

Superovulation, Embryo Transfer

Dr.I.J.Reddy

History of Embryo Transfer Embryo transfer in cattle has recently gained considerable popularity with seed stock dairy and beef producers.

Most of the applicable embryo transfer technology was developed in the 1970s and 1980s; however, the history of the concept goes back much farther.

Embryo transfer was first performed and recorded by Walter **Heape in 1890**.

He transferred two Angora rabbit embryos into a gestating Belgian doe. She went on to produce a mixed litter of Belgian and Angora bunnies.

Embryo transfer in food animals began

in the 1930s with sheep and goats, but it was not until the 1950s that successful embryo transfers were reported in cattle and pigs by Jim Rowson at Cambridge, England.

The first commercial embryo transfers in this country were done in the early 1970s.

Initially, embryos were recovered from valuable donors and transferred to recipient animals using surgical procedures. It was not until non-surgical methods were developed in the late 1970s, that embryo transfer grew in popularity.

Superovulation & Embryo Transfer

- **1890** **1st ET rabbit W. Heap**
- **1953** **1st live AI calf**
- **1972** **20 ET calves**
- **1977** **50,000 ET calves**
- **1978** **1st human transfer**
- **2003** **500,000 ET calves**

Superovulation & Embryo Transfer in the Cow

- Superovulate for multiple embryos for ET.
- Average 12 ovulations/embryos per superovulated cow.
- Average 60% normal embryos (n = 7).
- Eight Recipients needed for each donor cow.

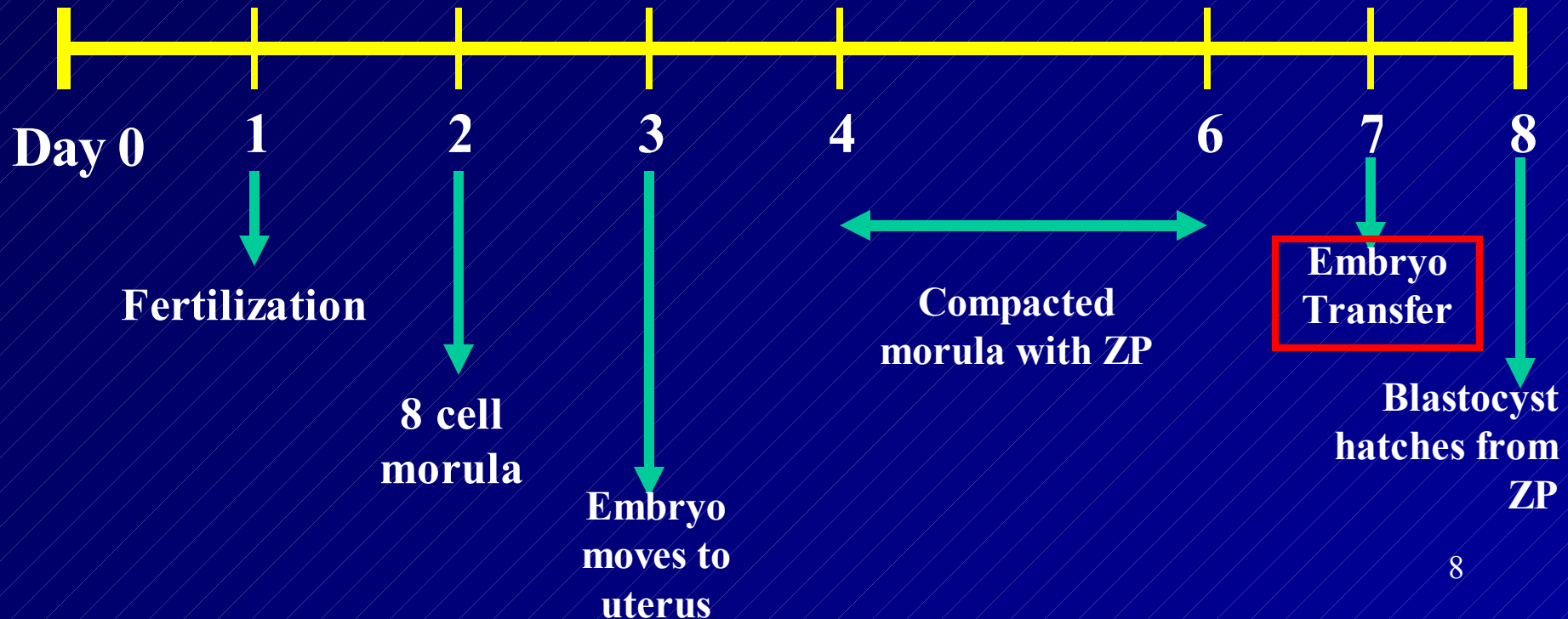
Superovulation & Embryo Transfer in the Cow

- **Hormone Treatments:**
 - **eCG (PMSG) 2,000 IU from blood of mare day 40 - 100 of pregnancy.**
 - **FSH from pituitary of pig or cow.**
 - **Recombinant FSH.**

Superovulation & Embryo Transfer

- **FSH**: given for 4 days, twice each day (starting on day 8 to 12 of cycle).
 - Results in multiple follicles producing estrogen
- **PGF_{2α}** on 3rd day to regress CL.
 - Removes the high progesterone allowing the preovulatory surge of GnRH/LH.
- No injection of LH, hCG or GnRH needed for ovulation.

