

**Minutes of the meeting of N.C.R.C to finalize the revised draft curriculum in
Animal Reproduction held at UGC Regional Centre, Karachi ,from May 21– 23,
2001.**

Meeting of National Curriculum Revision Committee to finalize the revised draft curriculum of Animal Reproduction was held in UGC Regional Centre, Karachi from May 21 -23, 2001. The following attended the meeting.

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| 1. | Prof. Dr. Rashid Ahmad Chaudhry
Department of Animal Reproduction,
College of Veterinary Sciences,
Lahore. | Convenor |
| 2. | Dr. Khuda Bux Mirbahar
Professor & Chairman,
Department of Animal Reproduction
Sindh Agriculture University,
Tandojam. | Member |
| 3. | Dr. R.H.Usmani,
Principal Scientific Officer
Animal Sciences Division
Pakistan Agricultural Research Council,
P.O.Box 1031, Islamabad | Member |
| 4. | Dr. M. Ata-ullah Khan,
Research Officer
VRI Peshawar. | Member |
| 5. | Dr. Asmatullah,
Department of Animal Reproduction,
Institute of Animal Husbandry
and Veterinary Sciences
Gomal University, D.I.Khan | Member |
| 6. | Dr.M..Akhtar Qureshi,
Assistant Professor,
Department of Animal Reproduction,
University College of Agriculture,
Rawalakot (Azad Kashmir) | Member |
| 7. | Lt. Col. Tariq Mehmood Khan,
ADRV & GHQ, Logistic Area,
Karachi. | Member |
| 8. | Dr. Laeeq Akbar Lodhi,
Associate Professor,
Department of Animal Reproduction, | Member/Secretary |

University of Agriculture,
Faisalabad.

9. Mr. Zaheer Ahmad Awan, Coordinator.
Education Officer,
UGC, Islamabad.

The meeting started with recitation from the Holy Quran by Prof. Dr. Rashid Ahmed Chaudhry. The Convenor welcomed the participants of the meeting and briefed them about the constitutional obligation of the Commission and the work done by the committee in its first meeting held on 15-17 March, 2001. Before taking the agenda of the meeting, letter of Prof. Dr. Manzoor Ahmed Qureshi was discussed where in he proposed to start a composite Degree of DVM for five years duration. Following a lively discussion, the Committee re-affirmed its view point submitted as recommendation during its meeting held on March 15-17, 2001.

The committee then took up the first revised draft curriculum for finalization based on the comments/ suggestions of subject experts in the field. The finalized curriculum of Animal Reproduction for DVM and M.Sc. (Hons) Animal Reproduction is reproduced below.

FINALIZED DRAFT CURRICULUM OF ANIMAL REPRODUCTION

1. DVM Courses

REPRODUCTION AND ARTIFICIAL INSEMINATION (A.I).

THEORY

Role of Animal Reproduction in Livestock Development.

Reproductive Endocrinology:

Hypothalamus and its releasing hormones; hormones of pituitary, thyroid, adrenal, ovaries, testis; hormones of pregnancy.

Functional anatomy of female reproductive system, Growth and puberty, Estrous cycle, factors affecting estrous cycle in farm animals, Ovulation and fertilization, development of embryo; sex differentiation, physiology of gestation, parturition and lactation.

Comparative aspects of reproduction in different species. Control of reproduction, reproductive efficiency; Embryo transfer.

Functional, anatomy of male reproductive system; Selection and evaluation of breeding bulls, semen collection, composition of semen, sperm morphology & metabolism; factors affecting semen quality; semen preservation, storage, transfer and handling.

Artificial Insemination: History, role of A.I. in Livestock Production, diseases transmissible through semen.

PRACTICAL

FEMALE

1. Anatomical & Histological study of female tract.
2. Palpation of female reproductive tract on the table
3. Biometry of female reproductive tract on the table
4. Palpation and measurement of various parts of covered female tract on the table.
5. Differential palpation of pregnant and non-pregnant female tract on the table.
6. Palpation of female reproductive tract in the experimental animals.
7. Palpation of uterine horns.
8. Palpation of ovaries and ovarian bursa.
9. Study of ovarian picture. Estrous detection and recording of various signs of estrous in farm animals.
10. Introduction to A.I equipment.

11. Insemination practice in the female tracts on the palpation table.
12. Insemination practice in the experimental animals
13. Pregnancy diagnosis through rectal palpation
14. Demonstration of pregnancy diagnosis through laboratory techniques.

