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Introduction

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Reproductive physiology and management constitute one of the most critical areas of veterinary medicine, as reproduction is the basis for maintaining and improving animal populations. In production systems, reproductive efficiency is a key driver of profitability, influencing calving intervals, milk yield, and genetic progress. This manual provides students with a structured combination of theoretical knowledge and practical training to ensure they acquire the necessary skills to manage reproduction effectively. The introduction to reproductive morphophysiology establishes the foundation by describing the anatomy and physiology of male and female reproductive organs, the hormonal regulation of the estrous cycle, and species-specific differences.

These fundamentals are crucial for interpreting clinical findings and developing treatment plans. Furthermore, the manual addresses practical skills such as rectal palpation, ultrasonographic pregnancy diagnosis, and artificial insemination techniques. These procedures are presented with an emphasis on biosafety, animal welfare, and diagnostic accuracy. By exposing students to hands-on practice, the manual ensures that they not only understand the theoretical background but also gain the manual dexterity and confidence required for real-world application. This introduction situates the importance of these topics within the Mexican livestock context, where challenges such as heat stress, seasonal forage availability, and infectious reproductive diseases require veterinarians to design evidence-based strategies that maintain reproductive performance and farm productivity.

The six selected topics cover the most relevant dimensions of veterinary reproduction and demonstrate a logical progression from anatomy to applied reproductive management. Morphophysiology of the reproductive system lays the groundwork by teaching students to identify organs, understand their functions, and recognize changes throughout the estrous cycle. Rectal examination of the cow builds on this knowledge by enabling direct assessment of the uterus, cervix, and ovaries, which is indispensable for reproductive planning. Pregnancy diagnosis integrates palpation and ovaries, which is indispensable for reproductive planning. Pregnancy diagnosis integrates palpation and ultrasonography to identify pregnant and open cows early, allowing timely rebreeding and optimizing herd fertility. The section on parturition and dystocia gives students the ability to distinguish between normal and complicated births and to apply obstetrical techniques to reduce calf mortality and economic losses.

Artificial insemination, one of the most impactful biotechnologies, equips students with skills in semen handling, estrus detection, and timing to improve conception rates and accelerate genetic improvement. Finally, reproductive management in production systems ties all these practices together, emphasizing record-keeping, nutritional support, biosecurity, and vaccination programs as essential components of herd-level reproductive strategies. Together, these topics form a comprehensive approach that enhances the veterinarian's ability to provide preventive, diagnostic, and therapeutic solutions to reproductive challenges.

the importance of veterinary medicine in different professional fields.

Morphophysiology is fundamental in veterinary medicine as it provides the anatomical and physiological knowledge required to identify, diagnose, and treat reproductive problems. This section of the manual focuses on the detailed study of the male and female reproductive systems. In females, it describes internal genital organs such as ovaries, oviducts, uterus, cervix and vagina, as well as external structures including the vulva and clitoris. It highlights the anatomical differences between domestic species-cattle, horses, pigs, sheep, goats, dogs, and cats-and emphasizes the importance of recognizing these variations during dissection and rectal palpation. Students are encouraged to work with slaughterhouse specimens or anatomical models to practice identification of normal structures.

In males, the manual covers testicular anatomy, epididymis, vas deferens, accessory sex gland (vesicular, prostate bulbourethral), penis, and prepuce. The physiological roles of these organs-hormone production, gamete transport, and copulation-are explained in detail. Understanding morphophysiology is critical because many reproductive disorders are linked to structural or functional abnormalities. Students learn to detect ovarian follicles, corpora lutea, and uterine tone across different phases of the estrous cycle. Knowledge of placentation types-diffuse, zonary, discoid, and cotyledonary-is also included to aid in species-specific pregnancy identification. Mastering this topic provides a strong foundation for clinical reasoning, differential diagnosis, and the implementation of correct therapeutic and surgical interventions. This competence is essential for veterinarians who will manage breeding programs, diagnose infertility, and assist producers in improving reproductive efficiency.

Rectal examination is one of the most essential skills for bovine reproductive practice. It allows evaluation of the uterus, cervix, and ovaries, which is crucial for determining a cow's reproductive status. The manual specifies the equipment, overalls, and boots and stresses biosecurity, hygiene, and animal welfare. Students are instructed to remove feces, carefully insert the hand, and palpate key anatomical structures including the pelvic floor, cervix, uterine body, and horns. Retracting the uterus is part of the technique to evaluate tone, volume, and contents. Special emphasis is placed on ovarian palpation, where follicles, corpora lutea, and other structures must be accurately distinguished. The manual provides a clinical code to record findings: UN (normal uterus), UE (edematous uterus), F (follicles, with size in mm), CL (Corpus luteum, in cm), CH (hemorrhagic body), and E (static ovaries).

This shorthand system enables rapid communication of results. Rectal palpation is also key for early pregnancy diagnosis, enabling detection of amniotic vesicles, membrane slip, and fetal presence. This practice develops tactile memory, manual dexterity, and diagnostic confidence in students. In Mexico, where cattle production represents a significant sector of the agricultural economy, precise rectal examinations directly influence fertility rates, calving intervals, and farm profitability. Consequently, rectal palpation is considered a core competency for veterinary graduates who will manage reproductive health in dairy and beef herds.

