

COURSE CODE:	ANP 504
COURSE TITLE:	ARTIFICIAL INSEMINATION
NUMBER OF UNITS:	2 Units
COURSE DURATION:	2 hours per week

COURSE DETAILS:

Course Coordinator:	DR. A. O. Ladokun, BSc, MSc, PhD, RAS
Email:	bimboladox@gmail.com ; ladokunao@unaab.edu.ng
Office Location:	COLANIM, ANIMAL PHYSIOLOGY STAFF OFFICE
Other Lecturers:	DR. J. O. Daramola and DR. J. A. Abiona

COURSE CONTENT:

PART I

The Role of AI and Reproduction in Livestock Improvement

1. Advantages and Disadvantages of AI
2. Status and Development of AI
3. Basic Genetics of Cattle Breeding
4. Reproductive organs of the cow and their functions
5. Reproductive organs of the Bull and their functions

PART II

Semen collection in Farm animals

6. Collection of semen from the bull
7. Collection of semen from the buck
8. Collection of semen from the Ram
9. Collection of semen from the Boar
10. Collection of semen from the Cock
11. Collection of semen from other farm animals

PART III

Semen evaluation; Extenders; Frozen semen

12. Evaluation of semen for General consideration
13. Evaluation of semen for Appearance and viability
14. Evaluation of semen for Concentration/enumeration of spermatozoa
15. Evaluation of semen for Live-Dead (Vital) Staining
16. Evaluation of semen for Morphology
17. Evaluation of semen for other measurements
18. Extenders and extension of semen
19. Frozen semen; Cryogenic storage; Transportation; Handling
20. Custom freezing of semen

PART IV

Insemination: Training, Pregnancy Determination and Reproductive Problems

21. How to inseminate Cattle, Sheep, Goat and Hens
22. Artificial Insemination of Beef cattle; Controlled estrus
23. Direct Herd service and herdsman-Instructor training
24. Pregnancy determination
25. Reproductive efficiency; Breeding problems; Conception rates

PART V

Sire selection; Bull health and management; AI organizations; Employment opportunities

26. Selection of Sires for AI use
27. Bull management and care
28. Health requirements for Sires in AI use
29. The AI Business – Organization
30. Records, Accounting, Regulations Pertaining to Registered Cattle
31. Carrier opportunities in the AI industry

PART VI

AI of Dairy Goats and Other Farm Animals

32. AI of dairy Goats and Sheep

33. AI of other farm animals and additional species

1.0 Introduction

1.1 How it all began

1.2 AI Worldwide

1.3 Status of AI in Developing Countries

1.4 Status of AI in Developed economies

1.5 Advantages and Consideration of AI

1.6 Basic Genetics of Cattle Breeding

1.7 Reproductive organs of the Bull and their functions

OBJECTIVES OF THIS INTRODUCTORY MODULE

- I. To become knowledgeable regarding the advantages and the disadvantages of AI
- II. To become familiar with the growth , development and present day activity of AI in the World
- III. To become familiar with the more important genetic principles influencing inheritance
- IV. To become familiar with the anatomy and physiological functions of the reproductive organs of the cow.
- V. To become familiar with the anatomy and physiological functions of the Bull

PRACTICAL I

This practical session aims at identifying the various organs in the reproductive tract of Cow and Bull

PART II: SEMEN COLLECTION

2.1 Collection of semen from the Bull

2.2 Collection of semen from the Goat Buck

2.3 Collection of semen from the Ram

2.4 Collection of semen from the Cock

2.5 Collection of semen from the Boar

2.6 Collection of semen from other farm animals (Rabbit Buck and Tom (Turkey))

PRACTICAL II

This practical session is mainly practice of semen collection in Bull, Goat Buck, Ram, Cock, Boar and other farm animals (Tom and Rabbit Buck)

OBJECTIVE OF PRACTICAL I & II

- To become familiar with the methods and equipments used in the collection of semen from the various species of farm animals
- To practice the proper method of semen collection from Bull, Buck, Boar, Cock e.t.c

PART III: SEMEN EVALUATION

3.1 Evaluation of semen: General Considerations

Objective

To understand the importance of evaluating semen quality in AI and to indicate certain evaluation

