**Bayero University, Kano (BUK)**

*Faculty of Veterinary Medicine*

Doctor of Veterinary Medicine (DVM)

**Proposed 30% additional courses to CCMAS/Summary**

100 Level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Code | Course Title | Units | Status | LH | PH |
| BUK-VMD 102 | Introductory Statistics for Veterinary Medicine | 3 | Core | 45 | - |
| BUK-VHM 102 | Basic Animal Nutrition, Feeds and Feeding | 3 | Core | 30 | 45 |
|  | **Total** | **6** |  |  |  |

200 Level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Code | Course Title | Units | Status | LH | PH |
| BUK-VAN 201 | Avian Anatomy | 2 | Core | 15 | 45 |
|  | **Total** | **2** |  |  |  |

300 Level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Code | Course Title | Units | Status | LH | PH |
| BUK-VAN 301 | Fish, Amphibian and Reptilian Anatomy | 3 | Core | 30 | 45 |
| BUK-VPY 301 | Avian and Aquatic Physiology | 2 | Core | 15 | 45 |
| BUK-VPY 302 | Production Animal Physiology | 3 | Core | 30 | 45 |
| BUK-VPY 303 | Principles of Animal Behaviour | 3 | Core | 30 | 45 |
|  | **Total** | **11** |  |  |  |

400 Level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Code | Course Title | Units | Status | LH | PH |
| BUK-VPY 401 | Radiobiology | 2 | Core | 15 | 45 |
| BUK-VMD 402 | Camelid Health and Diseases | 2 | Core | 15 | 45 |
| BUK-VPE 402 | Aquatic Parasitology | 2 | Core | 15 | 45 |
|  | **Total** | **6** |  |  |  |

500 Level

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Code | Course Title | Units | Status | LH | PH |
| BUK-VBC 501 | Basic Toxinology | 3 | Core | 30 | 45 |
|  | **Total** | **3** |  |  |  |

600 Level

| Course Code | Course Title | Units | Status | LH | PH |
| --- | --- | --- | --- | --- | --- |
| BUK-VMD 601 | Laboratory Animal Biomethodology and Welfare | 3 | Core | 45 | - |
| BUK-VMD 603 | Comparative Physiology and Biomedicine | 3 | Core | 45 | - |
| BUK-VPM 601 | Veterinary Research Methodology, Experimental Design and Data Analysis | 2 | Core | 30 | - |
| BUK-VPM 603 | Veterinary Practice Management | 2 | Core | 15 | 45 |
| BUK-VPM 604 | Veterinary Biological Risk Management and Biosecurity | 2 | Core | 30 | - |
| BUK-VPC 601 | Veterinary Botanical Medicine | 2 | Core | 30 | - |
|  | **Total** | **14** |  |  |  |
|  | **Grand Total** | **42** |  |  |  |

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPM 102 **Introductory Statistics for Veterinary Medicine** (3 Units; Core; L = 30; P = 0)

**Senate-approved relevance**

It is a fact that all biological sciences have evolved from simple qualitative description to concepts founded on numerical measurements and counts. Veterinary medicine, being an applied biological science, is no exemption to this trend. One question that likely comes to the mind of student veterinarians is: why do I need to study statistics? This is because the mathematical basis of the subject causes much uncertainty to veterinary students and the analytical approach is alien to them. However, in the professional life of a veterinarian, there are many examples of the relevance of statistics; such as, studies employing statistical procedures in the published scientific literature, the concept of evidence-based veterinary medicine, diagnostic services analyzing animal samples for health monitoring and maintenance, demonstration of safety and efficacy of veterinary products in an indisputable manner, and the regulation of safety and quality of food of animal origin for human consumption.

Introducing principles of statistical analysis early in the training of student veterinarians will engender conscientious, explicit and judicious use of current best evidence to inform clinical judgements and decision-making in veterinary care. This will accomplish a cardinal vision of the Faculty of Veterinary Medicine-BUK by training highly competent veterinarians that will address the challenges of veterinary practice and research in the 21st century and beyond.

**Overview**

Statistical techniques are essential in communicating information about health and disease of animals, and their agricultural productivity, or value as pets, or in the sporting or working environment. This course will, therefore, help the student veterinarian appreciate how statistical theory can be put to use in veterinary medicine.

The course will introduce the student veterinarian to the rudiments of the subject of statistics by providing a sound basis for managing straightforward study design and analysis. Set of exercises will be given to further check the understanding of the student in term of concepts and procedures. Student veterinarians will be exposed early in their training to foundational aspects of statistics that will facilitate their understanding of courses at higher levels for which statistical knowledge is a prerequisite. This will ensure mastery of statistical concepts and enable the BUK graduate of veterinary medicine play a fulfilled role in his/her chosen profession.

**Objectives**

The objectives of the course are to:

1. explain the basic concepts of descriptive statistics.
2. demontrate data using graphs and charts.
3. differentiate between measures of location, dispersion and partition.
4. describe the basic concepts of skewness and kurtosis as well as their utility function in a given data set.
5. differentiate rates from ratio and how they are used.
6. compute the different types of index number from a given data set.
7. describe population, sample, point and interval estimate.
8. outline the principles of hypotheses testing.
9. explain uses of computers in statistical computing.
10. demonstrate the use of different types of statistical packages in veterinary medicine.

**Learning outcomes**

On completion of the course, students should be able to:

1. list at least three (3) basic concepts of descriptive statistics.

1. illustrate data using graphs and charts.
2. compare measures of location, dispersion and partition.
3. identify skewness and kurtosis in a given data set.
4. compute rates and ratios
5. compute the different types of index number from a given data set.
6. differentiate population from sample as well as point from interval estimate.
7. name at least three (3) principles of hypotheses testing.
8. state at least three (3) uses of computers in statistical computing.
9. list at least three (3) statistical packages relevant to veterinary medicine.

**Course contents**

Statistical data. Types, sources and methods of data collection. Presentation of data. Tables, chart and graph. Errors and approximations. Frequency and cumulative distributions. Measures of location, partition, dipersion, skewness and kurtosis. Rates, ratios and index number. Population and samples. Random sampling distributions. Sampling and sampling distribution. Point and interval estimation. Principles of hypotheses testing. Introduction to parametric and non-parametric statistics. Uses of computers in statistical computing. Introduction to various statistical packages in solving problems in statistics. Spreadsheet applications.

**Minimum Academic Standards**

Computer laboratory with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VHM 102 **Basic Animal Nutrition, Feeds and Feeding** (3 Units; Core; L = 30; P = 45)

**Senate-approved relevance**

Veterinary Medicine and Animal Nutrition are separate specialties in the animal care industry; however, the veterinarian needs adequate exposure to the knowledge of nutrition in order to give good health care advice. As a primary care health provider to animals, the veterinarian is the one who actually has the eyes on the animals or on the herd, and in the best position to diagnose a nutritional problem and recommend specific products to help mitigate or completely resolve the identified problem. The impact of nutrition on health and disease is well established which led to the adoption of nutrition by the American Animal Hospital Association (AAHA) and World Small Animal Veterinary Association (WSAVA) as the “fifth vital sign”, indicating a health measure that should be assessed every time a pet is presented to a veterinarian. Since veterinarians play a critical role in providing nutrition consultation and supporting clients to adopt healthy dietary habits for their pets, it is essential for student veterinarians to be adequately exposed to applicable informative nutrition education during training. This becomes paramount particularly in the case of the current CCMAS for Veterinary Medicine where nutrition is grossly underrepresented, though sparsely embedded in some courses. The development of this course is, therefore, an attempt to give our Doctor of Veterinary Medicine graduate the much needed confidence to freely discuss nutrition with future clients; thus, furthering one of the fundamental objectives of the Bayero University Faculty of Veterinary Medicine by promoting and maintaining companion animal health through acquisition of nutrition competency.

**Overview**

Appropriate diet can help to maintain wellbeing and to prevent diet-related problems, whereas inadequate diet can cause substantial health issues. This course will, therefore, help student veterinarians to develop a solid grounding in animal nutrition and improve their ability to provide sound, evidence-based advice to clients wishing to maximize the profitability, health, longevity, product quality or athletic performance of production, companion, wild and laboratory animals.

The course will build on a platform of knowledge of nutritional principles. These principles will then be applied to feed formulation for dogs, cats, horses, beef cattle, dairy cattle, sheep, pigs, poultry, wildlife, microlivestock, exotic animals and fish. The consequences of an inadequate supply of the essential nutrients will be considered in detail. The course will also develop in student veterinarians an awareness of the importance of nutrition as a frontline determinant of animal health, welfare and production. This approach will bridge the gap in nutrition education in the veterinary curriculum and improve the overall nutrition competency of the BUK veterinary graduate.

**Objectives**

The objectives of the course are to:

* + - 1. define the nutrient requirements of different classes of animals.
      2. describe the characteristics of feedstuff and their use in ration formulation.
      3. discuss the methods used in evaluating the quality of feedstuff.
      4. relate knowledge of nutrient requirements to ration formulation.
      5. explain feed processing techniques and their effects on feed quality.

**Learning outcomes**

On completion of the course, students should be able to:

* + - 1. outline the nutrient requirements of different classes of animals.
      2. recall at least five (5) characteristics of feedstuff and their use in ration formulation.
      3. list at least three (3) methods used in evaluating the quality of feedstuff.
      4. apply knowledge of nutrient requirements to ration formulation.
      5. describe at least six (6) feed processing techniques and their effects on feed quality.

**Course contents**

Importance of nutrients in animal production and health. Digestion and absorption. Composition of animal body and plants. Nutritional terms and their definitions. Importance of minerals (major and trace elements) and vitamins in health and production, their requirements and supplementation in feed. Chemical analysis of feed. Digestibility of nutrients. Feed energy and partitioning of nutrients. Protein content in feed evaluation. Feeding standards. Ration formulation concepts. Feedstuff characteristics. Manufacturing and processing of feedstuff. Forage toxicity. Cow/calf nutrition. Feedlot nutrition. Dairy nutrition. Sheep and goat nutrition. Equine nutrition. Swine nutrition. Companion animal nutrition. Laboratory animal nutrition. Fish nutrition. Zoo and exotic animal nutrition. Microlivestock nutrition.

