Superovulation and embryo transfer in cattle

Prof G N Purohit

Head, Department of Veterinary Gynecology and Obstetrics, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, India

Superovulation

- Induction of multiple ovulations in a mono-ovular species by the exogenous administration of FSH at certain times of the estrous cycle

What is Embryo Transfer?

- ET involves the removal of an embryo from a female of superior genetics and the placement of the embryo into the reproductive tract of a female of average genetics.

- The goal of ET is to obtain the maximum number of genetically superior embryos in a minimum amount of time.

Purpose

- Obtaining multiple embryos from an outstanding female
- Transport genetics across long distances
- Production of identical offspring by embryo splitting

Benefits of Embryo Transfer

- Traditionally, cows produce only one calf per year. ET allows the production of many offspring within a year from a single cow.

Benefits (continued)

- ET can increase the genetic potential of a herd in a relatively short period of time.
- ET can increase milk production in dairy herds.
- ET can increase weaning weights in beef and dairy herds.

Benefits (continued)

- ET allows other producers to take advantage of superior genetics because frozen embryos can be shipped almost anywhere.

- ET preserves superior genetics for future generations due to embryo freezing.

Limitations of Embryo Transfer

- Expensive
- Labor intensive
- Requires extensive training and experience

History of embryo transfer

Events	Species	Year	Scientist
First successful ET	**Rabbit**	**1890**	**Walter Heape**
First successful ET	Rat	1933	JS Nicholas
First successful SOV	Cattle	1940	Casida
First successful ET	Sheep and Goat	1949	Warmick & Berry
First successful ET	Pig	1951	Kvansnickii
First ET reported in cattle	Cattle	1949	Umbaugh
First successful ET	Cattle	1951	Willett & assoc
Baby girl born through ET	Human	1979	Steptoe & Edwards
Calf -Frozen thawed Embryo	Cattle	1973	Wilmut & Rowson
Calf born by ET	Buffalo	1983	Drost and assoc

Components of embryo transfer

- Superovulation
- Artificial insemination of the donor female
- Recovery of embryos from the donor
- Maintenance of embryos
- Transfer of embryos to recipient female
- Freezing of extra embryos

DONOR SELECTION

- High milking ability

- High growth rate

- Outstanding reproductive capacity with proven ferttility

Recipient Cows

- Recipient cows can be low genetics but high fertility cows.
- Recipient cows serve as surrogate (foster) mothers to the calves, but contribute no genetic information.
- For this reason, the genetic makeup of the recipient cow is not as important as the makeup of the donor cow.

Bull Selection

- A bull with superior genetics should be selected.

- Breeding can occur naturally or by artificial insemination.

Superovulatory protocols

- eCG- cheap source but has a longer half life of 72 h hence more chances of obtaining unfertilized ova, more chances of development of ovarian cysts in treated cows.