Superovulation & Embryo Transfer – Day of Recovery



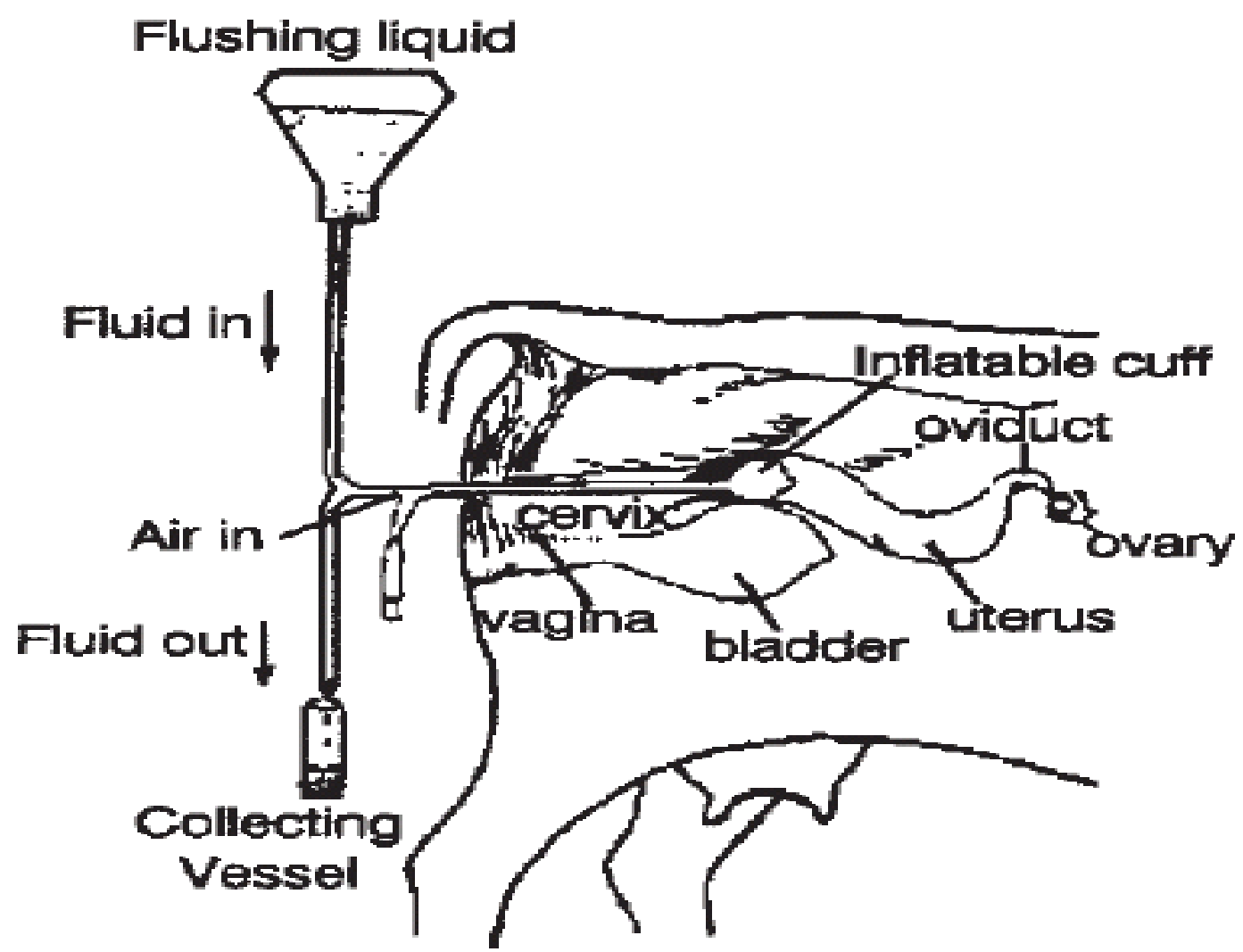


Figure 1. Diagram of the embryo flushing and recovery procedure.