**Minimum Academic Standards**

Feed analysis laboratory and feed mill with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VAN 201 **Avian Anatomy** (2 Units; Core; L = 15; P = 45)

**Senate-approved relevance**

Poultry farming is a highly commercialized agricultural sector in Nigeria. The population of nearly 200 million birds attests to the rapid growth of the Nigerian poultry industry. This clearly highlights the need for manpower to provide various services to poultry farmers and their birds. The recent decline in growth of the poultry industry as a result of several diseases has led to severe production and economic losses to poultry farmers. To address these challenges, the need to train veterinarians that will identify ways of preventing these diseases and promote food safety and environmental health cannot be overemphasized. Training highly competent veterinarians that will address the challenges of the poultry industry in Kano State, Nigeria, sub-Saharan Africa and Africa is part of the mission and vision of the Faculty of Veterinary Medicine-BUK. With sound knowledge of poultry structure and function, graduates of the BUK Doctor of Veterinary Medicine (DVM) programme are capable of delivering safe and community-driven poultry clinical services for the advancement of the poultry industry in the 21st century and beyond.

**Overview**

This course is designed to enable our DVM graduates to apply the knowledge of normal body structure and function to pathophysiologic mechanisms and the natural history of disease manifestations during the critical evaluation of disease in the avian patient. After graduation, products of the BUK DVM programme will rely on case history, clinical signs and postmortem lesions to arrive at a tentative diagnosis in the avian patient.

An understanding of avian gross and functional anatomy is, therefore, essential in determining a differential disease diagnosis list for avian patients that present with clinical signs involving various systems of the body. Accurate and timely poultry disease diagnosis and treatment will enhance the growth of the poultry industry in Kano State, the entire nation, sub-Saharan Africa, and Africa thereby achieving poverty reduction, zero hunger and good health and wellbeing in line with the United Nations Sustainable Development Goals 1, 2 and 3, respectively.

**Objectives**

The objectives of the course are to:

1. explain the anatomical terminologies of avian species.
2. describe the concept of pneumatic bones and air sacs.
3. describe the form and structure of bones and cartilages.
4. state the muscles of different body regions.
5. explain the form and structure of visceral organs.
6. describe the blood vascular and lymphatic organs.
7. describe the anatomical structures of the nervous system.
8. compare avian and mammalian anatomy.
9. contrast avian and mammalian anatomy.
10. relate the knowledge acquired to medicine, pathology, radiology, theriogenology and surgery courses at the clinical levels.

**Learning outcomes**

On completion of the course, students should be able to:

recall at least twenty-five (25) anatomical terminologies of the avian species.

1. outline the concept of pneumatic bones and air sacs.
2. identify the form and structure of avian bones and cartilages.
3. identify at least ten (10) avian muscles from different body regions.
4. identify the form and structure of avian visceral organs.
5. identify avian blood vascular and lymphatic organs.
6. identify the anatomical structures of the avian nervous system.
7. distinguish at least eight (8) differences between avian and mammalian anatomy.
8. identify at least five (5) similarities between avian and mammalian anatomy.
9. apply the knowledge acquired to medicine, pathology, radiology, theriogenology and surgery courses at the clinical levels.

**Course contents**

Special anatomical terminologies of birds. Morphological characteristics of bones of the axial skeleton of birds. Morphological characteristics of bones of the appendicular skeleton of birds. Segments, bones and joints of different body regions. Muscles of pectoral, abdominal and thigh regions. Segments of the gastrointestinal tract of birds. Accessory digestive organs of birds. Organs of the respiratory system of birds. Organs of the urinary system of birds. Organs of the male genital system of birds. Organ of the female genital system of birds. Organs involved in egg formation. Endocrine glands of birds. External and internal features of the heart, lymphatic organs, major vessels and their distribution in birds. Structure of the nervous system of birds. Special topics in the histology of the avian species. Comparative aspects of avian anatomy. Applications to clinical scenarios.

**Minimum Academic Standards**

Gross anatomy and histology laboratories and poultry necropsy room with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VAN 301 **Fish, Amphibian and Reptilian Anatomy** (3 Units; Core; L = 30; P = 45)

**Senate-approved relevance**

Fish farming is gaining rapid acceptance in northwestern Nigeria. Frog consumption is also an emerging culinary delight in Kano State. Unlike fish farming, frogs are not farmed but captured from the wild. Snake rearing is one of the most profitable trades in the world. The high cost of snake venom used by pharmaceutical industries has glorified the business. Veterinary graduates of BUK when exposed to this course in addition to the course on entrepreneurship and innovation will be equipped with the ability to think entrepreneurially, especially now that we are experiencing unprecedented times. Studying the anatomy of fish, amphibians and reptiles is, therefore, a cornerstone in the education of veterinary students and when blended with lessons from the entrepreneurship and innovation course in 200 level as well as the course on venture creation in 300 level and the basic toxinology course in 500 level, an entrepreneurial mindset is born with the BUK veterinary graduate finally becoming both a veterinarian and an innovator; thus, fulfilling one of the higher core values of BUK by inspiring innovation and creativity.

**Overview**

Fish, amphibian and reptilian anatomy is the basis for understanding the physiology and subsequent pathologic alterations in these species. From the anatomical point of view, fish and other exotic animals (amphibians and reptiles) are different from domestic animals. Most of these animals have over generations developed both physiological and anatomical adaptations to their habitats. These could result in distinctive characteristics that can only be recognized through the eyes of specialized veterinarians and technicians in charge of their care and conservation. Differentiating some anatomical aspects could assist in gaining a deeper insight into the different species and these aspects are capable of having an impact on their physiology and/or their behaviour.

This course is designed to enable our DVM graduates acquire basic knowledge focused on the comparative anatomy of fish, amphibians and reptiles from a clinically-oriented or a production point of view. Our purpose is to complement the anatomic instruction of veterinary students that may be interested in these species to apply the knowledge of normal body structure and function to pathophysiologic mechanisms and the natural history of disease manifestations during the critical evaluation of disease in the fish, amphibian and reptilian patients. After graduation, products of the BUK DVM programme will be able to provide clinical diagnostic services to clients rearing these animals or become owners of their own businesses as entrepreneurs. The emphasis on the innovation and entrepreneurship potential of this course aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation in line with the United Nations Sustainable Development Goal 9.

**Objectives**

The objectives of the course are to:

1. describe the external anatomy of fish, amphibian and reptilian species.
2. describe the internal anatomy of fish, amphibian and reptilian species.
3. demonstrate morphological techniques used in ichthyopathological diagnosis.
4. demonstrate microscopy of samples of fish blood, skin, branchia, anterior kidney, spleen, thymus and digestive and genital tracts.
5. describe specimens of amphibians (anura and urodela) and reptiles (lizards, snakes, turtles and crocodiles).
6. describe the topography of amphibian and reptilian organs.
7. describe the anatomy of available amphibian and reptilian specimens.
8. demonstrate using videos of diverse materials of interest related to amphibian and reptilian species.
9. describe the morphology of the venom gland in selected fish, amphibian and reptilian species.
10. relate the knowledge acquired to medicine, toxinology, toxicology, pharmacology, pathology, radiology, theriogenology and surgery courses at the paraclinical and clinical levels.

**Learning outcomes**

On completion of the course, students should be able to:

1. recognize at least ten (10) structures each that constitute the external anatomy of fish, amphibian and reptilian species.
2. recognize at least five (5) structures each that constitute the internal anatomy of fish, amphibian and reptilian species.
3. apply at least five (5) morphological techniques used in ichthyopathological diagnosis.
4. examine samples of fish blood, skin, branchia, anterior kidney, spleen, thymus and digestive and genital tracts.
5. identify the form and structure in specimens of amphibians and reptiles.
6. identify the topographic anatomy of amphibian and reptilian organs.
7. identify the anatomy of available amphibian and reptilian specimens.
8. identify video images of diverse materials of interest related to amphibian and reptilian species.
9. identify the form and structure of the venom gland in selected fish, amphibian and reptilian species.
10. apply the knowledge acquired to medicine, toxinology, toxicology, pharmacology, pathology, radiology, theriogenology and surgery courses at the paraclinical and clinical levels.

**Course contents**

Introduction to fish classification. Classification and characteristics of important West African fish species. Main differences between freshwater and marine fish. External and internal morphology of fish. Morphological techniques used in ichthyopathological diagnosis. Anatomy of poisonous glands in selected species of fish. Introduction and general facts about the Class Amphibia. Amphibian life cycle. Classification and characteristics of important West African amphibian species. Amphibian locomotor system. Amphibian splanchnology. Common integument in Class Amphibia. Amphibian nervous system and sense organs. Anatomy of poisonous glands in selected amphibian species. Introduction and general facts about Class Reptilia. Reptilian life cycle. Classification and characteristics of important West African reptilian species. Locomotor system of turtles, tortoises, lizards, snakes, and crocodiles. Splanchnology in turtles, tortoises, lizards, snakes and crocodiles. Common integument (shell) of turtles and tortoises. Common integument and shedding (ecdysis) in lizards and snakes. Common integument of crocodiles. Snake nervous system and sense organs. Methods of defense (poison production) in snakes. Gross anatomy of the snake venom gland. Histology, histochemistry and emptying mechanism of the venom glands of selected snake species.

**Minimum Academic Standards**

Gross anatomy and histology laboratories, necropsy room, and fish pond as well as herpetarium and serpentarium (orphidiarium) with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPY 301 **Avian and Aquatic Physiology** (2 Units; Core; L = 15; P = 45)

**Senate-approved relevance**

Training highly competent veterinarians that will address the challenges of poultry and fish farming in Kano State, Nigeria, sub-Saharan Africa and Africa is part of the mission and vision of the Faculty of Veterinary Medicine-BUK. The management of poultry and fish farms is deeply rooted in sound knowledge of the physiology of poultry and fish species. Early exposure of our students to this course will ensure the integration of physiological principles into poultry and fish management systems; thus, producing a Doctor of Veterinary Medicine (DVM) graduate that is capable of advancing professionalism through promotion of research, education and service delivery for the growth and development of the poultry and fish industries in the 21st century and beyond.

**Overview**

Fish and poultry are important sources of protein in Kano State. The BUK-trained veterinarian is expected, upon graduation, to be involved in the delivery of services to the existing multitude of poultry and fish farms in the State; thus, playing a great role in securing food for the teeming consumer population. In order to achieve this task in a hitch-free manner, there is need for manpower to address the challenges faced by these clients. Therefore, the need to train veterinarians that will identify effective ways of managing poultry and fish farms as well as promoting food safety and environmental health cannot be overlooked.