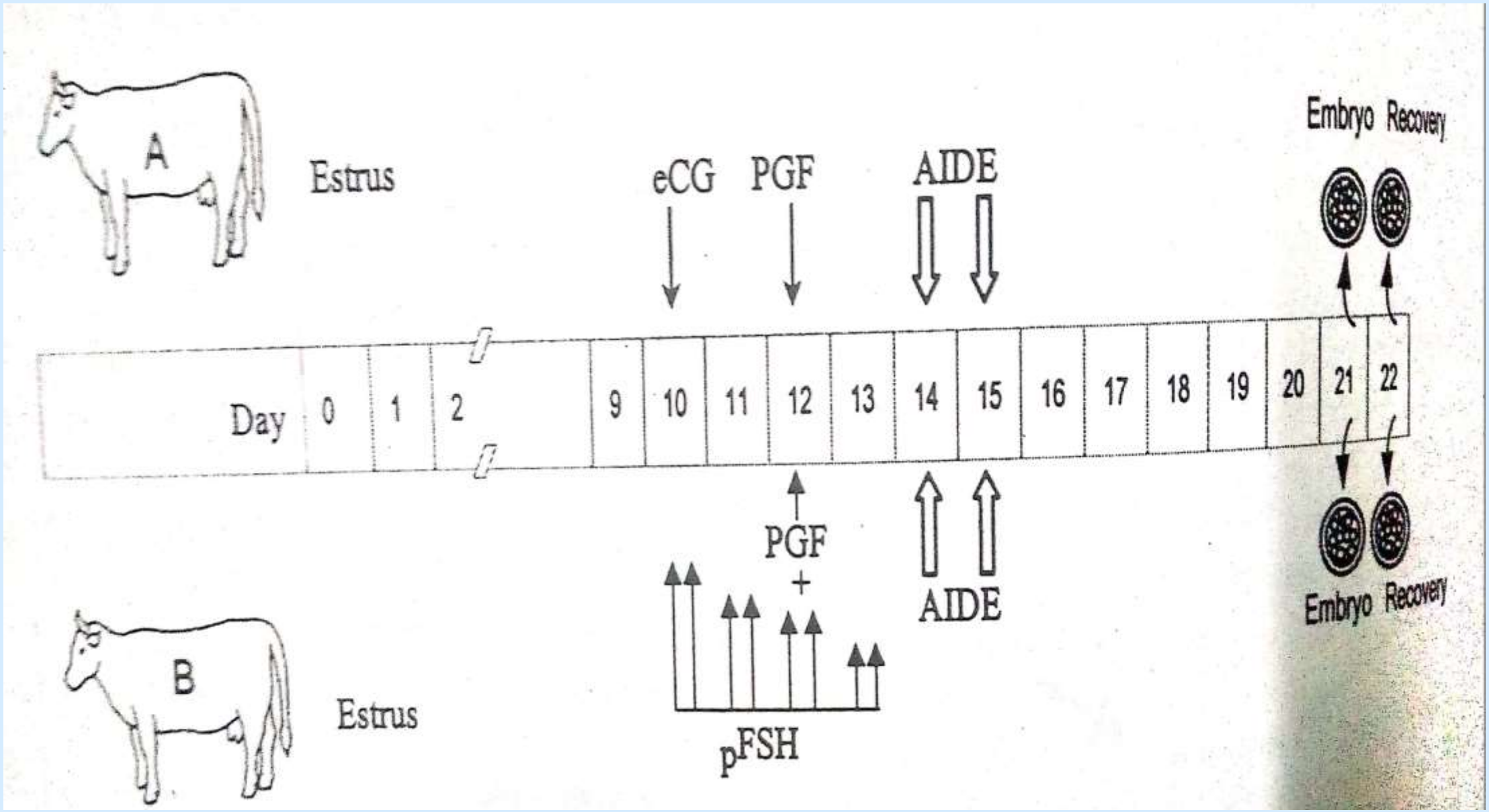
- Purified FSH -Folltropin-V (porcine origin) shorter half life 5 h
- Not started before Day 45 of calving

- A single IM injection of 2000-3000 IU of eCG is sufficient
- With porcine purified FSH administration has to be done every 12 h
- The administration of FSH is initiated between Day 9-13 of a natural estrous cycle.
- FSH administration can also be started from Day 9-13 of intra-vaginal placement of a progesterone implant.

- Purified FSH is administered every 12 h for 3- 4 days in equal or decreasing amount.

- Prostaglandin is administered 48 h after an eCG or 1 day before the last day of Folltropin-V