Pregnancy diagnosis plays a vital role in reproductive management because it allows producers to identify open cows early, rebreed them, and improve herd fertility. The manual covers two primary techniques: rectal palpation can reliably be performed from day 35 after insemination and enables detection of positive signs such as the amniotic vesicle, membrane slip, placentomes, and fetus. Students practice identifying these signs and estimating gestational age based on fetal size and uterine changes. Gentle technique is stressed to avoid embryonic loss.

The manual also introduces ultrasonography, a highly accurate, non-invasive tool that can confirm pregnancy as early as day 20 post-insemination and visualize the embryo, heartbeat, and early reproductive disorders such as pyometra or twin pregnancies. Hormonal assays, such as milk progesterone tests, are also mentioned as complementary tools, though they are less common in Mexico due to cost constraints. Accurate record-keeping of pregnancy status is encouraged as part of herd reproductive programs. Early pregnancy diagnosis reduces days open, improves calving intervals, and enhances overall profitability. In the context of Mexican production systems, where maximizing reproductive efficiency is a priority, this skill is highly valuable for veterinarians involved in herd health programs.

Knowledge of parturition and dystocia is critical for veterinarians to safeguard maternal and neonatal health. The manual explains the three stages of labor: cervical dilation, fetal expulsion, and expulsion of fetal membranes. It details the hormonal cascade that initiates parturition, including fetal cortisol secretion, prostaglandin release, and oxytocin stimulation. Recognizing normal labor progression helps veterinarians determine when intervention is necessary. Dystocia, or difficult calving, is a major cause of calf mortality and economic loss. The manual categorizes dystocia causes into maternal (pelvic narrowing, uterine inertia) and fetal (malpresentation, oversized fetus) and outlines systematic approaches for resolution.

Students are trained to assess fetal presentation, position, and posture using vaginal examination and to perform obstetrical maneuvers such as rotation, traction, and, when necessary, fetotomy. The criteria for cesarean section are also presented. Emphasis is placed on lubrication, hygiene, and correct restraint to minimize trauma and infection. Postpartum management is discussed, including care for retained placenta, uterine prolapse, and metritis. Timely intervention improves calf survival rates, reduces economic loss, and preserves the cow's future reproductive performance. In Mexican cattle operations, where calving rates and calf survival directly impact profitability, veterinarians play a key role in improving herd productivity through skilled obstetrical care.

Artificial insemination (AI) is among the most significant reproductive technologies in animal production. The manual provides detailed instruction on semen handling, estrus detection, and AI technique. Students learn to thaw frozen semen at the correct temperature, prepare AI guns, and deposit semen precisely in the uterine body at the appropriate time relative to ovulation. Hygiene, temperature control, and gentle technique are highlighted to prevent injury and optimize conception rates.

Estrus detection is emphasized as the cornerstone of AI success, with a review of behavioral signs and synchronization protocols to facilitate timed AI programs. The benefits of AI include genetic improvement using superior sires, reduction of venereal disease transmission, and increased farm safety by avoiding the need to keep bulls on-site. In Mexico, AI is widely used in dairy and beef production systems to enhance productivity and genetic progress. Record-keeping for conception rates, services per conception, and reproductive performance is encouraged as part of program evaluation. By mastering AI, students acquire a critical tool for improving reproductive efficiency and supporting producers in achieving higher profitability and herd genetic advancement.

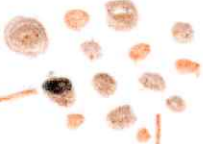
Reproductive management is the cornerstone of profitable livestock production. The manual describes comprehensive strategies for managing reproduction in dairy, beef, and dual-purpose herds. Students are taught to monitor key indicators such as calving interval, days open, conception rate, and services per conception, and to use this feed availability to maximize efficiency. Estrus synchronization protocols and controlled breeding seasons are emphasized to improve reproductive performance. Accurate record keeping of inseminations, pregnancy checks, and calving outcomes is considered essential.

Nutritional management is addressed, highlighting its role in promoting ovarian activity and fertility. In Mexican production systems, where seasonal forage shortages and heat stress are common, veterinarians must adopt management plans by recommending shade, water availability, and dietary supplementation to maintain reproductive efficiency. Biosecurity and vaccination protocols (IBR, BVD). By applying these integrated management strategies, veterinarians help producers reduce reproductive losses, improve herd health, and achieve better economic results. This multidisciplinary approach prepares future veterinarians to serve as consultants who combine physiology, nutrition, epidemiology, and farm economics to enhance productivity.

Reproductive medicine is a pillar of modern veterinary practice, and the knowledge acquired through this manual equips students with tools to become competent professionals and advisors in livestock production. Mastering reproductive anatomy and physiology enables accurate interpretation of clinical findings, while skills such as rectal palpation and pregnancy diagnosis allow veterinarians to monitor and manage fertility efficiently. Competence in artificial insemination provides opportunities to enhance genetic progress and improve herd productivity without relying on natural service bulls, which improves safety and biosecurity. The management component encourages a holistic view, integrating reproductive data with nutrition, health, and production records to support evidence-based decisions.

This approach is particularly valuable in Mexico, where cattle production must adapt to environmental stressors, disease prevalence, and market demands. Veterinarians trained in these techniques can contribute to shorter calving intervals, reduced reproductive losses, and higher profitability for producers.

In addition, they promote animal welfare by preventing dystocia-related trauma and ensuring healthy neonates. The manual fosters critical thinking, problem-solving, and the ability to evaluate outcomes, preparing graduates not only for clinical practice but also for roles in research, teaching, and industry. As a result, reproductive health management becomes a strategic tool for improving food security, genetic resources, and economic sustainability in animal agriculture.



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