The course is designed to introduce our DVM students to aspects of poultry and fish physiology with particular emphasis on systems and functions related to poultry meat, egg and fish production. In addition, students will have multiple opportunities to work with fish and live birds. Integration of sound physiological principles into the poultry and fish production systems will enhance the growth of poultry and fish farms in Kano State, the entire nation, sub-Saharan Africa, and Africa thereby achieving poverty reduction, zero hunger and good health and wellbeing in line with the United Nations Sustainable Development Goals 1, 2 and 3, respectively.

**Objectives**

The objectives of the course are to:

1. state the important environmental variables in the terrestrial and aquatic environments that impact the physiology of poultry and aquatic (fish) animals, respectively.
2. categorize various physiological systems that fish use to live in an aquatic environment.
3. identify the fundamentals of bioenergetics as a basis for understanding how birds and fish gain and invest energy in various physiological processes.
4. describe the physiological adaptations of poultry and aquatic (fish) animals to their environment.
5. state the basics of gamete development, the diverse reproductive strategies displayed by fish and the underlying regulatory mechanisms.
6. demonstrate how physiological knowledge can be used in an applied sense, ranging from predicting environmental impacts, to controlling reproduction.
7. describe abnormal physiological mechanisms that impact avian health and discuss how unsustainable resource management and human perturbations in the environment affect fish at the physiological level.
8. describe physiological differences between groups of fish and how fish physiological systems may be similar to, differ from, or have evolved into those in terrestrial vertebrates.
9. demonstrate theoretical and practical experience in experimental techniques for understanding the physiology of avian and aquatic animals.
10. develop the ability to access, analyze and critically evaluate key literature in avian and aquatic animal physiology.

**Learning outcomes**

On completion of the course, students should be able to:

1. recall at least three (3) important environmental variables each in the terrestrial and aquatic environments that impact the physiology of poultry and aquatic (fish) animals, respectively.
2. identify various physiological systems that fish use to live in an aquatic environment.
3. outline the fundamentals of bioenergetics as a basis for understanding how birds and fish gain and invest energy in various physiological processes.
4. identify at least five (5) physiological adaptations each of poultry and aquatic (fish) animals to their environment.
5. explain the basics of gamete development, the diverse reproductive strategies displayed by fish and the underlying regulatory mechanisms.
6. explain how physiological knowledge can be used in an applied sense, ranging from predicting environmental impacts, to controlling reproduction.
7. explain abnormal physiological mechanisms that impact avian health and how unsustainable resource management and human perturbations in the environment affect fish at the physiological level.
8. explain physiological differences between groups of fish and how fish physiological systems may be similar to, differ from, or have evolved into those in terrestrial vertebrates.
9. apply theoretical and practical experience in experimental techniques for understanding the physiology of avian and aquatic animals.
10. analyze key literature in avian and aquatic animal physiology.

**Course contents**

Introduction to avian physiology. The avian integument. Skeletal system of aves. Avian muscles. Immune system and lymphatics in aves. Vaccines for the avian species. Avian special senses. Avian cardiovascular system. Respiration in aves. Renal system and acid-base balance in aves. Avian digestion. Calcium metabolism in aves. Avian bioenergetics. Thermoregulation in birds. Nervous system of aves. Avian behaviour. Avian endocrinology. Stress/Hypothalamic-pituitary-adrenal axis in birds. Avian sexual development. Reproduction in the male bird. Reproduction in the female bird. Characteristics of aquatic environments. Fish bioenergetics. Fish respiration. Blood chemistry and function in fish. Fish muscle function and locomotion. Buoyancy regulation. Thermoregulation in fish. Fish nutrition. Fish reproduction. Fish growth. Osmoregulation.

**Minimum Academic Standards**

Physiology and biochemistry laboratories, necropsy room, fish pond and aquarium, and poultry farm with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPY 302 **Production Animal Physiology** (3 Units; Core; L = 30; P = 45)

**Senate-approved relevance**

Animal production is the translation of physiological responses of domestic or game animals into yield or monetary value. In other words, the production of egg, milk, meat and fibre (all of which are physiological responses) are defined in terms of the quantity produced (yield) or financial gain (monetary value). The student veterinarian needs all round exposure to the physiological basis of animal production for efficient provision of production or food animal medical services. Food animals that received better veterinary services are capable of enhanced production. Enhancement of animal production will provide employment, reduce hunger and improve the health and wellbeing of BUK’s host community, the nation, Africa and beyond. This is in agreement with the philosophy and mission of BUK’s Faculty of Veterinary Medicine to produce academically competent graduates with high ethical standards and excellent skills to meet the ever-increasing challenges of veterinary practice in addressing food security and public health as well as veterinary service delivery issues in the context of global best practice.

**Overview**

Our teaching mission in the Faculty of Veterinary Medicine-BUK is to broaden the education of student veterinarians interested in food or production animal medicine, so that they become capable of identifying and solving herd health management problems. The course will, therefore, focus on both domestic and game animals found in BUK’s host community as well as those that are capable of adapting to the environment. It will cover aspects not given adequate attention by the traditional physiology courses in the CCMAS (70%) or not properly aligned to animal production such as animal growth and development, mammary gland and lactation physiology, animal biometeorology, physiology and biochemistry of egg production in birds, and game production and utilization.

Students admitted to the Faculty usually have less exposure to production animals, introducing a course that exposes them to physiological principles in relation to animal production will encourage vertical integration of concepts and correlation of knowledge acquired to para-clinical and clinical courses. This way they can leverage on their knowledge to support the health and improve the production and efficiency of the food supply chain; thus, fulfilling the United Nations Sustainable Development Goals 1 (no poverty), 2 (zero hunger) and 3 (good health and wellbeing).

**Objectives**

The objectives of the course are to:

1. discuss knowledge of animal physiology with emphasis on distinct production characteristics of different livestock and game species.
2. identify basic and advanced information in the disciplinary area of animal physiology.
3. develop reasoning mechanisms useful for the interpretation of data and resolution of physiological problems.
4. discuss how climate change will impact on wildlife and livestock production.
5. develop habits and methods of self-assisted learning, including good use of bibliographic databases.

**Learning outcomes**

On completion of the course, students should be able to:

1. apply knowledge of animal physiology with emphasis on distinct production characteristics of different livestock and game species.
2. develop competencies for the understanding of basic and advanced information in the disciplinary area of animal physiology.
3. examine physiological problems in animal production.
4. develop mitigating strategies against the impact of climate change on wildlife and livestock production.
5. demonstrate habits and methods of self-assisted learning, including good use of bibliographic databases.

**Course contents**

Basic concepts of animal structure. Domestication of farm animals. Growth and development under ideal conditions. Effects of breed, sex and nutrition on growth and development. Growth curves. Compensatory growth. Allometry. Energy for growth. Bone growth and calcium metabolism. Endocrine control and manipulation of growth. Meat grading and cutting. Functional anatomy of the mammary gland. Mammary growth, differentiation and lactation. Synthesis and secretion of milk. Milking physiology, milkability and milk production. Biological functions of milk. Factors affecting lactation. Livestock, temperature and rainfall in Africa. Direct and indirect effects of climate change on livestock. The effect of climate change on beef and dairy production. The effect of climate change on small ruminants. The effect of climate change on monogastric animals. The effect of climate change on game animal production. Life history costs of egg production. Energy costs during egg production. Nutrition and egg production. Physiological mechanisms for resource-based costs of egg production. Protein depletion, muscle function and flight ability. Resource availability and immune function. Physiological mechanisms for non-resource-based costs of egg production. Estrogens, lipoprotein metabolism and oxidative stress. Anaemia and aerobic performance as a cost of egg production. Game production. Harvesting strategies and problems of game cropping. “Bush meat” processing methods. Traditional uses of game and game products. Hunting techniques. Game ranching and domestication. Growth, behaviour and reproduction of animals in captivity. Habit and food preferences. Design of paddocks, animal houses and cages. Husbandry techniques and health care in captivity.

**Minimum Academic Standards**

Physiology and biochemistry laboratories, livestock and poultry farms, weather station, abattoir, and zoological garden with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPY 303 **Principles of Animal Behaviour** (3 Units; Core; L = 30; P = 45)

**Senate-approved relevance**

Knowledge of animal behaviour is an extremely important component of modern veterinary practice. Appreciation of species typical behaviour ensures that veterinary patients are handled safely and humanely. It also plays a central role in the diagnosis of health and welfare problems in animals, including the recognition of pain and distress. Student veterinarians who acquire a good understanding of animal behaviour will become better clinicians and be in the best position to promote and repair the “human–animal bond,” which is a very important connection between people and companion animals. Animal behaviour problems, if not attended to adequately and professionally, can negatively impact this critical relationship. Therefore, identifying, preventing, and treating behavioural problems is important in maintaining the human–animal bond. By including education in animal behaviour as an integral part of the veterinary curriculum of the Doctor of Veterinary Medicine programme, a foundation has been laid for the training of a generation of veterinarians in veterinary behavioural medicine which will fulfill the philosophy and mission of the BUK Faculty of Veterinary Medicine in addressing veterinary services delivery issues with respect to companion animals in the context of global best practice.

**Overview**

Diagnostic acumen in physical and neurological examinations involves an assessment of behaviour. Behavioral concomitants of disease and poor health should be presented in didactic veterinary lectures on internal medicine, endocrinology, and other subjects integral to veterinary medical education. Therefore, a course on animal behaviour with emphasis on principles will provide the necessary prerequisite to the afore-mentioned subjects.

This course will cover the scientific study of behaviour across a wide range of animal species. Information will be presented within the context of classical and modern concepts of behaviour. Lectures will cover key topics and will present examples across a range of organisms taking cognizance of the ecological and evolutionary forces that shape animal behaviour and the conditions that may lead individuals to live solitarily or in groups. Throughout this course key principles of the scientific method will be introduced, discussed, and related to animal behaviour experiments. The course is designed to encourage critical and independent thinking, promote discussion, and improve written and oral communication, and be highly interactive, requiring student participation during both lecture and laboratory periods. The collaborative and interactive nature of instruction will equip BUK student veterinarians to comfortably maximize their ability to communicate with clients and observe as well as interpret patient behaviour; thus, becoming astute clinicians capable of maintaining excellent veterinarian-patient-client relationship in line with the mission of BUK to train high quality graduates.

