Bachelor of Science

Veterinary and Wildlife Science

Bachelor of Science: Veterinary and Wildlife Science

MISSION STATEMENT

The Bachelor of Science in Veterinary Science and Wildlife at SRU is committed to fostering a holistic understanding of animal health, conservation, and ecological dynamics. Our program integrates regional perspectives with global relevance, equipping students with the knowledge and skills needed to address critical challenges in veterinary medicine and wildlife management while advancing research in the field.

At Springfield Research University, our **Bachelor of Science in Veterinary and Wildlife Science** program prepares students for impactful careers in animal care, public health, scientific research, education, and advocacy. Rooted in academic excellence, this program equips students with essential knowledge, practical skills, and hands-on experience in veterinary medicine and wildlife conservation.

Program Pillars:

1. **Academic Excellence:**
    - We uphold rigorous standards, fostering critical thinking and intellectual growth.
    - Through engaging coursework, practical training, and evidence-based practice, we empower students to excel in the complex world of veterinary and wildlife science.
    - Students gain a solid foundation in animal anatomy, physiology, disease management, and conservation principles.
2. **Cutting-Edge Research:**
    - Our faculty and students actively contribute to advancing veterinary and wildlife science.
    - By addressing real-world challenges, exploring innovative approaches, and shaping industry practices, we drive positive change within the field.
    - Students engage in research projects, field studies, and wildlife monitoring, enhancing their ability to provide innovative solutions.
3. **Societal Impact:**
    - We recognize our responsibility to animals, ecosystems, and communities.
    - Our graduates are not only knowledgeable professionals but also ethical stewards who advocate for animal welfare, conservation, and global biodiversity.
    - We empower them to make meaningful contributions to wildlife health, ecosystem resilience, and sustainable practices.

Program Focus:

- Our program emphasizes both veterinary medicine and wildlife science. Here's how we achieve this:

1. **Foundational Sciences:**
    - Students delve into core subjects such as animal anatomy, physiology, and disease pathology.
    - These foundational sciences provide the essential groundwork for understanding animal health, behavior, and ecosystem dynamics.
2. **Applied Correlations:**
    - Lectures and practical sessions correlate theoretical knowledge with real-world scenarios.
    - For example, students learn about wildlife population dynamics and immediately apply it during field studies or wildlife rehabilitation.
3. **Case-Based Learning:**
    - Real-world cases serve as powerful teaching tools.
    - Students analyze animal health issues, wildlife conservation challenges, and ethical dilemmas.
    - This approach bridges theory and practice, reinforcing veterinary and wildlife science concepts.
4. **Wildlife Experiences:**

- Fieldwork and wildlife encounters are integral to our program.
- Students participate in habitat assessments, wildlife tracking, and conservation projects.
- They gain firsthand knowledge of wildlife behavior, ecology, and habitat management.

5. **Industry Collaborations and Internships:**
   - During placements and internships, students work directly with veterinarians, wildlife biologists, and conservation organizations.
   - They apply theoretical knowledge in clinical settings, wildlife rehabilitation centers, and research labs.
6. **Research and Conservation Efforts:**
   - Students critically evaluate research articles, contribute to wildlife surveys, and engage in conservation initiatives.
   - This integration of evidence-based practices ensures that knowledge acquisition aligns with current best practices in veterinary medicine and wildlife science.

By seamlessly weaving theory, practical experiences, and evidence-based approaches, our program prepares graduates to contribute effectively to the dynamic fields of veterinary care and wildlife conservation. Our mission is to nurture visionary thinkers and compassionate professionals who safeguard animal health, promote biodiversity, and inspire positive change in the natural world.

The mission of SRU's veterinary and wildlife science degree offers a regional perspective relevant to local wildlife and animal health, and will also highlight key issues of international relevance by exploring suitable examples and case studies. Laboratory-based learning is supported by fieldwork at sites such as farming and breeding enterprises, animal health practices and natural habitats with wildlife populations. The students will study a wide range of topics including anatomy, animal health, biochemistry, cellular metabolism, immunology, microbiology, physiology and zoology.

RATIONALE FOR BACHELOR OF SCIENCE IN VETERINARY AND WILDLIFE SCIENCE

At Springfield Research University, our **Bachelor of Science in Veterinary and Wildlife Science** program is meticulously designed to prepare students for impactful careers in animal care, wildlife conservation, public health, scientific research, and education. Rooted in academic excellence, this program equips students with essential knowledge, practical skills, and hands-on experience in veterinary medicine and wildlife management.

1. **National Needs (Eswatini):**
   - **Quantitative Expertise:**
     - Eswatini demands skilled professionals who can navigate complex scenarios in animal health, wildlife management, and conservation.
     - The program equips students with quantitative proficiency and critical thinking abilities to assess animal populations effectively.
   - **Cutting-Edge Practices:**
     - Graduates advocate for evidence-based decision-making, ensuring animal welfare, ecosystem health, and equitable treatment.
     - By enhancing their understanding of wildlife ecology, disease control, and habitat management, they contribute to better conservation outcomes.
   - **Policy and Innovation:**
     - The program fosters critical thinking, enabling graduates to engage in research, policy formulation, and informed decision-making at the national level.
2. **Regional Needs (SADC):**
   - **Harmonization of Practices:**

        - SADC member states face common wildlife conservation challenges.
        - The program aligns with SADC's goal of harmonizing wildlife management frameworks, promoting cooperation, and advancing conservation practices.
    - **Human Capital Development:**
        - Wildlife professionals play a pivotal role in regional ecosystems, biodiversity, and sustainable development.
        - The program contributes to building a skilled workforce capable of addressing cross-border wildlife complexities.
    - **Technological Advancements:**
        - SADC's prosperity relies on informed wildlife practices.
        - Our graduates contribute to maintaining ecological balance, resolving conservation challenges, and fostering regional well-being.

Purpose of the Program:

1. **Technical Leadership:**
    - The program educates ethical leaders who champion evidence-based practices, animal welfare, and ecosystem health.
    - Graduates not only assess scientific data but also shape policies, regulations, and protocols for sustainable wildlife management.
2. **Innovative Research:**
    - Students engage in specialized wildlife research, addressing contemporary challenges such as habitat loss, disease outbreaks, and climate change.
    - They contribute to technological advancements in wildlife tracking, conservation genetics, and community-based conservation efforts.

Program Learning Objectives (PLOs) for Veterinary and Wildlife Science Graduates:

1. **Professional Competence:**
    - Graduates will demonstrate professional behaviors and practices in the discipline of veterinary science.
    - They will adhere to the graduate competencies required by the Veterinary Boards Councils, ensuring ethical and competent veterinary care.
2. **Legal and Ethical Knowledge:**
    - Graduates will integrate broad and coherent knowledge of the veterinary legislative environment and ethical codes.
    - They will understand legal responsibilities, animal welfare regulations, and professional standards.
3. **Critical Reflection and Stakeholder Perspectives:**
    - Graduates will critically reflect on stakeholder perspectives, cultural values, and national/international considerations.
    - They will consider diverse viewpoints when addressing ethical and sustainable animal production systems.
4. **Diagnostic Skills and Problem-Solving:**
    - Graduates will diagnose the health status of individual animals and populations.
    - When necessary, they will analyze complex problems, formulate effective solutions, and communicate treatment and management plans.
    - They will collaborate with clients, carers, animal owners, and communities to optimize animal health.
5. **Health Promotion and Epidemiology:**
    - Graduates will promote and optimize the health and welfare of individuals and animal populations.
    - They will apply principles of epidemiology, zoonosis (disease transmission between animals and humans), and public health.

- Their work will contribute to disease prevention, health surveillance, and ecosystem well-being.

Program Learning Outcomes (PLOs) for Veterinary and Wildlife Science Graduates:

1. **Effective Communication Skills:**
   - Graduates will emphasize verbal, written, and interpersonal communication skills.
   - They will convey complex veterinary and wildlife science information clearly to diverse audiences, including clients, colleagues, and the public.
2. **Critical Thinking and Problem-Solving:**
   - Graduates will develop critical thinking abilities.
   - They will analyze health-related evidence, evaluate research findings, and interpret quantitative and qualitative information accurately and sensitively.
3. **Collaborative Health Care:**
   - Graduates will deliver safe and effective collaborative health care.
   - They will work effectively in interdisciplinary teams, exercising independent judgment when seeking professional advice in clinical situations.
4. **Public Health and Sustainable Solutions:**
   - Graduates will identify problems related to public health and animal health.
   - They will formulate and apply sustainable solutions, considering tropical and rural environments.
   - Their work will contribute to disease prevention, ecosystem health, and community well-being.
5. **Professional Skills and Ethics:**
   - Graduates will provide specialist advice and functions in diverse workplace contexts.
   - They will adhere to organizational principles, professional ethics, and occupational health and safety regulations.
6. **Lifelong Learning and Career Management:**
   - Graduates will reflect on their current skills and veterinary knowledge.
   - They will plan ongoing personal and professional development, taking responsibility for managing their careers effectively.
7. **Independent Research and Communication:**
   - Graduates will retrieve and critically evaluate peer-reviewed scientific literature independently.
   - They will prepare research proposals and communicate their findings clearly and coherently in well-developed English language proficiency.

ENTRY REQUIREMENTS

The student must have 6 credits and/or passes in SGCSE/GCE/IGCSE O' level including a pass with Grade C or better in English Language and at least four other subjects. Special: Mathematics and any other two from Agriculture/Geography, Biology, Chemistry, Combined Science, Physics, Physical Science and/or Human and Social Biology. Faculty may set mature entry requirements subject to approval by Senate.

CAREER OPPORTUNITIES FOR VETERINARY AND WILDLIFE SCIENCE GRADUATES:

1. **Veterinarian:**
    - Graduates are internationally recognized as multi-skilled professionals committed to animal health and welfare.
    - They can practice as veterinarians in various countries, diagnosing and treating illnesses, performing surgeries, and promoting preventive care.
2. **Veterinary Clinics and Hospitals:**
    - Graduates work in private practices, providing medical care to companion animals (pets) and livestock.
    - They handle routine check-ups, vaccinations, surgeries, and emergency cases.
3. **Agriculture and Livestock Management:**
    - Graduates contribute to livestock health and production.
    - They advise farmers on disease prevention, nutrition, and herd management.
4. **Biosecurity and Quarantine Services:**
    - Graduates play a crucial role in preventing the spread of diseases.
    - They work at borders, airports, and ports, ensuring safe import/export of animals and animal products.
5. **Public Health and Zoonotic Diseases:**
    - Graduates address health risks at the intersection of animals and humans.
    - They work in public health agencies, monitoring zoonotic diseases (those transmitted between animals and people).
6. **Zoos and Wildlife Sanctuaries:**
    - Graduates care for captive wildlife, ensuring their health and well-being.
    - They collaborate on conservation efforts, breeding programs, and rehabilitation of injured animals.
7. **Research and Academia:**
    - Graduates pursue research in various fields:
        - Clinical care: Investigating new treatments and diagnostics.
        - Animal science: Studying behavior, genetics, and nutrition.
        - Pharmacology: Developing drugs for animals.
        - Biomedicine: Exploring disease mechanisms and therapies.
8. **Wildlife Conservation and Ecology:**
    - Graduates contribute to wildlife management and conservation.

- They work with NGOs, government agencies, and research institutions to protect endangered species and their habitats.