3.2 Evaluation of semen: Appearance and viability

Objective

To become familiar with appearance and viability characteristics of semen

3.3 Evaluation of semen: Enumeration of spermatozoa (Concentration)

Objective

To become familiar with the technique of enumerating spermatozoa in semen by use of the haemocytometer and to understand the principles of other rapid methods of estimating sperm numbers

3.4 Evaluation of semen: Live-Dead (vital) Staining

Objective

To become familiar with the differential staining technique used to determine the percentage live sperm in semen

3.5 Evaluation of semen: Morphology

Objective

To gain understanding of the morphological assessment of sperm cells and obtain practice in preparing smears for examination

3.6 Evaluation of semen: Other measurements

Objective

To recognise other measures used to evaluate semen

PRACTICAL III

This involves Practice on colour (appearance, enumeration, vital staining, morphology and other measurements)

3.7 Extenders and Extension of semen

Objective

To study the preparation of extenders and extension of semen

PRACTICAL IV

This session involves preparation of extenders and extension of semen

3.8 Frozen semen; Cryogenic storage; Transportation; Handling

Objective

To become familiar with the processing and use of frozen semen, cryogenic storage methods, transportation and semen handling

3.9 Custom freezing of semen

Objective

To become familiar with the custom freezing of semen

PART IV: INSEMINATION: INSEMINATION TRAINING; PREGNANCY DETERMINATION AND REPRODUCTION PROBLEMS

4.1 How to Inseminate Cattle: Techniques

Objective

To learn the proper techniques and develop knowledge and skill in the artificial Insemination of Cattle

4.2 Artificial Insemination of Beef Cattle; Controlled Oestrus: Beef and Dairy

Objective

To become familiar with the role of artificial insemination in Beef improvement and how to make it work

4.2.2 Artificial Insemination of Sheep, Goat and Poultry: Techniques

Objective

To become familiar with the role of AI in species improvement

4.3 Direct Herd Service and Herdsman – Insemination Training

Objective

To become familiar with the importance of direct herd service, or “do it yourself” AI, and the necessity for adequate herdsman – Inseminator training Courses

4.4 Pregnancy Determination in the Cow, Ewe, Doe, Sow and Bitch

Objective

To become familiar with the principles of pregnancy diagnosis in these species

4.5 Reproductive Efficiency: Breeding problems: Conception rates

Objective

To become familiar with factors that affect reproductive efficiency in Cattle, Sow e.t.c and consideration for improvement breeding efficiency

4.6 Embryo Transfer and Related Practices

Objective

To become familiar with the technology, advantages and disadvantages of embryo transfer (ET); to review the progress been made and the biotechnology involved in splitting embryos, cloning and *In vitro* fertilization

PART IV: SIRE SELECTION

5.1 Selection of Sire for AI use

Objective

To review considerations in the selection of dairy and beef bulls for Artificial insemination

5.2 Bull Management and Care

Objective

To become familiar with some of the basic practices involved in the proper management of bulls used for artificial Insemination

5.3 Health Requirement for Sires in AI Use

Objective

To become familiar with the importance of using only health and disease free Sires for production of semen used for AI, the importance of proper hygiene in the collection and processing of semen, and the role of AI in controlling transmission of venereal disease in livestock

5.4 The AI Business-Organizations

Objective

To study the organization and conduct of AI and to become familiar with the operation of AI business

5.5 Records, Accounting, Regulations pertaining to Registered Cattle – Important concerns in operating an AI Business

Objective

To become familiar with the financial records, semen and laboratory records, regulations for registered cattle, and other records used in the conduct of an AI business

5.6 Career Opportunities in the AI Industry

Objective

To become familiar with the opportunities for a career in livestock improvement, the various positions in the expanding field of AI, and the qualifications for each

PART VI: AI OR DAIRY GOATS AND OTHER FARM ANIMALS

6.1 AI of Dairy Goats and Sheep

Objective

To become acquainted with the techniques and advantages of improving dairy goats and sheep

6.2 AI of Other Farm Animals and Additional Species

Objective

To become familiar in a general way with the use of AI for other farm animals and species

COURSE REQUIREMENTS:

This is a compulsory course for all 500 level students in the Department of Animal Physiology. In view of this, students are expected to participate in all the course activities and have minimum of 75% attendance to be able to write the final examination.

