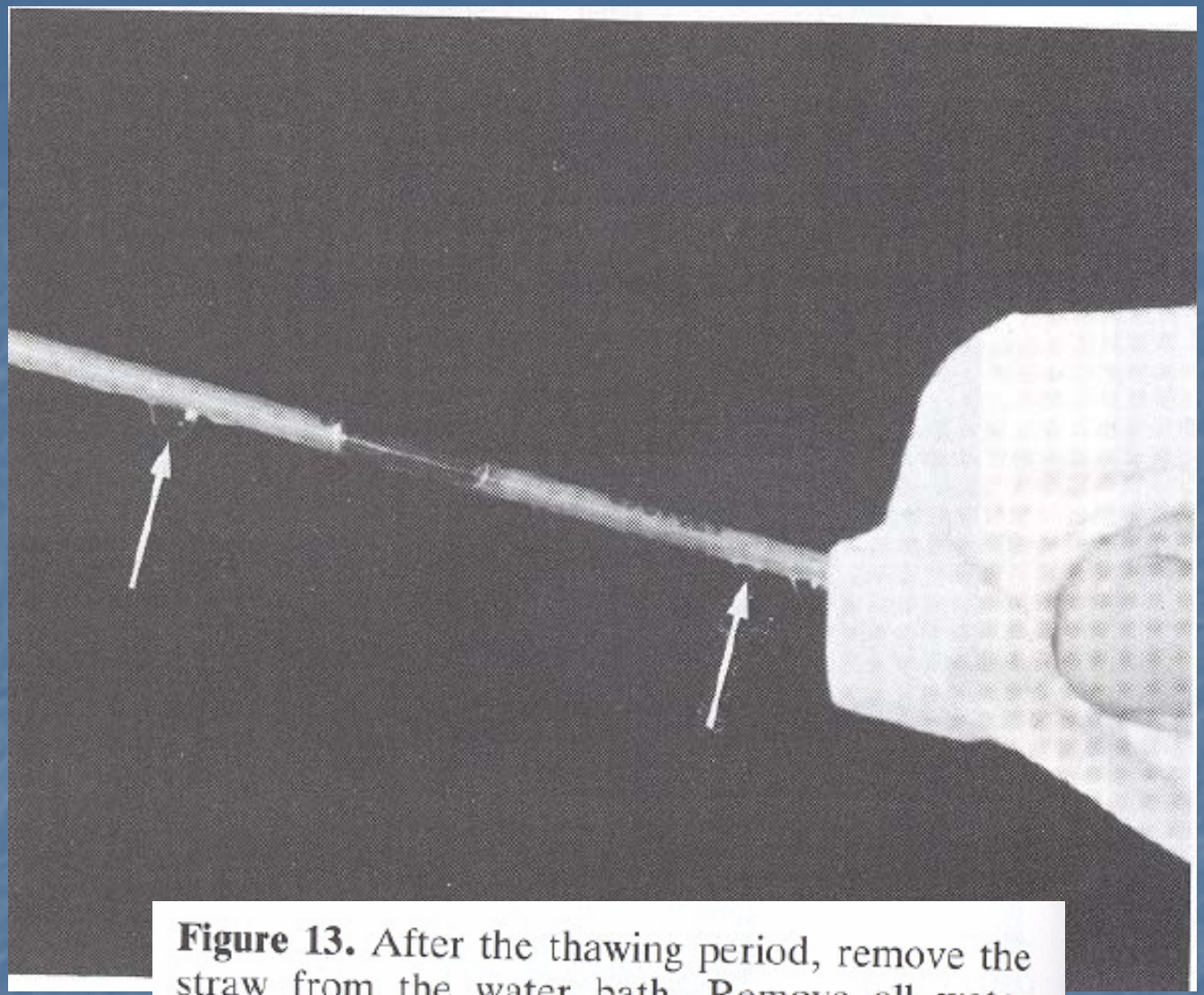