The Bachelor's Degree shall:

The Bachelor's degree program in Veterinary and Wildlife Science at Springfield Research University is designed to equip students with the skills and knowledge necessary for a successful career in this dynamic field. Here are the key features of our program:

1. **Duration**:
    - The program spans **four years** for full-time students or **six years** for part-time students, including an industrial attachment or internship period.
2. **Semester Structure**:
    - Each academic year consists of **two semesters**.
    - **Semester Duration**: Each semester runs for **20 weeks**.
        - **Orientation Week**: One week dedicated to orientation.
        - **Teaching Weeks**: A minimum of **14 weeks** for instruction.
        - **Mid-Semester Break**: A one-week break for students.
        - **Examination Period**: Two weeks for final exams.
        - **Results Processing**: Two weeks allocated for marking and result processing.

Our program ensures a rigorous academic experience while allowing flexibility for part-time students. Students engage in hands-on learning, theoretical coursework, and practical projects, preparing them for the exciting challenges of the Veterinary and Wildlife industry.

Special Departmental Regulations

1. **Course Completion Requirements**:
    - All **Core**, **Prerequisite**, **Required**, **General**, and **Elective** courses within the degree program are compulsory. Students must pass these courses with a minimum grade of **50%** to graduate.
    - However, during the third and fourth years, all courses must be passed with a minimum grade of **60%** (equivalent to a CGPA of **3.00**) to qualify for graduation.
2. **Optional Courses**:
    - Optional courses do not contribute to the final grade. Their marks are excluded from the computation of the overall grade.
3. **Externalization of Courses**:
    - All courses within the degree programs must be completed internally. Externalization is not permitted.
4. **Quality Control and Evaluation**:

- Regular academic audits and reviews occur every four years, overseen by external moderators. Internal program evaluation is ongoing.

5. **Competence and Preparation**:
    - The courses offered in the Bachelor of Science in Veterinary and Wildlife Science program provide adequate competences, preparing students for professional practice at the required academic level.
6. **Core and Prerequisite Courses**:
    - Students must pass all Core and Prerequisite courses with a minimum grade of **50%** before progressing to the next level or enrolling in additional courses.

Degree Award and Classification

- Upon successful completion of all **Core**, **Required**, and **Education** courses, as well as meeting the program requirements, a student will be awarded the degree of **Bachelor of Science in Veterinary and Wildlife Science** at the end of the final year.
- The **normal classification** of a Bachelor's Degree is determined based on the academic performance during the third and fourth years of study.

Rationale to Course Numbering

At Springfield Research University, we meticulously design our Veterinary and Wildlife Science curriculum to empower students with the knowledge and skills needed to thrive in this dynamic field. Our course numbering system serves as a roadmap, guiding students through their academic journey - ****100-level courses**** introduce foundational concepts. - ****200-level courses**** build on those foundations. - ****300-level courses**** explore more specialized topics. - ****400-level courses**** are advanced and often include research or project components. Let's delve into the reasons behind our thoughtful approach:

1. **Logical Progression**: Our course numbers reflect a logical progression. Foundational concepts begin with the "100" series, followed by deeper explorations in the "200" and "300" levels. Advanced topics and research opportunities reside in the "400" series.
2. **Prerequisites and Coherence**: Clear numbering helps students understand prerequisites and co-requisites. For instance, a 200-level course assumes knowledge from related 100-level courses, ensuring a coherent learning experience.
3. **Specialization and Depth**: As students advance, higher-level courses delve into specialized areas such as zoological medicine, behavioural medicine, and anaesthesia and analgesia. The numbering system communicates this depth of study.
4. **Alignment with Program Goals**: Each course number aligns with our program's learning outcomes. Whether it's mastering animal welfare or diving into anaesthesia and analgesia, students can track their progress.
5. **Transferability**: Consistent numbering facilitates credit transfer between institutions, supporting seamless academic mobility.

In summary, our course numbering isn't just a sequence—it's a deliberate framework that enhances learning, fosters curiosity, and prepares our students for impactful careers in

Veterinary and Wildlife science. Veterinary and Wildlife Science courses simplifies the course numbering system.

1. **100-Level Courses:**
    - **VET 101:** Introduction to Veterinary and Wildlife Science
    - **VET 110:** Linear Algebra for Veterinary Science
    - **VET 120:** Mechanics and Dynamics for Wildlife Science
2. **200-Level Courses:**
    - **VET 201:** Animal Behavior and Ecology
    - **VET 210:** Wildlife Health and Disease
    - **VET 220**: Anatomy and Physiology of Wildlife
3. **300-Level Courses:**
    - **VET 301:** Conservation Biology
    - **VET 310:** Wildlife Management Techniques
    - **VET 320:** Ethology and Wildlife Behavior
4. **400-Level Courses:**
    - **VET 401:** Wildlife Rehabilitation and Conservation
    - **VET 410:** Wildlife Genetics and Population Dynamics
    - **VET 420:** Wildlife Research and Field Studies

The Bachelor of Science: Veterinary and Wildlife Science is a four (4) program. The student is expected to accumulate 576 credit points to be considered to have met the requirements of the Bachelor of Science in Veterinary and Wildlife Science and must pass each module by at least 50%.

- Level 1 = minimum of credits 144 (1440 notional hours of study)
- Level 2 = minimum of credits 144 (1440 notional hours of study)
- Level 3 = minimum of credits 144 (1440 notional hours of study)
- Level 4 = minimum of credits 144 (1440 notional hours of study)

TOTAL credit points 576 (5760 notional hours of study)

Credit Transfer and Accumulation

1. Credits are derived from engagement of students in learning activities during lectures, seminars, tutorials, micro or macro field trips, directed and self-directed learning and writing examination tests and assignments.
2. Modules from the science (Agric and Earth) faculty are worth 12 credit. Lecture attendance is compulsory. Students who attend less than 80% of lessons will not be allowed to sit for their sessional examinations.

Weighting

The degree class shall be based on weighting the results from part 1, 2, 3, and 4, the Degree weighting shall be as follows:

Level 1 20%

Level 2 20%

Level 3 30%

Level 4 30%

Distribution of Notional Hours

Module	Lecture Hrs	Tutorials/ Seminars	Self-Directed Study	Assignment Tests/Exams	Notional Hrs	Credits
VET100	36	24	30	30	120	12
PROJECT	0	0	60	60	120	12

ASSESSMENT METHODS

1. **Formative Assessment (30%)**:
    - **Class Participation**: Actively engage in discussions, seminars, and practical activities related to veterinary and wildlife science.
    - **Quizzes and Short Tests**: Regular assessments on specific anatomical, physiological, and clinical topics relevant to animal health and wildlife studies.
    - **Draft Assignments**: Receive feedback on early drafts of assignments, refining your work in the context of veterinary and wildlife science.
    - **Peer Review**: Collaborate with peers to review and improve each other's clinical reasoning and treatment plans specific to wildlife and animal care.
2. **Summative Assessment (40%)**:
    - **Final Examinations**: Comprehensive exams covering the entire program content, assessing theoretical knowledge and clinical application related to veterinary science and wildlife management.
    - **End-of-Semester Papers**: Demonstrate analytical skills by critically evaluating research articles related to wildlife biology, conservation, and animal health.
    - **Oral Presentations**: Communicate effectively, presenting clinical cases, treatment approaches, and evidence-based recommendations within the context of veterinary and wildlife science.
3. **Continuous Assessment (30%)**:
    - **Clinical Placement**: Engage in supervised clinical placements, applying theoretical knowledge to real patients in the field of veterinary medicine and wildlife care. Assessments include patient interactions, treatment planning, and clinical reasoning specific to animals.

- **Assignments and Projects**: Regular tasks contribute to the overall grade, emphasizing practical skills and evidence-based practice relevant to veterinary and wildlife science.
- **Attendance and Participation**: Actively engage in lectures, workshops, and community health initiatives related to animal welfare and wildlife conservation.

Teaching Methods

At Springfield Research University (SRU), we are committed to employing a diverse array of teaching methods to ensure a comprehensive and engaging learning experience for our students. Our teaching methods are carefully selected to align with the programme's objectives and to meet the needs of our diverse student body. The following are the key teaching methods utilized across all SRU programmes:

1. Lectures:

- Lectures are used to introduce and explain key concepts, theories, and principles. They provide a structured and systematic approach to delivering content, allowing students to gain a solid foundation in their respective fields. Lectures are often supplemented with visual aids, multimedia presentations, and interactive elements to enhance understanding and engagement.

2. Seminars:

- Seminars are interactive sessions that promote critical thinking and in-depth discussion on specific topics. Students are encouraged to actively participate, share their perspectives, and engage in debates. Seminars provide an opportunity for students to develop their analytical and communication skills.

3. Workshops:

- Workshops are hands-on sessions that focus on practical skills and applications. These sessions allow students to engage in experiential learning, apply theoretical knowledge to real-world scenarios, and collaborate with peers on projects and activities. Workshops are designed to foster creativity, problem-solving, and teamwork.

4. Problem-Based Learning (PBL):

- Problem-Based Learning is a student-centered approach that involves presenting students with complex, real-world problems to solve. Students work in small groups to research, discuss, and propose solutions, developing critical thinking and collaborative skills in the process. PBL encourages independent learning and active engagement.

5. Case Studies:

- Case studies are used to analyze real-life situations and decision-making processes. Students examine and discuss case studies to understand the context, identify key issues, and evaluate possible solutions. This method helps students develop their analytical and problem-solving abilities while relating theoretical concepts to practical situations.

6. Clinical Practice:

- For programmes that include a clinical component, such as Health and Medical Sciences, clinical practice is an integral part of the curriculum. Students gain hands-on experience in clinical settings, working under the supervision of qualified

professionals. This method provides valuable opportunities for students to apply their knowledge, develop clinical skills, and gain insights into professional practice.

7. Research Projects:

- Research projects are designed to cultivate a culture of inquiry and innovation. Students engage in independent or group research projects, exploring topics of interest and contributing to the body of knowledge in their field. Research projects develop students' research skills, critical thinking, and ability to communicate findings effectively.

8. Online Learning:

- Online learning is incorporated to provide flexible and accessible education. SRU utilizes online platforms to deliver lectures, conduct discussions, and facilitate collaborative projects. Online learning allows students to access course materials, participate in virtual classrooms, and engage with peers and instructors remotely.

9. Continuous Assessment:

- Continuous assessment methods, such as quizzes, assignments, and presentations, are used to monitor students' progress and provide ongoing feedback. These assessments help identify areas for improvement and ensure that students are meeting learning objectives throughout the course.

10. Peer Learning:

- Peer learning encourages students to collaborate and learn from each other. Group projects, study groups, and peer review sessions provide opportunities for students to share knowledge, offer feedback, and support each other's learning journey.

At SRU, our commitment to employing diverse and effective teaching methods ensures that our students receive a well-rounded education that prepares them for success in their chosen fields. We continuously review and enhance our teaching practices to provide the best possible learning experience for our students.

Delivery Methods

At Springfield Research University (SRU), we utilize a variety of delivery methods to ensure that our educational programmes are accessible, engaging, and effective. Our delivery methods are designed to cater to the diverse needs of our students and to provide flexible learning opportunities. The following are the key delivery methods employed across all SRU programmes:

1. In-Person Delivery:

- **Classroom Lectures:** Traditional classroom lectures provide a structured and interactive environment where students can engage with instructors and peers. These sessions often include discussions, presentations, and multimedia resources to enhance learning.
- **Laboratory Sessions:** For programmes that require practical and experimental learning, laboratory sessions are conducted in specialized labs equipped with the necessary tools and equipment. These hands-on sessions allow students to apply theoretical knowledge in a controlled environment.