MALE

1. Study of male reproductive system (identification and measurement of various parts).
2. Preparation and handling of bull for semen collection
3. Preparation and assembling of artificial vagina for semen collection.
4. Semen collection and gross examination (Volume, colour, odor, density and pH).
5. Microscopic examination of semen.---Mass activity and motility
6. Determination of concentration of spermatozoa.

7. a) Staining for live and dead spermatozoa
b) Staining for morphology

8. a) Cephalexin filter test.
b) Methylene blue reduction test.

9. Semen processing: Dilution rates for liquid and frozen semen. Preparation of extenders for liquid and frozen semen.

10. a) Freezing techniques.
b) Storage of liquid and frozen semen and thawing of frozen semen.

11. Record keeping for semen.

BOOKS RECOMMENDED:

1. Hafez, E.S.E. 1993. Reproduction in Farm Animals. 6th Ed. Lea and Febiger, Philadelphia.
2. Salisbury, G.W. and N.L. Van Demark, 1978. Physiology of Reproduction and Artificial Insemination in Cattle. 2nd Ed. W.H. Freeman and Co. London, San Francisco.
3. Cupp[s, P.T. 1991. Reproduction in Domestic Animals. 4th Academic Press Inc., California.
4. Zemjenis, R. 1970. Diagnostic and Therapeutic Techniques in Animal Reproduction. The Williams & Wilkins Company. Baltimor.
5. Bearden, H.J & J.W Faquay 1997. Applied Animal Reproduction. Prentice Hall Upper Saddle Riv., N.J 0745B

OBSTETRICS & GENITAL DISEASES 4(2-4)

THEORY

Diseases and accidents of gestation period:

Early embryonic death; abortion; mummification; maceration, dropsy of fetal membranes; vaginocervical prolapse; paraplagia of pregnancy. Induction of parturition.

Dystokia:

Basic and immediate causes of dystokia; common forms of dystokia in farm animals; diagnosis and treatment of various forms of dystokia. Torsion of uterus: Diseases & injuries of puerperal period; parturient paresis, ketosis, postpartum haemoglobinuria. Retention of fetal membranes, postpartum infections metritis; factors affecting involution of uterus.

Infertility in Female:

Abnormalities of female reproductive tract; Causes of infertility, : functional disturbances; anoestrus, suboestrus and cystic ovarian degeneration; Non-specific and specific infectious diseases (Compylobacteriosis Brucellosis, Trichomoniasis, and Leptospirosis) ; environmental and nutritional causes of infertility, principles of hormonal Therapy.

Infertility in male:

Testicular hypoplasia, degeneration and orchitis. Pathological and functional disturbances of the epididymis, vas deferens and accessory glands. Abnormal sexual behaviour and its causes; Vices of the male sexuality. Diagnosis and treatment of infertility. Principles and uses of diagnostic ultrasound imaging in domestic animals.

PRACTICALS

1. Obstetrical anatomy
2. Identification and uses of various obstetrical instruments.
3. Demonstration of various presentations positions and postures.
4. Diagnosis and correction of different malpresentations, positions and postures of the fetus in the phantom box.
5. Demonstration of fetotomy Removal of fore limbs
6. Demonstration of fetotomy Removal of head and neck
7. Demonstration of fetotomy Removal of hind limbs
8. Demonstration of fetotomy Cutting through the spinal column
9. Demonstration of fetotomy Cutting at the sacral site
10. Demonstration of cesarean section in bovine and ovine
11. Correction of torsion
12. correction of vaginal and uterine prolapse
13. Removal of the retained fetal membranes.
14. Epidural anesthesia, paravertebral anesthesia in domestic animals.
15. Collection of uterine material for the diagnosis of endometritis.

16. Intra-uterine Therapy
17. Collection of sample from male for diagnostic purposes
18. Examination of breeding bulls for fertility
19. Ultrasound imaging of uterus and ovaries in normal and infertile females.
20. Demonstration of echotexture of testes and epididymides with lesions.

