# Animal Science Standards and Skills

January 2025



## **Table Of Contents**

[Animal Science Standards and Skills 1](#_Toc201925235)

[Table Of Con tents 2](#_Toc201925236)

[Health & Safety Standards 4](#_Toc201925237)

[Standard 1: Safety and Health in an Animal Science Environment 4](#_Toc201925238)

[Technical & Integrated Academic Standards 5](#_Toc201925239)

[Standard 2: Role of Animal Science Professionals in Society 5](#_Toc201925240)

[Standard 3: Animal Handling and Behavior 5](#_Toc201925241)

[Standard 4: Species, Breeds and Characteristics of Animals 6](#_Toc201925242)

[Standard 5: Animal Housing and Management 7](#_Toc201925243)

[Standard 6: Comparative Animal Anatomy and Physiology 8](#_Toc201925244)

[Standard 7: Genetics, Breeding and Reproduction of Domestic Animals 9](#_Toc201925245)

[Standard 8: Animal Health and Disease Prevention 10](#_Toc201925246)

[Standard 9: Animal Nutrition and Feeding Practices 11](#_Toc201925247)

[Standard 10: Animal Welfare and Animal Rights 12](#_Toc201925248)

[Companion Animals (Standards 11 – 16) 13](#_Toc201925249)

[Standard 11: Companion Animal Agribusiness and Customer Service Skills 13](#_Toc201925250)

[Standard 12: Animal Care, Management, and Risk Assessment 14](#_Toc201925251)

[Standard 13: Competing with and Showing Companion Animals 15](#_Toc201925252)

[Standard 14: Training Companion Canines 16](#_Toc201925253)

[Standard 15: Breeding Care and Maintenance of Companion Animals 18](#_Toc201925254)

[Standard 16: Animal Health and Disease Prevention 19](#_Toc201925255)

[Pet Grooming Industry (Standards 17 – 19) 20](#_Toc201925256)

[Standard 17: Pet Grooming Facility Safety and Risk Management 20](#_Toc201925257)

[Standard 18: Customer Service and Foundational Pet Grooming Techniques 21](#_Toc201925258)

[Standard 19: Advanced Grooming Techniques 22](#_Toc201925259)

[Equine Science (Standards 20 – 27) 23](#_Toc201925260)

[Standard 20: Equine Handling and Transportation 23](#_Toc201925261)

[Standard 21: Equine Daily Care and Management 24](#_Toc201925262)

[Standard 22: Equine Housing and Facility Maintenance 25](#_Toc201925263)

[Standard 23: Equine Feeding and Nutrition 26](#_Toc201925264)

[Standard 24: Equine Health, Fitness and Disease Prevention 27](#_Toc201925265)

[Standard 25: Equine Breeding and Reproduction 28](#_Toc201925266)

[Standard 26: Equine Tack and Training 29](#_Toc201925267)

[Standard 27: Equine Business Management and Operations 31](#_Toc201925268)

[Livestock and Poultry Science (Standards 28 – 36) 32](#_Toc201925269)

[Standard 28: Livestock and Poultry Industries 32](#_Toc201925270)

[Standard 29: Livestock and Poultry Management Systems 32](#_Toc201925271)

[Standard 30: Livestock and Poultry Safety Practices 33](#_Toc201925272)

[Standard 31: Livestock and Poultry Handling, Restraint, and Transportation 33](#_Toc201925273)

[Standard 32: Livestock and Poultry Housing and Facilities 35](#_Toc201925274)

[Standard 33: Livestock and Poultry Feeding and Nutrition 36](#_Toc201925275)

[Standard 34: Livestock and Poultry Breeding and Reproduction 36](#_Toc201925276)

[Standard 35: Livestock and Poultry Health 37](#_Toc201925277)

[Standard 36: Livestock and Poultry Maintenance Practices 38](#_Toc201925278)

[Marine and Aquaculture (Standards 37 – 45) 39](#_Toc201925279)

[Standard 37: Modern Oceanographic Concepts 39](#_Toc201925280)

[Standard 38: Marine Invertebrates 40](#_Toc201925281)

[Standard 39: Mammals 41](#_Toc201925282)

[Standard 40: Mammal Training 42](#_Toc201925283)

[Standard 41: Aquariums 43](#_Toc201925284)

[Standard 42: Fish 44](#_Toc201925285)

[Standard 43: Aquaculture 45](#_Toc201925286)

[Standard 44: Birds and Reptiles 45](#_Toc201925287)

[Standard 45: Advanced Studies of Sea Turtles and Sea Birds 46](#_Toc201925288)

[Research Animal Technology (Standards 46 – 54) 47](#_Toc201925289)

[Standard 46: Introduction to Laboratory Animal Science 47](#_Toc201925290)

[Standard 47: Ethical and Regulatory Practices in Laboratory Animal Research 48](#_Toc201925291)

[Standard 48: Animal Research Laboratory Health and Safety 49](#_Toc201925292)

[Standard 49: Equipment and Caging Systems in Animal Research Facilities 50](#_Toc201925293)

[Standard 50: Lab Animal Environment 51](#_Toc201925294)

[Standard 51: Laboratory Animal Health and Care 52](#_Toc201925295)

[Standard 52: Animal Feeding, Nutrition, and Daily Care 53](#_Toc201925296)

[Standard 53: Heredity and Breeding of Laboratory Research Animals 54](#_Toc201925297)

[Standard 54: Species Used in Research 55](#_Toc201925298)

[Employability Standards 56](#_Toc201925299)

[Standard 55: Employability Skills 56](#_Toc201925300)

[Entrepreneurship Standards 57](#_Toc201925301)

[Standard 56: Entrepreneurship 57](#_Toc201925302)

[Digital Literacy Standards 57](#_Toc201925303)

[Standard 57: Digital Literacy 57](#_Toc201925304)

## Health & Safety Standards

### Standard 1: Safety and Health in an Animal Science Environment

Students will apply essential health and safety practices for managing and maintaining equipment and tools required for various roles in animal science industries, including proper use of personal protective equipment (PPE), adherence to safety protocols, safe handling of hazardous materials, and preparedness for emergency situations, in accordance with industry standards.

* Aligned Industry Recognized Credentials: OSHA10 – General Industry, HOSTA Safe Tractor and Machinery Operation Certificate

#### Skills:

1. Identify, describe, and demonstrate the effective use of Safety Data Sheets (SDS) to meet documentation requirements, including identifying animal-specific chemicals, such as disinfectants or pesticides.
2. Locate emergency equipment, e.g., first aid kit, fire extinguisher, and review the emergency action and response plan, including labels and signage in animal care facilities, following OSHA’s Hazard Communication Standard (HAZCOM).
3. Understand and apply fire safety protocols, including identification of fire hazards in animal barns, and correct use of fire extinguishers and practice evacuation procedures with animals in mind.
4. Identify and compile contact information for relevant health and safety agencies and resources, including veterinary contacts and emergency animal rescue services.
5. Demonstrate safe dress and appropriate use of PPE when working with animals, including safety glasses, gloves, boots, face mask, helmets (when working with larger animals), and respirators for animal care areas with high ammonia levels.
6. Demonstrate safe body mechanics when lifting animal feed, equipment, or restraining animals to prevent injury.
7. Identify key zoonotic pathogens that pose risks to both humans and animals, and implement preventive measures and isolation protocols to minimize transmission in various environments.
8. Demonstrate safe use, inspection, maintenance, and storage of animal-related hand and power tools, e.g., hoof trimmers, syringes, following manufacturer guidelines.
9. Describe and apply safety practices when working around electricity in animal care areas, including proper use of GFCIs and checking for hazards in animal enclosures with electrical wiring.
10. Demonstrate safe handling, application, storage, and disposal of veterinary chemicals, e.g., pesticides, medication, in compliance with EPA, local, and state regulations.
11. Identify and apply safe storage and handling of flammable and combustible materials, e.g., fuel for animal farm equipment, bedding materials, to reduce fire risks.
12. Demonstrate appropriate workspace cleaning, sanitation, disinfection, and sterilization procedures required in specific animal care environments, following Workplace Housekeeping OSHA regulations.
13. Successfully complete a safe equipment operation course, demonstrating proficiency in handling and operating machinery and tools, ensuring safety and proper maneuvering in various animal science environments, including livestock, poultry, equine, and companion animal settings.
14. Identify and describe potential consequences for non-compliance with health and safety regulations in animal science, including legal and animal welfare concerns.

## Technical & Integrated Academic Standards

### Standard 2: Role of Animal Science Professionals in Society

Students will understand the diverse roles of animal science professionals and the historical, ethical, and regulatory frameworks that influence animal welfare, public health, and industry practices.

#### Skills:

1. Identify the various professions within animal science and their impact on animal welfare, public health, and society at large, e.g., veterinarians, animal trainers, agricultural scientists, animal nutritionists, etc.
2. Identify key milestones in the history of animal domestication and breeding, explaining their influence on contemporary breeding practices, animal adaptations, and the ongoing ethical and sustainability issues arising from modern genetic selection.
3. Describe the evolution of animal husbandry and contemporary management techniques, highlighting recent advancements in animal health, productivity, and welfare practices, and how modern technologies shape these areas.
4. Demonstrate knowledge of regulatory bodies and laws affecting animal industries at both the federal and state levels, including modern animal welfare and sustainability regulations, such as the Animal Welfare Act, the Horse Protection Act, the Marine Mammal Protection Act (MMPA), and poultry production regulations.

### Standard 3: Animal Handling and Behavior

Students will develop skills to recognize animal behavioral changes and apply appropriate restraint techniques in various situations, following industry standards with an emphasis on safe, effective handling that minimizes stress for both animals and handlers.

#### Skills:

1. Compare and contrast predator and prey behavioral responses to threats and explain how these instinctual behaviors manifest in different species, e.g., a dog vs. a rabbit.
2. Assess how an animal's predator or prey status influences its behavioral response to perceived threats and how these responses inform handling strategies based on fight or flight tendencies.
3. Observe and interpret an animal's body language, appearance, e.g., posture, vocalizations, tail position, and communication signals to assess its emotional state and behavior, adjusting handling techniques accordingly.
4. Demonstrate handling strategies that consider an animal’s body language and appearance to minimize stress and enhance safety during interactions.
5. Demonstrate the safe handling and selection of tools and equipment for specific tasks, such as grooming, feeding, and restraining animals.
6. Safely transfer an animal between different housing environments, ensuring minimal stress and compliance with safety protocols.
7. Assess the transfer process to identify potential risks or signs of distress in the animal and adjust the procedure to improve safety and comfort.
8. Explain the guidelines and requirements for animal restraint procedures, ensuring compliance with industry standards.
9. Evaluate the risks involved when restraining a loose animal, considering its fight or flight response, and modify the approach to ensure handler and animal safety.
10. Demonstrate safely approaching and interacting with an animal confined in a cage or enclosure, using appropriate techniques to minimize stress and adjusting handling methods as needed.
11. Identify, describe, and select common aides used in animal handling, e.g., leashes, muzzles, catch poles.
12. Evaluate restraint procedures based on specific situations, e.g., veterinary exams, grooming and ensure adherence to ethical and safety guidelines.
13. Assess the animal’s comfort level during grooming restraint and adjust techniques as needed to reduce stress.
14. Safely restrain an animal in situations where it may pose a threat to itself, other animals, or people, e.g., aggressive behavior, medical emergencies.

### Standard 4: Species, Breeds and Characteristics of Animals

Students will identify and analyze the characteristics, traits, and environmental needs of various animal species and breeds, focusing on their suitability for specific agricultural or companion purposes, and assess the relevance of these traits to modern farming practices and pet care.

#### Skills:

1. Apply the correct terminology for gender, reproduction, age, and group classifications for common animal species, e.g., cattle, poultry, horses, dogs, etc.
2. Analyze the physical traits, production qualities, and environmental adaptations of dairy cattle, e.g., Holstein, Jersey, Ayrshire, Brown Swiss, Guernsey, Milking Shorthorn, and beef cattle, e.g., Hereford, Angus, Charolais, Simmental, Belted Galloway, and compare their relevance to farming practices, including milk and meat production.
3. Identify the characteristics and evaluate the breeding potential and suitability of various sheep breeds, e.g., Suffolk, Dorset, Hampshire, Merino, Cheviot, for specific farming environments, focusing on wool quality, meat production, and disease resistance.
4. Identify the characteristics of swine breeds, e.g., Yorkshire, Landrace, Hampshire, Duroc, Poland China, and assess their role in modern agriculture, focusing on genetic traits that influence growth rate, feed efficiency, marketability, and economic impact.
5. Identify the characteristics of various goat breeds, e.g., Angora, Boer, Alpine, Nubian, Toggenburg, Saanen, and describe their suitability for meat, milk, or fiber production.
6. Identify the characteristics and performance traits of various horse and pony breeds, such as Belgian, Shetland Pony, Morgan, Quarter Horse, Appaloosa, Arabian, Thoroughbred, Miniature Horse, and American Saddlebred.
7. Identify the characteristics, species, and breeds of birds and specialty animals.
8. Identify the characteristics and environmental needs of specialty animals, such as alpacas, llamas, bison, ostriches, and emus.
9. Identify and evaluate the characteristics, productivity, and suitability of various poultry breeds, such as Rhode Island Red, Plymouth Rock, and Leghorn, with a focus on egg-laying capacity, growth rate, and climate adaptability.
10. Classify the species of pet birds based on their size, diet, and social behaviors, e.g., Lovebirds, Cockatiels, Parakeets, Cockatoos, Amazons, and Macaws.
11. Investigate the ecological roles and care requirements of reptiles and amphibians, e.g., Iguana, Bearded Dragon, Corn Snake, Ball Python, Gecko, Newt, Firebelly Toad, White Tree Frog, Red Eared Slider, and Blue Tongued Skink.
12. Identify characteristics and breeds of dogs according to the seven groups of the AKC, e.g., sporting, hound, working, terrier, toy, non-sporting, herding, and three most popular breeds from each group: Sporting - Labrador retrievers, Golden retrievers, and Cocker Spaniels. Hounds - Beagles, Dachshunds, and Basset Hounds. Working – Boxers, Rottweilers, and Doberman Pinschers. Terrier – Miniature Schnauzers, West Highland White Terriers, and Scottish terriers. Toy- Yorkshire Terriers, Shih Tzu, and Chihuahua. Non-Sporting – Poodles, Bulldogs, and Boston Terriers. Herding – German Shepherd, Shetland Sheepdogs, and Welsh Corgis.
13. Analyze the genetic, behavioral, and physical traits of different cat breeds for suitability as pets, e.g., long hair – Persian, Maine Coon, Ragdoll, and Domestic Long Hair; Short Hair – Exotic, Siamese, Abyssinian, and Domestic Short Hair.
14. Identify the characteristics and specific dietary, environmental, and behavioral requirements of small mammals, including species and breeds such as rodents, e.g., mice, gerbils, rats, hamsters, chinchillas, and guinea pigs, and rabbits, e.g., Dutch, Holland Lop, Netherland Dwarf, New Zealand, and Rex.

### Standard 5: Animal Housing and Management

Students will identify, analyze, and apply appropriate housing and management practices for different species of animals, focusing on environmental needs, safety, sanitation, and regulatory standards.

#### Skills:

1. Identify and apply industry-specific terminology for common management practices such as breeding, feeding, housing, and health care for different animal species.
2. Identify and describe appropriate housing for various types of livestock and poultry, including cattle, sheep, goats, chickens, turkeys, and ducks, focusing on space, ventilation, and safety requirements.
3. Identify housing needs for horses, including stalls, barns, and pastures, with attention to comfort, ventilation, and safety.
4. Identify and describe housing for research and domestic rodents, such as mice, rats, gerbils, and hamsters, emphasizing containment, ventilation, and enrichment.
5. Identify and describe housing requirements for reptiles and amphibians, including terrariums, humidity control, and temperature regulation for species like snakes, lizards, and frogs.
6. Identify housing needs for birds, including aviaries for exotic species and cages for domestic birds, with an emphasis on space, ventilation, and environmental enrichment.
7. Identify housing requirements for fish and other aquatic species, including aquariums, water filtration, temperature control, and space for different species.
8. Describe appropriate kennel systems for research and domestic dogs and cats, including space, ventilation, bedding, and safety features.
9. Explain state and local guidelines and legal requirements for the housing of large and small animals, including welfare standards, zoning laws, and building codes.
10. Identify and describe the impact of adverse housing conditions, such as cold, wet, unsanitary environments, poor ventilation, odors, and inadequate lighting, and their effects on animal health.
11. Describe the importance of environmental enrichment in animal housing, particularly for companion animals, exotic pets, and zoo animals, to promote physical and mental well-being.
12. Explain the problems associated with overcrowding in animal housing, including stress, disease transmission, and behavioral issues, and ways to mitigate them.
13. Describe appropriate sanitation and cleaning methods for different types of animal housing, including waste management systems, bedding replacement, and biosecurity protocols to prevent disease transmission.
14. Explain the importance of manure and waste management strategies that meet regulatory standards, ensuring safe and environmentally responsible disposal.