**Objectives**

The objectives of the course are to:

1. describe behaviours in animals.
2. explain the evolutionary origins of various behaviours.
3. discuss the role of natural and sexual selection in the evolution of behaviour.
4. discuss historical background and theory behind concepts of animal behaviour.
5. explain techniques used to study animal behaviour in a variety of animals.
6. describe emotion in animals and different views on emotion in animals with examples.
7. discuss forms of communication with common examples.
8. explain biological clocks.
9. contrast exogenous and endogenous rhythm.
10. discuss the main philosophical frameworks used in animal ethics and the meaning of sentience as well as the evidence for varying levels of cognition in animals.
11. describe traits of organisms that can be considered behaviours and the diversity of strategies animals may adopt to forage, escape predation, acquire and defend resources, find mates, and produce and care for offspring.
12. discuss the factors and mechanisms that shape the morphology, life cycle and behaviour of organisms, including those that involve adaptive (e.g., natural selection) and non-adaptive evolution.
13. explain the economics and evolution of different behavioural strategies, such as living solitarily or in groups; adopting generalist vs. specialist foraging strategies; ways of avoiding predation; being territorial vs. not; behaving selfishly vs. cooperatively or altruistically; choosing mates; monogamous vs. polygamous mating systems; modes of parental care; communication; learning and culture.
14. describe the use of models to understand and predict the behaviour of animals under different environmental and social conditions.
15. explain some of the mechanisms involved in the production of a behavioural sequence by an animal.
16. develop hypotheses related to animal behaviour using scientific methods.
17. state appropriate statistical procedures to analyse data on animal behaviour, with or without the aid of statistical software.
18. identify research findings through laboratory reports, following the rules of scientific writing.

**Learning outcomes**

On completion of the course, students should be able to:

1. identify at least five (5) types of behaviour in animals.
2. discuss the evolutionary origins of various behaviours.
3. illustrate the role of natural and sexual selection in the evolution of behaviour.
4. explain the historical background and theory behind concepts of animal behaviour.
5. practice techniques used to study animal behaviour in a variety of different organisms.
6. explain emotion in animals and different views on emotion in animals with examples.
7. explain at least four (4) forms of communication with common examples.
8. define biological clocks.
9. differentiate between exogenous and endogenous rhythm.
10. describe the main philosophical frameworks used in animal ethics and the meaning of sentience as well as the evidence for varying levels of cognition in animals.
11. identify traits of organisms that can be considered behaviours and the diversity of strategies animals may adopt to forage, escape predation, acquire and defend resources, find mates, and produce and care for offsprings.
12. identify the factors and mechanisms that shape the morphology, life cycle and behaviour of organisms, including those that involve adaptive (e.g., natural selection) and non-adaptive evolution.
13. infer the economics and evolution of different behavioural strategies, such as living solitarily or in groups; adopting generalist vs. specialist foraging strategies; ways of avoiding predation; being territorial vs. not; behaving selfishly vs. cooperatively or altruistically; choosing mates; monogamous vs. polygamous mating systems; modes of parental care; communication; learning and culture.
14. demonstrate the use of models to understand and predict the behaviour of animals under different environmental and social conditions.
15. discuss some of the mechanisms involved in the production of a behavioural sequence by an animal.
16. formulate hypotheses related to animal behaviour using scientific methods.
17. use appropriate statistical procedures to analyse data on animal behaviour, with or without the aid of statistical software.
18. outline research findings through laboratory reports, following the rules of scientific writing.

**Course contents**

History of ethology. Reflex and complex behaviour. Orientation and taxis. Fixed action pattern, motivation and drives. Display, displacement and conflict behaviours. Learning, communication and social behaviour. Social behaviour of primates. Hierarchical organization. Physiology of behaviour. Habitat selection, homing and navigation. Courtship and parenthood. Some basic concepts of applied animal behaviour. Behavioural profiles of domestic animals. Grazing animal management and behaviour. Design of facilities for management of livestock. Animal transport and behaviour. The behaviour of cats and dogs. Pets in society. The behaviour and management of pest species. Wild animals in captivity. The training of animals. An approach to behavioural and welfare problems.

**Minimum Academic Standards**

Physiology laboratory, livestock and poultry farms, polo club and stables, laboratory animal facility, abattoir, and zoological garden with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPY 401 **Radiobiology** (2 Units; Core; L = 15; P = 45)

**Senate-approved relevance**

Radiation, like in human medicine, is widely used in veterinary medicine. The most frequent use of radiography is in the examination of horses pre-purchase, or for breeding purposes. Also, dogs are radiographed for selective breeding programmes. Sheep, pigs and other animals may be subjected to computed tomography (CT) scanning to assess their fat and meat content. Apart from the diagnostic applications of radiation, there is also a therapeutic side (radiotherapy). Small and large pets (companion animals), exotic pets such as reptiles and those in zoological gardens and wildlife parks are treated with one form of radiation or the other. Radiotherapy primarily relates to cats, dogs and horses, and may involve brachytherapy and the application of radionuclides. Despite the myriad of applications of radiation to veterinary medicine, the BUK student veterinarian needs education on the harmful effects of radiation and ways of protecting the animal patient, client, handler, veterinary practitioner, other staff, and the environment from exposure in line with the dictates of the International Commission on Radiological Protection (ICRP). This will create awareness among our veterinary graduates and make them efficient in the discharge of their diagnostic and therapeutic responsibilities in accordance with global best practice. It will also fulfill one of the aims and objectives of the BUK Doctor of Veterinary Medicine (DVM) programme by producing graduates that will use problem-solving skills to evaluate an animal patient and synthesize diagnoses (differential, tentative or confirmatory) by applying appropriate use of clinical and laboratory techniques.

**Overview**

Our teaching mission in the Faculty of Veterinary Medicine-BUK is to broaden the education of student veterinarians, so that they become capable of identifying and solving health problems in a variety of animal species. The course will present methods and devices used for protection from ionizing radiation. It will teach student veterinarians the theories of biological effects, cell and organismal sensitivity, as well as somatic and genetic effects of ionizing radiation. The course will be devoted to radiation protection of the patient, personnel and environment, effects of ionizing radiation on biological systems as well as applications in radiotherapy and radioimmunoassay, all of which will be applicable during the clinical year of training. It will serve as a prerequisite to VSR 404 (Introductory Surgery and Basic Radiology) in the CCMAS (70%).

DVM students offering the course will benefit from its systematic approach by ensuring that there is a balance between the benefits from veterinary uses of ionizing radiation and the risks associated with exposure of personnel, clients and the environment. The BUK student veterinarian will also be sensitized to the need for ensuring safe management, transportation, storage and disposal of radionuclides when used for therapeutic reasons thereby fulfilling the United Nations Sustainable Development Goals 1 (no poverty), 2 (zero hunger), 3 (good health and wellbeing), 6 (clean water and sanitation), 7 (affordable and clean energy), 8 (decent work and economic growth) 11 (sustainable cities and communities), 12 (sustainable consumption and production), 14 (life below water), 15 (life on land), and 17 (partnerships for the goals).

**Objectives**

The objectives of the course are to:

1. describe the concept of radiation hazards.
2. use professional terminology appropriately.
3. recall quantities and units related to radiation protection.
4. describe means for radiation protection of personnel and clients.
5. describe means for radiation protection to animal patients.
6. identify safety concerns related to the use of x-ray equipment.
7. describe the effects of radiation on biological systems.
8. recall genetic effects related to the study of radiation.
9. discuss the term radiation oncology.
10. describe the radiation syndromes.

**Learning outcomes**

On completion of the course, students should be able to:

1. discuss the concept of radiation hazards.
2. recall at least twenty-five (25) professional terminologies appropriately.
3. identify at least fifteen (15) quantities and units related to radiation protection.
4. identify means for radiation protection of personnel and clients.
5. identify means for radiation protection to animal patients.
6. list at least four (4) safety concerns related to the use of x-ray equipment.
7. discuss the effects of radiation on biological systems.
8. identify the effects of radiation on biological systems.
9. define the term radiation oncology.
10. explain the radiation syndromes.

**Course contents**

Need for radiation protection. Basic interactions with matter. Quantities and units. Patient protection. Personnel protection. Maximum permissible dose. Personnel exposure monitoring. Effect of irradiation. Direct and indirect interactions. Molecular and cell biology. Modifying effects of radiation. Short-term effects. Genetics. Radiation effects on reproduction. Radiation effects on immunity. Immunology. Radionuclides and their administration. Principles of radioimmunoassay.

**Minimum Academic Standards**

Molecular biology and tissue culture laboratories, and x-ray room with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VMD 404 **Camelid Health and Diseases** (2 Units; Core; L = 15; P = 45)

**Senate-approved relevance**

The dromedary camel is the production animal for the future due to its resilience in the face of the current trend of global warming, desert encroachment, drought and low rainfall. These extraordinary characteristics have drawn attention to it with many scientists now engaging in research into various aspects of its physiology. Despite this renaissance in camelid research, the dromedary camel as a species has been sidelined by government with more attention devoted to cattle production. With the creation of the Faculty of Veterinary Medicine in BUK, there is need to provide training to student veterinarians as well as veterinary services to dromedary camels owned by herders in the semi-arid northwestern Nigeria. This will enable our veterinary graduates to efficiently and professionally discharge their diagnostic and therapeutic responsibilities to this emerging sector of the economy thereby availing our immediate community with healthy and wholesome meat and milk products from the dromedary camel. It will also fulfill one of the aims and objectives of the BUK Doctor of Veterinary Medicine (DVM) programme by producing graduates that will use problem-solving skills to evaluate the dromedary camel patient and synthesize diagnoses (differential, tentative or confirmatory) by applying appropriate use of clinical and laboratory techniques.

**Overview**

Our teaching mission in the Faculty of Veterinary Medicine-BUK is to broaden the education of student veterinarians, especially on the health problems of species like the dromedary camel which is capable of providing sustenance to the teeming population of Kano State in the face of environmental challenges occasioned by global warming and desertification. The course will provide veterinary students with the necessary theoretical and practical framework to support their progression towards competence in camelid medicine at both individual and herd level. It will also ensure readiness for the clinical year rotation in production animal practice.

DVM students offering the course will benefit from the clinical nature of the core knowledge and skills as well as interactive and problem-solving sessions. The BUK student veterinarian will also learn to exercise judgement in a dynamic situation that is potentially life-threatening for the handler, veterinarian and/or patient, while behaving in a professional, responsible manner thereby fulfilling a core value of the University which is discipline and commitment.