Embryos also are evaluated for their stage of development without regard to quality. These stages are also numbered:

Stage 1: Unfertilized

Stage 2: 2 to 12 cell

Stage 3: Early morula

Stage 4: Morula

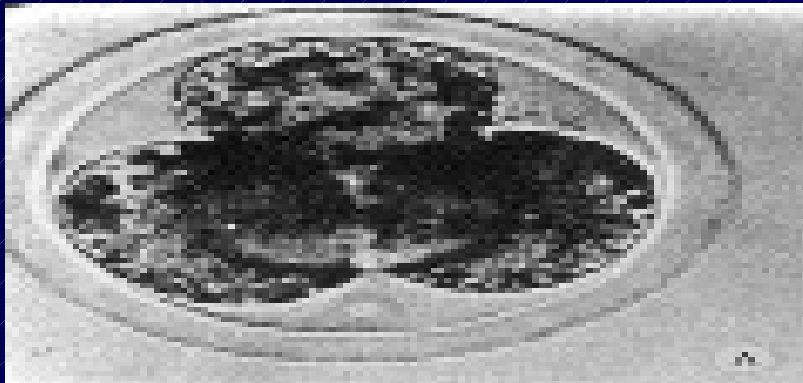
Stage 5: Early Blastocyst

Stage 6: Blastocyst

Stage 7: Expanded Blastocyst

Stage 8: Hatched Blastocyst

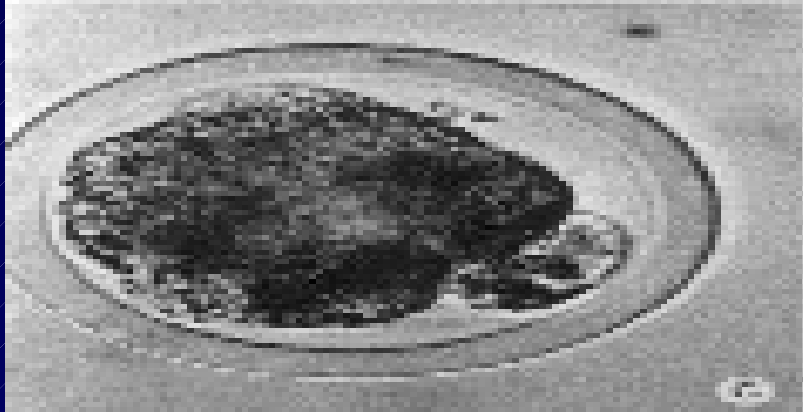
Stage 9: Expanding Hatched Blastocyst



A



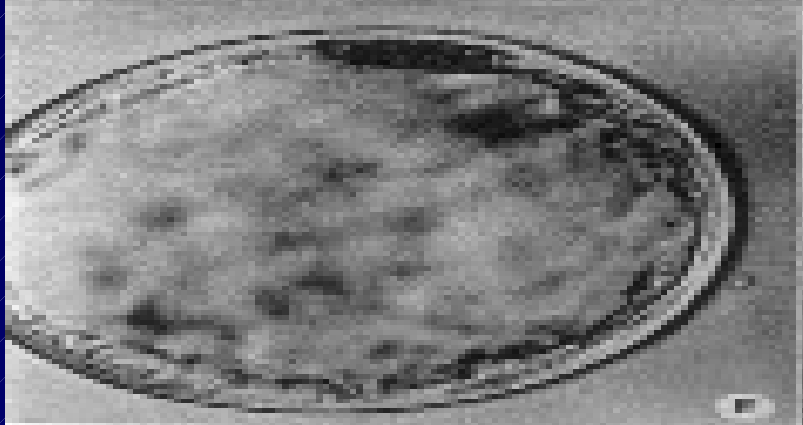
B



C



D



E



F

Superovulation & Embryo Transfer in the Cow

- Fresh ET: 83% pregnancy rate.
- Frozen ET: 69% pregnancy rate.
- 250,000 embryos frozen each year.
- 50% of recovered embryos are frozen.

Superovulation & Embryo Transfer Technique

- Embryo recovery – day 7 of pregnancy.
 - Surgical: midline incision or flank incision.
 - Nonsurgical: first reported in Japan 1965.
 - Two way Foley Catheter placed into cervix.
 - Flush in fluid and returned fluid carries embryos out.

In Vitro Fertilization

Rate of Success

- Oocytes aspirated off intact ovaries.
 - 50% discarded.
 - 50% used for IVF
 - 75% of these are fertilized.
 - »40% of these develop normally.
 - 50% overall pregnancy rate.

In Vitro Fertilization

Advantages

- Circumvent infertility.
- Produce large number of embryos.
- Produce sexed embryos via sexed semen (i.e. Holstein dairy heifers for milk production).
- Increase reproductive yield of cows that do not respond to superovulation.
- Obtain oocytes from donors in their first trimester of pregnancy.
- Recovery of oocytes from pre/post mortem ovaries.

In Vitro Fertilization

Disadvantages

- **Impractical.**
- **Requires great deal of skill and detail.**
- **Very expensive.**
- **Low rates of success.**
- **Freezing does not work well with IVF embryos.**
- **Large, abnormal calves with abnormal placentae born in some cases.**
 - **Large Offspring Syndrome (LOS)**