### Standard 6: Comparative Animal Anatomy and Physiology

Students will understand and compare the anatomical and physiological systems of large and small animals, examining key organ systems across species, breeds, and sexes.

#### Skills:

1. Identify, label, and explain external anatomical features of large and small animals, such as the head, limbs, tail, eyes, ears, and skin, and compare these features across species and breeds.
2. Differentiate, analyze, and compare external anatomical features between species, e.g., horses vs. cows, breeds, e.g., Holstein vs. Jersey cattle, and sexes, e.g., male vs. female pigs, focusing on size, shape, and function.
3. Diagram, label, and interpret the skeletal system of large and small animals, identifying key bones, e.g., vertebrae, femur, scapula, and compare skeletal structures across species, emphasizing functional adaptations.
4. Identify and explain the structure and function of the respiratory organs in large and small animals, e.g., lungs, diaphragm, trachea, alveoli, emphasizing species-specific differences in anatomy and function.
5. Identify, explain, and compare the circulatory organs in large and small animals, e.g., heart, arteries, veins, capillaries, with an emphasis on anatomical and functional differences between species.
6. Describe and compare the digestive organs in large and small animals, e.g., stomach, intestines, liver, pancreas, and explain how digestive processes differ across species, e.g., herbivores vs. carnivores.
7. Identify, compare, and contrast reproductive organs in large and small animals, e.g., ovaries, testes, uterus, focusing on functional differences between male and female anatomy and across species.
8. Explain the functions and adaptations of the muscular system in large and small animals, e.g., skeletal muscles, tendons, ligaments, highlighting how muscle structure varies across species.
9. Analyze and compare the urinary organs in large and small animals, e.g., kidneys, ureters, bladder, urethra, and discuss species differences in excretion mechanisms, e.g., mammals vs. reptiles.
10. Identify and explain the components of the nervous system in large and small animals, e.g., brain, spinal cord, nerves, comparing neural pathways, sensory organs, and adaptations across species.
11. Identify and compare the primary organs of the endocrine system in large and small animals, e.g., pituitary, thyroid, adrenal glands, explaining their roles in homeostasis.
12. Explain the functions and adaptations of the integumentary system, skin, hair, feathers, scales, in large and small animals, comparing how different species use these structures for protection, temperature regulation, and sensory input.
13. Compare and analyze mechanisms of homeostasis, e.g., thermoregulation, osmoregulation, across species, identifying how different animals maintain body temperature, pH, and hydration.
14. Discuss how physiological processes, e.g., digestion, respiration, vary between herbivores, carnivores, and omnivores, and explain how these differences are linked to anatomical features.
15. Identify and explain anatomical and physiological adaptations that enable animals to thrive in specific environments, e.g., desert-dwelling vs. aquatic species, focusing on structural and functional changes.
16. Analyze species-specific differences in major organ systems, e.g., heart structure and function in horses vs. cows, and explain how these differences are related to species behavior, diet, and lifestyle.
17. Identify and explain how diseases or conditions, e.g., bloat in ruminants vs. colic in horses, manifest in different species, and analyze the anatomical or physiological reasons behind these differences.
18. Compare developmental changes in animal anatomy from birth to maturity, highlighting differences in organ function and size across various species and life stages, e.g., neonatal vs. adult anatomy.

### Standard 7: Genetics, Breeding and Reproduction of Domestic Animals

Students will demonstrate an understanding of animal genetics, breeding, and reproductive systems by identifying reproductive anatomy, explaining key breeding practices, calculating genetic inheritance, and evaluating modern breeding technologies.

#### Skills:

1. Identify and label the male and female reproductive organs of domestic animals, including key structures such as the testes, ovaries, uterus, and penis.
2. Differentiate between male and female reproductive anatomy across species, e.g., cattle, pigs, horses, poultry, noting species-specific features and variations.
3. Define and explain common reproductive terminology, such as estrus, gestation, parturition, fertilization, and ovulation.
4. Identify the gestation periods for different species, e.g., dairy and beef cattle, sheep, swine, dogs, cats, small mammals, horses, birds, reptiles, amphibians, and compare the physiological differences between these reproductive cycles.
5. Compare and contrast the lactation periods of dairy cows with other mammals, discussing the factors that influence milk production and duration.
6. Explain the stages of reproduction, including mating, fertilization, mitosis and meiosis, gestation, parturition, and lactation, and describe their significance in the reproductive cycle.
7. Describe the key management practices and strategies used when caring for breeding animals, including housing, nutrition, and health considerations.
8. Compare and contrast artificial insemination (AI) and natural breeding methods, discussing the advantages, disadvantages, and appropriate applications for each.
9. Explain how data and criteria are used in selective breeding, including the importance of genetic traits, performance records, and breed standards.
10. Use a Punnett square to calculate the hereditary probabilities of a simple dominant-recessive trait, applying genetic principles to breeding decisions.
11. Identify strategies to increase genetic variation in closed breeding populations, such as outcrossing and the use of crossbreeding to improve resilience and disease resistance.
12. Discuss the ethical considerations and welfare issues associated with advanced reproductive technologies in domestic animals.
13. Compare and contrast the advantages and challenges of using genetic testing for selecting breeding animals, including the impact on genetic diversity and disease resistance.

### Standard 8: Animal Health and Disease Prevention

Students will analyze and evaluate the health and disease prevention strategies used in animal care, differentiating between healthy and unhealthy animal characteristics, identifying environmental and behavioral factors that impact animal health, and applying industry-standard disease prevention and management protocols to ensure the well-being of domestic animals.

#### Skills:

1. Analyze the behavioral and physical characteristics of healthy animals, including posture, activity levels, coat condition, and feeding habits.
2. Assess the signs and behaviors of unhealthy animals, including lethargy, poor coat condition, abnormal posture, and changes in feeding or drinking patterns.
3. Examine the relationship between temperature, pulse, and respiration (TPR) values, and correlate these vital signs to the overall health status of various animal species.
4. Utilize animal health monitoring technology, e.g., temperature sensors, GPS tracking, electronic health records, to identify early signs of disease and support disease prevention strategies.
5. Evaluate the impact of environmental factors such as temperature, humidity, space, ventilation, and sanitation on the health and well-being of animals.
6. Investigate and assess common adverse environmental conditions, such as overcrowding, poor ventilation, extreme weather, and unsanitary conditions, and their potential effects on animal health.
7. Differentiate between the processes of sanitizing, disinfecting, and sterilizing, and critically evaluate which agents and methods are most appropriate for achieving each level in animal care facilities.
8. Distinguish between quarantine and isolation procedures and justify the importance of each in managing the spread of disease in animal populations.
9. Classify common causes of animal disease, including bacterial, viral, fungal, parasitic, protozoan, prion, and genetic factors, and analyze how these affect the health of animals.
10. Evaluate the concept of zoonosis and identify key zoonotic diseases that can affect both animals and humans, including transmission methods and preventive measures.
11. Compare and contrast conventional and alternative animal health management strategies, such as holistic and organic approaches, in terms of effectiveness, risks, and benefits for animal health.
12. Develop and compare preventative health practices and vaccination regimens for various species, considering factors such as age, environment, and disease risk.
13. Evaluate how local, state, and federal animal health regulations, e.g., the Animal Welfare Act, USDA regulations, influence animal health management practices, including disease prevention and the treatment of sick or injured animals.

### Standard 9: Animal Nutrition and Feeding Practices

Students will demonstrate an understanding of the fundamental principles of animal nutrition and feeding practices, focusing on the six classes of nutrients, types of animal feeds, stages of nutrition, and proper feed storage techniques.

#### Skills:

1. Identify the six classes of nutrients (carbohydrates, proteins, fats, vitamins, minerals, and water) and classify examples of each within various animal feeds.
2. Describe the role and function of each nutrient class in animal health and productivity, explaining how they support physiological processes like growth, reproduction, and energy metabolism.
3. Categorize and evaluate animal feed types, e.g., hay, silage, pelleted, extruded, based on nutrient content, species suitability, and their role in supporting animal health and performance.
4. Analyze how deficiencies or imbalances in each class of nutrients, e.g., protein, vitamins, water, can impact animal health and performance, providing examples of specific conditions that result from poor nutrition.
5. Evaluate the nutritional value and cost-effectiveness of various feed types for specific animal species, considering factors like age, production goals, e.g., growth, lactation, and health status.
6. Identify and explain the different stages of nutrition, e.g., growth, maintenance, lactation, reproduction, and performance/work.
7. Explain how the nutritional requirements of animals change at different stages of life, e.g., from growth to reproduction, and recommend appropriate feeding strategies for each stage.
8. Assess the adequacy of a nutritional plan for animals in production or reproductive stages, explaining how feed adjustments support optimal performance, health, and reproductive success.
9. Demonstrate and assess proper feed storage practices to prevent spoilage and contamination, including monitoring temperature, humidity, pest control, and ensuring compliance with industry and OSHA standards.
10. Examine the role of precision feeding techniques and emerging technologies in optimizing nutrient intake and improving feed efficiency for livestock.
11. Assess the potential of alternative feed sources, e.g., insect proteins, algae. in enhancing animal health, sustainability, and cost-effectiveness, including challenges and opportunities for integrating them into conventional feeding systems.

### Standard 10: Animal Welfare and Animal Rights

Students will understand and critically evaluate the concepts of animal rights and animal welfare, exploring historical, ethical, and legal perspectives, and develop informed viewpoints on contemporary animal science issues.

#### Skills:

1. Define and differentiate between animal rights and animal welfare, explaining the core principles and philosophical foundations of each.
2. Explain the key distinctions between animal cruelty, abuse, and neglect, and evaluate how these terms are applied in legal and ethical contexts.
3. Develop a position and debate various viewpoints on contemporary animal science issues, such as common management practices, vegetarianism, and the use of animals in research, agriculture, and entertainment.
4. Trace the historical development of the animal rights and animal welfare debate and analyze how it has shaped current animal management practices and policies.
5. Identify and explain the significance of the three Rs of research (Replacement, Reduction, Refinement) in animal experimentation, and assess their impact on improving animal welfare in research settings.
6. Describe the five basic animal freedoms as outlined by the animal welfare movement and evaluate their importance in ensuring ethical treatment of animals in various settings.
7. Explain the importance of the Animal Welfare Act, its key provisions, and its role in regulating the treatment of animals in research, exhibition, transport, and by dealers.
8. Describe the principles of animal rescue, rehabilitation, and rehoming, and assess the ethical and practical considerations of rehabilitating animals rescued from abuse or neglect.
9. Research and identify key animal advocacy groups, e.g., PETA, ASPCA, Humane Society, World Animal Protection, and describe their missions, objectives, and collaborative efforts with governmental agencies, research institutions, and other organizations in advancing animal welfare.
10. Explore new methods of reducing animal use in research by investigating innovative technologies and alternative practices.

## Companion Animals (Standards 11 – 16)

### Standard 11: Companion Animal Agribusiness and Customer Service Skills

Students will develop professional skills and industry-specific knowledge necessary for effective operation in the companion animal service sector, including customer service, retail sales, communication, and agribusiness management.

#### Skills:

1. Demonstrate professionalism through both appearance and communication, adjusting personal presentation and language to meet the expectations of the business environment.
2. Demonstrate professional etiquette across various communication channels (telephone, email, chat, social media), ensuring clarity, accuracy, and courtesy in both verbal and written interactions with clients and colleagues.
3. Utilize Customer Relationship Management (CRM) software and office management tools, e.g., Salesforce, Zoho CRM, Square, to efficiently manage customer interactions, appointment scheduling, inventory, and customer data.
4. Identify different types of customers, e.g., new, repeat, emergency, and explain the importance of tailoring customer service approaches to meet their specific needs and expectations.
5. Organize and update client records accurately, ensuring that information is stored in compliance with legal and ethical standards and can be retrieved efficiently when needed.
6. Demonstrate high-quality customer service by greeting and assisting customers professionally, handling inquiries promptly with positive language and problem-solving skills, and evaluating service based on responsiveness, empathy, reliability, and personalization to ensure customer satisfaction.
7. Apply effective conflict resolution techniques to address customer complaints, implementing a structured process that includes key components of a comprehensive policy (such as complaint resolution, escalation procedures, and strategies to restore customer confidence), while maintaining professionalism and empathy throughout the process.
8. Apply modern inventory management software tools to analyze inventory data, ensuring effective stock rotation, minimizing waste, and optimizing product availability.
9. Manage the inventory of essential tools and equipment used in agribusiness operations by tracking quantities, condition, and location to ensure availability and readiness.
10. Perform routine maintenance and ensure proper storage of agribusiness tools and equipment, following manufacturer guidelines to extend the lifespan and ensure safe, efficient use.
11. Develop a budget that includes expected revenue, fixed and variable costs, and profit goals for the business.
12. Develop and apply pricing strategies to ensure products and services are competitively priced while covering costs and generating profit.
13. Use financial software, e.g., QuickBooks, or spreadsheets to track sales, operating costs, and expenses on a daily, weekly, or monthly basis.
14. Identify and demonstrate the process of making both primary and secondary sales, emphasizing effective sales strategies that meet customer needs and drive business growth.
15. Create a compelling advertising message using multimedia, print, and/or audio technologies to effectively promote companion animal services or products to the target market.
16. Research and analyze current market trends in the companion animal industry, e.g., popular pet products, pet health trends, evaluating how these trends could influence business strategies, products, and services.
17. Develop a comprehensive marketing plan for a companion animal business, outlining strategies for customer acquisition, branding, promotional campaigns, and market positioning.
18. Evaluate entrepreneurial opportunities within the companion animal service industry, considering market demand, competition, operational costs, and industry trends.
19. Research and summarize regulations at the local, state, and federal levels that impact the companion animal industry, including health and safety standards, animal welfare laws, and business licensing requirements.
20. Explain and apply ethical principles in the treatment and care of animals, including understanding animal welfare laws, humane practices, and the responsibilities of companion animal businesses toward the animals they serve.

### Standard 12: Animal Care, Management, and Risk Assessment

Students will develop the knowledge and skills to assess and manage the risks associated with animal care, understand ethical considerations in animal management, and apply appropriate practices for animal welfare in various settings, including retail operations, animal placements, and facilities.

#### Skills:

1. Assess and explain the risks associated with interacting with various pet species, emphasizing safety and proper handling techniques in the workplace environment.
2. Evaluate key decision-making factors when selecting a pet, such as temperament, size, age, and compatibility with potential owners' lifestyles, homes, and care capabilities.
3. Identify and address safety concerns related to interactions between children and pets, emphasizing proper training, supervision, and pet selection to minimize risks.
4. Develop a set of criteria for matching potential pet owners with appropriate animals based on the owner’s experience, lifestyle, living situation, and specific pet needs.
5. Demonstrate cultural sensitivity by assessing how diverse cultural beliefs and practices influence pet care and ownership and apply this understanding to tailor services to a broad range of clients.
6. Conduct a mock interview for a potential pet placement, assessing the applicant's readiness, lifestyle, and ability to care for a pet responsibly.
7. Utilize online resources, including breed clubs, rescue organizations, and reputable breeders, to locate potential animals for adoption or placement with suitable owners.
8. Explain the unique challenges and responsibilities of housing animals in a retail environment, including space management, care, and safety protocols to ensure the well-being of the animals.
9. Demonstrate how modern technology tools, e.g., health tracking software, online adoption platforms and accurate record-keeping, e.g., health, performance, ration records support animal welfare, regulatory compliance, and effective management in animal facilities.
10. Develop a maintenance schedule for a companion animal facility, including tasks such as cleaning, painting, safety checks, and inspections to maintain a safe and sanitary environment for animals.
11. Identify and explain the problems associated with overcrowding in animal facilities, including how overcrowding can affect animal welfare, and propose solutions to ensure animals' safety and well-being.
12. Develop an enrichment program for animals housed in groups or facilities, incorporating physical, mental, and social stimulation to reduce stress and promote well-being.
13. Analyze the ethical issues surrounding euthanasia in animal care facilities, considering factors such as animal quality of life, medical treatment options, and the emotional impact on staff and owners.
14. Evaluate local and federal animal welfare regulations and develop a comprehensive animal welfare policy for a facility that ensures legal compliance and promotes humane treatment of animals.
15. Design and implement sustainable practices in animal management, such as eco-friendly pet products and waste reduction strategies, to minimize environmental impact and promote responsible pet care.