BOOKS RECOMMENDED:

1. Arthur, G.H., D.E. Noakes & H. Pearson 1989. Veterinary Reproduction and Obstetrics, 6th Ed. Bailliere Tindall, London.
2. Bierschwal, C.J. and G.H.W. de Bois, 1980. Bonnes Springs. The Techniques of Fetotomy in Large Animals. VM Publishing Inc., Bonnes springs, Kansas, 66012.
3. Morrow, D.A. 1986. Current Therapy in Theriogenology, II.W.B. Saunders Company, Philadelphia, London.
4. Roberts, S.J., 1986. Veterinary Obstetrics and Genital Diseases. 2nd Ed., Edwards Brothers, Inc., Ann. Arbor. Michigan, USA.

ANIMAL REPRODUCTION CLINIC-I 1(0-2)

Introduction to Animal Reproduction Clinic. Training in palpation of Reproductive organs in experimental Animals, demonstration and practice of rod passing through cervix.

TEXT BOOK

Zemjanis, R., 1970 diagnostic and Therapeutic Techniques in animal Reproduction. The Wiliams and Wilkins company, Baltimore.

ANIMAL REPRODUCTION CLINIC-II 2(0-4)

Estrous cycle studies, Estrus detection, optimum time for insemination, practice of insemination techniques with fluid and frozen semen. Differential diagnosis of pregnancy. Clinical evaluation of fertility in male and female animals. Clinical report writing. Case recording for A.I, Anestrous/sub-estrus, Repeat breeding and other reproductive problems.

TEXT BOOK

Zemjanis, R., 1970 Diagnostic and Therapeutic Techniques in Animal Reproduction. The Wiliams and Wilkins company, Baltimore.

ANIMAL REPRODUCTION CLINIC-III 2(0-4)

Studies on parturition and its various stages. Care of the newborn and dam. Injuries and diseases of the puerperal period. Postpartum hemorrhages, lacerations and contusions of the birth canal. Treatment and surgical suturing of ruptured perineum. Diagnosis of uterine and ovarian abnormalities and their treatment. Clinical case recording and presentation.

TEXT BOOKS

1. Morrow D.A., 1986. Current therapy in Theriogenology 2. W.B. Saunders Company, Philadelphia.
2. Arthur, B.H., D.E. Noaskes and H. Pearson, 1989. Veterinary Reproduction and Obstetrics. 6th Ed. Bailliere Tindal & Co. London.

ANIMAL REPRODUCTION CLINIC-IV

2(0-4)

Clinical differential diagnosis of various types of abortion. Collection of materials for laboratory confirmation. Diagnosis and correction of torsion of uterus. Reduction and treatment of vaginocervical and uterine prolapse. Dystokia, diagnosis, handling and correction of malpresentations, removal of the retained placenta, and its treatment. Clinical case recording and presentation.

TEXT BOOKS

1. Morrow D.A., 1986. Current therapy in Theriogenology 2. W.B. Saunders Company, Philadelphia.
2. Arthur, B.H., D.E. Noaskes and H. Pearson, 1989. Veterinary Reproduction and Obstetrics. 6th Ed. Bailliere Tindal & Co. London.

HERD REPRODUCTIVE HEALTH MANAGEMENT PRACTICES 3(0-6)

Livestock farm visits, system of record keeping on livestock farms in the country; collection, tabulation and analysis of the available farm data. Parameters of fertility status assessment ; methods to improve herd fertility status; equipment and aids used for reproductive management ; use of computers packages in reproductive health management ; overview of major infertility problems of farm animals ; applications of the field tests for the diagnosis of reproductive diseases; measures to control infertility problems through nutritional supplementation, vaccination and therapy. Seminars, group discussion and report writing.

BOOKS RECOMMENDED:

1. Morrow, D.A. (1992) Current Therapy in Theriogenology. 2nd Ed. W.B.Saunders Co. London.
2. Radostits, O.M. Leslie K.E. Fetrow,J.(1994) Herd Health:Food Animal production medicine.2nd Ed. W.B. Saunders Co. Philadelphia U.S.A.

- The code numbers to different courses can be assigned by individual institutions.
- Minor changes in the title of the courses may be made by individual institutions judiciously.

M.Sc COURSES

REPRODUCTION OF FARM ANIMALS

4(3-2)

Basic principles, reproductive endocrinology (The pituitary, the thyroid, physiology of the ovary, hormones of pregnancy, physiology of testis).

Female Fertility: Reproductive system, the sexual cycle, photoperiodicity, the mammalian ovum, fertilization, implantation, gestation, prenatal development, reproductive efficiency in the female. Sexual behaviour in female. Environmental stress factors.