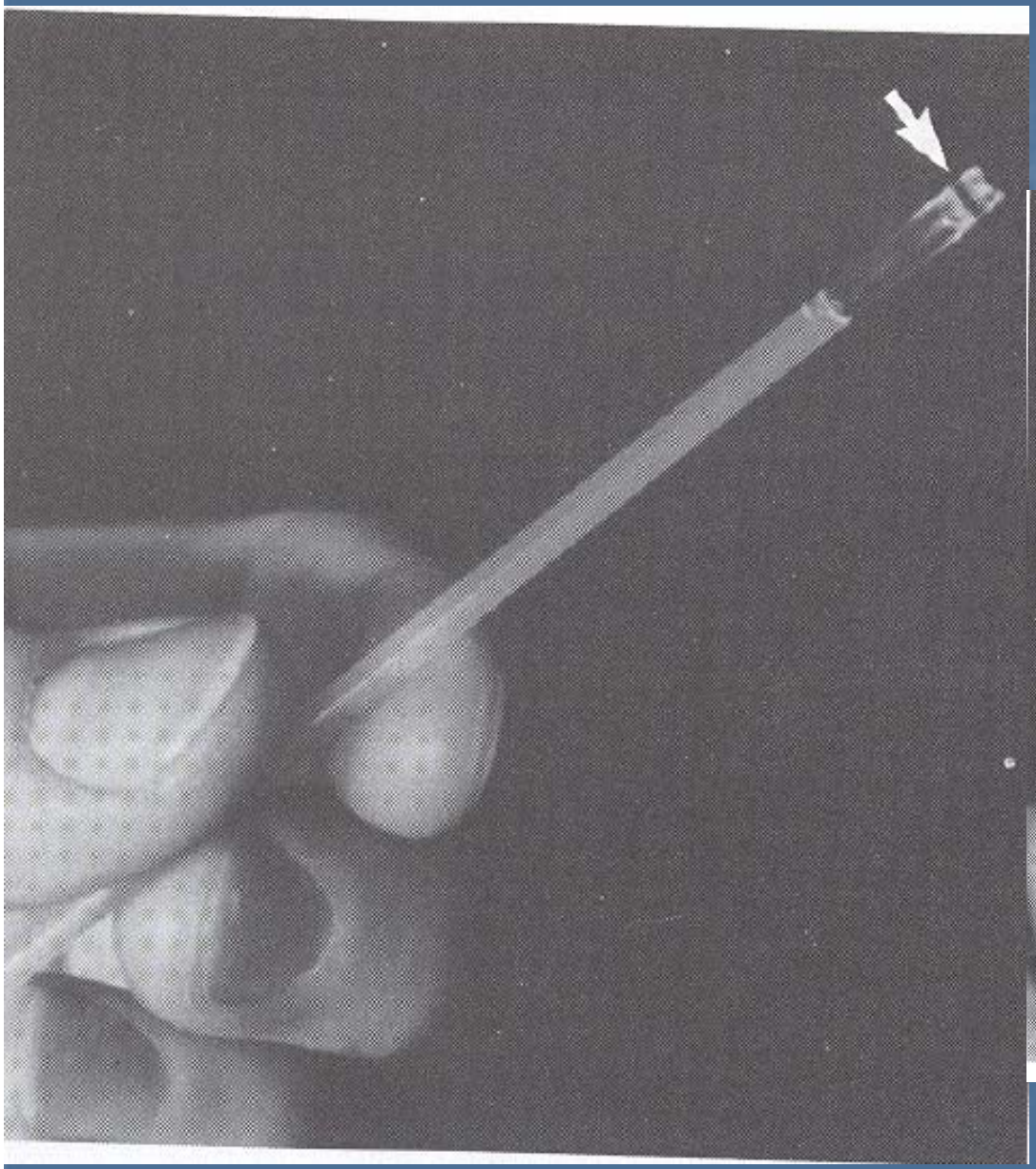
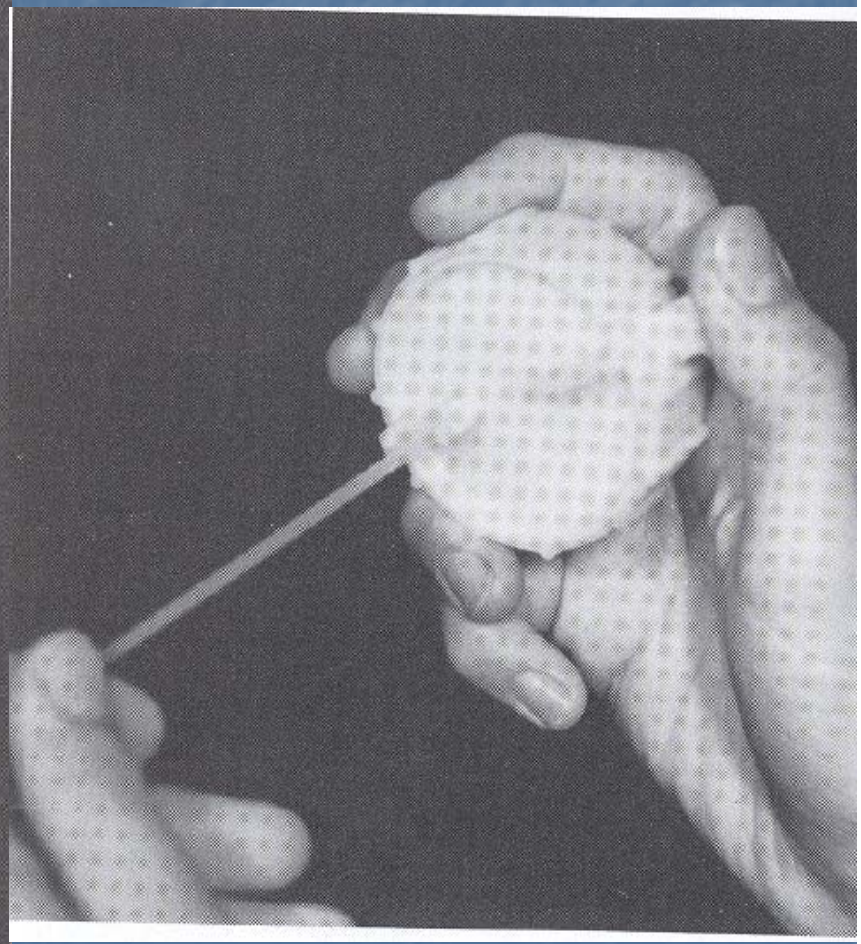