- Estrus detection is done and animals are mated or inseminated with high fertility proven semen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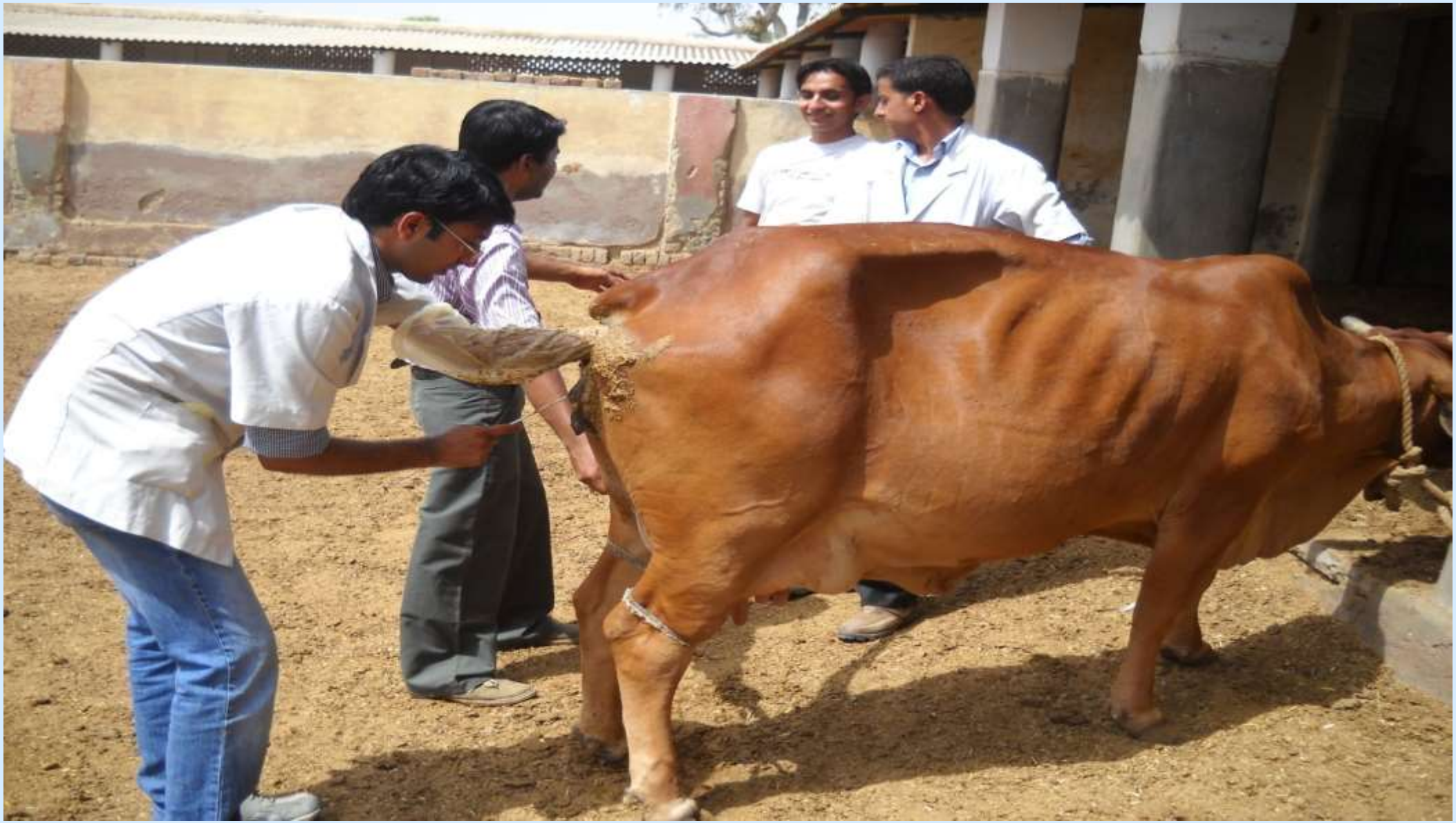
Estrus
eCG
PGF
AIDE
Embryo Recovery
Day
0
1
2
9
10
11
12
13
14
15
16
17
18
19
20
21
22
PGF
+
pFSH
AIDE
Embryo Recovery
B
Estrus