### Standard 13: Competing with and Showing Companion Animals

Students will develop the knowledge and skills necessary to understand and participate in the competitive showing of companion animals, including demonstrating showmanship, selecting appropriate breeds, understanding breed standards, and exploring the history and contracts related to animal breeding and purchasing.

#### Skills:

1. Identify and apply resources and strategies, such as digital health tracking tools, online training platforms, and social media communities, used when showing or competing with companion animals, demonstrating an understanding of how these tools enhance preparation, performance, and competition success.
2. Describe the characteristics of American Kennel Club (AKC) dog breeds by their assigned group, including traits such as temperament, size, and physical attributes.
3. Identify resources and practices associated with showing a cat, highlighting the specific requirements and techniques involved in preparing a cat for competition.
4. Describe the characteristics of Cat Fanciers Association (CFA) cat breeds, categorizing traits such as size, coat type, and personality, and utilizing online resources or breed databases to deepen understanding of breed standards.
5. Identify the characteristics of popular pocket pets, e.g., hamsters, guinea pigs, gerbils, ferrets, explaining breed differences, care, and their role in competitions.
6. Research the history and common uses of a select breed of companion animal, exploring how the breed has evolved over time and its common role in society and competitions.
7. Select a breed of companion animal and identify the official characteristics associated with the breed standard, including physical attributes, grooming requirements, and behavior traits.
8. Select a breed of companion animal and identify faults or disqualifications within the breed standard, understanding common flaws that can affect competition success.
9. Develop a quality brochure to provide information to customers about a companion animal breed selection, incorporating key traits, care requirements, and the breed's suitability for various owners.
10. Interpret different types of breeding contracts for a companion animal, analyzing terms related to health guarantees, breeding rights, and financial obligations.
11. Evaluate different types of purchasing contracts for a companion animal, evaluating conditions such as payment terms, health guarantees, and return policies.
12. Demonstrate advanced showmanship techniques for a specific dog according to AKC guidelines, applying proper posture, gait, and presentation techniques to highlight the dog’s qualities in the show ring.
13. Present a dog in a showmanship pattern, e.g., down-and-back, triangle, “L,” and “T,” demonstrating proficiency in handling and guiding the dog through each movement.
14. Conduct online research to explore the benefits of membership in professional canine handling organizations such as the Professional Handlers Association (PHA) and American Kennel Club (AKC) Professional Handlers, emphasizing networking, training, and competition opportunities.

### Standard 14: Training Companion Canines

Students will demonstrate the skills necessary to train companion animals using modern training techniques, with a focus on positive reinforcement, operant conditioning, and specialized training for service, therapy, and competitive events, while adhering to industry standards and ethical guidelines.

#### Skills:

1. Identify resources and practices of obedience training techniques, including the role of formal obedience classes, online platforms, and books, and how they enhance a dog’s behavior and training progress.
2. Understand the ethical principles in animal training, emphasizing stress-free, humane, and positive methods, and ensuring the animal’s emotional and physical well-being throughout the process.
3. Explain the benefits of pet therapy for both animals and humans, highlighting its impact on emotional well-being, stress reduction, and physical therapy in various settings, e.g., hospitals, nursing homes, schools.
4. Distinguish and categorize the differences between assistance animals, therapy animals, and emotional support animals, considering their legal definitions, training requirements, and roles in society.
5. Demonstrate training a dog in basic obedience commands (i.e., sit, heel, come, stay, down), utilizing positive reinforcement techniques to encourage desired behavior.
6. Compare and contrast training methods, specifically positive reinforcement versus punitive techniques, and evaluate their effectiveness and ethical considerations in canine training.
7. Identify and explain the fundamental principles of operant conditioning, applying these concepts to enhance training outcomes and modify behaviors in companion dogs.
8. Describe the fundamental AKC guidelines for training dogs in tracking, outlining the steps, expectations, and skills necessary for success in competitive tracking events.
9. Describe the fundamental AKC guidelines for training dogs in agility, highlighting the importance of coordination, speed, and communication between the handler and the dog during agility trials.
10. Describe the fundamental AKC guidelines for training dogs in rally obedience, including the required obedience exercises, performance expectations, and the role of the handler in guiding the dog through the course.
11. Describe the fundamental AKC guidelines for training dogs in lure coursing, detailing the basic requirements, dog behavior, and training methods used to prepare dogs for competitive coursing events.
12. Describe the fundamental AKC guidelines for training dogs in herding, including the essential commands, dog temperament, and training exercises needed to prepare for herding trials.
13. Describe the fundamental AKC guidelines for training dogs for earth dog competitions, including the necessary skills and techniques used to prepare dogs for these specialty events.
14. Describe the fundamental AKC guidelines for training dogs for hunt tests, focusing on the skills, timing, and precision required for successful performance in competitive field trials.
15. Describe the fundamental AKC guidelines for training dogs for various types of field trials, examining the specific skills and preparation involved in each discipline.
16. Demonstrate advanced obedience skill training techniques, such as group exercises, long sits and downs, and stand-for-examination, using clear communication and consistent reinforcement to achieve high levels of obedience in dogs.
17. Explore the role of technology in modern dog training, including the use of digital tools for behavior tracking, online training platforms, and virtual consultations.
18. Demonstrate teaching a dog to display a behavior using clicker training techniques, applying principles of operant conditioning to reinforce positive behaviors with a clear and consistent marker (the click) and ensuring the animal understands the behavior-reward connection.
19. Evaluate a local therapy dog training program, identifying the steps involved, program structure, and the specific requirements for dogs to become certified therapy animals.
20. Identify certification requirements for service animals in specialized roles, e.g., mobility assistance, medical alert, and explain how they differ from therapy and emotional support animals.
21. Document and track the timeline for dogs enrolled in canine assistance training program, detailing the key milestones, training objectives, and progress assessments during the training process.
22. Demonstrate techniques for modifying undesirable behaviors in dogs, including desensitization, counterconditioning, and handling fear or aggression in a training context.

### Standard 15: Breeding Care and Maintenance of Companion Animals

Students will understand the principles of breeding, selection, and care for companion animals, including understanding genetics, health screening, and proper breeding practices.

#### Skills:

1. Analyze and interpret pedigrees to identify key genetic traits, ancestral lineages, and potential health risks associated with specific breeding lines, explaining how this information informs breeding decisions.
2. Explain the importance of genetic testing for inherited diseases, e.g., hip dysplasia, heart conditions, demonstrating how health clearances ensure responsible breeding practices and improve long-term health outcomes for companion animals.
3. Evaluate the selection criteria for choosing a brood bitch or queen, considering health, temperament, genetics, and physical condition, and explain how these factors ensure a successful breeding process.
4. Evaluate the selection criteria for choosing a stud dog or tom cat, including genetic health, behavioral traits, and compatibility with the brood animal, ensuring optimal outcomes for offspring.
5. Design and describe the purpose of a whelping box, outlining its essential features (size, structure, safety) to ensure the well-being of the mother and her puppies or kittens during birth and early stages.
6. Explain the stages of labor in companion animals, identifying key physical and behavioral signs during each phase and the appropriate care required for the mother and offspring.
7. Describe the grading and selection of puppies or kittens, considering health, temperament, conformation to breed standards, and suitability for specific roles, e.g., pets, service animals, breeding stock.
8. Explain how temperament testing in puppies helps assess behavioral traits such as socialization, confidence, and trainability, and how this influences the suitability of the animal for specific roles, e.g., service dog, family pet.
9. Describe the developmental stages of a dog, highlighting key milestones in physical and behavioral development, and explain how these stages impact training, care, and socialization.
10. Identify and describe canine and feline body language, including common signals of stress, fear, aggression, and relaxation, and explain how this knowledge informs breeding, handling, and training practices.
11. Explain the genetic principles of dominant and recessive genes and their role in the inheritance of traits, e.g., coat color, size, temperament, in companion animals, applying these concepts to breeding decisions.
12. Describe the function and purpose of the Orthopedic Foundation for Animals (OFA), explaining how it evaluates and certifies the health of animals and how breeding decisions based on these evaluations impact the health of offspring.
13. Design and build a functional whelping box for a specific breed of dog, considering the breed’s size, structure, and safety needs, to ensure the well-being of the mother and puppies during the birthing process.
14. Explain how dogs are selected for specialized purposes, e.g., mobility assistance, nose work, search and rescue, emphasizing the importance of traits such as temperament, drive, and physical ability in suitability for these roles.
15. Complete a Punnett square for a real or hypothetical breeding pairing, predicting the genetic outcomes of specific traits, e.g., coat color, temperament, and explain how dominant and recessive genes influence these traits.
16. Define the term "health clearances" in relation to breeding and explain why genetic screening for common inherited diseases, e.g., hip dysplasia, heart conditions is critical for maintaining the health and longevity of companion animals.
17. Explain the significance of the Canine Health Information Center (CHIC) number, describing how it serves as a tool for breeders to track genetic health clearances and certifications, and how it supports responsible breeding practices.
18. Explain the key aspects of post-birth care for the mother and offspring, including proper nutrition, monitoring the health of puppies or kittens, and early socialization practices to ensure healthy development.
19. Discuss the ethical considerations in companion animal breeding, including the importance of adhering to breed standards, avoiding overbreeding, and prioritizing the health and welfare of both the mother and offspring.

### Standard 16: Animal Health and Disease Prevention

Students will demonstrate their understanding of animal health by applying preventive care practices, first aid techniques, and nutrition management for companion animals.

#### Skills:

1. Demonstrate routine preventive health care practices, e.g., dental care, grooming, parasite prevention, for a specific pet species.
2. Describe specific behavioral indicators that may indicate illness or injury and explain the rationale for intervention.
3. Evaluate how specific enrichment activities, e.g., puzzle toys, outdoor exercise, impact a pet's overall well-being and behavior.
4. Evaluate the contents of an animal first aid kit, considering the needs of various pets in different emergencies.
5. Identify and demonstrate the protocols and hands-on techniques for first aid in common pet injuries and conditions.
6. Accurately measure and record vital signs (temperature, pulse, respiration) on a companion animal, and compare to species-specific norms.
7. Demonstrate the proper technique for using a stethoscope and measuring vital signs to assess the health of a companion animal.
8. Explain vaccination schedules and their significance for different species.
9. Assess and categorize treatment options for common pet diseases, considering their effectiveness and application.
10. Examine methods of parasite prevention, treatment, and control, evaluating their applicability to different pets.
11. Describe basic nutritional needs based on species and age.
12. Compare and contrast different diet plans, analyzing pros and cons for specific species or conditions.
13. Develop and conduct a research project that investigates new innovations in pet food, nutritional analysis, or various diets and feedstuffs, analyzing the impact on pet health.
14. Identify signs of chronic conditions and describe long-term management strategies, including medication, diet, and lifestyle changes.
15. Demonstrate the proper techniques for administering both oral and injectable medications for treating chronic conditions in companion animals.

## Pet Grooming Industry (Standards 17 – 19)

### Standard 17: Pet Grooming Facility Safety and Risk Management

Students will develop the skills to assess safety hazards, design a compliant grooming facility, and implement effective risk management and emergency procedures, all while adhering to industry standards to ensure a safe environment for both pets and grooming professionals.

#### Skills:

1. Assess and analyze common safety hazards in the pet grooming environment, including risks related to client-owned animals, and develop strategies for minimizing these risks.
2. Develop and implement solutions to manage risks and liabilities inherent to pet grooming operations, including managing exposure to zoonotic diseases and aggressive animals.
3. Evaluate safety features of grooming tools and equipment to ensure their safe operation, maintenance, and compliance with industry standards.
4. Demonstrate the proper use of protective equipment, e.g., gloves, aprons, safety glasses, and ergonomic techniques, e.g., posture, lifting, during grooming procedures to reduce risks and prevent injury.
5. Analyze safety protocols for using grooming equipment, ensuring safe operation, proper maintenance, and the prevention of accidents.
6. Interpret the importance of working safely around animals in a grooming setting, including safe handling, restraint, and behavior management techniques to reduce injury to animals and groomers.
7. Identify key design concepts and safety features necessary for a professional grooming establishment, including facility layout, client interaction areas, and areas for animal care.
8. Evaluate the requirements for a safe and effective grooming facility, considering factors such as lighting, ventilation, safety exits, flooring, and accessibility for both animals and humans.
9. Investigate the licenses, permits, and processes required to start and operate a pet grooming business in Massachusetts, ensuring compliance with local zoning laws and health regulations.
10. Create a comprehensive safety plan for a grooming shop that addresses potential hazards and outlines emergency response protocols, including fire safety, evacuation plans, and first aid procedures.
11. Demonstrate the procedures to clean and sanitize a grooming facility in accordance with industry standards and OSHA regulations, ensuring proper sanitation of tools, surfaces, and the environment.
12. Evaluate and develop a comprehensive emergency response plan for a grooming facility, ensuring proper protocols for medical emergencies, accidents, and pet injuries.
13. Demonstrate basic first aid procedures for pets in a grooming context, including handling common injuries and responding appropriately in emergency situations.
14. Assess the safety of grooming areas and identify potential hazards that could lead to accidents, developing corrective actions to mitigate risks.
15. Assess and manage the risks involved in working with client-owned animals, including procedures for handling aggressive animals, animals with special needs, or animals in distress.
16. Compare the pros and cons of the mobile grooming industry in terms of customer service, logistics, safety, and operational effectiveness.
17. Evaluate a local mobile grooming service for its safety standards, operational effectiveness, and compliance with legal regulations.
18. Design a mobile grooming setup that adheres to safety standards, ensuring that it is functional, compliant, and safe for both pets and groomers***.***

### Standard 18: Customer Service and Foundational Pet Grooming Techniques

Students will demonstrate foundational animal grooming skills consistent with industry standards, focusing on grooming techniques, proper tool use, animal handling, client communication, and the safe application of grooming procedures for a variety of companion animals.

#### Skills:

1. Demonstrate communicating professionally with clients to assess their pet’s grooming needs, preferences, and any special requirements, e.g., allergies, skin conditions, or behavioral concerns.
2. Explain grooming procedures to clients, including the types of services offered, the expected results, and any safety protocols that will be followed during grooming.
3. Provide recommendations on grooming products, e.g., shampoos, conditioners, or flea treatments, based on the pet's breed, skin type, and specific grooming needs.
4. Advise clients on aftercare, such as brushing routines, skin care, and ongoing parasite prevention, ensuring clear and professional guidance.
5. Document client requests, preferences, and any special instructions in the grooming records to ensure consistency and quality of service for future appointments
6. Identify and select the appropriate tools needed in the grooming industry.
7. Demonstrate proper techniques for handling and restraining an animal for grooming procedures.
8. Recognize and respond to behavioral signs of stress or aggression in animals during grooming, applying appropriate safety protocols and behavioral modification techniques.
9. Apply brushing-out techniques to groom animals effectively.
10. Demonstrate de-matting techniques for a dog.
11. Demonstrate de-matting techniques for a cat.
12. Identify, categorize, and evaluate different types of shampoos and conditioners commonly used in the grooming industry, selecting the appropriate products based on the pet’s skin type, coat condition, and grooming needs.
13. Prepare a diluted shampoo solution from concentrate according to a specified concentration.
14. Demonstrate the process of bathing a dog, cat, or rabbit.
15. Demonstrate how to bathe additional small animal species, e.g., ferret, guinea pig, etc.
16. Evaluate the advantages and disadvantages of using a HydroSurge system for bathing animals in a professional grooming setting.
17. Identify various types of dryers used in a grooming shop, e.g., force dryers, hot air dryers, and their uses.
18. Demonstrate how to properly dry a dog and a cat after bathing.
19. Demonstrate proper nail trimming techniques for dogs and cats.
20. Demonstrate how to clean the ears of animals being groomed.
21. Research and develop a comprehensive pricing structure for a grooming business by investigating local industry trends, analyzing service pricing in your area, and creating a price list categorized by breed and services offered.

### Standard 19: Advanced Grooming Techniques

Students will demonstrate advanced grooming techniques, including clipping, equipment maintenance, specialized cuts, and proper safety protocols, while adhering to industry standards.