- **Clinical Placements:** Health and Medical Sciences programmes include clinical placements in hospitals, clinics, and healthcare facilities. These placements provide students with real-world experience under the supervision of qualified professionals.

2. Online Delivery:

- **Virtual Classrooms:** Online platforms are used to deliver lectures, conduct discussions, and facilitate collaborative projects. Virtual classrooms enable students to access course materials, participate in live sessions, and engage with peers and instructors from remote locations.
- **Recorded Lectures:** Recorded lectures are made available for students to access at their convenience. This flexible approach allows students to review and revisit course content as needed.
- **Online Assessments:** Online assessments, including quizzes, assignments, and exams, are conducted through secure online platforms. These assessments provide timely feedback and help monitor students' progress.

3. Blended Learning:

- **Hybrid Courses:** Blended learning combines in-person and online delivery methods to provide a flexible and comprehensive learning experience. Hybrid courses may involve alternating between classroom sessions and online activities.
- **Flipped Classroom:** In the flipped classroom model, students access instructional content online before class and use in-person sessions for interactive, application-based activities. This approach encourages active learning and deeper engagement with the material.

4. Independent Study:

- **Self-Paced Learning:** Self-paced learning allows students to progress through course materials at their own speed. This method is ideal for students who prefer to learn independently and manage their own schedules.
- **Research Projects:** Independent research projects provide students with the opportunity to explore topics of interest, develop research skills, and contribute to the body of knowledge in their field. Faculty advisors provide guidance and support throughout the research process.

5. Collaborative Learning:

- **Group Projects:** Group projects foster teamwork and collaboration among students. These projects often involve problem-solving, research, and presentations, allowing students to learn from each other and develop interpersonal skills.
- **Peer Review:** Peer review sessions encourage students to provide and receive constructive feedback on each other's work. This method promotes critical thinking, reflection, and improvement.

6. Experiential Learning:

- **Internships and Work Placements:** Internships and work placements provide students with practical experience in their chosen field. These opportunities allow students to apply their knowledge in real-world settings, develop professional skills, and build industry connections.

- **Field Trips and Excursions:** Field trips and excursions offer experiential learning opportunities outside the classroom. These activities provide students with firsthand exposure to relevant sites, industries, and practices.

7. Continuous Assessment:

- **Formative Assessments:** Formative assessments, such as quizzes, assignments, and in-class activities, provide ongoing feedback to students and help track their progress. These assessments are designed to support learning and identify areas for improvement.
- **Summative Assessments:** Summative assessments, including final exams, projects, and presentations, evaluate students' overall performance and mastery of course content.

At SRU, our diverse delivery methods ensure that students receive a well-rounded and flexible education that caters to their individual learning preferences. We are committed to continuously enhancing our delivery methods to provide the best possible learning experience for our students.

COURSE MODULES AND SYNOPSIS

YEAR 1: SEMESTER 1

Code	Course	Lectures	Practicals	Credits
VWS100	Introduction to Nutrition	**100**	**20**	**12**
VWS101	Principles of Biology	**100**	**20**	**12**
VWS102	Chemistry and Laboratory	**100**	**20**	**12**
VWS103	Scientific Practice	**20**	**100**	**12**
VWS104	Animal Handling and Husbandry	**100**	**20**	**12**
VWS105	Anatomy and Physiology I	**100**	**20**	**12**
TOTAL				**72**

YEAR 1: SEMESTER 2

Code	Course	Lectures	Practicals	Credits
VWS107	Systems Biology	**100**	**20**	**12**
VWS108	Communication for Academic Purposes	**120**	**0**	**12**
VWS109	Biodiversity Conservation	**100**	**20**	**12**
VWS110	General Microbiology	**20**	**100**	**12**
VWS111	Clinical Skills for Veterinary Practitioners	**100**	**20**	**12**
VWS112	Anatomy and Physiology II	**100**	**20**	**12**
TOTAL				**72**

YEAR 2: SEMESTER 3

Code	Course	Lectures	Practicals	Credits
VWS213	Animal Management and Disease	**100**	**20**	**12**
VWS214	Pathophysiology	**100**	**20**	**12**
VWS215	Mammalian Genetics	**100**	**20**	**12**
VWS216	Statistical Methods	**120**	**0**	**12**
VWS217	Fieldwork and Wildlife Management	**60**	**60**	**12**
VWS218	Pathology and Parasitology	**60**	**60**	**12**
TOTAL				**72**

YEAR 2: SEMESTER 4

Code	Course	Lectures	Practicals	Credits
VWS219	Immunology	**100**	**20**	**12**
VWS220	Case studies in Animal Management	**100**	**20**	**12**
VWS221	Animal Ecology	**100**	**20**	**12**
VWS222	Behavioral Ecology	**120**	**0**	**12**
VWS223	Veterinary Surgery	**60**	**60**	**12**
VWS224	Animal Health Practices	**60**	**60**	**12**
TOTAL				**72**

YEAR 3: SEMESTER 5: GENETICS AND BIODIVERSITY SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS325	Genetics	**100**	**20**	**12**
VWS326	Genetic Improvement of Livestock	**100**	**20**	**12**
VWS327	Modern Statistics for Life Sciences	**120**	**0**	**12**
VWS328	Population and Quantitative Genetics	**120**	**0**	**12**
VWS329	Internship I	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 6: GENETICS AND BIODIVERSITY SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS330	Ecological Methods	**100**	**20**	**12**
VWS331	Wildlife Resource Management	**100**	**20**	**12**
VWS332	Molecular Regulation of Health and Disease	**120**	**0**	**12**
VWS333	Microbial Disease Management	**120**	**0**	**12**
VWS334	Internship II	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 5: NUTRITION AND METABOLISM SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS335	Animal Nutrition and Physiology	**100**	**20**	**12**
VWS336	Nutrient Dynamics	**100**	**20**	**12**
VWS337	Feed Technology	**120**	**0**	**12**
VWS338	Health Welfare and Management	**120**	**0**	**12**
VWS339	Internship I	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 6: NUTRITION AND METABOLISM SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS340	Adaptation Physiology	**100**	**20**	**12**
VWS341	Aquaculture Production Systems	**100**	**20**	**12**
VWS342	Nutrition, Welfare and Reproduction in Aquaculture	**120**	**0**	**12**
VWS343	Human and Veterinary Immunology	**120**	**0**	**12**
VWS344	Internship II	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 5: GLOBAL AND SUSTAINABLE SPECIALIZATION

Code	Course	Lectures	Practicals	Credits

VWS345	Sustainability Assessment of Animal Systems	**100**	**20**	**12**
VWS346	Future Livestock Systems	**100**	**20**	**12**
VWS347	Aquaculture Production Systems	**120**	**0**	**12**
VWS348	Sustainability in Fish and Seafood Production	**120**	**0**	**12**
VWS349	Internship I	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 6: GLOBAL AND SUSTAINABLE SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS350	Quantitative Veterinary Epidemiology	**100**	**20**	**12**
VWS351	Management of Infectious Diseases in Animal Populations	**100**	**20**	**12**
VWS352	Global and Sustainability Practicum	**120**	**0**	**12**
VWS353	Animal Nutrition and Physiology	**120**	**0**	**12**
VWS354	Internship II	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 5: ADAPTATION, HEALTH AND BEHAVIOR SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS355	Health, Welfare and Management	**100**	**20**	**12**
VWS356	Adaptation Physiology	**100**	**20**	**12**
VWS357	Applied Animal Behavior and Welfare	**120**	**0**	**12**
VWS358	Quantitative Veterinary Epidemiology	**120**	**0**	**12**
VWS359	Internship I	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 6: ADAPTATION, HEALTH AND BEHAVIOR SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS360	Management of Infectious Diseases in Animal Populations	**100**	**20**	**12**
VWS361	Functional Zoology	**100**	**20**	**12**
VWS362	Developmental Biology of Animals	**120**	**0**	**12**
VWS363	Sustainability Assessment of Animal Systems	**120**	**0**	**12**
VWS364	Internship II	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 5: MOLECULE, CELL AND FUNCTIONING SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS365	Development and Healthy Aging	**100**	**20**	**12**
VWS366	Human and Veterinary Immunology	**100**	**20**	**12**
VWS367	Integrated Neuroendocrinology	**120**	**0**	**12**
VWS368	Molecular Regulation of Health and Diseases	**120**	**0**	**12**
VWS369	Internship I	**0**	**120**	**12**
TOTAL				**60**

YEAR 3: SEMESTER 6: MOLECULE, CELL AND FUNCTIONING SPECIALIZATION

Code	Course	Lectures	Practicals	Credits
VWS370	Genomics	**100**	**20**	**12**
VWS371	Modern Statistics for Life Sciences	**100**	**20**	**12**

VWS372	Microbial Disease Mechanics	**120**	**0**	**12**
VWS373	Commensal and Pathogen Host – Microbe Interactions in the Intestine	**120**	**0**	**12**
VWS374	Internship II	**0**	**120**	**12**
TOTAL				**60**

YEAR 4: SEMESTER 7

Code	Course	Lectures	Practicals	Credits
VWS475	Marine Resources Management	**100**	**20**	**12**
VWS476	Fisheries Ecology	**100**	**20**	**12**
VWS477	Life History of Aquatic Organisms	**120**	**0**	**12**
VWS478	Marine Animal Ecology	**120**	**0**	**12**
VWS479	Veterinary Practice I	**0**	**120**	**12**
TOTAL				**60**

YEAR 4: SEMESTER 8

Code	Course	Lectures	Practicals	Credits
VWS480	Ecological Methods	**100**	**20**	**12**
VWS481	Disease Ecology	**100**	**20**	**12**
VWS482	Applied Animal Behavior and Welfare	**100**	**20**	**12**
VWS483	Veterinary Practice II	**0**	**120**	**12**
VWS484	Research Project	**0**	**120**	**12**
TOTAL				**60**

DESCRIPTION OF COURSES

INTRODUCTION TO NUTRITION

In this course students will cover foundation knowledge in food, nutrition and health for humans and animals. Initially there is a focus on the function of both macronutrients and micronutrients. Food and nutrient recommendations for health and how we measure food intakes, along with dietary guidelines will be covered. Factors that influence food choice will also be highlighted.

PRINCIPLES OF BIOLOGY

This course is designed to introduce biology at an entry level by examining the hierarchy that ranges from the fundamentals of cell biology to the physiology of organisms, and the interactions among those organisms in their environment. The topics in this course include cell biology, genetics, molecular biology, evolution, physiology, and ecology.

CHEMISTRY

The contents of this course focus on introductory level general and physical chemistry principles which in turn complements the topics covered in the subsequent course, SCCHM1002 in semester 2. On completion of SCCHM1001, students will have gained an understanding of atomic structure, how atoms and molecules interact with each other and how this affects their bonding, reactivity, 3D structure and physical properties. Understanding stoichiometry as well as intermolecular forces will be a focus of this course. A number of important topics such as thermodynamics, kinetics and equilibria, will be covered which will help to prepare students for a deeper exploration of chemistry in further courses. The concepts

developed within lectures, workshops and tutorials are complemented through a laboratory program where students will have the opportunity to develop laboratory techniques and design their own experiments to solve a range of chemical problems.