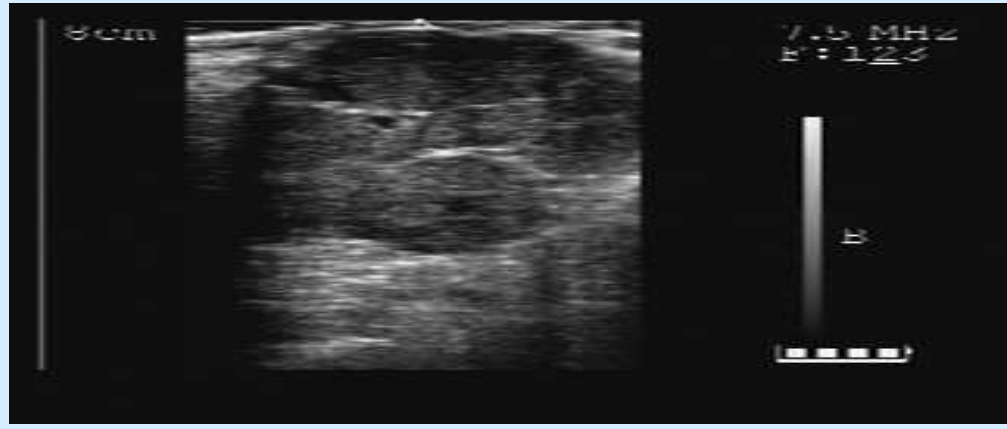
Breeding or Insemination of superovulated animals



Evaluation of ovulatory response

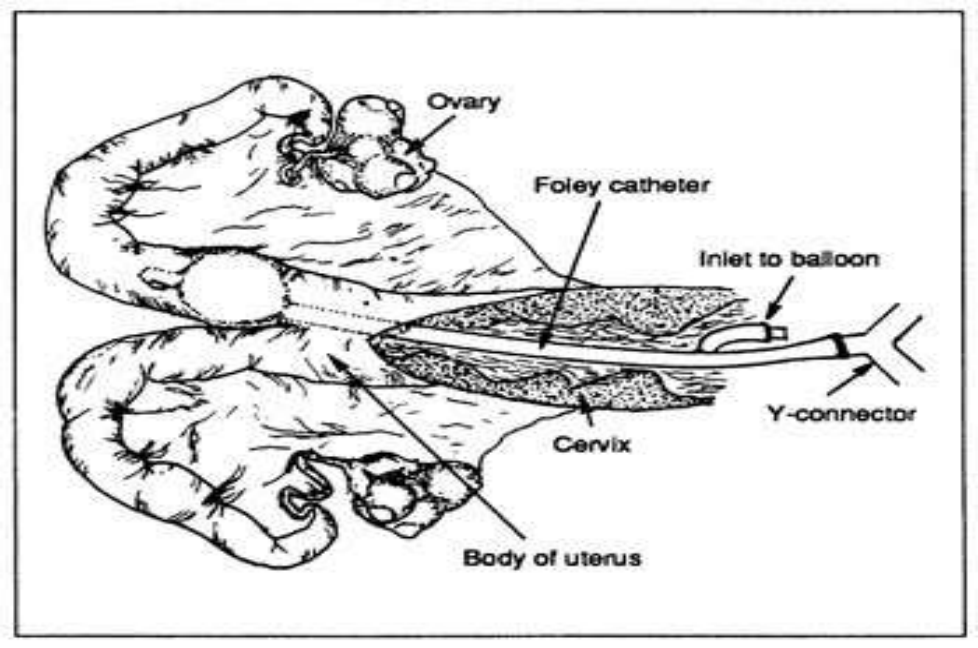
- Transrectal palpation of the ovaries to evaluate the number of CL one day before embryo recovery

- Transrectal ultrasonography



Embryo recovery Day 7 of mating

- Non-surgical- Standing cows
- Perineal washing
- Epidural anesthesia
- Cervical dilation using Cervical dilator
- Foley catheter/Three way continuous infusion catheter
- Y junction tubing attached to infusion bottle
- Media DBPS


