Artificial Insemination

John Parrish

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Two cows standing next to each other in a field. Daisy says to Dolly, "I was artificially inseminated this morning." "I don't believe you," said Dolly. "It's true, no bull!" exclaimed Daisy.

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History of Artificial Insemination

- Handout linked to lecture outline

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History of Artificial Insemination

- **Arab Chieftains**
  - » Stole semen to breed mares
- **Leeuwenhook - 1677**
  - » Used microscope to see sperm
- **Spallenzani - 1780**
  - » Sperm could fertilize
  - » Cooling and freezing inactivated sperm and upon warming sperm were reactivated

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History of Artificial Insemination

- **Ivanov (Russia) - 1900**
  - » Developed methods as we know today
  - » Most work was with horses but did some cattle and pig work
- **Denmark - 1933**
  - » First dairy cooperative
- **First US AI Cooperative - 1937**
  - » First US dairy cooperative in New Jersey

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History of Artificial Insemination

- Dairy cooperatives increase in numbers - 1940's and 1950's
- Dairy cooperatives merge and form large companies that dominate cattle AI industry - 1960's to present
- All turkey's bred AI - 1960's to present
- Expansion of swine AI - 1990's
- Expansion of horse AI - 1990's

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Quiz 10 a

- **What does Russia have to do with Artificial Insemination as we know it today?**

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Quiz 10 a

- **What does Russia have to do with Artificial Insemination as we know it today?**

- **Developed all the methods that we use today under direction of Professor Ivanov.**

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Objectives of Artificial Insemination

- **Genetic improvement of livestock**
- **Disease control mechanism**
- **Possible to increase fertility**
- **Decrease breeding expense**

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Current Status of US Industry

- **Dairy Cattle**
  - » **7 million (50%) - in Denmark, Japan, 90-100%**
- **Beef Cattle**
  - » **1.3 million (3%)**
- **Swine**
  - » **90 - 95%**
- **Turkey**
  - » **100%**
- **Horses**
  - » **Increasing rapidly**

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Advantages of AI

- **Genetic Improvement**
  - » **Wide spread use and availability of genetically superior sires**
  - » **1 bull can breed 500,000 cows in a lifetime**
  - » **After death, semen can be used**
    - · **Oldest frozen semen 40 - 45 years old**

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Advantages of AI

- **Rapid proof of sire**
  - » **Progeny testing examines offspring for desired traits**
  - » **With natural mating would only have 100's of offspring**
  - » **Genomic Evaluations!!!**

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Advantages of AI (cont.)

- **Availability of sires**
  - » **Sires anywhere in world**
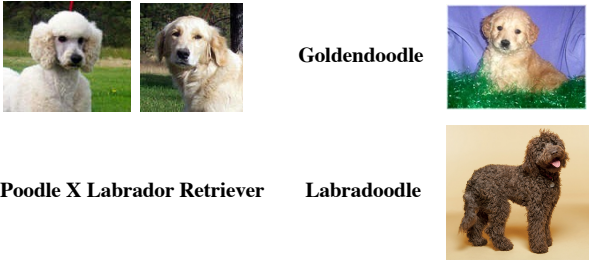
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Advantages of AI (cont.)

- Availability of sires
  - » Sires anywhere in world
- **Danger of bull (male) removed**
- **Disease reduction**
- **Crossbreeding**
  - » **Can try without buying sire**
  - » **Designer animals**

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Crossbreeding

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Crossbreeding (designer dogs)

Goldendoodle

Poodle X Labrador Retriever   **Labradoodle**

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Advantages of AI (cont.)

- **Economics**
  - » **Cost of sire genetics reduced**
    - **Many doses/ejaculate**
  - » **Sire maintenance cost reduced**
    - **Fewer sires required**

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Disadvantages

- **Estrus detection**
- **Trained inseminator**
- **Bull semen the best**
- **Use of poor male may increase so test**
- **Technology to store cooled or frozen semen**
  - » **Difficult to maintain**

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Question 10b

- **Why did AI take off in the US in pigs?**

a) **Genetic Improvement**
b) **Economics**
c) **Danger of the male removed**

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Question 10b

- **Why did AI take off in the US in pigs?**

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Insemination of the Female

- **Detection of estrus**
  - » **No need to review this material**
- **Time of insemination**
  - » **Cattle (2X daily heat detection)**
    - **12 hours after observed in standing heat (AM - PM rule)**
    - **Inseminate on the day of estrus**
    - **Ovsynch, Co-Synch, Cidr - timed AI**

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Insemination of the Female

» **Swine (2X daily heat detection)**
  · **Sow - 24 and 36 hours after first seen in estrus**
  · **Gilt - 12 and 24 hours after first seen in estrus**

» **Sheep**
  · **12 to 18 hours after first seen in estrus**

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Insemination of the Female

» **Horses**
  · **Every second day beginning on day 3 of heat**
  · **Breed when reach 40 - 45 mm follicle**
  · **Breed 24 hours after HCG injection**
    – HCG given when a >35 mm follicle is present
    – Ovulation is 36 to 40 hours after HCG
    – May also use GnRH agonist (Desmorelin)