#### Skills:

1. Demonstrate proper grooming equipment maintenance, including cleaning, lubrication, and storage of tools to ensure longevity and safety.
2. Explain the various clipping techniques used for dogs and cats, including the difference between breed-specific cuts and general grooming trims.
3. Demonstrate advanced clipping techniques for both a dog and a cat, ensuring precision and industry-standard results.
4. Perform at least one specialized grooming cut for a dog, demonstrating proficiency in breed-specific styles and detailing.
5. Identify and analyze the roles and practices of professional grooming organizations, e.g., New England Pet Grooming Professionals (NEPGP), and their impact on the grooming business.
6. Evaluate the circumstances under which a professional groomer may apply a muzzle to an animal for safety and comfort, considering animal behavior and safety protocols.
7. Compare the different types of muzzles available for grooming purposes, critiquing the advantages and disadvantages of each type.
8. Demonstrate the correct procedure for safely applying a muzzle to an animal, following industry standards for animal welfare.
9. Given a fixed budget, design a comprehensive grooming kit, cataloging the necessary items to groom various companion animals, ensuring cost-effectiveness and practicality.
10. Identify and describe the appropriate specialty clips used for specific breeds, e.g., Poodle, English Springer Spaniel, Cairn Terrier, explaining the significance of breed-specific grooming.
11. Design a creative clip for a Standard Poodle, incorporating grooming techniques that align with breed standards and client preferences.
12. Demonstrate and describe three distinct clipping/trimming techniques for grooming a dog’s foot, e.g., poodle foot, round foot, retriever foot, explaining the purpose and benefits of each style.
13. Demonstrate and describe the specific procedure for clipping a Standard Poodle’s face, adhering to breed standards and industry expectations.
14. Demonstrate and describe a body clip for a specific breed, such as the lamb cut for a Standard Poodle or a retriever clip for a Portuguese Waterdog, explaining the technique and its purpose for the breed.
15. Identify and describe show grooming standards and techniques for specific breeds, e.g., Poodles, Schnauzers, Terriers, emphasizing breed conformation and presentation requirements for competitive events.
16. Identify and describe the use of specialized grooming products for advanced grooming procedures, e.g., degreasers, conditioning treatments, texturizers, corded coat products, etc.
17. Recognize potential health concerns during grooming, e.g., hotspots, cuts, skin conditions, or parasite infestations, and take appropriate action to ensure the animal’s well-being.
18. Research and analyze current trends in the pet grooming industry, such as the introduction of eco-friendly products, new grooming tools, or emerging grooming styles, e.g., creative color applications or innovative grooming cuts.

## Equine Science (Standards 20 – 27)

### Standard 20: Equine Handling and Transportation

Students will demonstrate safe and humane handling and transportation of horses, applying industry practices and safety standards to ensure the well-being of both the horse and handler.

#### Skills:

1. Evaluate different handling methods in various environments and select the most appropriate techniques that ensure the safety of both the handler and the horse.
2. Analyze how a horse’s prey instincts and monocular vision contribute to its tendency to spook and apply strategies to mitigate this behavior.
3. Demonstrate the safe and effective haltering of a horse, ensuring proper positioning and minimizing stress for the animal.
4. Analyze the horse’s behavior and adjust leading techniques to ensure calmness and safety during movement.
5. Evaluate the security and safety of a quick-release knot and adjust if necessary to ensure emergency accessibility.
6. Apply alternative restraint methods effectively, ensuring the horse’s safety while maintaining control for the intended procedure.
7. Demonstrate the correct use of a chain lead over the horse’s nose to enhance control without causing unnecessary discomfort.
8. Evaluate the appropriate use of a twitch in various situations, ensuring its effectiveness and humane application.
9. Demonstrate procedures for safely moving horses in and out of housing areas and turnouts, minimizing stress and maintaining control.
10. Demonstrate proper leading techniques for inspections, ensuring the horse is calm and properly presented for evaluation.
11. Evaluate the effectiveness of a lip chain and apply it ethically when necessary to control the horse.
12. Identify the regulations and documents for inter- and intrastate transport, ensuring compliance with all requirements before transport.
13. Evaluate different trailering options based on the horse’s needs and select the most appropriate method for safe transport.
14. Identify the recommended safety equipment, e.g., extra halter, rope, flares, etc., for horse transport and ensure they are included in the transportation tool kit.
15. Evaluate and apply appropriate limb and head protection for the horse to prevent injury during transport.
16. Plan a transport route with appropriate stops for feeding and watering, ensuring the horse’s health and comfort during long trips.
17. Analyze truck and trailer specifications and licensing requirements, ensuring all criteria are met for safe and legal transport.
18. Demonstrate proper loading techniques for transporting a horse, ensuring calmness and safety throughout the process.

### Standard 21: Equine Daily Care and Management

Students will demonstrate proficiency in the daily care and management of horses, including evaluating facility safety, performing grooming and hoof care, managing mane maintenance, and understanding equine anatomy and conformation to ensure overall health and well-being.

#### Skills:

1. Evaluate potential risks in equine facilities and apply safe working practices to minimize hazards for both the horse and handler.
2. Create an accurate diagram of external equine anatomy and label the key anatomical structures.
3. Analyze the horse’s conformation and identify key features that contribute to its athleticism, soundness, and overall suitability for specific disciplines.
4. Explain how a horse’s anatomy and conformation collectively influence its performance abilities, endurance, and suitability for various tasks.
5. Demonstrate proper grooming techniques using the appropriate tools to maintain the horse’s coat and overall health.
6. Demonstrate safe and effective hoof cleaning techniques, ensuring proper care and assessment for health concerns.
7. Diagnose and treat thrush in a horse’s hooves by identifying symptoms and recommending treatment options.
8. Demonstrate safe mane-pulling techniques, achieving a neat and manageable length with minimal stress for the horse.
9. Apply a standing stable wrap securely to support a horse’s leg, ensuring comfort and proper positioning.
10. Apply a poultice or sweat to a horse’s leg to reduce swelling or discomfort, demonstrating proper technique.
11. Use and maintain small animal clippers according to manufacturer guidelines for optimal performance.
12. Demonstrate use and maintenance of large animal clippers following industry best practices to ensure continued effectiveness.
13. Demonstrate basic barn clipping techniques to maintain a clean, manageable coat, prioritizing the horse’s comfort.
14. Measure and apply blankets, sheets, or scrims to ensure proper fit and comfort for warmth or protection.
15. Analyze the benefits and drawbacks of keeping a horse barefoot and discuss its implications for health and performance.
16. Develop a yearlong shoeing schedule for a horse, coordinating with the farrier based on the horse’s needs.
17. Demonstrate the technique for a trace clip, managing the horse’s coat to ensure it remains functional and comfortable.
18. Perform a full body clip on a horse, achieving even coverage, minimizing stress, and ensuring the horse’s comfort.
19. Demonstrate two techniques for thinning or shortening a horse’s mane, e.g., scissors, clippers, or other tools, applying the most effective method for the desired result.
20. Demonstrate or explain proper clipping techniques for a show horse in two specific disciplines, ensuring show-readiness.
21. Demonstrate the correct application of boots or wraps to provide support and protection for a specific discipline.
22. Demonstrate proper braiding techniques for a horse’s mane, ensuring neatness and adherence to competition standards.

### Standard 22: Equine Housing and Facility Maintenance

Students will demonstrate the ability to maintain a safe, healthy, and sustainable equine environment by applying industry-standard practices in facility maintenance, pasture management, and riding ring care, while ensuring horse welfare through effective bedding, fencing, water systems, and hazard identification.

#### Skills:

1. Demonstrate an understanding of equine housing, ensuring the environment meets the needs of the horse’s health and safety.
2. Apply industry-standard cleaning practices to maintain a clean, safe, and hygienic stall and barn environment.
3. Evaluate the use of automated systems, e.g., temperature, humidity, and ventilation control systems, to maintain optimal conditions in horse housing and stabling areas.
4. Conduct a thorough safety check on an equine facility, identifying and correcting hazards to ensure safety.
5. Compare and contrast different bedding materials including environmentally sustainable bedding materials, e.g., recycled paper, hemp, sawdust alternatives, and demonstrate the installation and removal of each.
6. Analyze and compare three types of equine fencing, evaluating the benefits and drawbacks of each for safety and durability.
7. Evaluate and discuss the five key factors for effective pasture management, including footing, shelter, forage, rotation, and herd dynamics.
8. Analyze the advantages and disadvantages of automatic waterers for horses and explain their impact on horse care and facility management.
9. Identify five toxic plants commonly found in New England and explain their potential effects on equine health.
10. Research and develop sustainable manure management strategies, including the use of composting systems and waste-to-energy technologies, to reduce environmental impact while maintaining barn hygiene.
11. Evaluate and compare five different footing materials for a riding ring, considering durability, safety, and cost-effectiveness.
12. Create a comprehensive plan for the daily and annual care and maintenance of a riding ring to ensure optimal conditions for riding.

### Standard 23: Equine Feeding and Nutrition

Students will develop the ability to design and implement comprehensive, sustainable feeding programs tailored to a horse’s nutritional needs, while addressing common feeding-related health issues, including colic, laminitis, and feeding challenges specific to working horses, to optimize overall equine health, performance, and well-being.

#### Skills:

1. Evaluate and implement sustainable feeding practices, including the use of locally sourced forage, eco-friendly feed options, and reducing waste in equine nutrition.
2. Analyze typical eating patterns of horses and explain how these patterns influence feeding schedules and management.
3. Evaluate the nutritional needs of different horse breeds and uses and recommend appropriate feeds to meet those needs.
4. Evaluate the quality of grain, hay, and supplements, ensuring they meet the nutritional requirements of the horse.
5. Develop and implement a comprehensive feed management system that utilizes digital tools and smart technologies, e.g., feeding apps, automated feeding systems, to optimize feeding schedules, track nutritional intake, and monitor hydration, equine behavior, and health in real-time, improving overall horse health, performance, and well-being.
6. Categorize horses by breed and use and determine their specific nutritional requirements for optimal health.
7. Assess the body condition of horses using a standardized scoring system to guide nutritional adjustments.
8. Measure the height and weight of a horse accurately, using appropriate tools and methods for each.
9. Identify the parts of the horse’s digestive tract and explain their role in nutrient absorption and overall health.
10. Identify common symptoms of colic and formulate a list of signs that indicate potential colic in a horse.
11. Explain common treatments for colic, including immediate interventions and veterinary protocols.
12. Identify and apply immediate management protocols for a suspected colic case, ensuring proper care until veterinary help arrives.
13. Analyze feeding problems specific to working horses, e.g., azoturia, and discuss strategies to prevent and manage them.
14. Explain the underlying causes of laminitis, its association with overfeeding, and discuss effective prevention strategies for horses at risk.
15. Explain how laminitis affects the horse’s health and mobility, including long-term consequences.
16. Identify effective treatment protocols for managing laminitis and implement appropriate interventions.

### Standard 24: Equine Health, Fitness and Disease Prevention

Students will develop the skills to create and implement comprehensive health management, fitness, and disease prevention plans for horses, including conducting health assessments, applying veterinary protocols, analyzing fitness levels, and addressing specific health concerns and treatments.

#### Skills:

1. Design and implement a preventive health program for a horse, incorporating vaccinations, parasite control, and regular health checks.
2. Evaluate the effectiveness of an existing equine health management plan, providing recommendations for improvement based on horse health data.
3. Analyze the normal behavior of a horse, recognizing behavioral changes that may indicate health issues or stress.
4. Demonstrate taking and interpreting the temperature, pulse, and respiration (TPR) of a horse, applying industry standards to assess the horse’s health status and determine the need for intervention.
5. Explain and demonstrate the procedures for administering equine medications and vaccinations, ensuring compliance with veterinary protocols and industry standards.
6. Evaluate the effectiveness of a vaccination program and adjust the schedule or protocols based on the specific needs of the horse.
7. Analyze equine medical emergencies, determining the best course of action and ensuring clear communication when contacting a veterinarian.
8. Develop a set of emergency procedures for equine medical incidents, incorporating first aid techniques and preparation for immediate veterinary care.
9. Evaluate and implement integrated strategies for the control, treatment, and prevention of internal and external parasites in horses, using evidence-based practices.
10. Analyze common equine diseases, identifying key methods of control, treatment, and prevention, and justify the importance of vaccination and deworming schedules in disease management.
11. Identify and differentiate between common unsoundness and blemishes in horses, assess their effects on performance and health, and recommend corrective actions or treatments.
12. Apply appropriate dental care procedures, including identifying common dental problems and floating teeth, to improve the overall health and comfort of the horse.
13. Design a comprehensive fitness program for a horse recovering from an injury or illness, integrating conditioning exercises and appropriate rest periods to ensure safe recovery and return to performance.
14. Assess the need for conditioning programs based on the type of activity (eventing, racing, endurance) and design fitness plans that address recovery times and performance goals specific to each discipline.
15. Compare and contrast the health benefits and risks of alternative therapies, e.g., acupuncture, chiropractic care, massage for horses, evaluating their effectiveness based on specific health conditions.
16. Design a fitness program to safely transition an unfit horse into a fit one, gradually increasing exercise intensity, incorporating proper nutrition, and using monitoring techniques to ensure safe conditioning and optimal performance.
17. Conduct a lameness evaluation, analyzing limb anatomy and identifying signs of discomfort or injury, and create a treatment plan to address the condition.
18. Evaluate the signs and symptoms of conditions requiring immediate veterinary attention, providing a critical analysis of how to manage the situation until professional care is available.

### Standard 25: Equine Breeding and Reproduction

Students will develop an understanding of equine breeding and reproduction, including evaluating breeding stock, utilizing modern reproductive techniques and technologies, managing pregnancy, and assessing various breeding methods such as artificial insemination and live cover, with a focus on ethical and legal considerations.

#### Skills:

1. Evaluate horses for potential breeding stock, assessing conformation, genetic pedigree, and reproductive health using modern tools such as genetic testing and reproductive evaluations.
2. Explain the seasonality, estrous cycle, and signs of estrus in the mare, applying reproductive management techniques to optimize breeding efficiency.
3. Explain the use of breeding stocks, including their role in ensuring the health and safety of both mare and stallion during breeding, and how technology, e.g., automated breeding stocks, can assist in managing breeding programs.
4. Implement management strategies to enhance fertility and reproductive efficiency, incorporating practices such as nutritional optimization, controlled lighting, and advanced reproductive technologies like hormone manipulation and embryo transfer.
5. Explain methods of pregnancy testing in horses, covering traditional (ultrasound, blood tests) and modern methods, e.g., hormone assays, genetic testing, to confirm pregnancy and monitor fetal health.
6. Identify and explain the stages of gestation in a mare, incorporating the use of digital monitoring tools and techniques, e.g., fetal heart rate monitors, ultrasound imaging, to ensure maternal and fetal well-being.
7. Identify and explain the stages of foaling in a mare and apply modern tools like foaling cameras and foaling alarms to monitor and ensure the safe delivery of the foal.
8. Explain equine parturition, including normal and abnormal presentations, and detail the procedures for birth assistance and emergency protocols, incorporating modern veterinary interventions and equipment.
9. Understand the importance of colostrum and the critical window for its consumption, highlighting best practices for collecting, storing, and administering colostrum to foals in a timely manner to support immunity.
10. Describe the implications of a retained placenta, identifying preventive measures and modern interventions, e.g., pharmaceutical treatments, monitoring systems, to ensure rapid resolution and avoid complications.
11. Explain industry safety protocols related to stallion behavior, including handling and behavioral assessment tools, e.g., behavior analysis software, restraint techniques, ensuring the safety of handlers and mares.
12. Understand stallion housing and handling, including the importance of socialization, exercise, and controlled environments, and how modern reproductive technologies, e.g., semen collection equipment, are integrated into stallion management.
13. Identify the age at which horses reach sexual maturity, considering genetic factors and individual development, and use monitoring tools, e.g., hormonal assays to track the readiness for breeding.
14. Compare and contrast the advantages and disadvantages of pasture mating, live cover, fresh, cooled, and frozen semen breeding options, analyzing the cost-effectiveness, risks, and benefits of each method based on the goals of the breeding program.
15. Understand the variability of legal regulations surrounding the use of artificial insemination (AI) in horses, including ethical considerations, jurisdictional differences, and the evolving technology and laws affecting reproductive practices in the equine industry.

### Standard 26: Equine Tack and Training

Students will demonstrate an understanding of equine tack, training techniques, and industry standards, including proper saddle and bridle fitting, the use of training aids, and discipline-specific riding skills.

