



Nombre: Nataly Ayra Hernández Martínez

Nombre del docente: Arreola Jiménez Eduardo Enrique

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INTRODUCTION:

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- Research, biotechnology, and animal production.
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- Antibiotic resistance and responsible use.
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^{2020/2021} Veterinarians medicine has evolved into an evolved into an essential scientific discipline that not only addresses animal health and welfare but also impacts human health, food production, and environmental conservation. Today's veterinarians play a key role in research, disease prevention, and the development of innovative solutions that benefit society as a whole.

One of the greatest contributions of veterinary science is the creation of vaccines and medicines that help control diseases such as rabies, brucellosis, and avian influenza. These investigations not only protect animals but also prevent infections in humans and strengthen food security. At the same time veterinarians study antibiotic resistance, a global problem that threatens public health. In doing so, they promote the responsible use of drugs and explore alternative such as probiotics, preventive vaccines, and natural therapies.

Veterinary science has also driven biotechnology and assisted reproduction, with techniques such as artificial insemination, cloning, and the creation of transgenic animals. These tools contribute to improving genetics, conserving endangered species, and generating proteins useful for human medicine. Furthermore, laboratory animals, have been fundamental for testing treatments and vaccines, always under strict ethical and welfare principles supervised by veterinarians.

Finally, the One Health approach summarizes the importance of the profession: animal, human, and environmental health are closely interconnected. Under this vision, veterinarians collaborate with physicians, biologists, and authorities to prevent zoonoses, conserve ecosystems, and educate society.



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Introduction: Veterinary medicine has evolved considerably in recent decades, becoming a scientific discipline that goes beyond the basic care of animals. Today veterinarians are not only responsible for animal health and welfare but also play a crucial role in research, biotechnology, animal production, species conservation, and public health. This research aims to explore how veterinary medicine contributes to scientific development, highlighting its impact on disease prevention, the creation of vaccines and medicines, and the implementation of innovative techniques that benefit both animals and humans.

Veterinary science allows professionals to generate knowledge, design treatment protocols, and develop solutions that improve animals' quality of life. In addition, advances in biotechnology and assisted reproduction—such as artificial insemination, cloning, and the creation of transgenic animals—represent an area of innovation where veterinary medicine combines research, technology, and ethics. This integration supports species conservation, genetic improvement of production animals, and medical research, showing that the modern veterinarian is not only a practitioner but also a scientist and innovator.



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3.1 Concept of Veterinary Science and Research

Veterinary research is a scientific discipline focused on the systematic study of animals with the goal of improving their health, welfare and productivity, as well as their relationship with human health and the environment. It not only seeks to generate knowledge that helps prevent health problems, optimize animal production and contribute to species conservation.

The role of the veterinary researcher is fundamental acting as a bridge between medicine, biology, and applied science. Through controlled studies, data analysis, and the development of new technologies, veterinarians can identify disease patterns, develop innovative treatments, and contribute to the creation of public health policies. This includes the development of vaccines, medicines and assisted reproduction techniques, as well as the study of emerging diseases that affect both animals and humans.

Veterinary science also has a direct impact on animal production, biotechnology, and species conservation. For example, genetic research allows the selection of animals with desirable traits, while studies on assisted reproduction facilitate the preservation of endangered species. In addition, veterinary research contributes to public health by studying zoonotic diseases, those that can be transmitted from animals to humans, such as rabies or avian influenza.

In summary, veterinary research not only benefits animals but also has a significant impact on society, the economy, and the environment. Its multidisciplinary and scientific approach makes it possible to find innovative solutions to complex problems, consolidating veterinary medicine as a key profession in the development of animal and human health, as well as in the protection of the global ecosystem.



3.2 Contributions of Veterinary medicine to the development of vaccines and medicines.

The development of vaccines and medicines is one of the most important contributions of veterinary medicine to both animal and human health. Veterinary professionals actively participate in the research and creation of products that prevent and treat diseases in different species, including those that can be transmitted to humans known as zoonoses. The production of vaccines requires detailed studies of the pathogens that affect animals, the way they are transmitted, and how the immune system responds to them.

A clear example is the rabies vaccine, a deadly disease that affects both animals and humans. Thanks to veterinary intervention, mass vaccination programs have significantly reduced cases in many regions. Another relevant case is many regions. Another relevant case is brucellosis, which affects live stock and can be transmitted to people; veterinarians develop vaccination and management protocols to prevent its spread. Avian influenza is also a constant area of study, where veterinary medicine contributes to the creation of vaccines that protect poultry and prevent outbreaks that could affect the human population.

In addition to vaccines, veterinarians investigate and design medicines to treat infectious, parasitic, metabolic, or chronic diseases in animals. This not only improves animal health and welfare but also protects public health by reducing the risk of disease transmission. Veterinary research also contributes to the development of antibiotics, anti-inflammatories, and innovative therapies that allow diseases to be treated more efficiently and safely.



3.3 Research on Antibiotic Resistance and its impact on human and animal health

Antibiotic resistance is one of the most serious problems faced by modern medicine, both in humans and animals. Its origin is related to the excessive or inappropriate use of these drugs, which allows bacteria to develop defense mechanisms that make them harder to eliminate. Veterinary medicine plays a crucial role in researching and controlling this resistance, ensuring that antibiotics are used responsibly and effectively in companion animals, livestock, and wildlife.

