Artificial Insemination

- AI
- semen is deposited in the female reproductive tract by artificial techniques rather than natural mating.
- first successfully accomplished by Spallanzani in Italy in 1784 in dog
- 5% of beef cows
- 70%+ of dairy cows

Advantages

- rapid genetic improvement through superior sires
- reduction or elimination of cost associated with maintaining a herd sire
  - safety issue too
- reduced risk of spread of reproductive diseases

Disadvantages

- time required to detect estrus
- trained personnel for AI required
  - service and semen supplier
  - get trained as AI inseminator
- can accentuate poor sires
- potential lower conception rates compared to natural breeding

AI

- Volume of ejaculate is 2-10 ml
- 300-2,000 sperm per ml
- Potential 100-600 matings per ejaculate

Semen Collection

- Artificial vagina
  - heavy rubber outer cylinder
  - inner funnel-shaped rubber lining
  - warm water between then cylinder and liner
  - glass collection tube for semen
- used with a “teaser” cow or dummy
**Artificial Vagina**

**Semen Collection**
- Electroejaculation
  - probe is inserted into rectum
  - small electrical current passes through probe
  - current stimulates reproductive organs, causing ejaculation
  - funnel and collection tube for semen

**Semen Processing**
- evaluated for:
  - volume
  - concentration
  - motility
  - morphology
- diluted with extender
  - milk
  - egg yolk
  - citrate buffer
  - antibiotics
  - glycerol
  - dehydrates sperm protecting it against ice crystals during freezing

**Semen Storage Tank**

**Inseminating the Female**
- estrus detection
- proper timing of insemination
- proper handling of semen
 Estrus detection

- standing heat - females stands still while mounted
- restlessness
- mounting other females
- mucous discharge from vagina
- roughened tailhead or mud on the back or sides

 Estrus detection

- teaser or vasectomized males
  - chin ball marker
  - marking harness


“Teaser” Bull

VASECTOMIZED BULL

“Teaser” Bull

DEVESATED PENIS AND SHEATH (SIDE WINDER)

“Teaser” Bull

PEN-O-BLOCK

“Teaser” Bull

PENECTOMIZED BULL
### Duration of heat and length of cycle

<table>
<thead>
<tr>
<th>Species</th>
<th>Duration (hr)</th>
<th>Length (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>12-18</td>
<td>21</td>
</tr>
<tr>
<td>Doe</td>
<td>34-39</td>
<td>19-20</td>
</tr>
<tr>
<td>Ewe</td>
<td>24-36</td>
<td>16-17</td>
</tr>
<tr>
<td>Sow</td>
<td>48-72</td>
<td>20-21</td>
</tr>
<tr>
<td>Mare</td>
<td>90-170</td>
<td>19-23</td>
</tr>
</tbody>
</table>

### Timing of insemination

- **Cow**
  - heat in morning, inseminate in evening
- **Doe**
  - 12 hrs after beginning of estrus
- **Ewe**
  - 2nd half of estrus
- **Sow**
  - end of first day, beginning of second day

### Handling of semen

- frozen in liquid nitrogen (-F)
- thawing of semen

### Semen Thawing

- Straw is placed in 32-35°C water bath for 30 seconds
- Contents are deposited either in the vagina or the uterus

### Inseminating Tool
Estrus synchronization

- ES
- controlling or manipulating the estrous cycle so that females express estrus at the same time.
- controlling estrus and ovulation females means breeding is completed in a short period of time

Advantages

- It allows greater use of superior sires through artificial insemination (AI) or by natural service, makes AI programs more practical by reducing time and labor for heat detection, and allows more uniform management of cows and calves.

Disadvantages

- time-consuming
- expensive

Estrus Synchronization

- Estrus (heat) synchronization can help beef producers improve production efficiency and economic returns. Controlling estrus and ovulation in cycling females means breeding is completed in a short period of time.

Estrus Synchronization

- Instead of females being bred over a 21-day period, synchronization can shorten the breeding period to less than 5 days, depending on the program selected. The use of synchronization has great potential for improving beef production, but it requires good management for success.

Estrus Synchronization

- It allows greater use of superior sires through artificial insemination (AI) or by natural service, makes AI programs more practical by reducing time and labor for heat detection, and allows more uniform management of cows and calves.
**Estrus Synchronization**

- Yearling heifers need to reach "target weights" (650 to 750 lb., depending on breed) for a high percentage to be cycling before the breeding season. Cows generally should be 45 days post-calving before treatment starts.

**Prostaglandin**

- regresses CL, decreasing its function
- Females in Days 6 to 16 will return to estrus within 2 to 5 days
- Females in Days 17 to 20 will be in estrus normally within 1 to 4 days
- Females in Days 1 to 5 of the cycle and non-cycling females that do not have a mature CL will not respond

**Syncro-mate B**

- Syncro-mate B (SMB) consists of an ear implant containing a progestin (synthetic progesterone) and an injection containing an estrogen and progestin.

**Two-injection Example**

**Syncro-mate B**

- The implant is inserted under the skin in the middle of the back side of the ear. The injection is given intramuscularly in the rump at the time of implanting. Nine days later, the implant must be removed.
Syncro-mate B

- The SMB program can be used on females in all stages of the estrus cycle. It works by regressing the immature CL during early stages and by blocking estrus in all stages until the progestin implant is removed after 9 days (day 10). Females will cycle within 1 to 4 days after the implant is removed.

Syncro-mate B

- One advantage of SMB is that it can stimulate cycling in some non-cycling females, although conception rates may be slightly lower in these females. It has another advantage of not causing abortions in pregnant animals, but is more difficult to administer due to the implant insertion and removal.

Syncro-mate B Example

MGA

- melengestrol acetate, is a common inexpensive oral progestogen used in feedlots to suppress estrus of heifers and improve feed efficiency.

MGA

- works by allowing ovarian follicular development, but inhibits estrus and ovulation. After MGA treatment females have a synchronized estrus, but the estrus is subfertile. A program was developed combining MGA with a prostaglandin to produce a synchronized estrous with high conception rates.

MGA Example
### Advantages of Synchronization (AI)
- more calves saved due to use of calving-ease sires and group calving (about 3 percent)
- calves born earlier in shorter calving season so older at weaning (5-8 days)
- heavier calves at weaning due to better genetics and older age (up to 35 lbs)

### Advantages of Synchronization (AI)
- better quality heifers for replacements (up to $50 premium)
- fewer bulls needed for breeding (maybe 1/3 fewer)
- better use of labor and management ($?)

### Embryo transfer
- embryo is flushed from mother’s reproductive tract and transferred to recipient’s reproductive tract.
- hormones are given to superovulate dam.

### Advantage
- Increases the number of offspring that a superior female can produce.

### Disadvantages
- time-consuming
- expensive