#### Skills:

1. Compare and analyze the effectiveness of different bits and saddles, explaining their functions, construction, and impact on horse communication, control, and performance across various disciplines.
2. Demonstrate proper bridle and saddle fitting, ensuring correct fit, comfort, and safety for the horse, while addressing common fitting problems.
3. Design and implement a complete tack setup tailored for a specific discipline, optimizing comfort, control, and safety for both horse and rider.
4. Evaluate and compare various training aids, bits, and saddles, detailing how each works and their impact on horse behavior, training, welfare, and fit for specific disciplines.
5. Demonstrate the correct fitting process for Western and English saddles, ensuring optimal fit, comfort, and function for both horse and rider.
6. Assess and apply the proper use of various training aids and devices, selecting the most appropriate tools for different training scenarios and evaluating their impact on training and welfare.
7. Demonstrate equitation and show-ring skills, analyzing alignment with current industry standards for specific disciplines.
8. Demonstrate and evaluate the correct mounting and dismounting techniques for both riding horses and boarding or exiting a cart.
9. Explain and demonstrate the various gaits of a horse, evaluating their quality and how they affect performance.
10. Assess and demonstrate basic riding or driving skills, explaining their importance for training and discipline-specific requirements.
11. Walk and trot a horse under control, evaluating movement and performance.
12. Present a horse in hand professionally, demonstrating effective leading techniques and presentation skills.
13. Analyze and explain the phases of a horse jumping an obstacle, emphasizing timing, technique, and preparation.
14. Differentiate between related, closely related, and unrelated fences in jumping courses, explaining the rider’s approach, and timing.
15. Design and evaluate striding and lines for a jumping course, applying principles of distance, rhythm, and balance.
16. Set up and evaluate a trotting pole course leading to a cross-rail jump, considering stride length and coordination.
17. Assess the design and setup of five types of fences used in stadium jumping, analyzing their suitability for various skill levels.
18. Design a safety plan for disciplines outside the arena, based on US Polo Association Equine Welfare Standards.
19. Compare and contrast five types of jumps in cross-country and hunting, analyzing the techniques required for each.
20. Demonstrate and evaluate lunging and longlining techniques, emphasizing control, safety, and training principles.
21. Analyze equine behaviors and instincts, explaining their influence on training methods and human-horse interactions.
22. Compare and contrast five equine disciplines, evaluating their specific requirements and training techniques.
23. Explain the requirements and training principles for horses in various competitive disciplines, including racing.
24. Assess the benefits of disabled riding programs, emphasizing their impact on participants and horses.
25. Identify and analyze five career pathways in the equine industry, evaluating the necessary skills, training, and qualifications for each.
26. Diagram and assess the pyramid of training, explaining its relevance in creating an effective horse training program.
27. Identify and evaluate key equine industry organizations (FEI, USEF, USDF, etc.), comparing their roles and standards in equine sports and activities.
28. Research and assess various equine industry licenses and certifications, evaluating their impact on professional development and career opportunities.
29. Compare and contrast different theories or methods of horse training, evaluating their effectiveness for various equine behaviors.
30. Design and demonstrate a longlining exercise, explaining its purpose and benefits in horse training.

### Standard 27: Equine Business Management and Operations

Students will develop a comprehensive understanding of the business side of the equine industry, including legal, financial, and operational aspects.

#### Skills:

1. Analyze key components of the equine industry from an agribusiness perspective, including management, marketing, financial considerations, and customer relations.
2. Evaluate the role of agribusiness practices in the long-term sustainability and profitability of equine operations.
3. Explain the importance of accurate record keeping in equine businesses (for horse care, breeding, finances, and operations) and demonstrate how to create and maintain an efficient, legally compliant system.
4. Examine key state and federal legal requirements, including Massachusetts General Law 128D, and assess their impact on liability, risk management, and compliance in equine businesses.
5. Design an emergency plan for a stable or equine facility, covering emergency response protocols for health crises, natural disasters, and accidents.
6. Assess the various costs associated with owning and maintaining a horse, including feed, veterinary care, equipment, and insurance, and create a comprehensive annual budget for horse care, considering all relevant costs.
7. Explain the significance of contracts and waivers in protecting businesses and clients, with a focus on leasing, boarding, and employment agreements and assessing their role in liability protection.
8. Explain the purpose and benefits of a pre-purchase exam for evaluating the health and soundness of a horse before purchase.
9. Create a checklist for conducting or overseeing a pre-purchase exam to ensure all relevant health issues are addressed.
10. Research and identify local animal control laws and regulations related to equine care, including permit and license requirements.
11. Research and explain the criteria and process for obtaining a Massachusetts Riding Instructor’s license, including required qualifications and examinations.
12. Identify and compare three relevant industry certifications, such as PATH International, Certified Horsemanship Association, or USEF Trainer Certification, and analyze the benefits and limitations of each.
13. Create a recommendation guide for equine professionals, helping them select the best certification based on their career goals and interests.
14. Evaluate ethical considerations and develop a comprehensive plan for transitioning horses out of active service, including retirement, rehoming, and rehabilitation options.

## Livestock and Poultry Science (Standards 28 – 36)

### Standard 28: Livestock and Poultry Industries

Students will develop an understanding of the livestock and poultry industries, including species-specific terminology, product markets, and value-added opportunities.

#### Skills:

1. Demonstrate a comprehensive understanding of the livestock and poultry industries, including the role these sectors play in global and local food systems.
2. Utilize and apply industry-standard terminology for livestock and poultry species in various contexts, such as breeding, feeding, and health management.
3. Analyze and identify the diverse products and markets within the livestock and poultry industries, evaluating consumer trends, market segmentation, and demand for animal-based products.
4. Investigate niche markets and value-added products in the local livestock and poultry industry, analyzing opportunities for innovation and differentiation.
5. Demonstrate knowledge of Good Agricultural Practices (GAP) and its role in food safety and quality assurance, ensuring sustainable and ethical farming practices.
6. Examine local regulations and procedures related to animal permits and licenses for livestock and poultry operations, with an understanding of compliance, biosecurity, and welfare standards.
7. Analyze sustainable farming practices within the livestock and poultry industries, considering environmental, social, and economic impacts.
8. Explore the role of technology in the livestock and poultry industries, including animal health monitoring, genetic improvements, and automation in farming practices.
9. Examine ethical issues in livestock and poultry farming, focusing on animal welfare standards and consumer expectations for humane treatment and traceability.
10. Analyze global trade and export opportunities for livestock and poultry products, considering market demand, international standards, and trade policies.
11. Explain food safety regulations in the livestock and poultry industries, including HACCP principles and traceability requirements for consumer protection.
12. Identify professional organizations that could serve as valuable resources for producers, providing information on best practices, market trends, and regulatory updates.

### Standard 29: Livestock and Poultry Management Systems

Students will develop the skills to manage livestock and poultry records, apply selection principles, use identification methods, and understand key national programs for traceability and biosecurity.

#### Skills:

1. Maintain and manage a comprehensive record-keeping system for livestock and poultry, covering breeding, health, pedigree, injuries, disposition, and parturition, ensuring accurate tracking of each animal's history and performance.
2. Explain and apply selection principles for livestock and poultry based on type, pedigree, performance, and progeny data, optimizing breeding and production decisions.
3. Demonstrate and explain animal identification methods, such as ear tags, tattoos, and microchips, RFID tagging, and discuss their importance in production records, breed registries, and biosecurity measures.
4. Research and summarize key national programs like the National Animal Identification System (NAIS) and Farm Premises ID Plan, explaining their significance for enhancing traceability, biosecurity, and disease management within the livestock and poultry industries.

### Standard 30: Livestock and Poultry Safety Practices

Students will demonstrate the ability to apply safe working practices when handling livestock and poultry, emphasizing personal protection, equipment safety, biosecurity, and emergency preparedness.

#### Skills:

1. Analyze and apply appropriate PPE requirements for various livestock and poultry operations, identifying the necessary safety gear for specific tasks and environments.
2. Evaluate agricultural equipment safety precautions by demonstrating knowledge of manufacturer specifications, industry standards, OSHA guidelines, and local licensing requirements to ensure safe operation in livestock and poultry environments.
3. Explain and implement effective housekeeping practices to prevent health and safety hazards, demonstrating an understanding of how cleanliness and organization contribute to the overall safety and wellbeing of the operation.
4. Identify and interpret common agricultural safety signs and signals, understanding their significance in maintaining a safe work environment and preventing accidents or injuries in livestock and poultry operations.
5. Assess and adapt safe working practices for different weather conditions, explaining the importance of adjusting protocols to minimize risks associated with extreme temperatures, wet or slippery surfaces, and other environmental factors.
6. Apply the concept of the “flight zone” and “point of balance” to safely handle livestock, demonstrating an understanding of animal behavior and how it impacts handling techniques to prevent stress or injury to both the animals and handlers.
7. Explain and implement common biosecurity methods used in livestock and poultry operations, including quarantine protocols, sanitation practices, and disease prevention strategies to protect animal health and prevent the spread of infectious diseases.
8. Summarize and evaluate farm emergency and evacuation protocols, demonstrating the ability to identify potential hazards and formulate plans for safe and efficient evacuation in the event of fire, natural disasters, or other emergencies.

### Standard 31: Livestock and Poultry Handling, Restraint, and Transportation

Students will develop the necessary skills to handle, restrain, and transport livestock and poultry in compliance with industry standards, legal regulations, and animal welfare best practices.

#### Skills:

1. Demonstrate the correct procedure for tying a quick-release knot and explain its safety and operational importance in livestock handling.
2. Identify and evaluate various handling and restraint devices used in the livestock industry, discussing their specific functions and best-use practices.
3. Demonstrate the proper technique for catching and haltering a dairy and/or beef cow, ensuring animal safety and handler control.
4. Explain the use of a nose lead on dairy and/or beef cows, demonstrating its application and effect on animal movement.
5. Demonstrate or explain the correct use of a headgate on a dairy and/or beef cow, emphasizing safety and efficiency in restraining the animal.
6. Demonstrate or explain the method of casting a dairy and/or beef cow with a rope, ensuring safe and humane restraint during procedures.
7. Demonstrate the proper technique for tail restraint (tail jack) on a dairy and/or beef cow, ensuring minimal stress to the animal.
8. Catch and halter a sheep or goat, demonstrating proficiency in animal control and safety.
9. Demonstrate how to hold and move a sheep or goat with the chin or jaw, ensuring safe and effective handling.
10. Restrain a sheep or goat by rolling the animal onto its rump, explaining the purpose and safety precautions involved in the process.
11. Demonstrate or explain how to use a halter and lead line on a llama or alpaca, emphasizing safety and effective control.
12. Demonstrate or explain the application of a neck hold on a llama or alpaca, highlighting the importance of proper technique and animal welfare.
13. Restrain a pig using a hog snare, explaining the appropriate usage and safety protocols for the device.
14. Corner and/or move a pig using a hop panel or hurdle, demonstrating safe handling practices.
15. Catch individual chickens from a large flock using a catching hook, demonstrating skill and efficiency in poultry handling.
16. Corner and catch poultry using wire panels, explaining the process and safety measures to prevent injury to the birds.
17. Demonstrate the ability to load a beef cow into a blocking or squeeze chute, ensuring animal and handler safety during the process.
18. Identify and explain the key regulations and documents required for inter- and intrastate transport of livestock and poultry, ensuring legal compliance.
19. Describe the different trailering options for livestock and poultry, comparing the advantages and disadvantages of each method.
20. Create a list of essential safety equipment needed when transporting livestock, including extra halters, ropes, and emergency supplies, and explain their importance.
21. Map the travel route for transporting livestock and provide feeding and watering recommendations for animals during transport to ensure their welfare.
22. Research and report on the truck/trailer specifications and driver licensing requirements for transporting livestock, ensuring compliance with industry standards.
23. Demonstrate the ability to hobble a cow correctly, explaining its importance for safely controlling livestock during transport or other activities.
24. Explain the physiological and behavioral impacts of stress on livestock and poultry during handling and transport and identify strategies to minimize stress.

### Standard 32: Livestock and Poultry Housing and Facilities

Students will demonstrate skills in managing livestock and poultry housing, designing effective and sustainable facilities and pasture systems, and applying best practices in animal welfare, sanitation, and regulatory compliance.

#### Skills:

1. Research and apply the square footage and pasture space requirements for various livestock and poultry species, based on guidelines from the Massachusetts Society for the Prevention of Cruelty to Animals (MSPCA), Massachusetts Department of Agricultural Resources (MDAR), and local animal control laws.
2. Analyze the key elements of effective animal housing sanitation, including cleaning schedules and methods to prevent disease transmission.
3. Identify and describe the different types of livestock and poultry housing and facilities, including barns, sheds, broiler houses, egg-laying houses, feedlots, and milking parlors, explaining their functions and purpose.
4. Identify and describe the types of livestock and poultry equipment used in housing facilities, including feed troughs, waterers, nesting boxes, perches, and bedding systems.
5. Compare natural versus mechanical ventilation systems used in livestock and poultry housing, detailing the benefits and drawbacks of each, and discuss their impact on animal health, comfort, and productivity.
6. Describe different types of fencing used in livestock housing for protection, confinement, and pasture management, including wire, electric, and post-and-rail fences.
7. Demonstrate the ability to erect a section of electric fence suitable for a species of livestock, ensuring proper installation and safety standards.
8. Describe pasture management practices, such as continuous grazing, rotational grazing, and intensive rotational grazing, explaining the advantages of each method for maintaining healthy pastures and supporting animal welfare.
9. Explain and apply common manure management practices, including proper storage, composting, and land application, to minimize environmental impact and ensure regulatory compliance.
10. Develop a manure management strategy that incorporates best practices for odor control, nutrient recycling, and environmental sustainability, while ensuring compliance with local and state regulations.
11. Identify five plants commonly found in New England that are toxic to livestock and explain the potential risks they pose to animal health.
12. Select a species of livestock or poultry and design a suitable housing facility, considering space requirements, ventilation, bedding, and animal welfare needs.
13. Select a species of livestock or poultry and design an appropriate pasture system, including pasture rotation strategies, water access, and shelter for the animals.
14. Design an eco-friendly housing facility for livestock or poultry, integrating energy-efficient systems, waste management practices, and sustainable construction materials.

### Standard 33: Livestock and Poultry Feeding and Nutrition

Students will develop a comprehensive understanding of livestock and poultry nutrition, including formulating species-specific rations using both traditional methods and software tools, while evaluating feeding practices, nutrient quality, and pasture management techniques to optimize animal health and productivity.

#### Skills:

1. Demonstrate feeding practices used in livestock operations, ensuring balanced nutrition, and promoting optimal growth and productivity.
2. Demonstrate feeding practices for poultry operations, comparing feeding strategies for various poultry species and highlighting differences in nutrient needs.
3. Compare and contrast the digestive systems of livestock and poultry species, identifying anatomical and physiological differences that affect feeding and nutritional strategies.
4. Identify and explain the six classes of nutrients, carbohydrates, proteins, fats, vitamins, minerals, and water, focusing on their roles in supporting animal health, growth, and productivity.
5. Identify and describe feed types used in livestock and poultry nutrition, e.g., roughages, concentrates, and supplements, explaining their specific roles and applications for different species.
6. Evaluate feed quality based on nutritional value, palatability, and the potential impact on animal health and production.
7. Perform body condition scoring on various livestock species, explaining how scoring reflects nutritional status and overall animal health.
8. Explain pasture management practices to optimize nutrition for both livestock and poultry, focusing on rotational grazing, forage quality, seasonal considerations, and species-specific needs.
9. Maintain pasture quality through effective management techniques such as rotational grazing, fertilization, grazing control, harvesting, and weed management.
10. Formulate balanced rations for livestock and poultry using computer software or traditional methods, e.g., Pearson Square, ensuring species-specific nutritional needs are met.
11. Compare hay quality from different sources, evaluating nutrient content, moisture levels, and suitability for different species to ensure optimal nutrition.

### Standard 34: Livestock and Poultry Breeding and Reproduction

Students will evaluate breeding programs for livestock and poultry operations, assessing their inclusiveness, genetic diversity, reproductive efficiency, and ethical considerations, including animal welfare and genetic implications.