**Objectives**

The objectives of the course are to:

1. define a clinical diagnosis in the dromedary camel.
2. argue the clinical diagnosis with main observations.
3. describe additional examinations or diagnostic tests.
4. discuss the recommended therapy.
5. describe the most important differential diagnoses and their major differences to support the clinical diagnosis.
6. discuss practical advice to the herder on how to control the disease.
7. discuss the prevention of important diseases in the individual or a population of dromedary camels.
8. discuss appropriate herd health plans for dromedary camels.
9. discuss the principles of population medicine and production in terms of investigation, biosecurity and communication.
10. describe the common surgical procedures performed on dromedary camels.

**Learning outcomes**

On completion of the course, students should be able to:

1. generate a clinical diagnosis in the dromedary camel.
2. justify the clinical diagnosis with main observations.
3. name additional examinations or diagnostic tests.
4. identify the recommended therapy.
5. name at least three (3) most important differential diagnoses and their major differences to support the clinical diagnosis.
6. outline practical advice to the herder on how to control the disease.
7. state at least three (3) preventive measures for important diseases in the individual or a population of dromedary camels.
8. develop appropriate herd health plans for dromedary camels.
9. apply the principles of population medicine and production in terms of investigation, biosecurity and communication.
10. develop expertise in the common surgical procedures performed on dromedary camels.

**Course contents**

Challenges of providing clinical services to pastoral areas in Africa. Handling and restraint of dromedary camels. Sedation. General anaesthesia and neuroleptanalgesia. The normal healthy dromedary camel. General clinical examination of the dromedary camel (anamnesis, visual appraisal and physical examination). Laboratory samples. Abdominal examination. Ageing. Weight estimation. Medication. Weight loss. Pox-like skin lesions and other skin problems. Respiratory distress. The sick calf. Central nervous system problems. Acute death in adult dromedary camels. Abortion. Photographic overview of the main pathologies of the dromedary camel. Surgical conditions in the dromedary camel.

**Minimum Academic Standards**

Abattoir, veterinary field station, veterinary teaching hospital and camel farms with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPE 402 **Aquatic Parasitology** (2 Units; Core; L = 15; P = 45)

**Senate-approved relevance**

Fish plays a significant role in the aquatic ecosystem in addition to provision of high-quality food. With the current global climate change and the ever increasing world population, fish has gained prominence as a protein source for man. Fish parasites have been suggested to play the role of bioindicators of ecosystem health through long term monitoring of pollution and climate change. Furthermore, fish plays a decisive role in the life cycle of many parasites by acting as an intermediate or final host. Therefore, the student veterinarian offering this course is capable of improving fish production by controlling infestation and infection of fish with aquatic parasites as well as preventing the perpetuation of parasites of zoonotic importance from fish to man through the food chain; thus, fulfilling one of the general aims and objectives of the BUK Faculty of Veterinary Medicine which is to identify ways of preventing diseases through biosecurity measures, identifying zoonotic diseases and promoting food safety issues and awareness of the public on animal and environmental health.

**Overview**

Parasites belong to an important group of pathogens that cause infestation, infection and diseases of fish both in freshwater and marine environments. With increasing interests in aquaculture, parasitic infestations are becoming threats to fish health management and aquatic production throughout the world. Aquatic parasitology is, therefore, an essential area that needs proper attention in the contemporary veterinary curricula to facilitate sustainable aquaculture.

The course will explore aquatic parasitology using a multitude of learning approaches, including class lectures, paper discussions, field observations, laboratory observations, and both guided and open field and laboratory inquiries. It is designed to enable student veterinarian acquire basic knowledge focused on the morphology, life cycles, and epizootiological aspects. Diagnosis, prophylaxis and treatment will also be emphasized. Our purpose is to enable the veterinary student to relate knowledge gained during the course to the critical evaluation of parasitic disease in the fish patient. After graduation, products of the BUK DVM programme will be able to provide clinical diagnostic and laboratory services to clients in the aquaculture sector thereby enhancing fish production and the supply of healthy and wholesome food via the food chain. This will go a long way in promoting the United Nations Sustainable Development Goals 1 (no poverty), 2 (zero hunger), 3 (good health and wellbeing) and 14 (life below water).

**Objectives**

The objectives of the course are to:

1. describe the different taxonomic groups of parasites affecting fish.
2. explain the life cycle, mode of transmission and predilection sites of fish parasites.
3. describe the parasitological examination of fish.
4. discuss the basic factors contributing to the abundance of parasites and the evolution of host-parasite relationships.
5. explain preventive and therapeutic measures employed in the control of fish diseases, including those that are zoonotic.

**Learning outcomes**

On completion of the course, students should be able to:

1. recognize different taxonomic groups of parasites affecting fish.
2. describe the life cycle, mode of transmission and predilection sites of fish parasites.
3. recall at least four (4) steps in the parasitological examination of fish.
4. list at least six (6) basic factors contributing to the abundance of parasites and the evolution of host-parasite relationships.
5. list at least three (3) preventive and therapeutic measures each used in the control of fish diseases, including those with zoonotic potential.

**Course contents**

Definition of terms. Symbiosis and its types. Infestation. Infection. Classification of protozoan, helminth, copepod and annelid parasites of fish. Characteristics of protozoan, helminth, copepod and annelid parasites with examples. Host-parasite-environment relationship. Types of parasitism. Life cycle of representative protozoan and metazoan fish parasites – key to their control. Common protozoan parasitic diseases of fish. Common metazoan parasitic diseases of fish. Cell and tissue reactions to parasites. Immunity in fish against parasitic infestation and infection. Principles of immunization against protozoan and metazoan parasitic diseases of fish. Stress and susceptibility of fish to parasitic diseases. Infestation to infection and diseases. Fish as a carrier of human diseases (zoonotic diseases). Prevention and control of zoonotic diseases.

**Minimum Academic Standards**

Parasitology laboratory, fish necropsy room, and pond/farm with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

**BUK-VBC 501 BasicToxinology** (3 Units; Core; L=30; P=45)

**Senate-approved relevance**

Successful animal husbandry requires an adequate understanding of poisonous substances (animal and plant toxins) capable of affecting animal health. The elucidation of mechanisms of action and the best approaches to the development of potent antidotes for these toxins cannot be overemphasized in overcoming the menace of the various forms of toxicoses bedevilling livestock production in Nigeria. Equipping students of Veterinary Medicine with basic knowledge and skills on toxinology will give them a sound grounding in toxin biochemistry. This will prepare them for further specialisation in the veterinary applications of toxinology at the postgraduate level. It will also produce competent veterinarians that can meet the challenges of the 21st century and beyond in line with the mission of Faculty of Veterinary Medicine, Bayero University, Kano (BUK).

**Overview**

Animal products account for a large percentage of foods consumed in Nigeria. Animals, like humans, are susceptible to neglected tropical diseases, such as snakebite envenoming, which causes considerable morbidity perpetuated by the antivenom crisis in Africa. In recent years, farmers, exporters and local consumers have been grappling with issues ranging from poor harvest to food shortage and consequent economic losses due to contamination of feeds with mycotoxins. With the ever-growing demand for animal products, it has become imperative for the 21st century veterinarian to have an all-round understanding of the pathophysiology of snakebite envenoming and mycotoxicoses in order to tackle the menace of these health problems in animals. Venomics and antivenomics, being one of the four focal areas of research in the Faculty of Veterinary Medicine – BUK, serve as a robust pathway for exposing the BUK veterinary student to a frontier of knowledge that is full of innovation and dynamism.

Veterinarians have roles to play in herpetology as well as animal immunisation for the development of indigenous and affordable antivenoms. They can contribute immensely to the wealth of scientific information on the harmful and beneficial properties of animal toxins. With advances in science and technology, the list of toxin-derived therapeutic and diagnostic agents is increasing. This course is, therefore, aimed at introducing the BUK veterinary student to the field of toxinology at the undergraduate level. This will lay the foundation for future specialisation at the postgraduate level and subsequently, successful navigation of a career in veterinary toxinology; thus, creating a new generation of BUK veterinary graduates with the capacity to contribute to the actualisation of the sustainable development goals 2 (food security) and 3 (health and wellbeing) of the United Nations.

**Objectives**

The objectives of the course are to:

1. define toxinology and differentiate it from toxicology.
2. discuss subsets of toxinology and their relevance to veterinary medicine.
3. classify toxins of veterinary and human importance from different origins.
4. classify the snake venom toxins and mycotoxins.
5. explain the biochemistry of common toxins of veterinary and human importance.
6. explain the biochemistry of snake venom toxins and mycotoxins.
7. relate the biochemistry of toxins to the pathophysiology of envenomation and mycotoxicoses.
8. demonstrate the process of venom collection, processing, and storage.
9. outline the steps involved in venom and antivenom analyses.
10. explain the use of antivenoms and their mechanism of action
11. discuss types of antivenom based on method of production.
12. demonstrate the detection of mycotoxins in feeds, animal products and biologic fluids.
13. explain the process of antivenom development with reference to old and new approaches.
14. relate the knowledge gained in this course to the diagnosis of snakebite envenoming and mycotoxicoses in animals.

**Learning outcomes**

Upon completion of the course, students should be able to:

1. differentiate between toxinology and toxicology.
2. recall at least two (2) subsets of toxinology and their relevance to veterinary medicine.
3. list at least three (3) categories of toxins of veterinary and human importance from different origins.
4. list at least seven (7) types of snake venom toxins and six (6) types of mycotoxins.
5. examine the biochemistry of common toxins of veterinary and human importance.
6. describe the biochemistry of snake venom toxins and mycotoxins.
7. apply the biochemistry of toxins to the pathophysiology of envenomation and mycotoxicoses.
8. describe venom collection, processing and storage.
9. analyze venom and antivenom.
10. recall the use of antivenoms and their mechanism of action.
11. identify the types of antivenom based on method of production.
12. evaluate toxins of veterinary and human importance in body fluids, foods, and feeds
13. discuss the process of antivenom development with reference to old and new approaches
14. apply the knowledge gained in this course to the diagnosis of snakebite envenoming and mycotoxicoses in animals.