SCIENTIFIC PRACTICE

On completion of this course students should have developed the mathematical understanding and tools needed to undertake studies in a science discipline. After successfully completing this course, students will be able to demonstrate competency with basic calculation skills required for science including calculations involving percentages, proportions, ratios and fractions; recognise unit prefixes and confidently convert between units; use functions involving powers, logarithms and exponents; manipulate a wide range of algebraic equations in order to substitute values and to transform to solve for a particular variable; solve systems of linear equations; perform calculations involving area, surface area and volume on a range of two and three dimensional shapes; present data graphically and use numerical summaries; use a spreadsheet tool to graph experimental data including correct labelling and the use of error bars; apply the above skills in context to solve scientific problems.

SYSTEMS BIOLOGY

This course introduces students to the anatomy and physiology of the body. It focuses on anatomy (structure) from the cellular to the organ level of arrangement and how cells, tissues and organs work together to maintain physiology (function). Major concepts in cellular and subcellular biology are revised before understanding cellular function and arrangement into tissues, tissue function and arrangement into organs, and how organs work together both as part of separate systems and in cooperation with each other (integration).

SCIENTIFIC COMMUNICATION

This course will provide students with the generic skills necessary to acquire, analyse and communicate scientific ideas and information. This will involve techniques such as literature searching, information retrieval, preparation and presentation of laboratory reports and oral reports. After successfully completing this course, students will be able to use scientific reporting and grammatical conventions; record and present scientific information in an appropriate format; interpret and explain experimental data; search the literature to locate relevant, credible sources of scientific information; cite and reference appropriately; construct reference lists and bibliographies, using software tools; prepare and deliver written and oral reports; detect and avoid plagiarism.

BIODIVERSITY CONSERVATION

This course introduces students to the global environment and its basic natural systems. It is designed to develop in students an understanding of the application of biological and ecological principles to the conservation of global biological diversity. Major themes include the diversity and interrelationships of the biotic and abiotic components of the environment, plant and animal diversity, threatening processes, threatened species, conservation strategies, wildlife exploitation and conservation, and wildlife forensics. The course is taught by internal lectures, tutorials and fieldwork, and is also available on-line.

GENERAL MICROBIOLOGY

The course provides students with a strong foundation in microbiology. Students will gain the skills and knowledge needed to study higher level related subjects, and an understanding of the importance of microbiology in today's society. Students will learn about the diversity of microorganisms, focusing on morphological, physiological and ecological characteristics. Important taxonomic groups will be covered, ensuring students have the theoretical knowledge to distinguish between key taxonomic groups. Students will be introduced to

microbial growth, microbial genetics, mycology and virology. The theoretical knowledge will be supplemented by exercises that aim to develop capacity in the practical aspects of microbiology.

ANIMAL MANAGEMENT AND DISEASE

This course will analyse the basic parameters of animal health with respect to symptomatic observation and measurement of disturbance to body function through to clinical diagnostic methods. Disease states will be explored as case studies of common diseases in farm and pet animals and via analysis of the impacts of disease on the various organ systems of the body. Disease treatment and control methods will be described together with basic information on microbial infection systems relevant to animal protection and treatment. Information concerning specific health issues in various species will be explored via a number of examples. Specialist lectures from animal welfare and veterinary staff will be used to detail these examples and provide practical contexts. Field studies will explore the techniques and analyses of modern veterinary medicine.

PATHOPHYSIOLOGY

A study of the connections and functions between a group of major organs of the body (e.g. heart and blood supply, neurology). The study will feature correct function and once functionality is lost is part of the system. Focus will be on necessary diagnostic analysis, including laboratory procedures, to assist with appropriate corrective treatment.

MAMMALIAN GENETICS

Mammalian Genetics provides an in depth understanding of the principles underlying inheritance. The course begins with the mechanisms of cellular reproduction and chromosome replication and how this relates to genetic diversity and evolution. Students will learn about gene structure and function and the relationship between genes and proteins. Different types of genetic mutation will be discussed in the context of natural variability and disease. This course also covers pedigree analysis and the different modes of inheritance: recessive and dominant, autosomal and sex linked traits and how genetic changes can be observed and quantified at the population level. Students will also be asked to consider the ethical issues associated with new gene based technologies in animals and humans. This course also provides an introduction to bioinformatics; students will learn how to access and interpret information from large molecular databases and use this information to investigate a gene of interest.

STATISTICAL METHODS

This course introduces students to the full range of descriptive statistical techniques, and also introduces the key concepts underlying statistical inference. A wide range of basic inferential techniques are introduced. Data from various disciplinary contexts is utilised, and there is a strong emphasis on computing skills, interpretation of computer output and communication of statistical results and conclusions.

IMMUNOLOGY

The Immunology course will develop a broad understanding of the mammalian immune system and how it protects an individual from infectious disease. This will be contrasted with

the role of the defective immune system in causing pathology associated with chronic disease. The course begins with a detailed exploration of the two arms of the immune system, innate and adaptive immunity, demonstrating how innate immune cells and associated components work in collaboration with adaptive immune cells (lymphocytes) to provide effective defence against different types of pathogens. The important role of lymphocytes in antibody production and the development of immunological memory, a property critical to successful vaccination will be discussed. Finally, the course explores the impact of inappropriate activation or impairment of the immune system on normal physiological processes and reviews recent developments in immune based therapies that harness the immune system to treat disease.

CASE STUDIES IN ANIMAL MANAGEMENT

This course will provide an opportunity to explore the problems and threats to animal species in the human environment. A series of case studies allows students to explore issues raised by agricultural production techniques and in the management of pet species. In addition, natural animal populations are under significant stress due to human impacts including climate change and habitat destruction. Students will explore examples of topical issues in these various systems for a range of animal species and will develop possible solutions. Students will carry out research and analysis for each of the case studies and present their findings in seminars to their peers, lecturers and industry experts. Success in the subject will depend on the student's ability to work in groups and individually to produce oral and written reports exploring solutions to current and difficult scientific and ethical issues.

SPECIALISATIONS

GENETICS AND BIODIVERSITY

Animal breeding and genetics has become an integrated, worldwide industry. In recent years, the emphasis on animal biodiversity has been growing.

The specialisation Genetics and Biodiversity focuses on the genetic improvement of animals in relation to their environment, by integrating quantitative, biological and molecular approaches. DNA techniques are emphasised because they are increasingly used to determine genetic diversity in various animal populations. Focus can be on genetic management of domestic or semi-wildlife populations to ensure optimal health and performance or on the genetic basis of specific behaviours or characteristics in various animal species.

GENOMICS

This course discusses the structure and function of genomes of living organisms from all kingdoms. It is a compulsory course for students who want to focus on molecular genetics.

GENETIC IMPROVEMENT OF LIVESTOCK

By lectures, discussion meetings, excursions and practicals this course will provide advanced knowledge on genetic improvement schemes in livestock and companion animals. This course is compulsory for students with special interest in quantitative genetics and/or animal breeding.

MODERN STATISTICS FOR THE LIFE SCIENCES

In this course students will learn about a number of statistical models and associated methods for statistical inference. Applications of models and methods in quantitative genetics and epidemiology will be discussed.

POPULATION AND QUANTITATIVE GENETICS

This course explains genetic and molecular evolution and their relationship to phenotypic evolution, of natural, captive and domesticated populations of living organisms, ranging from microbes to plants and animals.

ECOLOGICAL METHODS I

Students learn how to analyse hypothesis-centred ecological field research projects on plants, animals, and their environment, with emphasis on the appropriate choice and application of statistical techniques for the analysis of ecological data.

WILDLIFE RESOURCE MANAGEMENT

Within a learning-by-doing context this course focuses on solving problems in the fields of wildlife management and conservation biology.

MOLECULAR REGULATION OF HEALTH AND DISEASE

This course focuses on regulatory (molecular, biochemical and cellular) mechanisms that have a central role in human and animal health.

MICROBIAL DISEASE MECHANISMS

This course will focus on the roles of microbes in health (human microbiome) and disease (pathogens). The molecular mechanisms of bacterial/viral virulence and the host response will be examined in order to develop an in depth understanding of the etiology of infectious diseases and the benefits derived from the human microbiome.

COMMENSAL AND PATHOGEN HOST-MICROBE INTERACTIONS IN THE INTESTINE

The course aims to teach students the concepts involved in the science of host microbe interactomics. The intestinal tract is colonized with a highly diverse and dense microbial population, and intestinal host microbe interactions play a prominent role in host-health and disease. Over the past years this field has expanded dramatically, and starts to decipher the molecular basis of these interactions and their importance in the determination of specific aspects of the host's physiology, including metabolism, immunity, and behaviour. It is the aim of the course on 'commensal and pathobiont host-microbe interactions in the intestine' to understand the model systems and technological approaches applied in this field. The model systems, including several (germ-free) animal and human volunteer models, and their use will be explained in the lecture series. The technologies that will be explained encompass both the holistic, 'omics based approaches as well as the mechanistic, cell-based approaches that employ molecular markers and reporters in combination with imaging. The latter technologies will include a demonstration (one afternoon) of the high-throughput high content microscopy set-up). During the case studies small groups of students work on a

provided specific research question, and this should lead to research proposals that address the question posed.

THESIS OR INTERNSHIP

A thesis or internship project for the specialisation Genetics and Biodiversity is conducted at the ABG, HMI or REG chair group and results in a scientific report and a presentation. A thesis project usually links up with ongoing research at one of the research groups or is conducted in cooperation with commercial or (non-)governmental organisations.

NUTRITION AND METABOLISM

Worldwide agricultural land use and feed production must become more efficient. An important way to achieve this aim, is to optimise the use of feed resources, for example in terms of nutrient flows. The discipline of Nutrition and Metabolism investigates the interaction between animals and their nutrition.

Nutrition and Metabolism aims to understand the relation between nutritional demands, diet formulation, digestion and metabolism in animals, and their responses in terms of growth, production and waste. The aim is to optimize nutrition for the production of safe and healthy foods for human consumption, to safeguard the animal's own health and welfare and to prevent negative effects of nutrition on the emission of waste to the environment.

ANIMAL NUTRITION AND PHYSIOLOGY

This uses three (practical) modules to provide you with basic knowledge on nutrient analysis, digestion physiology and the physiology of nutrient utilisation in animals.

NUTRIENT DYNAMICS

In this course, knowledge in the area of digestion and utilization of nutrients is addressed more in depth and quantified.

FEED TECHNOLOGY

The Feed Technology course provides insight into the preconditions for producing feeds. It integrates the knowledge that makes it possible to increase the nutritional and physical quality of animal feeds by using technology.

HEALTH, WELFARE AND MANAGEMENT

This course deals with multidisciplinary aspects of the functioning of animals, focusing on a selected number of themes.

ADAPTATION PHYSIOLOGY

This course goes more in depth into specific mechanisms of adaptation physiology (e.g. immunology, behaviour, reproduction or energy metabolism, including social and ethical aspects). Students will define a proper scientific work plan, based on a hypothesis gained from a literature review.

AQUACULTURE PRODUCTION SYSTEMS

This course deals with the relation between aquatic organisms (algae, fish, crustaceans, molluscs) and their environment, the latter comprising the direct production space and the wider environment in which farms operate.