#### Skills:

1. Compare and contrast the reproductive systems of various livestock and poultry species, analyzing their similarities and differences in terms of structure, function, and reproductive strategies.
2. Evaluate the suitability of livestock and poultry as potential breeding stock by assessing key traits such as genetic health, performance records, and reproductive history.
3. Identify and analyze the signs of estrus and estrous cycles in livestock, demonstrating the ability to distinguish between various stages and optimize breeding timing.
4. Identify and evaluate poultry management methods, such as controlled lighting, nutrition, and environmental conditions, and assess their impact on reproductive efficiency and fertility.
5. Explain and apply the principles and practices of semen collection and artificial insemination, demonstrating an understanding of the techniques and ethical considerations involved.
6. Review and synthesize the safety procedures associated with handling liquid nitrogen for semen storage and AI, ensuring compliance with industry standards and best practices for animal welfare.
7. Assess livestock management practices that can enhance fertility and reproductive efficiency, considering factors such as nutrition, housing, and environmental influences.
8. Identify and describe common reproductive health issues in livestock and poultry, such as retained placenta, dystocia, or reproductive tract infections, and discuss management strategies.
9. Explain and demonstrate methods of pregnancy testing in livestock, comparing various techniques such as ultrasound, blood testing, and physical examination.
10. Discuss the process of livestock parturition, including preparation for delivery and providing birth assistance, with a focus on managing normal and abnormal presentations.
11. Utilize progeny data, production records, performance information, and pedigrees to make informed decisions in the sire/ram/boar selection process for breeding operations.
12. Research and describe the procedures for embryo flushing in cows and embryo harvesting for transfer, highlighting the protocols involved in successful embryo transfer practices.
13. Describe and create a toolkit designed to support livestock producers during parturition, incorporating resources, tools, and protocols to ensure smooth birthing processes and minimize risks.
14. Demonstrate how to maintain and analyze reproductive records, including breeding dates, pregnancy rates, and progeny performance, to optimize future breeding decisions.
15. Research and explain the impact of emerging reproductive technologies such as genomic selection and sexed semen on improving breeding efficiency and genetic progress in livestock and poultry operations.

### Standard 35: Livestock and Poultry Health

Students will demonstrate the ability to manage livestock and poultry health by developing preventative health plans, applying disease prevention strategies, administering treatments, and ensuring animal welfare, with a focus on proper techniques and ethical considerations.

#### Skills:

1. Apply the "Rule of Comparison" to assess the normal appearance and behavior of livestock and poultry species, enabling early detection of disease, stress, or poor management.
2. Measure and record vital signs (temperature, pulse, respiration) for various species, identifying normal ranges and understanding the implications of deviations.
3. Maintain accurate health records for livestock and poultry, documenting vaccinations, treatments, diagnoses, and health outcomes to support decision-making and traceability.
4. Identify and evaluate methods of control, treatment, and prevention for common diseases in livestock and poultry, including vaccinations, biosecurity, and quarantine protocols.
5. Assess methods for controlling and preventing internal and external parasites in livestock and poultry, understanding their impact on animal health and productivity.
6. Calculate livestock weight using measurement formulas or weight tape, applying the results to assess animal health and plan for appropriate care.
7. Demonstrate techniques for administering medications, including intramuscular, subcutaneous, intravenous, intranasal, and intra-mammary routes, emphasizing correct procedures and animal welfare.
8. Demonstrate the oral administration of medications, including liquid medications (using a dose syringe), bolus (using a balling gun), and paste wormers, explaining the techniques and significance of each method.
9. Demonstrate and explain the procedure for applying topical medications to livestock and poultry, focusing on effectiveness, safety, and animal welfare.
10. Demonstrate the collection of diagnostic samples, including blood (tail bleeding or jugular vein), feces (for parasite evaluation), and urine, explaining the relevance to health diagnostics.
11. Administer a magnet to a cow using a balling gun, explaining its significance in preventing hardware disease.
12. Identify and organize necessary protocols and information that a producer should have when contacting a veterinarian in an emergency, ensuring effective communication and timely care.
13. Implement first-aid and emergency health interventions for livestock and poultry, including wound care, stabilization of ill animals, and basic life-saving procedures until veterinary assistance is available.
14. Investigate and assess the role of alternative or complementary treatments (such as herbal remedies or nutrition-based interventions) in maintaining the health and well-being of livestock and poultry.

### Standard 36: Livestock and Poultry Maintenance Practices

Students will demonstrate proficiency in livestock and poultry maintenance, learning to perform essential procedures that ensure animal health, welfare, and productivity while complying with industry standards and regulations.

#### Skills:

1. Demonstrate low-stress handling techniques when performing maintenance tasks, ensuring animal welfare, and minimizing stress during procedures.
2. Demonstrate proper biosecurity measures when performing maintenance tasks, including disinfecting tools and equipment to prevent the spread of disease.
3. Demonstrate dehorning techniques for calves or other livestock, emphasizing proper methods, animal welfare, and safety precautions.
4. Explain or demonstrate castrating techniques for bucklings or other livestock, ensuring understanding of the procedure, its purpose, and ethical considerations.
5. Demonstrate or explain clipping needle teeth of a piglet, focusing on correct technique and minimizing stress to the animal.
6. Demonstrate or explain ear tagging procedures for goats or other livestock, highlighting the importance of identification and management tracking.
7. Demonstrate or explain ear notching techniques for piglets, explaining its significance in tracking and identification.
8. Demonstrate or explain tattooing techniques for calves or other livestock, ensuring proper technique and safety.
9. Demonstrate or explain debeaking chickens, discussing the reasons for the procedure and ethical considerations.
10. Demonstrate or explain hoof trimming techniques for goats or other livestock, ensuring animal comfort and the prevention of health issues.
11. Demonstrate the maintenance and use of electric clippers and electric shears for animal grooming, focusing on proper care, safety, and technique for various livestock.
12. Demonstrate or explain the technique of skirting a fleece with hand shears, focusing on skill development and quality control in wool production.
13. Demonstrate or explain how to collect a milk sample through hand milking, focusing on cleanliness, accuracy, and animal welfare.
14. Target a specific marketing opportunity for livestock and outline the management procedures necessary to reach that market, including quality control, transport, and health certification.
15. Outline the components of a health inspection and certification protocol that meets state or regional sale requirements, ensuring regulatory compliance and animal health.

## Marine and Aquaculture (Standards 37 – 45)

### Standard 37: Modern Oceanographic Concepts

Students will demonstrate an understanding of oceanographic principles and explore modern technologies used in marine exploration and resource management, with a focus on their application in oceanography, deep-sea research, and aquaculture.

#### Skills:

1. Locate and describe the major ocean basins of the world, demonstrating an understanding of their geographic locations and significance to marine life.
2. Identify and explain five geological features of the ocean floor, e.g., Marianas Trench, Ring of Fire, Mid Atlantic Ridge, Puerto Rico Trench, Aleutian Trench, focusing on their formation, impact on marine ecosystems, and their role in oceanographic research.
3. Identify and label the parts of a wave, e.g., crest, trough, wave height, wavelength, explaining how each part influences marine organisms, coastal environments, and ocean circulation.
4. Diagram and describe the supratidal, intertidal, and subtidal zones, explaining the environmental conditions required for the survival of marine organisms and their distribution across these zones.
5. Define and differentiate between nekton, plankton, and benthos, explaining their roles in the marine food web, and how they contribute to ecosystem dynamics.
6. Explain the ecological significance of plankton in marine ecosystems, discuss their role in energy transfer and marine food chains, and classify plankton based on physical characteristics such as size, shape, and behavior.
7. Define SCUBA diving and explain the required safety training and certification necessary for underwater exploration and research, including modern diving technologies used in deep-sea exploration.
8. Evaluate water samples based on temperature, salinity, pH, and dissolved oxygen content, using modern sensors and technologies to analyze how each parameter influences marine life and environmental conditions.
9. Describe the unique properties of water and identify the types of aquatic animals best suited for different aquatic environments, including those adapted to extreme depths and temperatures.
10. Identify and compare the different layers of the ocean (based on light, pressure, depth, and temperature), explaining how these factors affect marine life at various ocean depths and how they guide exploration techniques.
11. Identify and describe three types of Remote Operated Vehicles (ROVs) commonly used in modern oceanographic research, exploring their technological capabilities, e.g., depth range, maneuverability, sensors, and scientific applications, e.g., underwater exploration, environmental monitoring, marine resource mapping, assessing how these technologies contribute to advances in ocean exploration and sustainable marine management practices.
12. Explore the use of other modern technologies such as Autonomous Underwater Vehicles (AUVs), and real-time water quality sensors in oceanographic research and aquaculture management, investigating their applications in deep-sea exploration, marine resource management, and environmental monitoring.

### Standard 38: Marine Invertebrates

Students will demonstrate proficiency in identifying key marine invertebrate species (arthropods, gastropods, bivalves, echinoderms), understanding their ecological roles, and applying modern management strategies for their cultivation and breeding.

#### Skills:

1. Identify six marine arthropods, such as the American lobster, horseshoe crab, ghost crab, hermit crab, spider crab, and explain their distinguishing features, ecological roles, and importance in marine ecosystems, particularly in food webs, nutrient cycling, and their commercial uses in industries like fishing, biotechnology, and aquaculture.
2. Identify ten gastropods, including Moon snail, Periwinkle, Olive snail, Top snail, Sundial snail, Turban snail, Auger snail, Cone snail, Atlantic Dogwinkle, and Murex, explaining their ecological significance in marine environments, including their roles in nutrient cycling, as prey for marine predators, and their growing importance in marine research.
3. Identify five bivalves, such as Rock oyster, Turkey wing, Surf clam, Calico scallop, and Jingle shell, and explain their role in water filtration, habitat formation, e.g., oyster reefs, and marine food webs, emphasizing their ecological restoration applications and importance in sustainable aquaculture.
4. Identify and classify six echinoderms, such as brittle star, seastar, sea cucumber, branching seastar, and sea urchin, and explain their ecological importance, including their roles in benthic ecosystems, nutrient cycling, and their contributions to marine biodiversity.
5. List the features that all mollusks share, such as a soft body, mantle, and foot, and explain how these features contribute to their survival and adaptation in various marine environments.
6. Diagram and label the water vascular system in echinoderms, explaining how it helps with movement, feeding, breathing, and waste removal and discuss how this system has evolved to help echinoderms survive in different marine environments.
7. Describe the characteristics of krill, including their biological features, life cycle, and their role as a primary food source in marine food webs.
8. Describe how marine arthropods (lobsters, crabs, shrimp) are farmed and bred, focusing on sustainable practices, disease control, reducing bycatch, using closed-loop systems, and protecting habitats.
9. Illustrate the management strategies employed in cultivating and breeding gastropods, focusing on habitat design, water quality control, breeding practices, and discussing their potential for sustainable aquaculture, particularly for food production and pharmaceutical applications, e.g., cone snails.
10. Discuss management strategies for cultivating and breeding bivalves (oysters, clams, scallops), focusing on sustainable farming, water filtration, and their role in ecological restoration and habitat improvement.
11. Describe management strategies for cultivating and breeding echinoderms (sea cucumbers, urchins), focusing on sustainable harvesting, enhancing reproductive success in captivity, and their economic value.
12. Compare invertebrate species (arthropods, gastropods, bivalves, echinoderms) in terms of anatomy, life cycles, reproductive strategies, and ecological roles, and discuss how these differences affect their management, conservation needs, and threats such as overfishing, habitat degradation, and climate change.

### Standard 39: Mammals

Students will develop a comprehensive understanding of marine mammal biology, ecology, and behavior by exploring the major groups of marine mammals (cetaceans, pinnipeds, and sirenians), their physical adaptations, feeding strategies, and ecological roles.

#### Skills:

1. Diagram and label the major groups of marine mammals, including cetaceans, pinnipeds, sirenians, and briefly explain their unique characteristics, e.g., adaptations for swimming, feeding strategies, etc.
2. Describe oceanic animals and birds commonly found on Massachusetts beaches, explaining their physical adaptations, migratory behaviors, and contributions to local ecosystems.
3. List six marine mammals from three major groups (cetaceans, pinnipeds, and sirenians), including one species from each group, and describe their ecological roles and key characteristics.
4. Differentiate between mysticetes and odontocetes, providing two examples of each, and explain the feeding methods, communication strategies, and behavioral adaptations.
5. Distinguish between dolphins and porpoises, highlighting differences in physical features, behavioral traits, and habitat preferences.
6. Differentiate between true seals and eared seals, focusing on differences in locomotion, hunting techniques, and social behavior.
7. Describe the characteristics of walruses, including their physical features, diet, social structure, and habitat, emphasizing their role in the Arctic ecosystem.
8. Identify five baleen whale species and discuss their feeding strategies, migration patterns, and ecological importance in marine ecosystems.
9. Explain why Cape Cod experiences frequent cetacean strandings, considering geographic features, migratory routes, and environmental factors like food availability and water temperature.
10. Identify the housing, nutritional, and health needs for marine mammals in captive environments, and discuss current ethical concerns and regulations regarding the care of marine mammals in captivity.
11. Describe the general physical characteristics of cetaceans, including size, internal anatomy, diet, and habitat, using the blue whale and orca as examples to illustrate these features in specific species.
12. Describe the physical characteristics of specific pinnipeds, e.g., harbor seal, sea lion, with a focus on their anatomy, diet, reproduction, and habitat.

### Standard 40: Mammal Training

Students will develop a comprehensive understanding of marine mammal behavior and training techniques, applying modern training strategies such as positive reinforcement, operant conditioning, and clicker training to real-world case studies.

#### Skills:

1. Explain the safety protocols and precautions when interacting with marine mammals, emphasizing the importance of both human and animal well-being.
2. Apply the understanding of these protocols by creating a checklist or scenario-based safety plan for marine mammal training environments.
3. Analyze the behaviors and instincts of various marine mammals, e.g., social, predatory, or migratory, and assess how these natural tendencies influence training methods.
4. Evaluate how different training strategies (such as positive reinforcement, shaping, and behavior modification techniques) can be adapted to suit the natural behaviors of specific marine mammal species.
5. Describe the typical behavioral patterns of marine mammals, including feeding, mating, and socializing, across different species, e.g., cetaceans, pinnipeds, sirenians.
6. Identify the signs of health and distress in marine mammals by observing behaviors in a controlled setting or through video examples.
7. Apply knowledge of training techniques such as positive reinforcement, operant conditioning, and clicker training to case studies involving marine mammals, incorporating modern technologies for enhanced learning and assessment.
8. Analyze the effectiveness of these methods for specific behavioral goals, e.g., target behaviors, behavior maintenance, or extinction.
9. Evaluate the stages of training for complex behaviors, including breaking down behaviors into manageable steps, e.g., shaping or reinforcement schedules.
10. Create a detailed training plan for a multi-step behavior change for a specific marine mammal species, incorporating assessment criteria, reinforcement strategies, and evaluation techniques using modern technology.

### Standard 41: Aquariums

Students will demonstrate the skills to design, maintain, and manage aquariums, focusing on water quality, filtration, aquascaping, and the ethical sourcing of species, while using modern technologies like digital monitoring systems to create sustainable aquatic environments.

#### Skills:

1. Demonstrate routine checks and tasks for aquarium maintenance, including cleaning and managing water quality and filtration systems.
2. Describe how filtration works, the different types of filtrations (mechanical, biological, and chemical), and their importance in maintaining water quality.
3. Conduct water tests for pH, ammonia, nitrate, and nitrite, interpret results, and explain their significance in maintaining a healthy aquarium.
4. Examine the use of digital monitoring systems to track and manage water quality parameters, e.g., pH, ammonia, nitrite, nitrate, in an aquarium.
5. Design and arrange aquarium elements, e.g., rocks, plants, substrate, to create a visually appealing and functional aquatic environment.
6. Explain the advantages of live plants, e.g., oxygen production, natural filtration, and habitat benefits, versus plastic plants in creating a healthy aquarium ecosystem.
7. Identify key considerations such as swimming areas for fish, visual security, slope of the substrate, and the use of natural plants in designing an aquarium.
8. Describe how habitat design impacts the well-being of aquatic species and the importance of replicating natural environments for fish and other aquatic animals.
9. Create a diagram or graph illustrating the nitrogen cycle, including key stages (ammonia, nitrites, nitrates) and the role of beneficial bacteria.
10. Safely and correctly use nets and bags to handle fish during transport, ensuring minimal stress and harm to the animals.
11. Conduct regular maintenance tasks such as cleaning filters, removing debris, and performing partial water changes to ensure optimal water quality.
12. Perform tasks related to the maintenance of large-scale tanks, including water quality monitoring, filtration, and system checks.
13. Explain the necessary PPE and safety protocols when working with large aquatic systems, ensuring safety for both the workers and the aquatic animals.
14. Describe how filtration systems are adapted for larger water volumes and the unique challenges involved in maintaining water quality at scale.
15. Create a design for a large marine aquarium, exploring the use of 3D aquascaping software if available, considering space requirements, water flow, species selection, and habitat design for marine life.
16. Describe how habitat design and environmental factors affect the health and behavior of species in large aquatic systems and why this is critical for their well-being in captivity.
17. Identify and explain the ethical considerations involved in sourcing aquatic species for aquariums with an emphasis on preventing the introduction of invasive species.