**Course contents**

Toxinology (definition and subsets). Differences between toxinology and toxicology. Types and classification of toxins. Animal and plant toxins of veterinary and human importance. Snake venom biochemistry. Classification of snake venom toxins. Mechanism of action of snake venom toxins. Milking of snakes (snake venom collection). Snake venom processing. Snake venom storage. Analysis of snake venoms (venomics). Development of antivenoms. Analysis of antivenoms (antivenomics). Mycotoxins (definition, types and classification). Mycotoxins of veterinary and human importance in Nigerian foods and feeds. Biochemistry of mycotoxins. Detection of mycotoxins in foods and feeds.

**Minimum Academic Standards**

Biochemistry and molecular biology laboratories and animal house with NUS-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VMD 601 **Laboratory Animal Biomethodology and Welfare** (3 Units; Core; L = 45; P = 0)

**Senate-approved relevance**

The veterinarian in Nigeria majorly plays a role in food animal health and production to the detriment of other areas of relevance. This perceived lopsidedness could be due to the main catalyst for the development of the profession in Nigeria and other African countries being the need to find solutions to the outbreak of diseases of food animals. Due to error of commission or omission, the developers of the curriculum for the training of veterinarians in the country maintained the existing bias for food animals. There is, therefore, the need to create awareness among students of Veterinary Medicine that their roles extend beyond agricultural animals used in food production to the biomedical sciences and comparative medicine. Veterinarians employ the use of animals in translational research and other applications in which humans or animals serve as end users. This paradigm shift in the training of veterinarians is in line with the philosophy of Bayero University Kano in producing world class academics and professionals that are capable of community-driven veterinary research for the advancement of human and animal health. Furthermore, this approach is a fulfillment of one of the four unique focal areas of the Bayero University Faculty of Veterinary Medicine which is to achieve excellence in Laboratory Animal Medicine and Welfare.

**Overview**

Veterinarians in Nigeria are uniquely positioned to conduct biomedical research. However, one most critical challenge is the shortage of courses on laboratory animal medicine and science in the curriculum. Making these courses available will lay a solid foundation for advanced biomedical research training. It will also curtail the dearth of Nigerian veterinarians in biomedical research.

In the current 70% NUC contribution to the CCMAS, animal production and management courses captured only food, companion and wild animals as well as poultry and fish. Laboratory animals were not included, though aspects of their diseases were mentioned under a course with the composite nomenclature of “Small/laboratory animal and microlivestock medicine”. In the afore-mentioned course, emphasis was made only on clinical signs, diagnosis, treatment and control; thus, reducing the scope of relevance of the veterinarian to these important areas but not capturing other contemporary roles such as husbandry, research ethics, welfare assessment, research animal model selection and so on.

By introducing a course of this nature, the identified gaps will be filled and graduates of the BUK DVM programme will be better equipped to provide wide range of services to support clients who use animal models for biomedical research in human diseases. This is in pursuance of the United Nations Sustainable Development Goal 3 which aims to ensure healthy lives and promote wellbeing for all at all ages. Our graduates will also be capable of providing services in the areas of veterinary care, support for grant applications, model selection, anaesthesia, analgesia, euthanasia, other procedural techniques, vivarium operational reviews, vivarium facilities design, and animal care workshops. This will further improve the employability of the BUK DVM graduate and properly position him/her to face the challenges of animal-based biomedical research in Nigeria, sub-Saharan Africa and Africa in the 21st century and beyond.

**Objectives**

The objectives of the course are to:

1. explain the biomedical importance of laboratory animals.
2. explain the difference between strains and stocks of laboratory rodents
3. describe different types of animal models and their uses in research.
4. describe the basic needs of laboratory animals.
5. explain the basic biology of laboratory rodents.
6. describe behavioural changes in laboratory rodents.
7. describe handling and restraint of laboratory rodents for routine procedures.
8. assess weight, age and gender of laboratory rodents.
9. describe techniques for physical examination and administration of substances in laboratory rodents.
10. describe the composition and key elements of the Animal Care Committee’s Terms of Reference
11. describe the major components of an Animal Care Programme.
12. outline and evaluate the required elements of an Animal Use Protocol (AUP).
13. define the 3Rs.
14. recognize intrinsic and extrinsic factors that may alter animal-based research data.
15. explain key elements of an appropriate quality control programme for monitoring rodent health.
16. describe steps that should be considered when investigating disease outbreak in a laboratory animal facility.
17. describe appropriate anaesthetic protocols for various laboratory animal species.
18. describe a Standard Operating Procedure for an appropriate technique to euthanize rodents with carbon dioxide.
19. describe potential occupational health and safety hazards for employees working in a vivarium.
20. explain the role of personal protective equipment in minimizing the development of laboratory animal allergy.
21. describe the early clinical signs and associated species for common zoonotic agents found in selected laboratory animals.
22. define biosafety levels.
23. identify appropriate husbandry and diet for selected laboratory animal species.
24. explain common indicators of normal and abnormal behaviour for selected laboratory animal species.
25. describe common diseases and their presentations as well as preventative health maintenance programmes required for selected laboratory animal species.

**Learning outcomes**

On completion of the course, students should be able to:

1. recall the biomedical importance of laboratory animals.
2. identify differences between strains and stocks of laboratory rodents
3. list at least four (4) different types of animal models and their uses in research.
4. list at least five (5) basic needs of laboratory animals.
5. describe the basic biology of laboratory rodents.
6. recognize behavioural changes in laboratory rodents.
7. practice the handling and restraint of laboratory rodents for routine procedures.
8. practice weight, age and gender determination in laboratory rodents.
9. demonstrate techniques for administration of substances and physical examination in laboratory rodents.
10. list the composition and key elements of the Animal Care Committee’s Terms of Reference
11. list the major components of an Animal Care Programme.
12. list at least six (6) required elements of an Animal Use Protocol (AUP).
13. recognize the 3Rs.
14. list at least three (3) intrinsic and extrinsic factors each that may alter animal-based research data.
15. recall at least five (5) key elements of an appropriate quality control programme for monitoring rodent health.
16. identify at least four (4) steps that should be considered when investigating disease outbreak in a laboratory animal facility.
17. explain appropriate anaesthetic protocols for various laboratory animal species.
18. develop a Standard Operating Procedure for an appropriate technique to euthanize rodents with carbon dioxide.
19. identify potential occupational health and safety hazards for employees working in a vivarium.
20. describe the role of personal protective equipment in minimizing the development of laboratory animal allergy.
21. identify the early clinical signs and associated species for common zoonotic agents found in selected laboratory animals.
22. identify at least three (3) biosafety levels.
23. apply appropriate husbandry and diet for selected laboratory animal species.
24. identify common indicators of normal and abnormal behaviour for selected laboratory animal species.
25. identify at least ten (10) common diseases and their presentations as well as develop preventative health maintenance programmes required for selected laboratory animal species.

**Course contents**

Ethical aspects of relationships between humans and research animals. What are laboratory animals? European definition of laboratory animal. Swedish definition of laboratory animal. Selected species of laboratory animals and their biomedical importance. Why are rodents the most commonly used laboratory animals? Basic needs of laboratory rodents. Common names for various body parts of laboratory rodents. Identification of different life stages and breeds/strains of laboratory rodents. Basic housing and husbandry. Humane and safe handling and restraint techniques. Substance administration. Physical examination. Ageing, weighing and sexing. Basic behaviour. Welfare assessment. Enrichment. Rodent breeding management. Bioethics. Oversight of animal care and use. Local oversight by the Animal Care Committee. Animal models and alternatives. Factors affecting animal-based research data. Anaesthesia, analgesia and euthanasia. Pain assessment. Occupational health and safety. Biosafety. Facility Operations. Overview of common animal species as research models. Selected guidelines in laboratory animal science and medicine.

**Minimum Academic Standards**

Animal house (vivarium) with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VMD 603 **Comparative Physiology and Biomedicine** (3 Units; Core; L = 45; P = 0)

**Senate-approved relevance**

It is a fact that all activities of veterinarians have a bearing on human health either directly through biomedical research and public health engagement or indirectly through their role in addressing domestic animal, wildlife or environmental health. Veterinary research plays a central as well as critical role at the interface between human and animal health. This is undervalued and often not understood. A vision for the Bayero University Kano (BUK) graduate of veterinary medicine is, therefore, to contribute to advancing One Medicine by leveraging on the interconnectedness of relationships and transferability of knowledge in solving health problems in all species. This vision can be achieved through early exposure of our students to comparative physiology which is an essential complement to other disciplines within physiology that commonly exploit model organisms to elucidate basic mechanisms of function or dysfunction. By so doing, we have deviated from the age old curriculum that emphasizes the health of food producing animals and embraced a veterinary curriculum that recognizes contemporary courses that are often in context to human disease; thus, bringing to the fore the role and centrality of the 21st century veterinarian in biomedical research.

**Overview**

The course will focus on natural animal models. A natural animal model is an animal group or species that exhibits biochemical/physiological characteristics natural for that animal but pathological for man. With a course of this nature, our students will take advantage of the “research” performed by nature in animal design testing and selection to gain valuable insights into the causation and therapy of various human clinical disorders. Solutions presented by these natural animal models represent adaptations that have evolved within the context of multifunctionality of body systems.

The broad aim of the course is to train the graduate of veterinary medicine to solve human clinical problems using a comparative physiological approach rooted in the use of natural animal models. Physiology, being an invaluable foundational discipline to the training of veterinarians, can be used to frame important questions about human function. To appreciate the fact that human functions are not unique but shared in part by an assortment of animals, our students need exposure to comparative physiology at the undergraduate level. Furthermore, the use of natural animal models in doing so is an extension of the afore-mentioned concept.

Upon graduation, our graduates working in the biomedical field will be confronted with a plethora of problems of abnormal human function as a result of disease process or functional disorders. When this happens, they should be able to ask whether an animal exists which has solved a similar problem through the pressures of natural selection. They should also ask whether the solution, if available, can be transferred partly or completely to the human subject with the abnormal function. It is, therefore, our goal that the BUK veterinary graduate will be able to convincingly answer these questions in the affirmative having passed through this course. Answering such questions is foundational to breakthroughs in research and development in the biomedical field which is in line with the vision of BUK to lead in research and education in Africa.

**Objectives**

The objectives of the course are to:

1. explain the Krogh principle.
2. discuss the philosophy behind the comparative method.
3. explain the history of comparative physiology and biology.
4. describe the characteristics that make birds a natural model for diabetes mellitus.
5. explain the metabolic/physiological adaptations of the bear as a natural model of chronic renal failure, disuse osteoporosis and disuse muscular atrophy.
6. describe features/mechanisms/adaptations of the fish as a natural model of artherosclerosis and ammonia toxicity.
7. describe features/mechanisms/adaptations of hypoxia tolerant animal models.