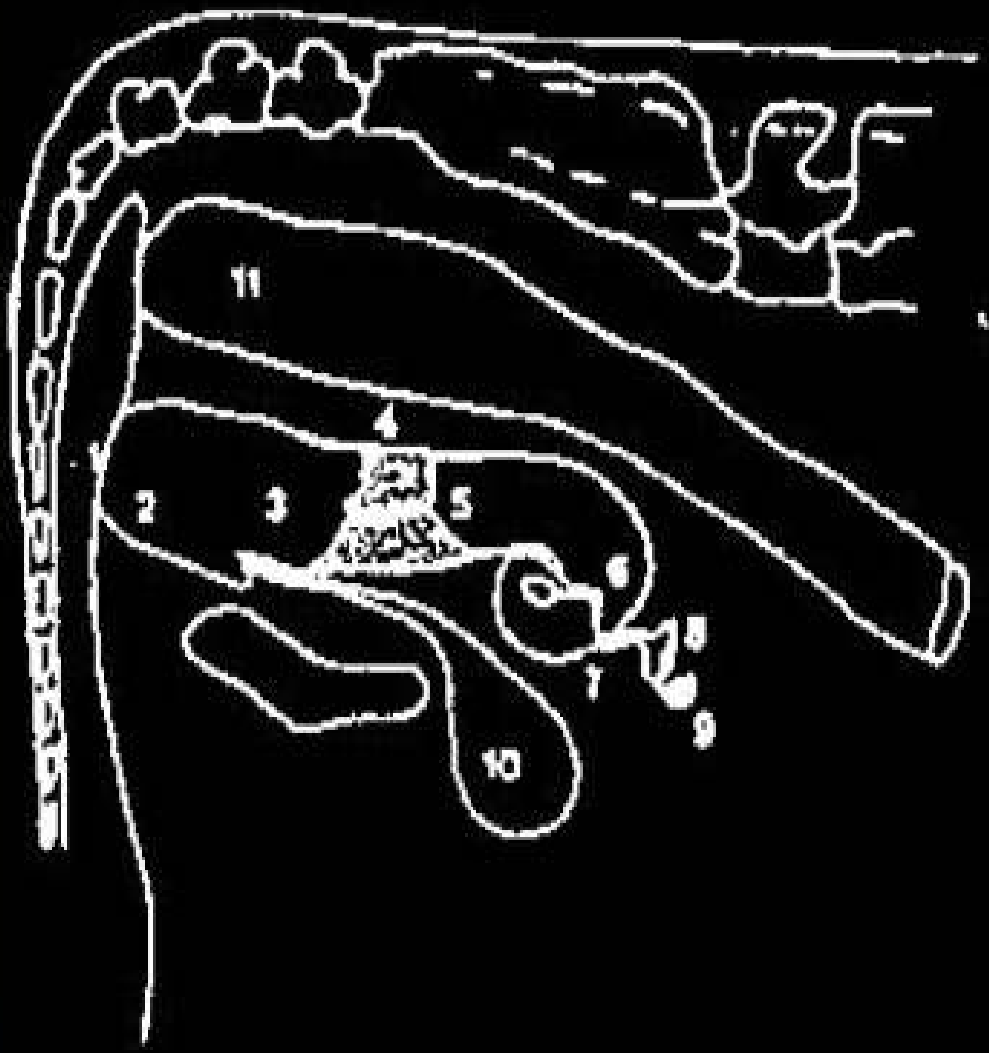