Veterinarians investigate how the use of antibiotics in animals can affect public health. For example, the indiscriminate administration of antibiotics in livestock can generate resistant bacteria that when transmitted to humans through meat, milk, or direct contact, represent a significant risk. This situation has led to the development of responsible-use protocols that regulate dosage, frequency, and antibiotic type, minimizing the risk of resistance.

In addition, veterinary research seeks alternatives to traditional antibiotics, such as the use of probiotics, preventive vaccines, natural therapies, and sanitary management strategies that reduce the need for medication. These innovative solutions not only protect animal health but also contribute to the prevention of zoonotic diseases and to food security.

The role of veterinary researcher is therefore key to identifying resistance patterns, designing control strategies and educating producers and pet owners about the proper use of antibiotics. Thanks to this research, the emergence of resistant bacteria has been reduced, animal health has been protected, and human risks minimized, demonstrating that veterinary medicine is essential to global health and the well-being of all living beings.

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3.4 Biotechnology and assisted reproduction in Animals
Biotechnology and assisted reproduction are fundamental tools in modern veterinary medicine, as they make it possible to improve the health, production, and conservation of animal species. These techniques apply scientific and technological knowledge to manipulate biological processes in a controlled way, bringing benefits both to production animals and endangered species.

3.4.1. Artificial insemination

is a method of assisted reproduction that consists of depositing the male's semen directly into the female's reproductive tract, without the need for natural mating. This technique improves animal genetics, allows for the selection of desirable traits, and reduces the spread of sexually transmitted diseases. It is also a key tool in species conservation, as it facilitates the production of animals that are at risk of extinction or that live in environments where natural reproduction is difficult.

3.4.2. Cloning

Cloning consists of creating an individual genetically identical to another previously selected. Although this technique still faces ethical and technical challenges, it has proven useful in reproducing animals with exceptional genetic traits, preserving endangered species, and advancing scientific research. Cloning allows scientific research to study diseases, evaluate treatments, and conserve the genetic diversity of animal populations, ensuring that valuable characteristics are not lost.



Page - 34.3 Transgenic Animals.

Transgenic animals are those that have been genetically modified to contain genes from other species, while the goal of studying diseases, producing medicines or enhancing specific traits. This technology exemplifies the connection between science, research, and veterinary medicine, enabling significant advances in both animal health and human medicine.

The creation of transgenic animal involves introducing specific genes into the embryo or germ cell so that these are expressed in the organism. Thanks to this technique, scientist can produce animals that generate human proteins, enzymes, or antibodies necessary for medical treatments. For example, certain transgenic cows produce milk with human proteins used in therapies for genetic diseases, demonstrating how veterinary medicine contributes to the development of innovative medicines.

In addition to medical applications, transgenic animals are used in research to better understand the functioning of genes related to hereditary or degenerative diseases. This makes it possible to test new treatments and evaluate the effectiveness before applying them to human reducing risks and accelerating the development of medical solutions.

Despite their benefits, the creation and use of transgenic animals require strict ethical and regulatory standards to guarantee animal welfare and experimental safety. Veterinarians play a central role in supervising these procedures, ensuring compliance with bioethical protocols and the responsible treatment of animals.



3.5 Use of laboratory Animals in Biomedical Research

3.5.1 Ethics and Regulations The use of laboratory animals is an essential tool in veterinary and biomedical research, as it allows scientists to study diseases, test drugs, and develop treatments before applying them to humans or domestic animals. However, this practice requires a rigorous ethical approach to ensure animal welfare. International regulations exist to govern handling, housing, feeding, and experimentation ensuring that animals do not suffer unnecessary harm.

The veterinarian plays a fundamental role in supervising compliance with these regulations evaluating experimental protocols, and ensuring adherence to the "three Rs" principles: Replacement (using alternatives when possible) Reduction (using the minimum number of animals necessary), and Refinement (minimum suffering). This guarantees that research remains responsible, ethical, and reliable.

3.5.2 Contributions to Human and animal medicine. Laboratory animals have enabled significant advances in both veterinary and human medicine. For example studies in mice, rabbits, and pig have contributed to the development of vaccines, antibiotics, treatments for genetic diseases, and innovative therapies. The information obtained from these animal models provides a better understanding of organs, systems, and biological processes, as well as an evaluation of the safety and effectiveness of new medicines.

In summary, the ethical use of laboratory animals demonstrates how veterinary medicine integrates science, ethics, and technology, promoting animal welfare, advancing biomedical research, and significantly benefiting both public and animal health.



Veterinary medicines, beyond its traditional role of caring of animal health, has established itself as a key scientific discipline in research, biotechnology and public health. Through the development of vaccines medicine, assisted reproduction, techniques, and advances biotechnology, veterinarians directly contributes to the prevention and control of diseases, the improvement of animal production, and the conservation of species.

The study of antibiotic resistance and research involving laboratory animals demonstrate how veterinary medicine integrates science, ethics, and technology to generate effective and responsible solutions, protecting animal health while reducing risks to humans. The creation of transgenic animals and the use of research models make it possible to understand complex diseases and advances the development of new treatments and therapies consolidating the role of the veterinarian as both a researcher and innovator.

Likewise, the one Health approach highlights the interconnection between animal, human, and environmental health, showing that the veterinarians work goes far beyond individual animal care and has a global impact. The prevention of zoonoses, ecosystem conservation, and community education are clear examples of how veterinary medicine contributes to the planet's sustainability and well-being.



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