### Standard 42: Fish

Students will demonstrate knowledge and practical skills in identifying, understanding, and caring for fish species across freshwater, brackish, and saltwater environments, including their anatomical features, unique housing and nutritional needs, diseases, and suitability for community or single-species tanks.

#### Skills:

1. Explain the differences between freshwater, brackish, and saltwater fish species, describing their unique environmental needs.
2. Identify and name ten marine fish species, such as the Yellow Tang, Mandarin Fish, Firefish, and others, using visual aids and descriptions.
3. Correctly identify and name ten freshwater fish species, such as the Clown Loach, Guppy, and Neon Tetra.
4. Correctly identify and name five brackish water fish species, such as the Black Molly and Green Spotted Puffer.
5. Create a diagram of a fish, labeling key external and internal parts, e.g., gills, fins, heart, digestive system, and explain the function of each part.
6. Draw and label the internal and external anatomy of a shark, highlighting unique features such as the dorsal fin, ampullae of Lorenzini, and spiracles.
7. Correctly identify and name five shark species, such as the Great White and Nurse Shark.
8. Identify three common fish diseases, e.g., Ichthyophthirius multifilis, Gill Disease, Fin Rot, and discuss their symptoms, causes, and treatment options.
9. Identify the common health issues faced by three freshwater and three marine species and describe their specific care needs, including disease prevention and treatment.
10. Identify preventive measures for common fish diseases, e.g., water quality control, quarantine procedures, etc.
11. List and explain the specific housing requirements for six fish species, three freshwater and three marine, covering factors such as tank size, water temperature, salinity, and water parameters.
12. Compare and contrast the nutritional needs of six fish species, including diet composition, e.g., pellets, live food, algae, for three freshwater species and three marine species.
13. Analyze and compare the behavioral and environmental requirements of different fish species to determine which are suitable for community tanks versus single-species tanks.

### Standard 43: Aquaculture

Students will analyze and explain the fundamental practices, biological principles, and environmental factors involved in aquaculture, including species suitability, feeding techniques, water management, and breeding programs.

#### Skills:

1. Explain common aquacultural practices used to raise aquatic species (water management, feeding techniques, and breeding programs).
2. Analyze and summarize the biological characteristics that make certain species more suitable for aquaculture production (growth rate, feed conversion, disease resistance, reproductive traits).
3. Analyze the effects of various environmental and biological factors, e.g., temperature, oxygen levels, water quality, on growth rates and health in aquaculture systems.
4. Identify and define six occupational roles within the aquaculture industry, e.g., hatchery manager, water quality technician, and describe their responsibilities.
5. List and identify methods and equipment used for feeding aquatic species in aquaculture, e.g., automated feeders, hand-feeding systems.
6. Explain polyculture in aquaculture and describe its ecological and economic benefits, e.g., nutrient cycling, biodiversity.
7. Identify and describe common predators that pose a threat to aquaculture operations, e.g., birds, fish, mammals, and discuss strategies for managing these threats.
8. Compare and evaluate the advantages and disadvantages of releasing aquaculture-grown species into natural ecosystems, e.g., ecological impact, genetic diversity.
9. Use digital research tools to explore the history and future of aquaculture, analyzing key milestones, technological advancements, sustainability practices, and the role of aquaculture in addressing global food security, present findings in a written report or presentation.

### Standard 44: Birds and Reptiles

Students will analyze and compare the fundamental characteristics, evolutionary adaptations, and ecological roles of sea birds and marine reptiles, with a focus on species identification, environmental needs, and care requirements in captivity.

#### Skills:

1. Analyze and compare the key characteristics and adaptations of birds and reptiles, focusing on evolutionary differences, physiological traits, and how these adaptations suit their environments.
2. Classify the four groups of marine reptiles, e.g., sea turtles, marine iguanas, crocodiles, and sea snakes, explaining their distinguishing features, habitats, and ecological roles.
3. Identify and describe six species of sea birds, including their physical features, habitats, migratory behaviors, and how they are adapted to life in marine environments.
4. Analyze and explain the four key evolutionary adaptations in marine birds, e.g., salt glands, specialized beaks, webbed feet, and migratory patterns, focusing on how these changes differ from those of terrestrial birds and enhance their survival in aquatic environments.
5. Evaluate and explain the housing, nutritional, and healthcare requirements of sea birds in captivity, including species-specific needs and best practices for providing proper care in controlled environments.
6. Assess and explain the housing, nutritional, and healthcare requirements of marine reptiles in captivity, citing specific examples of species such as sea turtles or marine iguanas, and how to meet their unique needs for proper care.

### Standard 45: Advanced Studies of Sea Turtles and Sea Birds

Students will analyze and explain the biological, ecological, and conservation-related aspects of sea turtles and sea birds, exploring their role in marine ecosystems, adaptations to marine life, threats to their populations, and the environmental changes impacting their survival.

#### Skills:

1. Analyze and explain the basic biological and ecological concepts related to sea turtles, including their role in marine ecosystems.
2. Classify all sea turtle species, providing key features that differentiate each species.
3. Investigate and explain the threats facing sea turtles, identifying which species are endangered or threatened and the factors contributing to their decline.
4. Evaluate and discuss the environmental changes, e.g., climate change, habitat loss, which have impacted sea turtle populations, citing specific examples.
5. Illustrate and compare the life cycles of male and female sea turtles, highlighting key differences in their reproductive behavior and development.
6. Utilize digital mapping tools or species-tracking software, e.g., Google Earth, Sea Turtle Conservancy's "Track a Turtle", to analyze the migratory patterns and geographic distribution of sea turtle populations.
7. Compare and contrast the physical traits, habitats, anatomy, diet, behaviors, and reproductive strategies of different sea turtle species, highlighting key adaptations to their environment.
8. Analyze and explain key concepts related to sea birds, including their role in ecosystems and their specialized adaptations for marine life.
9. Investigate the interdependent relationships between sea turtles and sea birds within marine ecosystems, focusing on their roles in nutrient cycling, food webs, and habitat maintenance.
10. Identify and classify different groups or types of sea birds, e.g., albatrosses, cormorants, terns, providing details on their physical characteristics, behaviors, and adaptations to marine life.
11. Investigate and explain the challenges faced by sea birds, detailing which species are endangered or threatened and the factors contributing to their status.
12. Analyze and explain the environmental factors that have affected shorebird populations, including habitat loss and climate change.
13. Analyze and discuss the environmental changes, e.g., ocean temperature, pollution, affecting pelagic bird populations and their ecosystems.
14. Identify and explain the unique nesting locations of sea birds, including migratory patterns and the importance of these habitats.
15. Use digital mapping tools, e.g., Google Earth, ArcGIS, or online mapping software, to map and describe the geographic distribution of sea bird populations, highlighting nesting areas, migratory routes, and key habitats.
16. Compare and contrast the physical traits, habitats, internal anatomy, diet, behaviors, and reproductive strategies of various sea bird species, considering their adaptations to marine life.
17. Analyze how local conservation programs in Massachusetts, such as the New England Aquarium's Sea Turtle Rescue Program and Mass Audubon’s Shorebird Conservation Program, contribute to the protection and recovery of endangered species.
18. Evaluate the role of Marine Protected Areas (MPAs) in protecting marine species, particularly sea turtles and sea birds and examine how MPAs contribute to preserving critical habitats, such as nesting beaches and feeding grounds, and how they help reduce human-related threats like overfishing and habitat degradation.

## Research Animal Technology (Standards 46 – 54)

### Standard 46: Introduction to Laboratory Animal Science

Students will explore the history, ethical considerations, and professional roles within laboratory animal science, while gaining an understanding of key industry standards and regulations.

#### Skills:

1. Summarize the historical development of laboratory animal medicine, analyzing key milestones and their impact on current practices, with emphasis on changes in animal welfare and regulatory standards.
2. Define and apply medical terminology commonly used in laboratory animal research facilities, ensuring accurate communication in real-world settings.
3. Identify and explain the roles and responsibilities of various members of a laboratory animal research team, e.g., veterinarians, animal care technicians, researchers, and analyze how their collaborative efforts contribute to the success of animal research protocols.
4. Explore and investigate various career opportunities within lab animal science, detailing the qualifications, certifications, and career advancement paths for each role.
5. Define 'bioethics' and analyze its influence on laboratory animal research by evaluating case studies involving ethical dilemmas in modern research contexts.
6. Describe the function and purpose of Institutional Animal Care and Use Committees (IACUC) and analyze their vital role in ensuring ethical standards and compliance with animal welfare regulations.
7. Identify and demonstrate the key protocols for animal use in research facilities, ensuring compliance with ethical, legal, and institutional standards.
8. Define the purpose and structure of an IACUC and analyze its role in ensuring compliance with ethical guidelines and protecting animal welfare in research facilities.
9. Evaluate the responsibilities of each IACUC member and assess how their duties contribute to maintaining high standards of animal welfare and ethical conduct in research.
10. Explain the importance of animal use protocols and analyze how these protocols ensure regulatory compliance and ethical treatment of research animals.
11. Evaluate the animal research facility inspection process, analyzing its role in maintaining ethical standards and ensuring compliance with governmental and institutional regulations.
12. Describe the function and purpose of the American Association for Laboratory Animal Science (AALAS) and evaluate its contributions to advancing best practices in laboratory animal medicine.
13. Define AALAS and explain its role in supporting professional development in laboratory animal science, with emphasis on its certifications and the technical skills they promote.
14. List and analyze the levels of AALAS certification, evaluating how certification impacts career opportunities, technical skills, and employability in the lab animal science field.
15. Review and analyze the timeline of AALAS history, identifying key developments and evaluating their influence on current lab animal research practices and ethical standards.
16. Define and detail the daily responsibilities of an Assistant Laboratory Animal Technician (ALAT), analyzing how this role contributes to the ethical care of research animals.
17. Define and detail the daily responsibilities of a Laboratory Animal Technician (LAT), evaluating how their technical expertise ensures the successful operation of research protocols and animal care.
18. Investigate the ethical considerations of modern laboratory animal science, evaluating the role of alternative testing methods, e.g., in silico models, 3Rs initiatives, in reducing the need for animal testing.
19. Explore the role of sustainability in modern laboratory animal science, discussing how research facilities are adopting greener practices in waste management, resource consumption, and animal care.

### Standard 47: Ethical and Regulatory Practices in Laboratory Animal Research

Students will be able to evaluate and apply the ethical principles and regulatory frameworks governing laboratory animal research, integrating the influence of animal rights advocacy, modern welfare science, and current compliance standards to promote humane, transparent, and scientifically valid research practices.

#### Skills:

1. Evaluate the influence of animal rights activism and key organizations on the policies, public awareness, and practices within laboratory animal research, critically assessing their role in shaping scientific protocols, facility operations, and public trust.
2. Analyze the diverse perspectives of animal rights groups, synthesizing their impact on research integrity, regulatory practices, and the ethical considerations in the daily functioning of animal research facilities.
3. Analyze the comprehensive regulatory framework governing laboratory animal research, comparing the principles of animal welfare with those of scientific research integrity.
4. Examine the fundamental principles of the Animal Welfare Act, alongside federal regulations, and local laws, and evaluate their impact on animal research practices.
5. Classify animals covered and not covered under the USDA regulations and assess the implications for research practices and animal welfare.
6. Explain and apply the 3 Rs (Replacement, Reduction, Refinement) to the design and execution of ethical research, evaluating their effectiveness in minimizing animal use and enhancing welfare.
7. Interpret the key guidelines set forth in *The Guide for the Care and Use of Laboratory Animals* (including updates to welfare science, enrichment, and alternative methods), applying them to evaluate facility compliance and improve research outcomes.
8. Evaluate the facility accreditation process, discussing the significance of compliance with regulatory standards and the role of oversight bodies in ensuring ethical practices.
9. Analyze the specific rules and regulations concerning the housing of livestock in research settings, comparing them to those applied to other animals and evaluating their relevance to humane care standards.
10. Assess the safety protocols for visitors to animal research facilities, ensuring compliance with ethical standards and regulations designed to protect both animals and humans.
11. Evaluate the role of technological advancements (such as in vitro models, artificial intelligence, or organ-on-a-chip technology) in reducing animal use and advancing ethical research practices.
12. Assess the importance of positive animal welfare and enrichment programs in laboratory settings, emphasizing the role of behavioral science in improving research outcomes.
13. Compare international animal welfare standards and regulations, discussing the global landscape of laboratory animal research and its impact on ethical practices.

### Standard 48: Animal Research Laboratory Health and Safety

Evaluate and apply comprehensive health, safety, and security protocols in animal research laboratories, integrating modern technologies, risk management strategies, and regulatory standards to ensure the protection of personnel, animals, research data, and facility integrity in diverse operational conditions.

#### Skills:

1. Identify and utilize personal protective equipment (PPE) commonly used in animal research facilities (ARFs), demonstrating how these measures protect both personnel and animals from potential hazards, including emerging zoonotic threats.
2. Identify and evaluate various hazards present in an animal research facility, including physical, chemical, biological, and ergonomic risks, and propose strategies for mitigating these risks to ensure workplace safety.
3. Analyze risk assessment processes specific to different animal species in ARFs, identifying safety concerns unique to each species and formulating strategies to address these risks in the workplace.
4. Explain the importance of health surveillance in ARFs, emphasizing its role in monitoring employee and animal health using modern technologies, and ensuring early detection of potential health issues, including zoonotic diseases.
5. Explain the role of sentinel animals in detecting pathogens and other health risks in animal populations and discuss how sentinel programs integrate with health surveillance systems to prevent the spread of zoonotic diseases.
6. Identify common zoonotic diseases present in animal research settings, discussing preventative measures and the importance of proper PPE, hygiene, and facility protocols in reducing risks to personnel and animals.
7. Demonstrate the proper handling, disposal, and decontamination of syringes, sharps, and biohazardous materials, ensuring compliance with current OSHA standards and best practices for infection control.
8. Describe and assess security measures in ARFs, highlighting their role in safeguarding physical space, sensitive research materials, animal welfare, and research data from unauthorized access or breaches.
9. Develop and implement comprehensive security and emergency response protocols, including strategies to prevent security breaches, manage crises (such as fires, spills, and natural disasters), and protect personnel, animals, and research integrity.
10. Identify and interpret common signage found in ARFs, explaining the purpose of each type of signage in relation to safety, health, and regulatory compliance.
11. Develop and implement a comprehensive emergency response and biosecurity plan for an animal research facility, addressing natural disasters, fire, spills, security breaches, and the protection of both research data and facility integrity.

### Standard 49: Equipment and Caging Systems in Animal Research Facilities

Students will describe and apply best practices in the design, operation, and maintenance of equipment and caging systems in animal research facilities (ARFs), integrating modern technologies, regulatory standards, and sustainability practices to ensure optimal animal welfare, research integrity, and operational efficiency.

#### Skills:

1. Identify and evaluate common laboratory animal facility equipment, explaining its function in supporting animal health, welfare, and research integrity, including modern technologies such as automated feeders and health monitoring systems.
2. Describe and assess various caging systems used in ARFs, discussing the benefits, limitations, and advancements, e.g., automated environmental control, enrichment systems, of each system in terms of animal welfare, research needs, and biosecurity.
3. Examine the design of animal facilities, assessing factors such as positive and negative air flow, materials used, noise control, lighting, temperature, and humidity, and their impact on both animal well-being and research outcomes.
4. Identify and explain the essential spaces required in a research animal facility, including quarantine, barrier, PIV, conventional, and biosafety level (BL2) areas, emphasizing their role in maintaining biosecurity, research integrity, and effective disease control.
5. Describe and evaluate waste management systems in ARFs, including the disposal of animal waste, bedding, and biohazards, and how these systems contribute to facility sanitation, safety, and regulatory compliance.
6. Identify and assess the types of bedding commonly used in ARFs, discussing their effects on animal health, comfort, behavior, and environmental impact, and the potential for using eco-friendly alternatives.
7. Describe and compare different methods for housing livestock animals in ARFs, including pens, stalls, and other systems, evaluating their suitability for different species and research needs, and incorporating modern technologies like automated monitoring for livestock management.
8. Explain the importance of environmental monitoring systems in ARFs, discussing how they support animal welfare, safety, and research validity through continuous tracking of temperature, humidity, ventilation, and other environmental factors, using real-time data and predictive analytics to maintain optimal conditions.
9. Describe the key components of animal room design, including ventilation, space requirements, lighting, and other environmental factors that optimize animal health, behavior, and research outcomes.
10. Describe the methods used to store feed and bedding in animal research facilities, ensuring that proper storage practices maintain the quality of supplies, prevent contamination, and support efficient facility operations.
11. Explain the types of equipment maintenance performed in ARFs, including routine checks, cleaning, calibration, and troubleshooting, and how these practices ensure equipment functionality, animal safety, and regulatory compliance. Incorporate the role of predictive maintenance technologies in modern labs.
12. Outline a comprehensive facility design plan for an animal research facility, addressing key considerations such as layout, biosecurity zones, equipment placement, and compliance with regulatory standards, and incorporating sustainability in the design and operation.