Figure 13. After the thawing period, remove the straw from the water bath. Remove all water from the external surface (arrows) of the straw with an absorbant tissue. *Water is lethal to spermatozoa.*



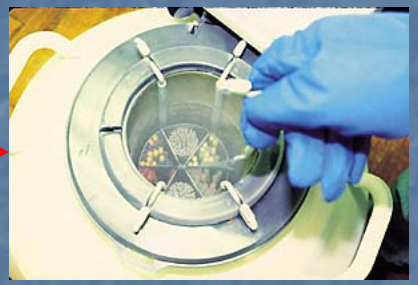


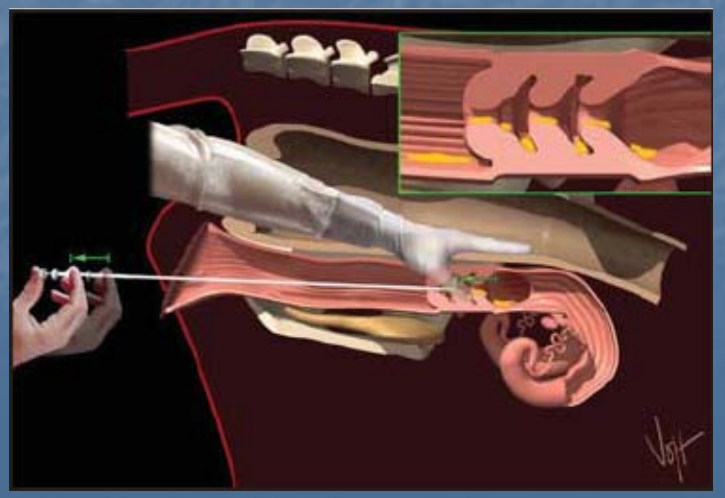


1 Vulva
2 Vestibule
3 Vagina
4 Cervix
5 Uterine Body
6 Uterine Horn
7 Oviduct (Egg duct)
8 Infundibulum ("Trumpet")
9 Ovary
10 Urethra (Bladder)
11 Rectum

1	Clitoris
2	Vestibule
3	Opening of the Urethra
4	Vagina
5	Cervix
6	Uterine Body
7	Uterine Horn
8	Caruncles
9	Oviduct (Egg duct)
10	Infundibulum ("Trumpet")
11	Ovary