NUTRITION, WELFARE AND REPRODUCTION IN AQUACULTURE

This course deals with the aspects and mechanisms at the organism level and organ level, with the focus on the first. Various disciplines (e.g. breeding, nutrition, husbandry) will be dealt with in an integrative approach.

HUMAN AND VETERINARY IMMUNOLOGY

The aim of this course is to implement knowledge of the functioning of the immune system at both cellular and organ level and its evolutionary development.

DEVELOPMENT AND HEALTHY AGING

This course highlights three related areas of science relevant to development and healthy aging, namely muscle origin and function, energy homeostasis and immunology.

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INTEGRATED NEUROENDOCRINOLOGY

In this course you will take a closer look at different aspects of brain function in relation to behaviour. Several functions are explored, e.g. sleep, emotion, stress, homeostasis and digestive behaviour.

GLOBAL AND SUSTAINABLE

Approaches to animal production that go beyond the individual animal level are becoming increasingly important. Solutions to problems in animal production can only be found by taking into account the many interrelationships between the production sector and the socio-economic environment.

The specialisation Global and Sustainable Production combines knowledge from different disciplines (such as animal sciences, economics and social sciences) to study the development of sustainable animal systems across the world. The aim is to guarantee sufficient food supply for mankind in a responsible way, without compromising culture and the environment.

SUSTAINABILITY ASSESSMENT OF ANIMAL SYSTEMS

During this course you will analyse core issues related to sustainable animal production. You will learn to apply various methods to tackle complex problems.

FUTURE LIVESTOCK SYSTEMS

In this course you will think about and explore future possibilities for livestock production.

AQUACULTURE PRODUCTION SYSTEMS

This course deals with the relation between aquatic organisms (algae, fish, crustaceans, molluscs) and their environment, the latter comprising the direct production space and the wider environment in which farms operate.

SUSTAINABILITY IN FISH AND SEAFOOD PRODUCTION

The course deals with the economic, ecological and managerial sustainability of fish capture and aquaculture.

QUANTITATIVE VETERINARY EPIDEMIOLOGY

This course addresses the occurrence and transmission of diseases in populations, as well as risk factors that contribute to the occurrence of these diseases (epidemiology) and how the importance of these risk factors can be quantified.

MANAGEMENT OF INFECTIOUS DISEASES IN ANIMAL POPULATIONS

This course is focused on preventive management of infections and diseases. Veterinary epidemiology is one of the basic sciences that contributes to management of disease, including monitoring and surveillance.

ADAPTATION, HEALTH AND BEHAVIOUR

Animal health and behaviour are becoming increasingly important when talking about sustainability of animal production systems. This specialisation utilises a multidisciplinary, animal-level approach focusing on the effects of the animal's environment on its health.

The specialisation Adaptation, Health and Behaviour studies the effects of the immediate environment on physiological responses of individual animals, and what these responses mean for animal health and welfare. Immunological status, energy metabolism, thermoregulation, reproduction and behaviour are major responses of animals, being studied in this specialisation.

HEALTH, WELFARE AND MANAGEMENT

This course deals with multidisciplinary aspects of the functioning of animals, focusing on a selected number of themes.

ADAPTATION PHYSIOLOGY

This course goes more in depth into specific mechanisms of adaptation physiology (e.g. immunology, behaviour, reproduction or energy metabolism, including social and ethical aspects). Students will define a proper scientific work plan, based on a hypothesis gained from a literature review.

HEALTH, WELFARE AND MANAGEMENT

This course deals with multidisciplinary aspects of the functioning of animals, focusing on a selected number of themes.

APPLIED ANIMAL BEHAVIOUR AND WELFARE

In this course you learn to link concepts of animal behaviour to welfare issues in modern husbandry of livestock and companion animals.

QUANTITATIVE VETERINARY EPIDEMIOLOGY

This course addresses the occurrence and transmission of diseases in populations, as well as risk factors that contribute to the occurrence of these diseases (epidemiology) and how the importance of these risk factors can be quantified.

MANAGEMENT OF INFECTIOUS DISEASES IN ANIMAL POPULATIONS

This course is focused on preventive management of infections and diseases. Veterinary epidemiology is one of the basic sciences that contributes to management of disease, including monitoring and surveillance.

FUNCTIONAL ZOOLOGY

In this course a theoretical basis is created as well as practical exercise in quantitative analysis of the functioning of animals.

DEVELOPMENTAL BIOLOGY OF ANIMALS

A comparative overview of the early development in a variety of animals is taught in this course.

SUSTAINABILITY ASSESSMENT OF ANIMAL SYSTEMS

During this course you will analyse core issues related to sustainable animal production. You will learn to apply various methods to tackle complex problems.

FUTURE LIVESTOCK SYSTEMS (APS-31306)

In this course you will think about and explore future possibilities for livestock production.

ANIMAL NUTRITION AND PHYSIOLOGY

This course uses three (practical) modules to provide you with basic knowledge on nutrient analysis, digestion physiology and the physiology of nutrient utilisation in animals.

NUTRIENT DYNAMICS

In this course, knowledge in the area of digestion and utilization of nutrients is addressed more in depth and quantified.

MOLECULE, CELL AND ORGAN FUNCTIONING

This specialisation focuses on the mechanisms of health and disease at the level of the organism, the animal level. The relation between morphology, function and regulation of function is central in this specialisation.

Molecule, Cell and Organ Functioning is a fundamental specialisation looking into mechanisms and processes at all levels of physiology: from molecules to organs to whole animals. In this specialisation the functioning of animals is studied to acquire animal or computer models for health, disease resistance, growth and aging.

DEVELOPMENT AND HEALTHY AGING

This course highlights three related areas of science relevant to development and healthy aging, namely muscle origin and function, energy homeostasis and immunology.

HUMAN AND VETERINARY IMMUNOLOGY

The aim of this course is to implement knowledge of the functioning of the immune system at both cellular and organ level and its evolutionary development.

DEVELOPMENT AND HEALTHY AGING

This course highlights three related areas of science relevant to development and healthy aging, namely muscle origin and function, energy homeostasis and immunology.

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This course highlights three related areas of science relevant to development and healthy aging, namely muscle origin and function, energy homeostasis and immunology.

INTEGRATED NEUROENDOCRINOLOGY

In this course you will take a closer look at different aspects of brain function in relation to behaviour. Several functions are explored, e.g. sleep, emotion, stress, homeostasis and digestive behaviour.

MOLECULAR REGULATION OF HEALTH AND DISEASE

This course focuses on regulatory (molecular, biochemical and cellular) mechanisms that have a central role in human and animal health.

MOLECULAR REGULATION OF HEALTH AND DISEASE (HAP-31806)

This course focuses on regulatory (molecular, biochemical and cellular) mechanisms that have a central role in human and animal health.

GENOMICS

The course discusses the structure and function of genomes of living organisms from all kingdoms.

MODERN STATISTICS FOR THE LIFE SCIENCES

In this course students will learn about a number of statistical models and associated methods for statistical inference. Applications of models and methods in quantitative genetics and epidemiology will be discussed.

ANIMAL ECOLOGY

How do animals and their (natural) environment interact with each other? In this specialisation the focus lies on wildlife, grazing animals, marine animals and aquatic organisms.

The specialisation Animal Ecology focuses on the interaction between animal populations and their wider environment, the ecosystem. The environment can be natural or affected by human intervention, i.e. an agro-ecosystem. Mechanisms that underlie the impact of animals on their environment, by food intake behaviour, by interaction with other animals, are studied to understand animal and aquatic ecological systems.

MARINE RESOURCES MANAGEMENT

Fishing has dominant direct and indirect impacts on marine community and their habitats, but changes occur through other uses as well. You will gain insights in basic fisheries and marine ecological and environmental economic concepts.

FISHERIES ECOLOGY

This course deals with the ecology of fishes and other aquatic organisms in relation to the exploitation of aquatic resources.

LIFE HISTORY OF AQUATIC ORGANISMS

This course deals with the biology and ecology of aquatic organisms, with an emphasis on life history theory.

MARINE ANIMAL ECOLOGY

This course aims at understanding the functioning, resilience, and health of animals in interaction with their environment, and linking this to management of biodiversity and use of marine animal resources.

ECOLOGICAL METHODS I

Students learn how to analyse hypothesis-centred ecological field research projects on plants, animals, and their environment, with emphasis on the appropriate choice and application of statistical techniques for the analysis of ecological data.

ANIMAL ECOLOGY

The course will provide a deeper understanding of animal-animal, animal-food and animal-environment interactions at various levels.

DISEASE ECOLOGY

The overarching aim of the course is to offer a current and comprehensive view of the causes and consequences of infectious disease at the levels of individuals, populations, communities, and ecosystems.

BEHAVIOURAL ECOLOGY

This course provides insight in how evolution through natural selection shapes behaviour of animals (domestic or wild, vertebrate or invertebrate).

APPLIED ANIMAL BEHAVIOUR AND WELFARE

In this course you learn to link concepts of animal behaviour to welfare issues in modern husbandry of livestock and companion animals.

COURSE OUTLINES

Course Title: VWS100: Introduction to Nutrition

Course Description:

This course provides foundational knowledge in food, nutrition, and health for both humans and animals. We will explore the essential functions of macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins and minerals). Additionally, we'll cover food and nutrient recommendations for optimal health, methods of measuring food intake, and dietary guidelines. Factors influencing food choices will also be highlighted.

Learning Outcomes:

By the end of this course, students will be able to:

1. Understand the role of nutrients in maintaining health.
2. Evaluate dietary recommendations and guidelines.
3. Analyze factors affecting food choices.
4. Apply knowledge of macronutrients and micronutrients to practical situations.

Topics:

1. **Introduction to Nutrition Science**
    - Importance of nutrition in overall well-being
    - Historical context and evolution of dietary knowledge
2. **Macronutrients: Functions and Sources**
    - Carbohydrates: Energy sources and fiber
    - Proteins: Building blocks and essential amino acids
    - Fats: Types, functions, and health implications
3. **Micronutrients: Vitamins and Minerals**
    - Role of vitamins in metabolism and disease prevention
    - Essential minerals and their impact on health
    - Micronutrient deficiencies and excesses
4. **Dietary Recommendations and Guidelines**
    - Dietary Reference Intakes (DRIs)
    - Canada's Food Guide and other national guidelines
    - Nutrient labeling and interpretation
5. **Measuring Food Intake**
    - Food diaries and recall methods
    - Portion sizes and energy estimation
    - Challenges in accurate assessment
6. **Factors Influencing Food Choices**
    - Cultural, social, and psychological influences
    - Economic considerations and food accessibility
    - Trends in dietary patterns (e.g., vegetarianism, plant-based diets)

Assessment and Grading:

- Quizzes and Knowledge Checks: 30%
- Research Project on Dietary Patterns: 40%

Course Title: VWS101: Principles of Biology

Course Description:

This course serves as an introductory exploration of biology, covering fundamental concepts from cell biology to organism physiology. We will delve into the interactions among living organisms within their environment. Key topics include cell biology, genetics, molecular biology, evolution, physiology, and ecology.

Learning Outcomes:

By the end of this course, students will be able to:

1. Understand the basic principles of biology.
2. Describe the structure and function of cells.
3. Explain genetic inheritance and variation.
4. Analyze evolutionary processes.
5. Explore physiological adaptations.
6. Appreciate ecological relationships.