Ovary
Foley catheter
Inlet to balloon
Y-connector
Cervix
Body of uterus

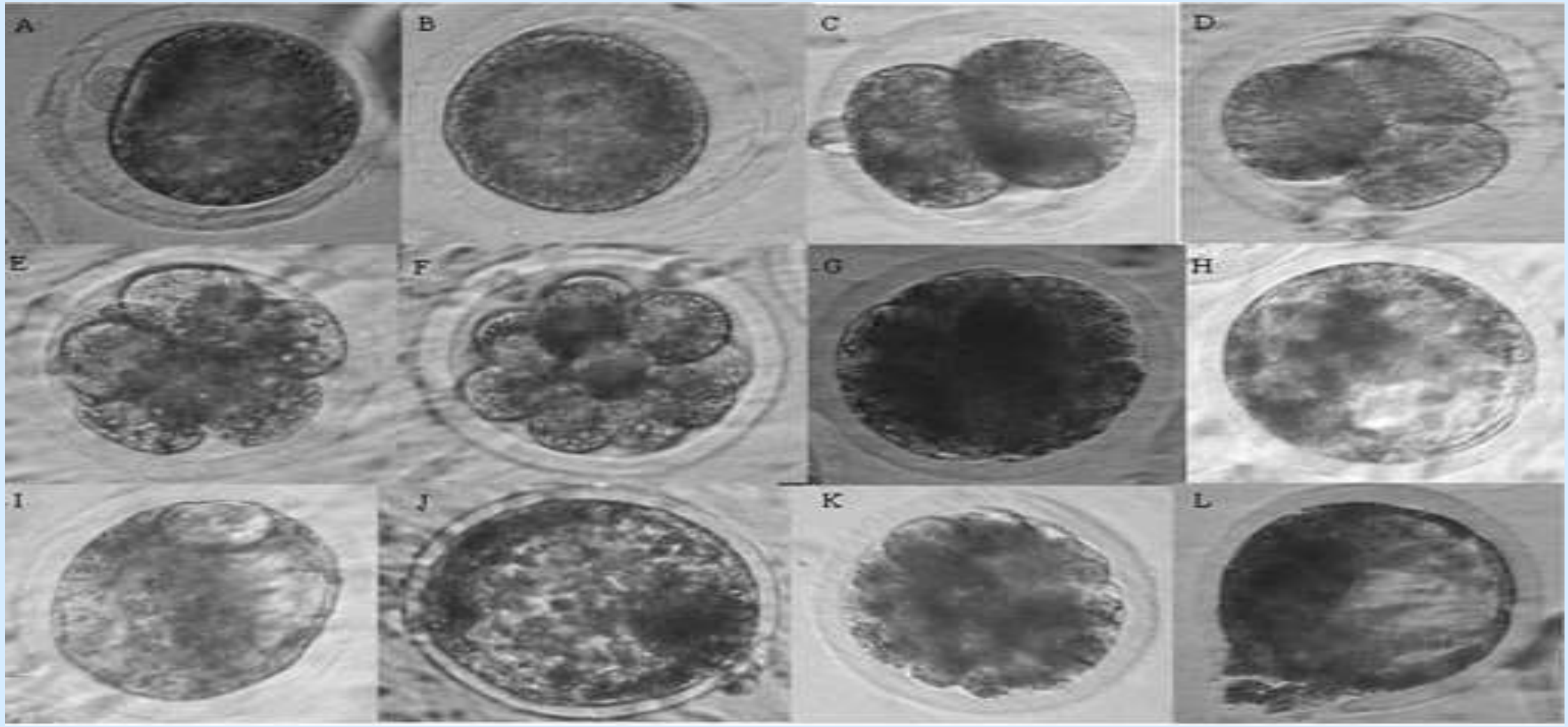

24/12/2010


24/12/2010

Embryo evaluation

- Under stereozoom microscope→ Overall diameter of embryo 150-190µm including Zona Pellucida