Artificial insemination





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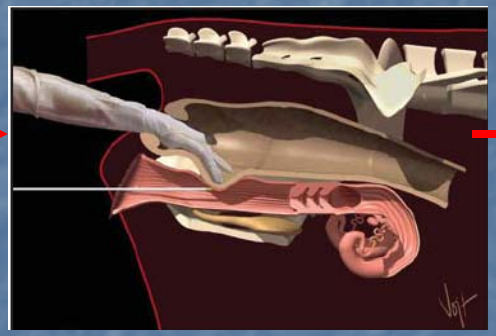
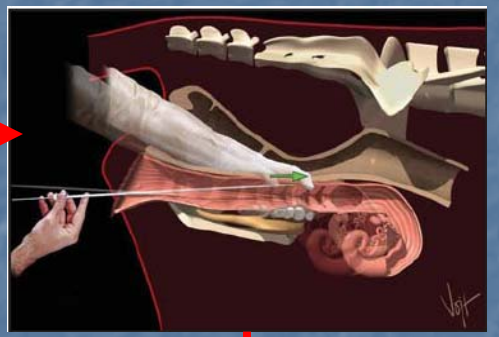
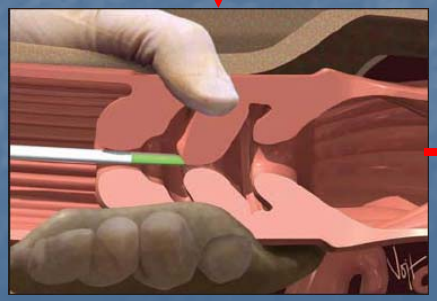
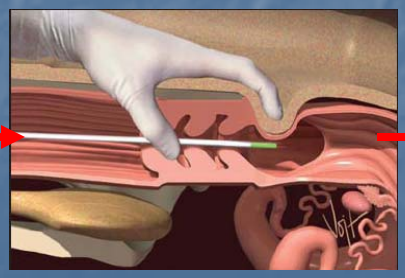
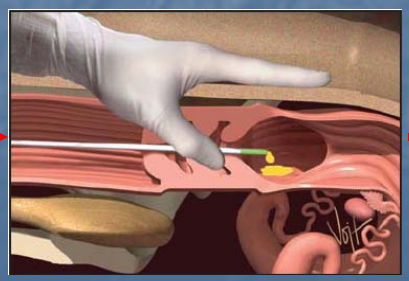
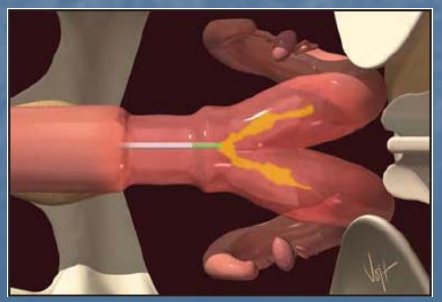










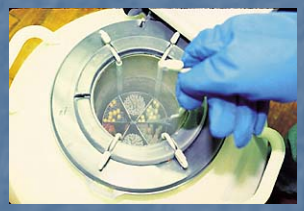


HACCP
Hazard Analysis & Critical Control Points

Critical Control Points

•Cow in estrus
•Reproductive Health
•Disease Free
•Optimal body weight

•Fertile Bull
•Calving Ease
•High Genetic Merit
•Disease Free



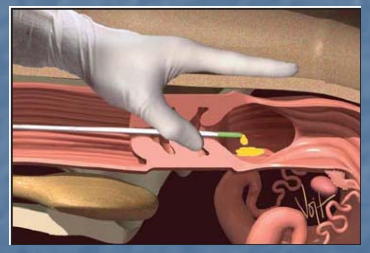
•Semen Storage
•Liquid Nitrogen (-196°C)
•Semen Identification
•Correct Handling

•Clean Equipment

•Thaw Semen
•33°C to 35°C (95°F)
•45 – 60 s
•Avoid Cold Shock

10 – 15 minutes

•Adequate restraint
•Work cleanly
•Work Gently
•Take your time



•Training and practice!!
•Be Gentle: Avoid force
•2-step process
•Deposit semen just through cervix