Topics:

1. **Introduction to Biology**
    - The scientific method and inquiry
    - Levels of biological organization
    - Unifying themes in biology
2. **Cell Biology**
    - Cell structure and organelles
    - Cellular processes (metabolism, respiration, photosynthesis)
    - Cell division and reproduction
3. **Genetics and Inheritance**
    - Mendelian genetics
    - Chromosomes and DNA
    - Genetic variation and mutations
4. **Molecular Biology**
    - DNA replication and protein synthesis
    - Gene expression and regulation
    - Biotechnology and genetic science
5. **Evolutionary Processes**
    - Natural selection and adaptation
    - Speciation and phylogenetics
    - Fossil evidence and the fossil record
6. **Physiology of Organisms**
    - Homeostasis and organ systems
    - Nervous system and sensory perception
    - Circulatory, respiratory, and digestive systems
7. **Ecology and Interactions**
    - Ecosystem dynamics and energy flow
    - Population ecology and community interactions
    - Conservation biology and environmental issues

Assessment and Grading:

- Quizzes and Knowledge Checks: 30%

- Lab Practicals and Experiments: 40%

Course Title: VWS102: Chemistry

Course Description:

This course focuses on introductory-level general and physical chemistry principles. It serves as a foundation for more advanced topics covered in subsequent courses (such as SCCHM1002). By completing VWS102, students will gain an understanding of atomic structure, molecular interactions, bonding, reactivity, 3D structure, and physical properties. Key concepts include stoichiometry and intermolecular forces.

Learning Outcomes:

By the end of this course, students will be able to:

1. Describe the fundamental principles of chemistry.
2. Explain atomic structure and bonding.
3. Analyze molecular interactions and reactivity.
4. Understand the 3D structure of molecules.
5. Apply stoichiometry concepts to chemical problems.

Topics:

1. **Introduction to Chemistry**
    - Historical context and development of chemistry
    - Scientific method and inquiry
2. **Atomic Structure and Bonding**
    - Subatomic particles (protons, neutrons, electrons)
    - Electron configuration and periodic trends
    - Types of chemical bonds (ionic, covalent)
3. **Chemical Reactions and Reactivity**
    - Balancing chemical equations
    - Types of reactions (acid-base, redox)
    - Factors affecting reaction rates
4. **Stoichiometry and Quantitative Analysis**
    - Mole concept and Avogadro's number
    - Calculations involving mass, moles, and volume
    - Limiting reactants and percent yield
5. **Intermolecular Forces and Properties**
    - Van der Waals forces and hydrogen bonding
    - Properties of liquids and solids
    - Solubility and colligative properties
6. **Laboratory Techniques and Experiments**
    - Safety protocols and equipment usage
    - Measurement precision and accuracy
    - Designing and conducting chemical experiments

Assessment and Grading:

- Quizzes and Knowledge Checks: 30%

- Laboratory Reports and Practical Skills: 40%

Course Title: VWS103: Scientific Practice

Course Description:

This course equips students with essential mathematical skills necessary for scientific studies. By the end of the course, students will be proficient in fundamental calculations relevant to science. Topics covered include percentages, unit conversions, algebraic manipulation, functions, logarithms, exponents, linear equations, and geometric calculations. Additionally, students will learn to present data graphically and use spreadsheets for scientific analysis.

Learning Outcomes:

By the end of this course, students will be able to:

1. Perform basic calculations involving percentages, proportions, ratios, and fractions.
2. Convert between different units using unit prefixes.
3. Apply mathematical functions (powers, logarithms, and exponents) to scientific problems.
4. Manipulate algebraic equations to solve for specific variables.
5. Solve systems of linear equations.
6. Calculate area, surface area, and volume for two- and three-dimensional shapes.
7. Present data graphically and summarize numerical results.
8. Utilize spreadsheets for scientific data analysis.

Topics:

1. **Mathematical Fundamentals for Science**
    - Percentages, proportions, and ratios
    - Unit conversions and prefixes
    - Basic algebraic expressions
2. **Functions and Exponents**
    - Powers and logarithms
    - Exponential growth and decay
    - Graphing functions
3. **Algebraic Manipulation**
    - Solving equations for specific variables
    - Systems of linear equations
    - Quadratic equations
4. **Geometry and Measurement**
    - Area and perimeter calculations
    - Surface area and volume of geometric shapes
    - Error analysis and propagation
5. **Data Presentation and Analysis**
    - Graphical representation (bar charts, scatter plots, etc.)
    - Descriptive statistics (mean, median, standard deviation)
    - Spreadsheet tools for data visualization

Assessment and Grading:

- Quizzes and Problem Sets: 40%
- Laboratory Exercises and Data Analysis: 30%

Course Title: VWS104: Systems Biology

Course Description:

This course provides an introduction to systems biology, emphasizing the interplay between cellular structure (anatomy) and function (physiology). Students will explore how cells, tissues, and organs collaborate to maintain overall physiological balance. Major concepts in cellular and subcellular biology will be reviewed, followed by an understanding of tissue organization, organ function, and system integration.

Learning Outcomes:

By the end of this course, students will be able to:

1. Describe the hierarchical organization of biological systems.
2. Explain the relationship between cellular structure and function.
3. Analyze tissue specialization and its role in overall physiology.
4. Understand how organs collaborate within separate systems.
5. Appreciate the importance of integration for overall health.

Topics:

1. **Introduction to Systems Biology**
    - Defining systems biology
    - Emergent properties and holistic approaches
    - Levels of biological organization
2. **Cellular Anatomy and Function**
    - Cellular organelles and their roles
    - Metabolism and energy production
    - Cell signaling and communication
3. **Tissue Organization and Specialization**
    - Types of tissues (epithelial, connective, muscle, nervous)
    - Tissue structure and function
    - Homeostasis and tissue repair
4. **Organ Systems and Physiology**
    - Overview of major organ systems (digestive, circulatory, respiratory, etc.)
    - Organ function and interdependence
    - Regulation of physiological processes
5. **Integration and Homeostasis**
    - Feedback loops and control mechanisms
    - Hormonal regulation
    - Adaptation to environmental changes
6. **Health and Disease**
    - Disruptions in system integration
    - Common diseases and their impact on organs
    - Strategies for maintaining overall health

Assessment and Grading:

- Quizzes and Knowledge Checks: 30%
- Laboratory Exercises (if applicable): 20%

Course Title: VWS105: Scientific Communication

Course Description:

This course equips students with essential skills for acquiring, analyzing, and effectively communicating scientific ideas and information. Students will learn techniques such as literature searching, information retrieval, and the preparation and delivery of laboratory reports and oral presentations. By successfully completing this course, students will be proficient in scientific reporting, grammatical conventions, data interpretation, and proper citation practices.

Learning Outcomes:

By the end of this course, students will be able to:

1. Use scientific reporting conventions and grammatical standards.
2. Record and present scientific information in appropriate formats.
3. Interpret and explain experimental data effectively.
4. Locate relevant and credible scientific sources through literature searches.
5. Properly cite and reference information.
6. Construct reference lists and bibliographies using software tools.
7. Prepare and deliver well-structured written and oral reports.
8. Demonstrate awareness of plagiarism and avoid it.

Topics:

1. **Introduction to Scientific Communication**
    - Importance of effective scientific communication
    - Overview of course objectives and expectations
2. **Literature Searching and Information Retrieval**
    - Using databases (PubMed, Google Scholar, etc.)
    - Evaluating sources for credibility
    - Proper citation practices
3. **Laboratory Reports and Data Presentation**
    - Structuring laboratory reports (abstract, methods, results, discussion)
    - Graphical representation of data (tables, charts, figures)
    - Interpreting experimental findings
4. **Oral Presentations and Effective Delivery**
    - Organizing oral presentations (introduction, content, conclusion)
    - Visual aids (slides, posters)
    - Public speaking techniques
5. **Citation and Referencing**

- Different citation styles (APA, MLA, etc.)
- In-text citations and bibliographies
- Using reference management software (e.g., EndNote, Zotero)

6. **Avoiding Plagiarism**
   - Understanding plagiarism and its consequences
   - Strategies for proper attribution
   - Academic integrity and ethical practices

Assessment and Grading:

- Literature Search and Source Evaluation: 20%
- Laboratory Report and Data Presentation: 30%
- Oral Presentation: 30%

Course Title: VWS106: Biodiversity Conservation

Course Description:

This course introduces students to the global environment and its fundamental natural systems. It aims to develop students' understanding of applying biological and ecological principles to the conservation of global biodiversity. Major themes include the diversity and interrelationships of biotic and abiotic components, plant and animal diversity, threatening processes, conservation strategies, wildlife exploitation, threatened species, and wildlife forensics. The course is delivered through internal lectures, tutorials, fieldwork, and online resources.

Learning Outcomes:

By the end of this course, students will be able to:

1. Understand the importance of biodiversity conservation.
2. Describe the interplay between biotic and abiotic components in ecosystems.
3. Analyze threats to biodiversity and their impact on species.
4. Evaluate conservation strategies and their effectiveness.
5. Apply ecological principles to real-world conservation scenarios.

Topics:

1. **Introduction to Biodiversity Conservation**
   - Defining biodiversity and its significance
   - Ecosystem services and human well-being
   - Legal and ethical frameworks for conservation
2. **Biotic and Abiotic Components of Ecosystems**
   - Species interactions (competition, predation, mutualism)
   - Nutrient cycles and energy flow
   - Habitat fragmentation and connectivity
3. **Threats to Biodiversity**
   - Habitat loss and degradation
   - Invasive species and pollution
   - Climate change and its impact
4. **Conservation Strategies**

    - Protected areas and reserves
    - Habitat restoration and rewilding
    - Community-based conservation
5. **Wildlife Exploitation and Forensics**
    - Legal and illegal wildlife trade
    - Wildlife trafficking and poaching
    - Forensic techniques for species identification
6. **Case Studies and Fieldwork**
    - Endangered species recovery programs
    - Conservation success stories
    - Field visits to local conservation sites

Assessment and Grading:

- Quizzes and Knowledge Checks: 30%
- Fieldwork Reports and Case Studies: 40%

Course Title: General Microbiology (VWS107)

Course Description:

This course provides students with a foundational understanding of microbiology. Students will explore the diversity of microorganisms, focusing on their morphological, physiological, and ecological characteristics. The course covers essential taxonomic groups, enabling students to differentiate between key microbial categories. Additionally, students will delve into microbial growth, genetics, mycology, and virology. Practical exercises will complement theoretical knowledge, enhancing students' capacity in microbiological techniques.

Learning Objectives:

By the end of this course, students will be able to:

1. Describe the fundamental principles of microbiology.
2. Identify and classify different types of microorganisms.
3. Understand the significance of microbiology in various fields.
4. Explain microbial growth, genetics, mycology, and virology.
5. Apply practical skills related to microbiology.