READING LIST:

Osinowo, O. A. Animal Introduction. Sophie Academic, 2006.

Foote, R. H. Collecting and processing semen with vision, decision and revision: Producing and maintaining a quality product. Proc. 14th Tech. Conf. On Artificial Insemination and Reproduction. 1992.

Herman, H. A., Jere, R. M. and Gordon, A. D. The artificial insemination and embryo transfer of dairy and beef cattle: A handbook and laboratory manual. Interstate publishers, Inc. USA. 1994.

LECTURE NOTES

LECTURE NOTE ON ARTIFICIAL INSEMINATION

SEMEN COLLECTION

Semen collection refers to the process of obtaining semen from domestic animals with the use of various methods, for the purpose of artificial insemination or medical study.

Semen can be collected from animals via three distinct methods/techniques. These involve:

- (a) Use of artificial vagina
- (b) Rectal massage method
- (c) Electro-ejaculation

The technique used depends on the species and condition of the individual animal concerned.

Artificial Vagina

Several methods of obtaining semen have been developed. Artificial vaginas (AV) are used to collect semen from many species, most prominently cattle and horses, but also sheep, goats, rabbits and even cats. An AV uses thermal and mechanical stimulation to induce ejaculation. An AV is composed of a tube with an outer rubber lining that hold water, into which is placed an inner liner that is lubricated just prior to use. The outer liner is filled and pressurized somewhat with water at 42-48 degrees Celsius.



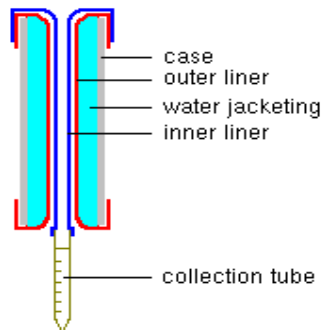
AV USED IN CATTLE, DOG AND CAT

Source:

Note: The use of hand gloves is commonly used in pigs with dummy for semen collection

Components Parts of Artificial vagina

Artificial vaginas are of different shapes and sizes. The component parts are listed below:



Source: www.innovis.org.uk

- a. Rigid rubber casing with an opening at both end
- b. Rough-textured latex inner liner
- c. Rubber band
- d. Rubber funnel
- e. Graduated glass collection tube
- f. Insulated and zippered jacket during cold season

Facilities needed for semen collection

There are some key facilities that must be put in place for effective semen collection to be realised. Some of these facilities are listed below:

- A. Facilities for safety of collector
- B. Earthen floor to prevent slipping
- C. Means to restrain teaser animals
- D. Easy access for semen collection

Materials needed for semen collection

There are some essential materials that are needed for effective semen collection, especially when artificial vagina is the preferred method of collection. Some of these materials are listed as follow:

- Artificial vagina
- Lubricant (sterile)
- Glass rod
- Collection tube
- Hot water at required temperature

After semen collection exercise, it becomes necessary that artificial vagina and other materials used be cleaned, sterilized and stored properly. The inner liner and rubber funnel should be soaked for 5 min. in 70% ethanol after washing, and then dried under UV light in a dust-free cabinet.

Sexual stimulation prior to collection with the artificial vagina

There is need for sexual stimulation of animal in semen collection. This will influence positively the volume of ejaculate from such animal. The effects of such stimulations are not well defined in boar and stallion, but notable in **bull**. The main reasons for sexual stimulation are:

- To ensure that bull will mount and ejaculate reasonably, and
- To ensure that collection of maximum number of sperm with highest possible quality per ejaculate are realized.