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Follicle Size Determination

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Insemination of the Female

» **Dogs**
  · **Bitches ovulate around day 10 after they enter proestrus (discharge) or about 1 - 2 days of estrus.**
  · **Ovulation can be detected by:**
    – **LH assay (peak LH value + one day)**
    – **Progesterone assay (>5 ng/ml)**
    – **Cytology of vaginal smear (>50% cornified cells)**

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Insemination of the Female

· **Canine oocytes are ovulated as**
  – **1° oocytes and must mature to 2° oocyte before fertilization.**
· **Fresh or cooled semen, inseminate 2 days after ovulation detected and again 48 - 72 hr latter.**
· **Frozen semen, inseminate on day 5 - 7 after ovulation**
· **Uterine insemination better than cervical**

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Question 10c

· **Which species is breed 24 hours after HCG injection; HCG given when a >35 mm follicle is present.**

Bovine
Porcine
Equine
Ovine

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Question 10c

- **Which species is breed 24 hours after HCG injection; HCG given when a >35 mm follicle is present.**
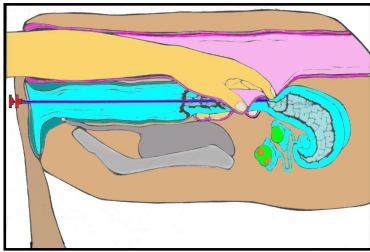
  Bovine
  Porcine
  Equine
  Ovine

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Insemination of the Female

- **Insemination protocol**
  - » **Rectal-vaginal**
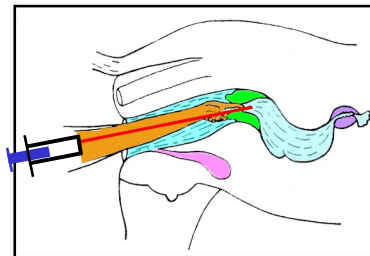 - » **Vaginal**

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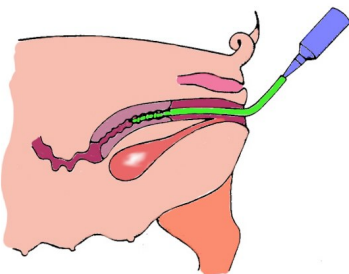## Insemination of the Cow

Rectal-Vaginal Approach

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Artificial Insemination in the Mare

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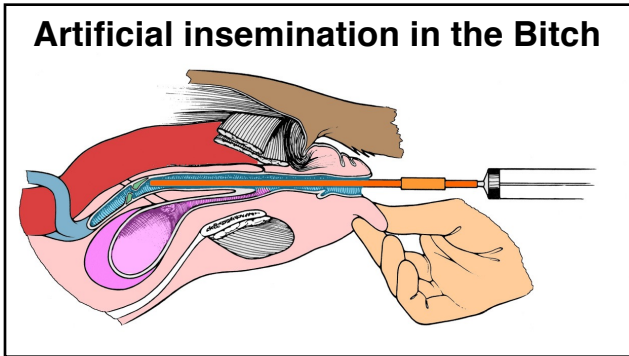## Artificial Insemination in the Sow

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Sow AI Equipment

Spiral Tip   **Foam Tip**   **Intrauterine**

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Artificial insemination in the Bitch

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Question 10 d

- **Which species is easiest to inseminate?**

    Bovine
    Equine
    Porcine

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Question 10 d

- **Which species is easiest to inseminate?**

    Bovine
    Equine –
    Porcine –

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Question 10 d

- **Which species is easiest to inseminate?**

    Bovine
    Equine – easy to inseminate hard to get timing correct.
    Porcine – easy to inseminate and female only allows you during estrus – best overall

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Factors Effecting Conception Rate

- **Time of insemination**
    - » If after ovulation then get aging of oocytes
        - Exception is the dog
- **# of sperm inseminated**
- **Fertility of males**
- **Skill of inseminator**
- **Season of semen collection**
    - » Hot periods of the year are bad

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Use and Success of AI

Species	Liquid	Frozen	Preg. Rate	Major Problems
Dairy Cattle				
(Heifer/Dry)	OK	OK	60-70	Logistics of timed AI
(Lact. Cow)	OK	Fair	20-35	Do not show heat
Beef Cattle	OK	OK	55-65	Range area large; logistics of timed AI
Sheep	OK	Fair	50-65	Large range; low value of ewe

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Use and Success of AI

Species	Liquid	Frozen	Preg. Rate	Major Problems
Swine	OK	Fair	65-90	Estrus detection, timed AI not practical
Horses	OK	Fair	30-60	Timing insemination, breed restrictions
Turkey	OK	Poor	90	None
Humans	OK	Fair	5-30	Donors; infertility; time
Dogs	OK	Fair-Good	30-90	Frozen must be IUI

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