Male Fertility; Reproductive system, puberty, spermatogenesis selection of sire for A.I., semen production, artificial breeding, sexual behaviour in male, environmental stress factors.

PRACTICALS

Anatomy of male and female reproductive tracts of Farm animals. Histology of male and female gonads and reproductive organs. Estrous cycle study. Rectal palpation of male and female reproductive organs, pregnancy diagnosis. Evaluation of semen.

TEXT BOOKS

1. Hafez, E.S.E. 1998 Reproduction in Farm Animals. Lea and Febiger, Philadelphia.

BOOKS RECOMMENDED:

1. Cupps, P.T. (1991) Reproduction in Domestic Animals, 4th Edition, Academic Press, New York.
2. Knol, E. & J.D. Neil. 1994. The physiology of reproduction. Raven Press Ltd., New York.

ARTIFICIAL INSEMINATION

4(3-2)

History, scope and development of artificial insemination, collection, evaluation and processing of semen. Evaluation of reproductive health status of female. Insemination techniques. Organization of artificial insemination and record keeping.

PRACTICALS

Collection of semen by different methods. Estimation of rate of motility. Concentration, livability of spermatozoa. Dilution of semen. Handling of semen, evaluation of stored semen. Estrus detection and timing of insemination. Insemination techniques.

TEXT BOOKS

1. Perry, E.J. 1963 Artificial Insemination of Farm Animals 3rd Rev. Rutgers Univ. Press, New Brunswick.

BOOKS RECOMMENDED:

1. Salisbury, G.W. & N.L. Van Demark, 1978. Physiology of Reproduction and Artificial Insemination of Cattle. W.H. Freeman & Co., San Francisco.
2. T. Mann. 1991. Biochemistry of Semen. London

COMPARATIVE REPRODUCTION

4(3-2)

THEORY

Prenatal and postnatal development of gonads. Comparative aspects (in different species) of reproductive anatomy and endocrinology, sexual season, sexual maturity and behaviour, ovulation, fertilization, cleavage, implantation, gestation, parturition, pregnancy tests in different species.

Variation in sperm morphology and semen composition in different species. Physiological and endocrinological aspects of fertility and infertility in different species of animals.

PRACTICALS:

Comparative functional anatomy of male and female reproductive organs. Types of placentas in different species. Comparative reproductive behaviour of different species.

TEXT BOOKS

1. Austin, CR and Short, RV. (1982) Reproduction in Mammals. Cambridge University press, London.
2. McDonald L.E. 1990.

BOOKS RECOMMENDED:

1. Cupps, PT, (1991) Reproduction in Domestic Animals, 4th Edition, Academic Press, New York.

BIOCHEMICAL ASPECTS OF SEMEN 4(3-2)

THEORY

Morphology of spermatozoa, spermatogenesis: composition of sperm cell and plasma; organic and inorganic constituents of semen; physio-chemical properties of semen, osmotic pressure; electrical pH and buffer system in semen.

Energy production; transfer; possible storage and utilization system in spermatozoa; Metabolism of spermatozoa glycolysis; respiration; aerobic glycolysis; factors influencing metabolic rate.

PRACTICALS

Study of morphology of sperm cells; measurements of metabolic activity of sperm cells; resistance of spermatozoa and livability of sperm cells.

TEXT BOOKS

1. Salisbury, G.W. & N.L. Van Demar, 1978. Physiology of Reproduction and Artificial Insemination of Cattle W.H. Freeman & Co. San Francisco.
2. Mann, T., 1964. Biochemistry of Semen. London.

REFERENCE BOOKS

1. Hafez E.S.E. 1993. Reproduction in Farm Animals. Lea and Febiger, Philadelphia.

SEMEN PRESERVATION TECHNIQUES 4(2-4)

Introduction. Theory of cooling and freezing of semen, Dilution, storage and transportation of liquid/frozen semen. Methods of deep freezing.

PRACTICALS

Determination of osmotic pressure of semen diluters. Preparation of semen for deep freezing. Deep freezing of semen by different methods. Thawing of deep frozen semen for A.I. of animals. Care and handling of apparatus used for deep freezing of semen.