Course Outline:

1. **Introduction to Microbiology**
    - Historical overview
    - Importance of microbiology in science and society
2. **Microbial Diversity**
    - Classification of microorganisms
    - Morphological and physiological characteristics
    - Ecological roles
3. **Taxonomy and Nomenclature**
    - Key taxonomic groups (bacteria, archaea, fungi, viruses)
    - Binomial nomenclature
4. **Microbial Growth and Reproduction**

    - Growth phases
    - Factors affecting growth
    - Reproductive strategies
5. **Microbial Genetics**
    - DNA replication, transcription, and translation
    - Mutations and genetic variation
6. **Mycology**
    - Study of fungi
    - Fungal morphology, life cycles, and ecological roles
7. **Virology**
    - Structure and classification of viruses
    - Viral replication and pathogenesis
8. **Laboratory Techniques in Microbiology**
    - Aseptic techniques
    - Culturing and identifying microorganisms
    - Antibiotic sensitivity testing

Assessment Methods:

- Quizzes and exams
- Laboratory reports
- Practical demonstrations
- Group projects

Course Title: VW208 Animal Management and Disease

Course Description:

This course focuses on the fundamental aspects of animal health, including symptomatic observation, diagnostic methods, and disease management. Students will explore common diseases in both farm and pet animals, analyzing their impact on various organ systems. Additionally, the course covers disease treatment, control methods, and microbial infection systems relevant to animal protection. Specific health issues in various species will be examined.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the basic parameters of animal health assessment.
2. Apply clinical diagnostic methods for disease identification.
3. Analyze disease states through case studies.
4. Describe the impact of diseases on different organ systems.
5. Explain disease treatment and control strategies.
6. Explore microbial infection systems related to animal health.

Course Outline:

1. **Introduction to Animal Health and Disease**
    - Parameters for assessing animal health
    - Symptomatic observation

    - Diagnostic techniques
2. **Common Diseases in Farm and Pet Animals**
    - Case studies of prevalent diseases
    - Organ system involvement
3. **Disease Treatment and Control**
    - Methods for managing diseases
    - Basic information on microbial infections
4. **Species-Specific Health Issues**
    - Health considerations for different animal species
    - Comparative analysis
5. **Specialist Lectures and Practical Contexts**
    - Guest lectures from animal welfare and veterinary experts
    - Real-world examples and practical applications
6. **Field Studies in Veterinary Medicine**
    - Techniques and analyses in modern veterinary practice
    - Hands-on experience

Assessment Methods:

- Quizzes and exams
- Case study presentations
- Practical demonstrations
- Field reports

Course Title: VW209 Pathophysiology

Course Description:

Pathophysiology explores the disruptions in normal physiological processes that occur due to disease, injury, or other factors. Students will study the connections and functions between major organs within the body. The course emphasizes understanding both normal function and the consequences when functionality is compromised. Diagnostic analysis, including laboratory procedures, will be a key focus to guide appropriate corrective treatment.

Learning Objectives:

By the end of this course, students will be able to:

1. Describe the normal physiological processes in major organ systems.
2. Identify common pathophysiological conditions.
3. Understand the underlying mechanisms of disease.
4. Analyze diagnostic methods for assessing pathophysiological changes.
5. Apply knowledge to recommend appropriate treatments.

Course Outline:

1. **Introduction to Pathophysiology**
    - Definition and scope
    - Etiology and risk factors
2. **Cardiovascular System Disorders**
    - Heart function and common diseases (e.g., hypertension, heart failure)

    - Blood supply disruptions (ischemia, thrombosis)
3. **Neurological Disorders**
    - Brain and nervous system function
    - Neurological diseases (e.g., stroke, epilepsy, neurodegenerative disorders)
4. **Respiratory System Disorders**
    - Lung function and respiratory diseases (e.g., asthma, chronic obstructive pulmonary disease)
5. **Gastrointestinal System Disorders**
    - Digestive system function
    - Common gastrointestinal diseases (e.g., gastritis, peptic ulcers)
6. **Renal and Urinary System Disorders**
    - Kidney function and renal diseases (e.g., renal failure, urinary tract infections)
7. **Endocrine System Disorders**
    - Hormonal imbalances and related conditions (e.g., diabetes, thyroid disorders)
8. **Diagnostic Methods in Pathophysiology**
    - Laboratory tests (blood work, imaging)
    - Biopsies and other procedures

Assessment Methods:

- Quizzes and exams
- Case studies
- Diagnostic analysis reports
- Treatment recommendations

Course Title: VW210 Mammalian Genetics

Course Description:

Mammalian Genetics delves into the fundamental principles of inheritance and genetic variation. The course begins by exploring cellular reproduction, chromosome replication, and their implications for genetic diversity and evolution. Students will gain insights into gene structure, function, and the interplay between genes and proteins. Additionally, various types of genetic mutations will be examined in the context of natural variability and disease.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the mechanisms of cellular reproduction and chromosome replication.
2. Describe gene structure and its relationship to protein synthesis.
3. Identify different types of genetic mutations.
4. Analyze the impact of genetic changes on populations.
5. Consider ethical issues related to gene-based technologies in animals and humans.
6. Gain an introduction to bioinformatics and molecular databases.

Course Outline:

1. **Cellular Reproduction and Chromosome Replication**
    - Mitosis and meiosis
    - Chromosomal abnormalities

2. **Gene Structure and Function**
    - DNA, RNA, and protein synthesis
    - Transcription and translation
3. **Genetic Variation and Evolution**
    - Natural selection
    - Adaptation and speciation
4. **Types of Genetic Mutations**
    - Point mutations, insertions, deletions
    - Frameshift mutations
5. **Modes of Inheritance**
    - Autosomal and sex-linked traits
    - Pedigree analysis
6. **Population Genetics**
    - Hardy-Weinberg equilibrium
    - Quantifying genetic changes
7. **Ethical Considerations in Genetics**
    - Gene editing and designer organisms
    - Animal and human applications
8. **Introduction to Bioinformatics**
    - Accessing molecular databases
    - Investigating specific genes

Assessment Methods:

- Quizzes and exams
- Case studies
- Ethical debates
- Bioinformatics projects

Course Title: VW211 Statistical Methods

Course Description:

Statistical Methods introduces students to a wide range of descriptive statistical techniques and lays the groundwork for understanding statistical inference. Through practical examples, students will explore key concepts related to data analysis. Specialist lectures from animal welfare and veterinary experts will contextualize statistical methods within real-world scenarios. Additionally, field studies will delve into modern veterinary medicine techniques and analyses.

Learning Objectives:

By the end of this course, students will be able to:

1. Apply descriptive statistical techniques to analyze data.
2. Understand the principles of statistical inference.
3. Interpret statistical results in practical contexts.
4. Explore specialized statistical methods relevant to veterinary science.

Course Outline:

1. **Introduction to Descriptive Statistics**
    - Measures of central tendency (mean, median, mode)
    - Measures of dispersion (range, variance, standard deviation)
2. **Probability and Distributions**
    - Probability concepts
    - Common probability distributions (normal, binomial, Poisson)
3. **Sampling Techniques and Estimation**
    - Simple random sampling
    - Confidence intervals
4. **Hypothesis Testing**
    - Null and alternative hypotheses
    - Types of errors (Type I and Type II)
5. **Analysis of Variance (ANOVA)**
    - One-way ANOVA
    - Post hoc tests
6. **Regression Analysis**
    - Linear regression
    - Correlation coefficients
7. **Special Topics in Veterinary Statistics**
    - Epidemiological study design
    - Survival analysis
8. **Practical Applications and Case Studies**
    - Analyzing veterinary data
    - Interpreting statistical findings

Assessment Methods:

- Quizzes and exams
- Data analysis projects
- Case study presentations
- Practical exercises

Course Title: VW212 Immunology

Course Description:

The Immunology course provides students with a broad understanding of the mammalian immune system and its role in protecting individuals from infectious diseases. Additionally, the course explores the impact of immune system dysfunction on chronic diseases. Students will delve into the intricacies of innate and adaptive immunity, examining how immune cells collaborate to defend against various pathogens. Key topics include lymphocyte function, antibody production, immunological memory, and recent developments in immune-based therapies.

Learning Objectives:

By the end of this course, students will be able to:

1. Explain the components and functions of the innate and adaptive immune systems.
2. Understand the role of lymphocytes in immune responses.
3. Describe the development of immunological memory.
4. Analyze the impact of immune system dysfunction on health.

5. Explore therapeutic approaches that utilize the immune system.

Course Outline:

1. **Introduction to Immunology**
    - Overview of the immune system
    - Immune response components
2. **Innate Immunity**
    - Cellular and molecular components
    - Inflammation and phagocytosis
3. **Adaptive Immunity**
    - Antigen recognition by lymphocytes
    - B cells and T cells
4. **Lymphocyte Function**
    - Antibody production
    - Immunological memory
5. **Immune System Dysregulation**
    - Autoimmunity and hypersensitivity
    - Immunodeficiency disorders
6. **Immune-Based Therapies**
    - Vaccination strategies
    - Monoclonal antibodies and immunomodulators
7. **Ethical Considerations in Immunology**
    - Balancing immune responses and potential risks
    - Public health implications

Assessment Methods:

- Quizzes and exams
- Case studies
- Immunology research projects
- Discussions on ethical dilemmas

Course Title: VW213 Case Studies in Animal Management

Course Description:

This course provides students with an opportunity to explore the challenges and threats faced by animal species in the human environment. Through a series of case studies, students will delve into issues related to agricultural practices, pet management, and the impact of human activities on natural animal populations. The course emphasizes critical thinking and problem-solving, aiming to develop solutions for complex scientific and ethical issues.

Learning Objectives:

By the end of this course, students will be able to:

1. Identify and analyze problems affecting animal species.
2. Evaluate the impact of agricultural production techniques and pet management practices.

3. Understand the consequences of climate change and habitat destruction on animal populations.
4. Propose effective solutions based on case study analysis.

Course Outline:

1. **Introduction to Animal Management Challenges**
    - Overview of human-animal interactions
    - Importance of case studies
2. **Agricultural Production Techniques**
    - Case studies related to livestock farming, crop production, and environmental impact
    - Balancing productivity and animal welfare
3. **Pet Management Issues**
    - Challenges in pet breeding, housing, and care
    - Responsible pet ownership
4. **Human Impacts on Natural Animal Populations**
    - Climate change effects on wildlife
    - Habitat destruction and fragmentation
5. **Case Studies Across Species**
    - Endangered species conservation
    - Urban wildlife management
6. **Research and Analysis**
    - Gathering data for case studies
    - Interpreting findings
7. **Oral and Written Presentations**
    - Seminars with peers, lecturers, and industry experts
    - Effective communication of solutions

Assessment Methods:

- Case study reports
- Oral presentations
- Group collaboration
- Ethical considerations in animal management

Course Title: VW214 Animal Ecology

Course Description:

Animal Ecology explores the intricate interactions between animals, their environment, and other organisms. Students will gain insights into animal-animal interactions, predator-prey dynamics, and the impact of environmental factors on animal behavior and distribution. The course emphasizes fieldwork, data collection, and ecological principles.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of animal ecology.
2. Analyze animal behavior and adaptations.

3. Explore ecological niches and trophic interactions.
4. Investigate population dynamics and community structure.
5. Apply ecological concepts to real-world scenarios.