Steps involved in sexual stimulation

- By exposing bulls to teaser for several min. or 2 to 3 false mounting
- Introducing a new teaser animal
- Moving teaser animal to different area
- Presenting 2 teasers
- Allowing teaser or another bull to mount the bull to be collected
- Bringing new bull into the collection area



A: Fausle mounting



B: Sustained erection



C: Diversion of penis into AV Source:

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

RECTAL MASSAGE

Rectal massage is the stimulation of the animal by massaging the vesicular gland and ampullae by way of rectum for semen collection. These organs take part in the sexual response cycle, and are essential for ejaculation. These organs are found to be most active during time of ejaculation. Due to close proximity to the anterior rectal wall, it can be stimulated manually via the anus. It should be noted that rectal massage method is the most appropriate way for semen collection in cock apart from other ruminants.

ELECTRO-EJACULATION

Electro-ejaculation involves applying a series of short, low-voltage pulses of current to the pelvic nerves which are involved in the ejaculatory response. It sounds like an extremely

unpleasant experience, but doesn't seem to cause much distress in bulls (although they do need to be securely restrained), and is conducted under anesthesia in many species.

With few exceptions, electro-ejaculation is the only technique useful for collecting semen from wild animals, in which case the male is anesthetized prior to the procedure. Another advantage of electro-ejaculation is that it does not require a mount animal, and can be applied in the field using a battery-powered unit. Finally, electro-ejaculation can be used to obtain semen from animals that are physically incapable of mounting due to musculoskeletal disease or injury. It is used for collecting semen from animal that cannot mount due to spinal cord injury.

With bulls, where there is abundant experience collecting semen by both artificial vagina and electro-ejaculation, the samples collected using an electro-ejaculator usually have a larger volume (due to excessive accessory gland secretion) and a lower number of sperm.

Three pieces of equipment are required for electro-ejaculation. The electro-ejaculator itself is a power supply with rheostats to control the amplitude of the delivered current and lots of circuitry to prevent accidental electrocution. Second, one needs a collection tube, usually attached to a latex rubber cone ("loving cup") in which to collect the semen. Finally, the pulses of current are applied through an electro-ejaculator probe. The probe is inserted into the rectum such that the electrodes lie within the pelvic cavity. Older probes had circular electrodes, which often caused undesirable muscle contractions; probes with parallel electrodes on one side minimize this problem. Successful electro-ejaculation of an animal demands skill. It is not simply a matter of punching buttons and turning knobs, but requires finesse in determining the proper timing and amplitude of pulses to apply to a given male.

Below are the diagrams of different types of electro-ejaculator used in different species ranging from small to large.



Source: <http://www.allvet.org/electroejac.htm>

ELECTROEJACULATOR

Conditions applicable to the collection of semen

1. The floor of the mounting area should be clean and provide safe footing. A dusty floor should be avoided.
2. The hindquarters of the teaser, whether a dummy or a live teaser animal, should be kept clean. A dummy should be cleaned completely after each period of collection. A teaser animal should have its hindquarters cleaned carefully before each collecting session. The dummy or hindquarters of the teaser animals should be sanitized after the collection of each ejaculate. Disposable plastic covers may be used.
3. The hand of the person collecting the semen should not come into contact with the *animal's* penis. Disposable gloves should be worn by the collector and changed for each collection.
4. The artificial vagina should be cleaned completely after each collection where relevant. It should be dismantled, its various parts washed, rinsed and dried, and kept protected from dust. The inside of the body of the device and the cone should be disinfected before re-assembly using approved *disinfection* techniques such as those involving the use of alcohol, ethylene oxide or steam. Once re-assembled, it should be kept in a cupboard which is regularly cleaned and disinfected.
5. The lubricant used should be clean. The rod used to spread the lubricant should be clean and should not be exposed to dust between successive collections.

6. The artificial vagina should not be shaken after ejaculation, otherwise lubricant and debris may pass down the cone to join the contents of the collecting tube.
7. When successive ejaculates are being collected, a new artificial vagina should be used for each mounting. The vagina should also be changed when the *animal* has inserted its penis without ejaculating.
8. The collecting tubes should be sterile, and either disposable or sterilised by autoclaving or heating in an oven at 180°C for at least 30 minutes. They should be kept sealed to prevent exposure to the environment while awaiting use.
9. After semen collection, the tube should be left attached to the cone and within its sleeve until it has been removed from the collection room for transfer to the laboratory.