TEXT BOOKS

1. Salisbury, G.W. and N.L. Van Demark, 1978. Physiology of Reproduction and AI in Cattle. 2nd Ed. W.H. Freeman and Co. London.
2. Mann T. 1991

ADVANCED OBSTETRICS

4(3-2)

THEORY;

Importance of obstetrics, aetiology and incidences of various types of dystokia, general considerations, economic importance and evaluation of various obstetrical procedures and their preferences, pregnancy and its diagnosis-modern techniques, recent advances related to gestational problems, induction of parturition in mature and premature pregnancies, injuries during handling of dystokia, preventive and treatment procedures of diseases incidental to parturition, prevention and treatment of puerperal disorders.

PRACTICALS

Training phantoms, recent advances in obstetrical operations, various types of obstetrical procedures used in relieving dystokia in large and small animals, use of obstetrical instruments and Thygessan's fetotome, cesarean procedures, its practice in experimental/clinical animals, handling of clinical cases of dystokia, induction and control of parturition.

TEXT BOOKS

1. Roberts, S.J. 1986 Veterinary Obstetrics and Genital Diseases. Edwards Brothers Inc., Ann Arbor, USA.
2. Arthur, G.H., D.E. Noakes and H. Pearson 1989. Veterinary Reproduction and Obstetrics. Bailliere Tindal, UK.
3. David A. Morrow, 1986. Current Therapy in Theriogenology 1,2. W.B. Saunders Company, UK.

INFERTILITY AND GENITAL DISEASES

4(3-2)

THEORY

General aspects of pathology of reproduction in male and female. Causes of infertility: hereditary and environmental factors and combination of both.

Factors affecting serving ability of male and spermatogenesis, Malformations of the sexual organs, Endocrine imbalance. Pathological changes in the sexual organs. Factors affecting estrous and ovulation. Malformation of the female genital organs. Endocrine imbalance in female. Enzootic infertility due to brucellosis, trichomoniasis, Vibriosis, viral infections etc. Infertility due to malnutrition. Physiology and pathology of pregnancy; various types of abortions, Hydroamnion, Hydroallantois. Mummification and maceration of fetus. Pregnancy toxemia.

PRACTICALS

Evaluation of male and female animals for fertility and infertility. Diagnosis and treatment of gynecological disorders. Diagnosis of infectious infertility and various causes of abortion.

TEXT BOOKS

1. Roberts, S.J. 1986. Veterinary Obstetrics and Genital disease Edwards Brothers, Inc. Ann. Arbor USA.
2. Morrow, D.A. 1986. Current Therapy in Theriogenology, II W.B. Saunders Company, Philadelphia, London.

EQUINE REPRODUCTION 4(3-2)

THEORY

Puberty, estrous cycle, estrous and ovulation. Effects of photoperiod on reproduction and methods of artificial control. Gestation, pregnancy diagnosis and parturition. Peculiarities of maternal and fetal hormones and gonads during pregnancy in the mare. Abortion and other diseases of gestation, dystokia and postpartum complications. Endometritis and other fertility problems Genital disorders of stallion. Factors affecting equine fertility.

PRACTICAL

Study of equine reproductive organs; Clinical & laboratory methods for pregnancy diagnosis; Rectal palpation for the determination of physiological and pathological condition of the internal genitalia; Diagnosis and treatment of infertility problems; Examination of stallion and mare for breeding soundness. Preparation, collection, processing, dilution and evaluation of stallion semen. Use of ultrasound imaging techniques.

BOOKS RECOMMENDED:

1. Arther, G.H. D.E. Noakes & H. Pearson, 1989. Veterinary Reproduction and obstetrics. 6th Ed. Bailliere London.
2. Laing, J.A., W.J.B. Morgan & W.C. Wagner, 1988. Fertility and Infertility in Veterinary Practice. 4th Ed. Bailliere Tindall, London.
3. Morrow, D.A. 1986. Current Therapy in Theriogenology, II W.B. Saunders Company, Philadelphia, London.
4. Higgins, A. J. & I. M. Wright. 1999. The equine Manual. Saunders company, Philadelphia, London.
5. McKinnon, A.O. & James, L. Woss. 1993. Equine Reproduction. 1st Ed., Lea & Febiger, Philadelphia, London.

CANINE REPRODUCTION 4(3-2)

THEORY

Puberty in the dog and bitch, estrous cycle, its induction and prevention in bitch. Breeding management of the bitch. Physiology and endocrinology of canine pregnancy. Pseudo-pregnancy and its complications. Management of pregnant bitch, normal and abnormal parturition. Developmental congenital anomalies of reproductive tract. The inherited lethal and non-lethal defects in the dogs. Relationship of ovaries and mammary gland diseases. Reproductive disorders of male reproductive tract. Abnormal sexual behavior in canine species. Infertility in the canine.