- *Good quality embryo→ Spherical, symmetrical, uniform sized cells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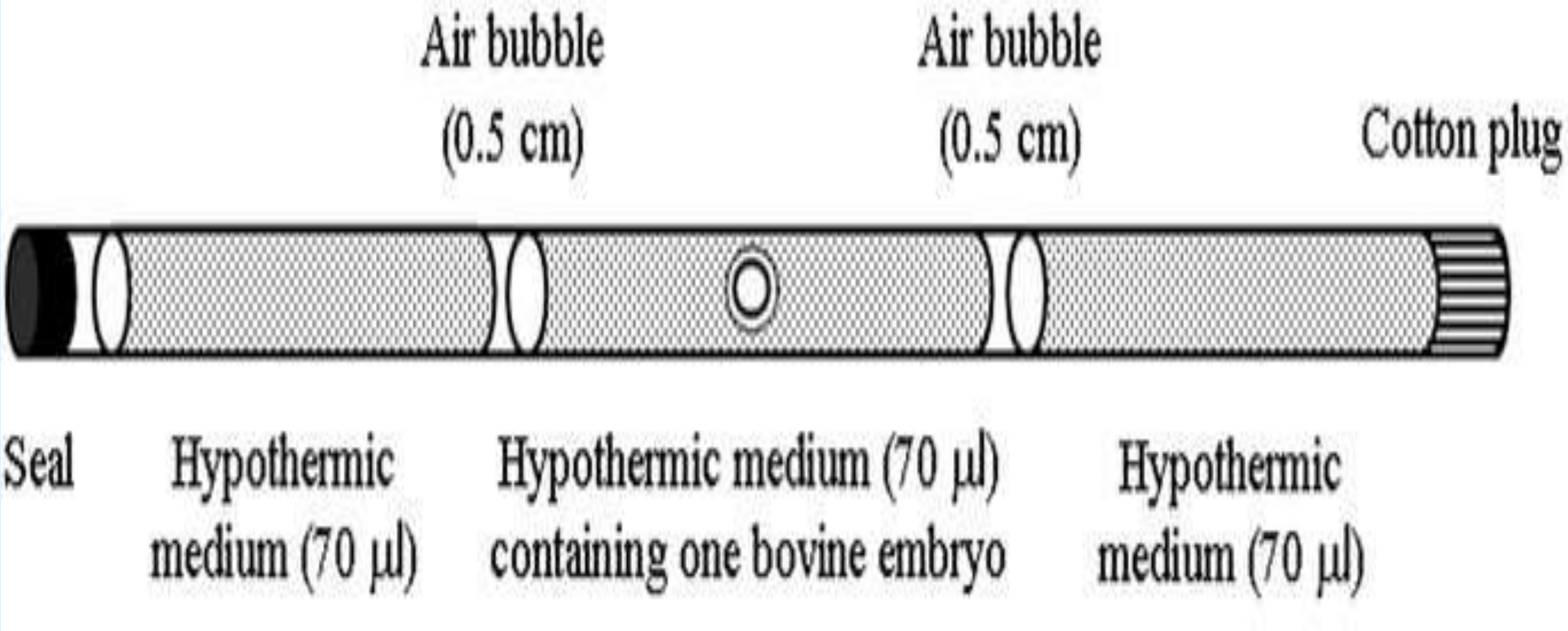
L

Embryo holding

- **Embryo holding media**
  DPBS+Glucose+Soduim pyruvate+Penicillin+Streptomycin+BSA

Filling of embryos

Embryos are filled in pre-sterilized empty semen straws using micropipettes or embryo exhauter



- **Storage of embryos:-**
- Short term-
- *Room temperature→2-3 hours in holding medium
- *Incubator→24-48 hours
- *Refrigeration→2 days
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- Long term- Cryostorage (In Liquid Nitrogen)
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- Recently-
- Vitrification→ Solidification of the Liquid by extreme increase in viscosity during ultra-cooling (Prevents the embryo from cryopreservation damage)

Synchronization of recipients

- Low productive but regularly cyclic females are administered PG for estrus induction one day before donors. They are then kept indoors to prevent accidental breeding.

Embryo Transfer

- The recipient is prepared and the embryo is transferred in the uterine horn ipsilateral to the CL bearing ovary.

- The above lectures are also explained in video lectures at my YouTube Channel Govind Narayan Purohit

- Kindly share the videos and subscribe to my channel if you like them

- Thanks