### Standard 50: Lab Animal Environment

Students will be able to identify and implement best practices for maintaining optimal laboratory animal environments, integrating modern technologies, regulatory standards, and ethical considerations to support research integrity, animal welfare, and human safety.

#### Skills:

1. Describe the laboratory animal environment, identifying key factors, e.g., temperature, humidity, lighting, that impact animal welfare and research outcomes.
2. Distinguish between sanitation, disinfection, and sterilization, explaining their roles in maintaining a safe, healthy environment for both animals and personnel, and describe appropriate methods for each.
3. Examine sanitization technologies such as UV light disinfection systems, automated cleaning robots, and other advanced sanitation tools to maintain a sterile and controlled environment, minimizing the risk of pathogen transmission within the facility.
4. Develop and implement room and equipment cleaning procedures, ensuring compliance with environmental health and safety standards, and maintaining a sanitary environment.
5. Demonstrate proficiency in basic husbandry procedures for various laboratory animal species, ensuring proper care and adherence to industry standards for animal welfare.
6. Identify and implement effective record-keeping strategies in laboratory animal facilities, including logs for animal care, health monitoring, and regulatory compliance.
7. Identify temporary and permanent methods of identification for laboratory animals, including the use of ear tags, microchips, tattoos, and other techniques, and explain the importance of accurate identification for research tracking and regulatory compliance.
8. Define environmental enrichment and design enrichment plans for different lab animal species, incorporating modern techniques and technologies to promote natural behaviors and well-being.

### Standard 51: Laboratory Animal Health and Care

Students will be able to manage and promote laboratory animal health by recognizing signs of illness, administering treatment, implementing biosecurity measures, ensuring ethical animal sourcing, and following regulatory standards to support animal welfare and human safety.

#### Skills:

1. Demonstrate recognizing signs of illness, administering medication and vaccinations, and managing animal health records to ensure proper treatment and ongoing monitoring of animal health.
2. Identify signs of pain, distress, and abnormal behaviors in laboratory animals, including physical and behavioral indicators, and describe appropriate interventions and animal welfare considerations.
3. Define the terms SPF (Specific Pathogen-Free), axenic, gnotobiotic, and HPP-free, explaining their significance in research settings, particularly regarding animal health, microbiome control, and experimental validity.
4. Discuss common laboratory animal health issues, including barbering, head tilt, fight wounds, hydrocephalus, dehydration, diarrhea, conjunctivitis, rectal prolapse, malocclusion, dystocia, and emaciation, and explain how to identify, prevent, and manage these conditions.
5. Differentiate between various routes of administration of substances, including oral, subcutaneous, intravenous, intramuscular, and topical administration, and explain the factors influencing the choice of route based on the research study and animal species.
6. Explain methods of disease control, treatment, and prevention in research animal facilities, focusing on quarantine protocols, biosecurity measures, and vaccination programs to prevent the spread of pathogens and ensure animal health and safety.
7. Describe methods for procuring animals for research, including ethical considerations and regulations involved in sourcing animals from breeders or in-house breeding programs.
8. Describe animal transport procedures, including safe handling, proper documentation, regulatory compliance, and steps to ensure the welfare of animals during transport and upon arrival at the facility.
9. Explain the importance of an incoming animal examination, identifying key health indicators and ensuring animals are fit for use in research prior to introduction into the facility.
10. Apply modern biosecurity protocols for handling incoming animals, including quarantine, health screening, and acclimation processes, ensuring animals are free from diseases that could affect health, research integrity, or personnel safety.
11. Describe quarantine, acclimation, and conditioning processes, explaining their roles in minimizing stress, promoting animal health, and ensuring animals are fit for research.
12. Identify and assess human health considerations in the animal research setting, e.g., allergens, zoonoses, biohazards, and bites, and implement appropriate safety protocols to mitigate risks.
13. Categorize types of drugs commonly used in the animal research facility, detailing their purposes, methods of administration, and potential side effects on animals.
14. Identify the five classes of controlled substances found in the animal research setting, explaining their legal implications, proper handling, and record-keeping requirements.
15. Describe the importance of tracking drug expiration dates and maintaining proper drug storage practices, ensuring compliance with regulatory requirements and safe use.
16. Explain the importance of maintaining accurate drug treatment records, ensuring proper documentation for controlled substances and all administered treatments.
17. Explain the role and ethical considerations of euthanasia in a research animal facility, identifying appropriate euthanasia methods for different lab animal species and adhering to AVMA guidelines.
18. Cite the AVMA guidelines on euthanasia, explaining their ethical implications and application in the laboratory animal setting.
19. Describe the proper procedures for carcass disposal in accordance with environmental health standards, biosecurity protocols, and regulatory compliance.
20. Explain how to confirm death after euthanasia, ensuring proper verification and documentation in accordance with ethical and legal standards.

### Standard 52: Animal Feeding, Nutrition, and Daily Care

Students will perform the daily care and management of laboratory animals, demonstrating proficiency in routine husbandry tasks, ensuring optimal feeding, hydration, environmental conditions, and animal welfare practices.

#### Skills:

1. Explain the feeding and nutrition of laboratory animals, identifying key nutritional requirements to support optimal animal health, research integrity, and ethical practices.
2. Identify the essential nutrients (proteins, vitamins, minerals) and how these needs vary based on species, age, and research purpose.
3. Summarize principles of feed and nutrition for laboratory animals, including macronutrient balance, micronutrient needs, water requirements, and the importance of diet composition for disease prevention and research reliability.
4. Explain types of diets used in an ARF, including standard laboratory chow, specialized diets, and the use of liquid or pelletized feed for different species.
5. Explain the importance of monitoring the shelf life of feed, including storage protocols, ensuring feed quality, and the effects of expired or improperly stored feed on animal health and research outcomes.
6. Discuss protocols related to reward, enrichment, and behavior modification using feed, emphasizing positive reinforcement and dietary enrichment strategies.
7. Demonstrate proficiency in daily husbandry tasks, including feeding, watering, cage cleaning, and ensuring proper environmental conditions, e.g., temperature, humidity, ventilation.
8. Monitor animal health daily, assessing body condition, behavior, hydration, and any signs of illness.
9. Identify and address any health issues that arise during daily care, making sure to follow proper protocols for intervention and reporting.
10. Ensure all animals receive appropriate hydration and proper feeding frequency based on their age, species, and health status.
11. Apply environmental enrichment strategies to reduce stress and promote natural behaviors, ensuring animals have appropriate stimulation to enhance physical and psychological well-being.
12. Integrate behavioral health and nutrition by incorporating feeding protocols that support positive reinforcement and reduce the risk of behavioral problems such as aggression.
13. Collaborate with veterinary staff to manage nutritional interventions for animals with health issues and ensure staff are trained in feeding, handling, health monitoring, and documentation.
14. Supervise and ensure compliance with animal welfare standards, ensuring proper care is consistently delivered to all animals under supervision.
15. Understand the need for and implementation of medical diets, including therapeutic and specialty diets for managing specific health conditions, e.g., obesity, diabetes, malnutrition.
16. Identify species-specific feeding needs and tailor feeding protocols to accommodate such differences in diet or feeding techniques, e.g., carnivorous vs. herbivorous diets.

### Standard 53: Heredity and Breeding of Laboratory Research Animals

Students will demonstrate an understanding of heredity and breeding in laboratory animals, utilizing modern genetic technologies, ethical considerations, and breeding practices to support scientific research and animal welfare.

#### Skills:

1. Analyze genetic principles related to heredity, including dominant and recessive traits, inheritance patterns, and genetic variation in laboratory animals.
2. Identify and compare various mating systems, e.g., outbreeding, inbreeding, crossbreeding, used in laboratory animal breeding programs including the advantages and disadvantage of each system in terms of genetic diversity, research applications, and animal welfare.
3. Explain the role of genetic editing tools, e.g., CRISPR, and gene modification techniques in creating genetically modified research animals.
4. Assess the ethical implications and benefits of using genetically modified animals in biomedical research, focusing on disease modeling and drug testing.
5. Formulate strategies for maintaining genetic diversity and ensuring the health of breeding stock, including techniques to avoid inbreeding depression and maintaining specific pathogen-free (SPF) colonies.
6. Assess components of breeding programs to preserve genetic health and meet the requirements for scientific research.
7. Create and maintain accurate breeding records using modern digital tools, tracking genetic lines, mating dates, and animal health data.
8. Assess the role of breeding records in optimizing breeding decisions, maintaining genetic health, and supporting research validity.
9. Develop a breeding plan for laboratory rodents that considers genetic traits, optimal mating pairs, and the timing of reproduction.
10. Demonstrate techniques to confirm pregnancy in rodents, including behavioral signs, physical examination (palpation), and advanced methods like ultrasound.
11. Evaluate methods for monitoring reproductive health and managing breeding outcomes to support research objectives.
12. Examine the ethical issues surrounding genetic modifications and breeding programs in laboratory animals, including animal welfare, genetic engineering, and research integrity.
13. Identify and design breeding programs tailored to produce laboratory animals for specific research models, including genetically modified or disease-resistant animals.
14. Evaluate the significance of these breeding programs in advancing medical research and improving the accuracy of experimental outcomes.
15. Investigate the welfare challenges faced in breeding systems, such as overcrowding or stress, and propose strategies to minimize harm and promote animal well-being.
16. Evaluate the use of modern technologies such as automated breeding systems and data management tools in laboratory animal breeding.

### Standard 54: Species Used in Research

Students will demonstrate knowledge of common animal species and breeds used in research, applying proper handling, restraint techniques, and classification systems to ensure animal welfare and research integrity.

#### Skills:

1. Identify and describe common and emerging species used in laboratory research, noting their specific applications, advantages, and significance in contemporary scientific research.
2. Classify and describe strains and breeds of laboratory animals, including newer genetically modified strains, and discuss their genetic and phenotypic characteristics.
3. Differentiate between outbred and inbred strains of mice and rats, including CRISPR-engineered and transgenic lines, and assess their role in research reproducibility.
4. Demonstrate accurate sexing techniques for laboratory animals, including advanced methods for identifying sex in genetically modified species.
5. Demonstrate safe and effective handling and restraint methods for mice, rats, hamsters, gerbils, guinea pigs, rabbits, cats, and dogs, ensuring minimal stress and injury to the animals during procedures.
6. Report and analyze biological data, including the use of modern data management tools, e.g., digital health records, tracking systems for lab animals such as mice, guinea pigs, and nonhuman primates.
7. Classify the taxonomy and breeds of swine used in research settings, noting differences in genetics, biology, and common uses in research.
8. Classify the taxonomy and breeds of sheep commonly used in the research facility, describing their relevance to research and breeding characteristics.
9. Demonstrate appropriate techniques for handling and restraining livestock animals, such as swine and sheep, in a research setting, ensuring safety and welfare for both animals and staff.
10. Identify and describe common nonhuman primates used in research, such as macaques and baboons, describing their role in biomedical and behavioral research.
11. Distinguish between New World and Old-World monkeys, including their specific roles in biomedical research and differences in genetic research.
12. Describe ethical guidelines and methods for handling and restraining nonhuman primates, ensuring their mental well-being, and minimizing distress.
13. Identify and discuss common amphibians, particularly genetically modified species, and their role in developmental biology and drug toxicity screening.
14. Describe safe methods for handling and restraining common amphibian species, ensuring minimal stress and injury to the animals.
15. Identify fish species, such as zebrafish, medaka, and guppy, and their growing importance in genetic research, drug testing, and environmental studies.
16. Identify common bird species used in research, such as chickens, ducks, and parrots, emphasizing their roles in various research fields, including genetics and pharmacology.
17. Describe appropriate handling and restraint methods for common bird species used in research, ensuring humane treatment, and minimizing stress.

## Employability Standards

### Standard 55: Employability Skills

Students will demonstrate essential employability skills needed in the animal science industry, including communication, leadership, teamwork, problem-solving, professionalism, and ethical practices, to ensure success in various animal science careers.

#### Skills:

1. Communicate clearly and professionally across various platforms including face-to-face interactions, telephone conversations, written, and electronic correspondence with pet owners, clients, veterinarians, and colleagues, ensuring accurate and compassionate communication about animal care, grooming needs, or research objectives.
2. Demonstrate providing exceptional customer service by explaining pet care protocols, grooming services, or animal welfare guidelines in a variety of settings, such as grooming salons, animal shelters, or research facilities.
3. Listen actively to client concerns, e.g., pet behavior, grooming issues, or health inquiries, providing guidance and recommendations based on expertise and animal welfare principles.
4. Analyze complex problems and develop effective solutions, applying critical thinking and problem-solving techniques relevant to animal science industries.
5. Collaborate effectively in teams to achieve common goals, demonstrating coordination and cooperation with other professionals in the various animal science fields.
6. Apply effective time management techniques, including task prioritization, deadline management, and efficient workload handling.
7. Demonstrate cultural competency in animal care, recognizing how cultural perspectives influence attitudes toward animal welfare and ensuring respectful, inclusive communication when working with clients and colleagues from diverse backgrounds.
8. Maintain professional ethics and integrity in all interactions with animals and clients, respecting animal welfare and following industry standards, including ethical considerations for working with lab animals, marine life, or companion animals.

## Entrepreneurship Standards

### Standard 56: Entrepreneurship

Students will be able to identify entrepreneurial opportunities and evaluate the value proposition of business ownership across various sectors of the animal science industry.

#### Skills:

1. Evaluate the licensing, regulatory, and tax implications of self-employment and business ownership in various sectors of the animal science industry, e.g., livestock farming, pet services, and animal nutrition and compare these factors to the implications of W-2 employment.
2. Understand current job trends, skill and educational requirements, and potential areas of growth within the modern animal science industry, including emerging fields like animal welfare, sustainability practices, and biotechnologies in animal breeding and genetics.
3. Explore entrepreneurial opportunities within the livestock, poultry, and companion animal industries, including direct marketing, small-scale farming, agribusiness ventures, e.g., feed supply, breeding programs, and pet-related services, and the development of sustainable practices in animal husbandry.
4. Analyze market demand for animal products and services, including trends in sustainable farming, ethical sourcing, and the growing consumer interest in plant-based and alternative protein products, and determine how these trends create new opportunities for entrepreneurship.
5. Identify professional organizations, trade groups, and networking opportunities that support career growth in animal-related fields, and explain how membership or involvement in these organizations can benefit career advancement and business growth.
6. Explore the certification requirements for becoming a certified dog groomer through the National Dog Groomers Association of America (NDGAA) as part of developing a business model for a dog grooming service and explain how professional certification can add value to a grooming business.

## Digital Literacy Standards

### Standard 57: Digital Literacy

Students will demonstrate digital literacy skills in animal science, including the use of diagnostic software, data management, technical documentation, and digital communication, to effectively conduct maintenance and management tasks in modern animal science practices.

#### Skills:

1. Demonstrate effective communication and collaboration with team members, clients, researchers, and suppliers, including virtual consultations to share information on animal health, care, and research.
2. Utilize online resources and diagnostic software to troubleshoot and solve technical issues related to animal health equipment, monitoring systems, or care technologies.
3. Use digital tools for business management, including scheduling, inventory management, and accounting software tailored to animal care services or research operations.
4. Utilize digital record-keeping systems to maintain accurate, compliant logs for animal health, behavior, and care activities.
5. Analyze and interpret data from digital tools and sensors, e.g., health monitors, environmental sensors, to make informed decisions on animal care, behavior, and well-being.
6. Utilize digital tools to track and optimize sustainability efforts, such as resource use, waste management, and environmental impact in animal care practices.
7. Apply ethical principles when using digital tools, ensuring the responsible collection and use of animal data, maintaining privacy, and safeguarding animal welfare.
8. Use mobile apps and wearable technology to monitor and track animal health, behavior, and location, interpreting data for care decisions.
9. Understand and apply basic cybersecurity principles to protect digital records, client information, and research data related to animal care.