PRACTICAL

Diagnostic techniques for pregnancy in canine. Vaginal cytology, clinical examination and diagnosis for infertility. Use of vaginal cultures for diagnostic purposes. Semen collection, evaluation and artificial insemination. Use of ultrasound imaging techniques.

BOOKS RECOMMENDED:

1. Cole, H.H. & P.T. Cupp, 1977. Reproduction in Domestic Animals. III Ed. Academic Press, New York, Sanfransisco, London.
2. Greep, R.O. 1975. Reproductive Physiology. Physiology series one. Volume 8. Butterworths, London.
3. McDonald, L.E. 1980. Veterinary Endocrinology and Reproduction. III Ed. Lea & Febiger, Philadelphia, London.
4. Morrow, D.A. 1986. Current Therapy in Theriogenology. 2nd Ed. Saunders Company, Philadelphia, London.

EMBRYO TRANSFER IN FARM ANIMALS 4(1-6)

THEORY

History and development of embryo transfer in farm animals; Selection of donors, superovulation, various methods of embryo collection, isolation and evaluation of embryos, culture and storage of embryos; programming of recipients for embryo transfer. Embryo transfer – surgical and non surgical, embryo freezing, various methods of embryo freezing. Embryo - pathogen interactions in relation to disease transmission, micro-manipulation of embryos.

PRACTICAL

Preparation of flushing and culture media for embryos; embryo collection with non surgical technique. Evaluation of embryos on the basis of morphology. Embryo freezing; addition of cryoprotectants ;filling the straw; cooling; thawing and transfer of embryos to the recipient through non-surgical technique.

BOOKS RECOMMENDED:

1. Adams, C.E. 1982. Mammalian Egg. Transfer. CRC Press Inc. Boca Raton, Florida, USA.
2. Elsdon, R.P. & Jr. Seidel, 1984. Embryo Transfer Procedures for Cattle. Animal Reproduction Laboratory, Colorado State University, USA.
3. Gordon, I. 1983. Controlled Breeding in Farm Animals. Pergamon Press Oxford, New York.
4. Morrow, D.A. 1986. Current Therapy in Theriogenology. II. W.B. Saunders company, Philadelphia, USA.
5. Curtis, J.L. 1991. Cattle Embryo Transfer Procedure.
6. Stringfellow, D.A. & S.M. Seidel. 1998. Manual of the International Embryo Society. 3rd Ed. 1111 North Dunlop Ave. Savoy, IL. 61874, USA.

DIAGNOSTIC ULTRASONOGRAPHY IN ANIMAL REPRODUCTION

3(1-4)

THEORY

Introduction to diagnostic ultrasonography: Definition, principle and nature of ultrasound, and its scope in animal reproduction. Acoustic variables and characteristics of ultrasound waves. Frequency, wave length and amplitude. Generation of ultrasound waves: Piezoelectric crystals, transducers and their types. Linear and curvilinear arrays and sector scanners, receivers and their functions. Propagation speed and attenuation of ultrasound waves. Display formats, amplitude, brightness and motion modes. Doppler effects. Interpretation of ultrasound images, echo patterns, hyperechoic, hypoechoic and anechoic images. Commonly encountered artifacts, reverberation, acoustic shadowing, enhanced through transmission and mirror images. Bioeffects of ultrasound.

PRACTICALS

Ultrasound equipment and its operation. Prerequisites for ultrasound imaging. Section of the transducer and wave frequency. Ultrasound imaging of the female and male reproductive organs from slaughtered animals.

Transrectal imaging of ovaries, uterus and cervix in normal and infertile cows and buffaloes during various phases of estrous cycle. Demonstration of the echotexture of luteinized follicles, ovarian cysts and tumors, endometritis, pyometra, hydrometra, mummified and macerated fetus. Imaging of uterus at different stages of pregnancy. Transcutaneous imaging in sheep and goats for pregnancy diagnosis. Demonstration of the ultrasound-guided oocyte collection in the cow and pregnancy diagnosis in the mare.