**Learning outcomes**

On completion of the course, students should be able to:

1. recall the Krogh principle and identify its applications.
2. outline the philosophical basis of the comparative method.
3. identify milestones in the historical evolution of comparative physiology and biology.
4. recognize features/mechanisms/adaptations in birds that make them natural models for diabetes mellitus.
5. recognize features/mechanisms/adaptations in the American black bear that makes it a natural model for chronic renal failure, disuse osteoporosis and disuse muscular atrophy.
6. recognize features/mechanisms/adaptations in fish that make them natural models for artherosclerosis and ammonia toxicity.
7. recognize features/mechanisms/adaptations in selected animals that make them natural models for hypoxia/ischaemia tolerance.

**Course contents**

The Krogh principle. Investigative philosophy of the comparative method. A history of comparative physiology and biology. Blood glucose levels in birds. Resistance of birds to high blood glucose concentration. Avian eye and kidney design features in relation to diabetes mellitus in humans. The physiology of the failing kidney. Metabolic rate and renal function. Nitrogen and urea metabolism. Urea transport proteins. Protein turnover. Alterations in urea and protein metabolism in chronic renal failure. The American black bear, a natural model of chronic renal failure. Artherosclerosis in mammals. Biology of the arterial system. Genesis of artherosclerotic lesions. Fish as a natural model for artherosclerosis. Disuse osteoporosis. Disuse muscular atrophy. The American bear as a natural model of disuse osteoporosis and disuse muscular atrophy. Ammonia tolerance and metabolism. Brain ammonia metabolism. Mechanism of ammonia neurotoxicity. Ammonia and the fish central nervous system. Selected animals as natural models of hypoxia/ischaemia.

**Minimum Academic Standards**

Library and e-learning centre with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPM 601 **Veterinary Research Methodology, Experimental Design and Data Analysis** (2 Units; Core; L = 30; P = 0)

**Senate-approved relevance**

Veterinarians in academia, industry, or the government are often leaders or key team members involved in a broad array of research including basic science research, biomedical research with applications to animal or human health, laboratory animal medicine, public health, and medical product development. With their background and training, veterinarians have unique skill sets that enable them to serve as important members of interdisciplinary research teams. To improve the quality of research in the biomedical sciences and other relevant research areas, this course will, in addition to VPM 507 (Veterinary Biostatistics and Economics), expose the BUK student veterinarian to rigorous research designs, research data management and analysis as well as writing of high quality and scientifically sound reports and manuscripts. This will ensure that the vision of BUK to lead in education and research in Africa is achieved.

**Overview**

Student veterinarians need skills to outline a convincing research design which is the most crucial part of the research project that they will conduct in the final year. This is due to the fact that research design forms the frame on which other skills are assembled and connected to one another. The course is, therefore, oriented towards helping student veterinarians to design, conduct and write up their research with a specific focus on the final year research project. Different approaches to research as well as problems, experiences and challenges which tend to surface during the research process will be discussed.

The broad aim is to equip BUK graduates of veterinary medicine with methods, skills and tools that will help in making informed decisions during their own research and help them analyse data, write academic texts and present findings. The course attempts to situate theory and methods across a wide variety of empirical settings and contexts. By so doing, it will strengthen the scientific impact of the core mission of veterinary research (i.e. animal health) while firmly reinforcing its societal and global relevance.

**Objectives**

The objectives of the course are to:

1. discuss ethical considerations in research.
2. explain the philosophy of science.
3. appraise proper research projects.
4. describe relevant techniques and approaches applicable to research projects.
5. explain how established techniques of research and enquiry are used in veterinary medicine.
6. discuss hypotheses and tests of hypothesis.
7. discuss experimental design.
8. demonstrate data collection.
9. demonstrate data exploration, handling and analysis.
10. demonstrate results interpretation and reportage.
11. demonstrate effective written, oral and graphical presentation skills.
12. describe project management in the context of planning a research project through working in small groups.
13. demonstrate the use of a wide range of appropriate software for data analysis as well as presentation/communication of results to the audience.

**Learning outcomes**

On completion of the course, students should be able to:

1. apply ethical considerations in research.
2. describe the philosophy of science.
3. develop proper research projects.
4. apply relevant techniques and approaches to research projects.
5. apply established techniques of research and enquiry to veterinary medicine.
6. formulate hypotheses and design tests of hypothesis.
7. design experiments.
8. collect data.
9. analyze data.
10. interpret results.
11. demonstrate effective written, oral and graphical presentation skills.
12. practice project management in the context of planning a research project through working in small groups.
13. use a wide range of appropriate software for data analysis as well as presentation/communication of results to the audience.

**Course contents**

Ethics in research. Philosophy of science. The scientific method. The four-question strategy. Research methods. Experimental design diagram. Principles of experimental design and survey techniques. Design of field experiments. Data exploration. The analysis of research data. Analysis of categorical data. Missing data. Principles of animal experimentation. The PREPARE and ARRIVE guidelines. The scientific writing process. Preparation of scientific presentations. Presentation and communication of scientific research results.

**Minimum Academic Standards**

E-learning centre/computer laboratory with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPM 603 **Veterinary Practice Management** (2 Units; Core; L = 15, P = 45)

**Senate-approved relevance**

Student veterinarians in the 21st century are exposed to extremely intensive courses of study with pre-clinical, para-clinical and clinical components. To prepare them for survival in these unprecedented times, the provision of an in-depth knowledge and understanding of the scientific and clinical aspects of the profession must be blended with a firm grasp of the legal, ethical, management and social elements of veterinary practice. Therefore, communication and interpersonal skills; responsible and professional behaviour, and an understanding of the business context of veterinary practice are important areas that define the contemporary veterinary curricula. Availing the BUK veterinary graduates with knowledge of business planning, marketing, human resource management and an awareness of the veterinary business environment would equip them to offer clients treatments and disease prevention strategies that are both cost-effective and aligned with the needs of the individual veterinary business within which they work; thus, fulfilling some of the core values of the University by producing graduates that are disciplined and committed as well as innovative and creative.

**Overview**

To properly position business topics within the professional strand of the veterinary curriculum, this course will employ a combination of directed learning sessions, workshops, tutorials, practicals and case-based learning. Formal lectures will not form a considerable component of the method of instruction for the course. The more practical and reflective assessment methods associated with mainstream business education will be introduced with gradual refinement from student feedback and industry consultation.

Tutors will be drawn from a pool of seasoned veterinary practice managers, colleagues from the Faculty of Management Sciences, the Dangote Business School, the Centre for Entrepreneurship Research and Training (CERT) and the Faculty of Social Sciences, as well as staff of the Faculty of Veterinary Medicine. Student veterinarians will use principles learned in previous courses on venture creation as well as entrepreneurship and innovation and apply them to “real world” circumstances with the supervision and assistance of the course tutors. They will interview practice owners, apply one or more analytical tools to evaluate problems and provide corrective recommendations and plans. At the end of the evaluation, cohesive business recommendations will be formulated for practice owners based on observations and financial analysis.

**Objectives**

The objectives of the course are to:

1. discuss the importance of team building, human resources, and ethical and legal considerations in veterinary practices.
2. describe the appropriate design, technology, diagnostic laboratory, and marketing strategies required in veterinary practices.
3. explain the methods used to ensure an efficient and compassionate communication process with clients.
4. explain the various intricacies involved in managing appointments, records, inventory, logs, and controlled substances.
5. discuss the importance of animal health insurance in veterinary practice and safety at workplace.
6. describe the various clinical assistance procedures and the calculations and conversions related to veterinary practices.

**Learning outcomes**

At the end of the course students should be able to:

1. analyze the importance of team building, human resources, and ethical and legal considerations in veterinary practices.
2. point out the appropriate design, technology, diagnostic laboratory, and marketing strategies required in veterinary practices.
3. analyze the methods to ensure an efficient and compassionate communication process with clients.
4. categorize the various intricacies involved in managing appointments, records, inventory, logs, and controlled substances.
5. point out the importance of animal health insurance in veterinary practice and safety at workplace.
6. categorize the various clinical assistance procedures and the calculations and conversions related to veterinary practices.

**Course contents**

Introduction. Responsibilities of veterinary practice managers. Qualities of good veterinary hospital managers. Fulfilling the mission and vision of hospital owners. Sample Practice Manager job description. Certification process for veterinary practice managers. Professional associations for veterinary practice managers. Job titles, credentials and responsibilities of personnel in veterinary practice. Veterinarians as owners, partners, managing partners or associates. Veterinary technicians. Veterinary assistants/kennel staff. Receptionists, bookkeepers, cashiers. Chain of command/organizational chart. Planning for employee acquisition. Recruiting veterinary practice employees. Employee training in veterinary practice. Performance evaluations. Promotions and raises. Termination of employment. Personnel records. Employment laws. Management and supervision of reception. Front-desk procedures in veterinary practice. Client relations. Information technology and telecommunications systems in veterinary practice. Marketing. Veterinary medical records management. Veterinary hospital revenue and financial control. Accounting and bookkeeping. Veterinary hospital inventory control and management. Veterinary facilities management. Accreditation programmes.

**Minimum Academic Standards**

Private veterinary practices in the host community, ICT laboratory and veterinary teaching hospital with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPM602 **Veterinary Biological Risk Management and Biosecurity** (2 Units; Core; L = 30, P = 0)

**Senate-approved relevance**

Biological Risk Management (BRM) is a term used to describe the overall process of evaluating a veterinary clinic, farm, or an animal housing facility based on the risk of infectious disease entry and spread. BRM is important due to increased interaction with animals, the rise in emerging and re-emerging infectious diseases, the far reaching economic ties to agriculture, increasing globalization and changing food production practices. Veterinarians have an essential role to play in BRM. This is because they focus on providing animal healthcare services and educating clients about disease prevention. They are trained in disease diagnosis and zoonotic awareness and prevention.