Transcutaneous imaging of the testis and epididymis in normal males. Demonstration of ultrasound imaging of the testis and epididymis in normal males. Demonstration of the ultrasound appearance of various testicular and epididymal lesions e.g. testicular degeneration with mineralization, abscesses and neoplasm, spermatocele, hydrocele and sperm granulomata.

BOOKS RECOMMENDED:

1. Khan W., D. Volkmann and R.M. Kenney, 1994. Veterinary Reproductive Ultrasonography. Mosby-Wolfe, London.
2. Kremkau, F.W. 1993. Diagnostic Ultrasound: Principles and Instruments. 4th Ed., W.B. Saunders Company, Philadelphia.
3. Bartru, R.J. Jr. and H.C. Crow, 1977. Gray-scale Ultrasound: A manual for Physicians and Technical Personnel. W.B. Saunders Company, Philadelphia.

Recommendations made by the NCRC for effective implementation of Revised Curriculum of Animal Reproduction

UNDERGRADUATE LEVEL:

1. All the institutions awarding DVM degree must follow a uniform curriculum and evaluation system. All the veterinary educational institutions should award a composite DVM degree of 5 years including a compulsory internship of 6 months so as to equip the graduates with the breadth of knowledge expected of them for efficient livestock development in the country.
2. To improve the quality of education imparted to students the admission to the DVM program should be restricted depending upon the facilities in terms of appropriate student teacher ratio, lab. facilities and experimental animals.
3. Due to movement of animals out of city limits, the stationary clinics in the departments of Animal Reproduction at various campuses are not attracting sufficient

number of animals for practical training of students. It is, therefore, imperative that Animal Reproduction departments should be facilitated by UGC to set up field stations and until then should be provided transport facilities as recommended by the NCRC in its meeting held in July, 1997 to carry the students to and from the closest facility available for their training.

POSTGRADUATE LEVEL:

4. Postgraduate education in Animal Reproduction should be based on uniform standards in all the Vet. educational institutions. The Ph.D. degree program must consist of course work of substantial number of credit hours to ensure that the candidate has acquired sufficient background knowledge to pursue a Ph.D research program.

5. Adequate staff and residential facilities be provided/created at each campus to cater the needs of postgraduate students of Animal Reproduction for quality research.

6. The committee strongly endorsed the recommendations of the Curriculum Revision Committee which met in Lahore on July 21-23, 1997 to upgrade the departments of Animal Reproduction at Faisalabad, Lahore and Tandojam as Centres of excellence and suggested that chairmen of these departments should initiate necessary action through the respective universities.

7. The facilities/laboratories to carry out hormone assays need to be established at the Departments of Animal Reproduction at Faisalabad, Lahore and Tandojam to facilitate the postgraduate research.

EXECUTIVE SUMMARY:

No course has been deleted from the existing curricula of the undergraduate programme. All courses have been reviewed and necessary modifications have been suggested in contents of theory and practicals for certain courses.

Some new/latest Text Books/Reference Books have been recommended for certain undergraduate/postgraduate courses.

A new course on Reproductive Endocrinology and Immunology is suggested for incorporation in the M.Sc.(Animal Reproduction) programme. A proposed draft is attached as Annexure- A.

Dr. Laeeq Akbar Lodhi
Secretary.

Prof. Dr. Rashid Ahmad Ch.
Convener.

Course Title: Reproductive Endocrinology And Immunology 5(4-2)

THEORY

Organization of endocrine system, Classification & functions of hormones, Hypothalamus and pituitary hormones, Regulation, secretion, transport and metabolism of hormones, Sex differentiation, Male sex hormones, Female sex hormones, Role of hormones in Fertilization, implantation and maintenance of pregnancy, Role of hormones in various stages of parturition, Endocrinology of early postpartum period, Role of pineal, thyroid, parathyroid and adrenal hormones in reproduction, Endocrine disorders

Introduction to immune system, Immunology and reproduction in male animals
Immunology and reproduction in female animals, Immunological implications of pregnancy, Passive transfer of immunity, Immunological disorders in relation of infertility

PRACTICALS

Assessment of endocrine functions through bioassays and use of exogenous hormones eg, estrogens, progestogens, gonadotropins and prostaglandins for demonstration of animal response.

Study tours of related research laboratories conducting EIA and RIA of steroid and protein hormones. Calculations of precision, sensitivity, cross reactivity, repeatability and coefficients of variation (inter and intra-assay) of immunoassays.