BRM takes a comprehensive approach to identifying the risk of disease entry and spread and developing a management plan. The establishment of the Faculty of Veterinary Medicine in BUK is in furtherance of this approach, especially the need to stem future occurrence of the 2006 outbreak of Avian Influenza in which Kano experienced the highest number of outbreaks. It is, therefore, imperative that the BUK veterinary graduate receives proper training to readily identify ways of preventing diseases through biosecurity measures, identifying zoonotic diseases and promoting food safety issues and increasing awareness of the public on animal and environmental health. This can be achieved through the introduction of a course on BRM in our curriculum. The course will help in realising one of the specific objectives of the 2021 Nigeria BRM Curriculum Development Workshop (in which the National Universities Commission was a key stakeholder) which emphasizes the need to specifically target students in universities, as future leaders, and empower them with the necessary knowledge, attitudes and skills related to BRM as a more effective and sustainable way of domesticating BRM in Nigeria. It will also improve Nigeria’s score in biosafety and biosecurity capacity from the recorded least possible score obtained in the 2017 World Health Organization Joint External Evaluation report.

**Overview**

Research and diagnostic laboratories are sources of infection to humans and animals when biological agents are not handled professionally. This could be due to accidents or faulty laboratory facilities and equipment. Some infectious disease outbreaks may have economic and psychological impact on the community. Appropriate knowledge of biosafety and biosecurity (biorisk management system) will reduce or eliminate the risk of potential exposure to biological hazards as well as prevent the loss, theft or misuse of biological agents/materials and sensitive information.

The course will provide the student veterinarian with a foundation in biorisk management. It will provide an overview of the microbiological hazards in various environments that may include water, soil, food, animals (including humans), the atmosphere and buildings. The student veterinarians will work through some particular case studies of pathogenic microbial hazards. They will gain knowledge of how exposure to microbial agents occurs and the adverse health effects that may ensue. The course will develop the knowledge of veterinary students to determine the extent of exposure over a given period of time. An understanding of qualitative and quantitative risk assessment for predicting the probability of adverse health (response) following a particular exposure (dose) will be gained. The management, regulations and standards that set limits for exposures to microbiological hazards will be discussed. The students will obtain an introductory understanding of quantitative microbial risk assessment.

The knowledge and skills acquired will enable BUK veterinary graduates to develop and implement a comprehensive biosafety and biosecurity management programme in biomedical laboratories of various industries (e.g., education, healthcare, pharmaceutical, biomedical sciences and technology), animal production facilities and aquaculture operations. This will improve their marketability as well as competence in safeguarding ecosystem health and fulfilling one of the focal areas of interest of the BUK Faculty of Veterinary Medicine by becoming a centre of excellence in zoonoses prevention and control.

**Objectives**

The objectives of the course are to:

1. discuss the importance of BRM.
2. explain the concepts of risk perception and risk assessment.
3. discuss various routes of transmission that could introduce disease pathogens.
4. describe tools used to implement practical disease management plans for practice owners, clients and producers.
5. create awareness regarding disease introduction and spread.
6. describe biological agents and classify them into their risk groups.
7. outline steps involved in risk assessment.
8. discuss a strategy for mitigation of the risk posed by biological agents by the application of pertinent controls.
9. describe Standard Operating Procedure (SOP) for specific processes.
10. discuss the performance of the controls.

**Learning outcomes**

At the end of the course students should be able to:

1. illustrate the importance of BRM.
2. outline the concepts of risk perception and risk assessment.
3. recall at least three (3) routes of transmission that could introduce disease pathogens.
4. apply tools to implement practical disease management plans for practice owners, clients and producers.
5. demonstrate awareness regarding disease introduction and spread.
6. list at least three (3) biological agents and their respective risk groups.
7. prepare a risk assessment.
8. develop a strategy for mitigation of the risk posed by biological agents by the application of pertinent controls.
9. design a Standard Operating Procedure (SOP) for a specific process.
10. assess the performance of the controls by conducting a review of the process.

**Course contents**

Introduction. The BRM toolbox. Importance of BRM. Risk perception. Risk assessment. Routes of transmission. Risk management plan. Risk communication. Role of the veterinarian in BRM. Principles of laboratory biosecurity. Circles of disease transmission. General principles of biosecurity in animal production and veterinary medicine. Biosecurity and its relationship with health, production and antimicrobial use. How to motivate farmers to implement biosecurity measures. How to measure biosecurity and the hygiene status of farms. Cleaning and disinfection. Hygienic aspects of air and decontamination of air. Feed hygiene. Drinking water hygiene and biosecurity. Promoting biosecurity through insect management at animal facilities. Rodent control in animal production. Transmission of pig diseases and biosecurity in pig production. Transmission of poultry diseases and biosecurity in poultry production. Transmission of cattle diseases and biosecurity in cattle farms. Biosecurity for horse facilities. Biosecurity measures for dog merchants and canine breeding kennels. Biosecurity in veterinary practices and clinics. Biosecurity in laboratory animal research facilities. Biosecurity in aquaculture. Standard operating procedures.

**Minimum Academic Standards**

Livestock, horse and poultry and fish farms, laboratory animal facilities, canine breeding kennels, veterinary teaching hospital, veterinary practices, horse racing facilities, abattoir, feed mill and diagnostic laboratories with NUC-MAS facilities.

Bayero University, Kano (BUK)

Veterinary Medicine

Veterinary Medicine

Doctor of Veterinary Medicine

BUK-VPC 601 **Veterinary Botanical Medicine** (2 Units; Core; L = 30; P = 0)

**Senate-approved relevance**

It is a reality that the world is facing serious problems as a result of the ineffectiveness of commercially available drugs in both human and veterinary medicine. The development of resistance by parasites and microorganisms when targeted by these drugs has necessitated a return to nature’s pharmacy. This shift in focus in search of the magic bullet is not only glaring in human medicine but also in veterinary medicine where hardly any new molecules have been developed over the past decades to control parasites and microorganisms. Therefore, in line with the realities of our time, introducing a course on veterinary herbal medicine to our curriculum is timely and capable of encouraging veterinary graduates to engage in the practice of alternative veterinary medicine in the event that the orthodox approach fails. This will thoroughly bake the BUK veterinary graduate in the crucible of knowledge by enhancing the integration of scientific, clinical and traditional knowledge into the practice of veterinary medicine for the greater benefit of the health and well-being of animals as enshrined in the mission statement of the American College of Veterinary Botanical Medicine. Such a holistic approach to the training of student veterinarians is also in line with the mission of BUK to address African developmental challenges through cutting-edge research, knowledge transfer and training of high quality graduates.

**Overview**

The course introduces the history of herbal medicine, and looks at the parallel emergence of veterinary herbal medicine including the current renaissance in contemporary practice. It explores the history and philosophies of some major historical figures in Western Herbal Medicine as well as touching on other ancient healers and systems including Egyptian, Arabian, Roman and Greek medical systems. The Traditions of Western herbal medicine will be investigated including the Humoral Theory, Physicomedicalism, Eclectic Movement and Doctrine of Signatures which underpin the development of Modern Herbalism and Modern Veterinary Herbal Medicine.

After graduation, products of the BUK DVM programme will be able to apply veterinary herbal medicine techniques and strategies to solve challenging cases. The course will provide the foundation and opportunity for students interested in searching for green solutions to parasitic and microbial infections in animals to enroll for postgraduate studies to further isolate and test bioactive compounds from plants and follow up on aspects such as toxicology, pharmacology, testing activity in animals, mechanism of activity, industrial application and enabling rural use. This implies that the course has bioprospecting and entrepreneurship potential that in the long term aims to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation in line with the United Nations Sustainable Development Goal 9.

**Objectives**

The objectives of the course are to:

1. describe the basic history of herbal medicine and in particular the use of herbs for the treatment of animals.
2. explain where African herbal medicine fits into the global herbal medicine systems.
3. discuss phytomedicine.
4. describe basic herbal preparations in veterinary practice.
5. discuss herbal phytochemicals and their action.
6. explain basic terminology used in herbal medicine from alternatives to vulneries.
7. discuss principles employed in the selection of an appropriate dose for a herbal medicine and for a patient.
8. discuss potential herb-drug interactions.
9. describe the use of herbs for the treatment of animals in everyday cases.

**Learning outcomes**

On completion of the course, students should be able to:

1. recall the basic history of herbal medicine and in particular the use of herbs for the treatment of animals.
2. recognize the position of African herbal medicine in the global herbal medicine systems.
3. define phytomedicine.
4. prepare at least three (3) basic herbal preparations in veterinary practice.
5. classify herbal phytochemicals and their action.
6. recall at least five (5) basic terminologies used in herbal medicine from alternatives to vulneries.
7. apply principles used in the selection of an appropriate dose for a herbal medicine and for a patient.
8. recognize potential herb-drug interactions.
9. identify at least ten (10) herbs for the treatment of animals in everyday cases.

**Course contents**

What is herbal medicine? A brief history of herbal medicine. Veterinary herbal medicine history. Major herbal medicine systems. What is phytomedicine? Plant parts used in medicine. Preparation term. History of US herbalists, Eastern, Unani-Tib, Greek, European allopathic medicine development. Medicinal and toxic plant families. Ecological influence of plant constituents, timing of harvest. Endangered species and conservation. Issues and quality with respect to sources of herbal medicine. Herbal manufacture. Preparations. The complexity of herbs. Phytochemicals. Classification of herbal constituents. Plant families that contain phytochemicals. The action of phytochemicals. Terminology and the language of herbal medicine. Introduction to materia medica. Foods considered medicine. Herbs enhancing the effect of a healthy diet. Good food is medicine. Supplements derived from plants. Phytoceuticals sold as supplements. Wholism and vitalism. Health and disease. Therapeutic approach in veterinary herbal medicine. Taking the case. Chinese medicine (5 elements, Yin-Yang theory, 5 vital substances, 12 organs, e.t.c.). Six phases. Major schools. Review of systems. 8 principles. Tongue diagnosis, e.t.c. Diagnostics (how do you know that what is wrong is wrong, physical features to support the patterns). Holistic physical diagnosis, including pulse, tongue, coat, ears, breath, foot pads, behaviour, interaction. Interpretation of laboratory and radiological/imaging results. Synergy. Blending. Review of dosage approaches. Dosing considerations. How to give herbs to animals. Adverse reactions. Potential toxicities. Prescribing and dispensing. Herb-drug interactions. A basic herbal pharmacy. CTM materia medica. Ayurveda/Middle Eastern materia medica. Ethnobotany. Native American materia medica. American botanical medicine. Additional materia medica (European, African, South American, e.t.c.). Triune formulation/therapeutic classes (i.e., herbal gastroenterology, sleep disorders, e.t.c.).

**Minimum Academic Standards**

Biochemistry, pharmacology and pharmacognosy laboratories, and herbarium with NUC-MAS facilities.