Course Outline:

1. **Introduction to Animal Ecology**
    - Definition and scope
    - Historical perspectives
2. **Behavioral Ecology**
    - Foraging behavior
    - Reproductive strategies
    - Social interactions
3. **Population Ecology**
    - Population growth models
    - Density-dependent and density-independent factors
4. **Community Ecology**
    - Species interactions (competition, predation, mutualism)
    - Biodiversity and ecosystem functioning
5. **Habitat Ecology**
    - Habitat selection
    - Niche differentiation
6. **Applied Ecology**
    - Conservation biology
    - Human impacts on ecosystems
7. **Fieldwork and Data Collection**
    - Observations and experiments
    - Sampling techniques

Assessment Methods:

- Field reports
- Ecological modeling projects
- Presentations
- Case studies

Course Title: VW215 Behavioral Ecology

Course Description:

Behavioral Ecology explores how natural selection influences the behavior of animals, whether they are domestic or wild, vertebrate or invertebrate. Students will delve into the adaptive significance of various behaviors, considering ecological contexts, reproductive strategies, and survival mechanisms. The course emphasizes the interplay between genetics, environment, and behavior.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of behavioral ecology.

2. Analyze the evolutionary basis of specific behaviors.
3. Explore mating systems, parental care, and communication.
4. Apply ecological concepts to behavioral adaptations.

Course Outline:

1. **Introduction to Behavioral Ecology**
    - Evolutionary perspectives on behavior
    - Proximate vs. ultimate causes
2. **Adaptive Behaviors**
    - Foraging strategies
    - Anti-predator behaviors
    - Social behaviors
3. **Mating Systems and Reproductive Strategies**
    - Monogamy, polygamy, and promiscuity
    - Sexual selection
4. **Parental Care and Offspring Survival**
    - Parent-offspring conflict
    - Parental investment
5. **Communication and Signaling**
    - Vocalizations, displays, and chemical cues
    - Honest vs. deceptive signals
6. **Case Studies in Behavioral Ecology**
    - Examples from different animal taxa
    - Field observations and experiments

Assessment Methods:

- Behavioral observations
- Research papers
- Presentations
- Ethical considerations in studying animal behavior

Course Title: VWSGB3 Genetics

Course Description:

This course provides an introductory overview of major topics in genetics, covering classical, molecular, and population genetics. Students will explore the principles underlying heredity and genetic variation. The course aims to present a balanced perspective on genetics, emphasizing both theoretical concepts and practical applications.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the fundamental principles of genetics.
2. Analyze patterns of inheritance based on Mendelian genetics.
3. Explore molecular mechanisms related to genetic material.
4. Investigate genetic variation within populations.
5. Apply genetic concepts to real-world scenarios.

Course Outline:

1. **Introduction to Genetics**
    - Historical context and significance
    - Overview of genetic research areas
2. **Mendelian Inheritance**
    - Laws of inheritance (e.g., segregation, independent assortment)
    - Pedigree analysis
3. **Molecular Genetics**
    - DNA structure and replication
    - Gene expression and regulation
4. **Population Genetics**
    - Genetic drift
    - Hardy-Weinberg equilibrium
5. **Quantitative Genetics**
    - Polygenic traits
    - Heritability
6. **Phylogenetics and Evolution**
    - Constructing phylogenetic trees
    - Genetic basis of evolutionary processes
7. **Laboratory Investigations**
    - Techniques in modern genetics
    - Hands-on experiments

Assessment Methods:

- Quizzes and exams
- Laboratory reports
- Case studies
- Application of genetic principles

Course Title: VWSGB4 Genetic Improvement of Livestock

Course Description:

This course focuses on advanced knowledge related to genetic improvement schemes in livestock and companion animals. Students will explore quantitative genetics, animal breeding, and practical applications. The course is compulsory for those with a special interest in genetics and animal breeding.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand genetic improvement strategies.
2. Apply quantitative genetics principles.
3. Evaluate breeding programs.
4. Explore practical aspects of genetic improvement.

Course Outline:

1. **Introduction to Genetic Improvement**
    - Historical context and significance
    - Genetic variation and heritability
2. **Quantitative Genetics**
    - Breeding value and selection
    - Genetic prediction models
3. **Breeding Programs**
    - Selection methods (phenotypic, genomic)
    - Inbreeding and outbreeding
4. **Practical Applications**
    - Livestock case studies
    - Companion animal breeding
5. **Field Excursions and Practical Sessions**
    - Hands-on experience
    - Industry visits

Assessment Methods:

- Exams and quizzes
- Breeding program analysis
- Practical exercises

Course Title: VWSGB5 Modern Statistics for the Life Sciences

Course Description:

This course provides an introduction to statistical models and methods relevant to the life sciences. Students will learn how to apply statistical techniques to analyze data in fields such as quantitative genetics and epidemiology. The course emphasizes practical applications and inference.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand fundamental statistical concepts.
2. Apply statistical models to real-world problems.
3. Analyze data using appropriate methods.
4. Interpret statistical results in the context of life sciences.

Course Outline:

1. **Introduction to Statistical Models**
    - Overview of statistical inference
    - Model formulation and assumptions
2. **Descriptive Statistics and Data Visualization**
    - Measures of central tendency and variability
    - Graphical representations
3. **Probability Distributions**
    - Normal distribution
    - Binomial distribution

4. **Statistical Inference**
    - Hypothesis testing
    - Confidence intervals
5. **Linear Regression and Correlation**
    - Simple linear regression
    - Multiple regression
6. **Experimental Design and Analysis**
    - Randomization and control groups
    - Analysis of variance (ANOVA)
7. **Generalized Linear Models (GLMs)**
    - Logistic regression
    - Poisson regression
8. **Applications in Quantitative Genetics and Epidemiology**
    - Heritability estimation
    - Disease risk modeling

Assessment Methods:

- Quizzes and exams
- Data analysis projects
- Case studies

Course Title: VWSGB6 Population and Quantitative Genetics

Course Description:

Population and Quantitative Genetics explores the genetic and molecular evolution of natural, captive, and domesticated populations across various living organisms. From microbes to plants and animals, students will delve into the relationship between genetic changes, molecular processes, and phenotypic evolution. The course emphasizes both theoretical concepts and practical applications.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of population genetics.
2. Analyze genetic variation within populations.
3. Explore the impact of molecular evolution on phenotypic traits.
4. Apply quantitative genetics methods to real-world scenarios.

Course Outline:

1. **Introduction to Population Genetics**
    - Genetic diversity and allele frequencies
    - Hardy-Weinberg equilibrium
2. **Evolutionary Processes**
    - Natural selection
    - Genetic drift and gene flow
3. **Molecular Evolution**
    - DNA mutations and substitutions

    - Molecular clocks
4. **Quantitative Genetics**
    - Heritability estimation
    - Breeding value and response to selection
5. **Phenotypic Evolution**
    - Adaptation and fitness
    - Phenotypic plasticity
6. **Applications in Agriculture and Conservation**
    - Breeding programs
    - Genetic conservation strategies

Assessment Methods:

- Quizzes and exams
- Data analysis projects
- Case studies

Course Title: Ecological Methods (VWSGB7)

Course Description:

Ecological Methods focuses on analyzing hypothesis-centered ecological field research projects related to plants, animals, and their environment. The course emphasizes the selection and application of appropriate statistical techniques for ecological data analysis.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of ecological research design.
2. Apply statistical methods to ecological data.
3. Analyze and interpret field observations.
4. Develop practical skills for ecological investigations.

Course Outline:

1. **Introduction to Ecological Research**
    - Hypothesis formulation
    - Experimental design
2. **Sampling Techniques**
    - Random sampling
    - Stratified sampling
3. **Field Data Collection**
    - Observations and measurements
    - Data recording protocols
4. **Statistical Analysis in Ecology**
    - Descriptive statistics
    - Inferential statistics
5. **Species Interactions and Biodiversity**
    - Community structure
    - Species richness and diversity indices

6. **Population Dynamics**
    - Population size estimation
    - Mark-recapture methods
7. **Ecological Modeling**
    - Habitat suitability modeling
    - Species distribution modeling
8. **Practical Applications and Case Studies**
    - Field experiments
    - Data interpretation

Course Title: Wildlife Resource Management (VWSGB8)

Course Description:

This course emphasizes a learning-by-doing approach to solving problems in wildlife management and conservation biology. Students will explore key concepts related to wildlife populations, species behavior patterns, and human impacts on wildlife. The course aims to develop practical skills for managing wildlife habitat and populations effectively.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand fundamental principles of wildlife management.
2. Apply ecological concepts to wildlife populations.
3. Evaluate habitat assessment techniques.
4. Analyze predator-prey relationships.
5. Identify wildlife species and their biology.
6. Resolve human-wildlife conflicts.
7. Comprehend the role of hunting in conservation.
8. Interpret game and fish laws and regulations.

Course Outline:

1. **Introduction to Wildlife Management**
    - Historical context and significance
    - Learning-by-doing approach
2. **Wildlife Ecology and Behavior**
    - Population dynamics
    - Animal behavior patterns
3. **Habitat Assessment Techniques**
    - Survey methods
    - Habitat quality evaluation
4. **Predator-Prey Relationships**
    - Trophic interactions
    - Ecological balance
5. **Wildlife Species Biology and Identification**
    - Species diversity
    - Field identification skills
6. **Human-Wildlife Conflict Resolution**

    - Mitigating conflicts
    - Coexistence strategies
7. **Conservation and Hunting**
    - Role of hunting in wildlife management
    - Sustainable practices
8. **Legal Framework and Regulations**
    - Game and fish laws
    - Wildlife protection legislation

Assessment Methods:

- Quizzes and exams
- Fieldwork and data collection
- Case studies
- Practical exercises

Course Title: Molecular Regulation of Health and Disease (VWSGB9)

Course Description:

This course delves into the regulatory mechanisms at the molecular, biochemical, and cellular levels that play a central role in both human and animal health. Students will explore how these mechanisms impact disease processes and contribute to maintaining overall well-being.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the molecular basis of health and disease.
2. Analyze regulatory pathways and their dysregulation.
3. Explore the interplay between genetics, environment, and health.
4. Apply knowledge to real-world health challenges.

Course Outline:

1. **Introduction to Molecular Regulation**
    - Overview of cellular processes
    - Signaling pathways
2. **Biochemical Mechanisms in Health and Disease**
    - Enzyme function
    - Metabolic regulation
3. **Cellular Signaling and Gene Expression**
    - Transcription factors
    - Epigenetic modifications
4. **Genetics and Disease Susceptibility**
    - Genetic variants and risk
    - Mendelian disorders
5. **Environmental Factors and Health**
    - Toxins and pollutants
    - Nutritional impact
6. **Disease Pathways and Therapeutic Targets**

    - Cancer pathways
    - Immune system regulation
7. **Application of Molecular Insights**
    - Personalized medicine
    - Drug development

Assessment Methods:

- Quizzes and exams
- Case studies
- Research projects

Course Title: Microbial Disease Management (VWSGB10)

Course Description:

Microbial Disease Management focuses on preventing the transmission of organisms in healthcare settings. Students will gain essential skills and knowledge related to infection control, microbial transmission, and disease prevention. The course covers bacterial, fungal, parasitic, and viral infections, emphasizing practical skills such as using personal protective equipment and maintaining sterile environments. Additionally, the role of the immune system in defending the human body and recognizing inflammation will be explored.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of infection control.
2. Identify and manage common microbial infections.
3. Apply practical skills related to maintaining sterile conditions.
4. Recognize the role of the immune system in disease defense.

Course Outline:

1. **Introduction to Microbial Disease Management**
    - Importance of infection control
    - Microbial transmission and reproduction
2. **Bacterial Infections**
    - Common bacterial pathogens
    - Antibiotic resistance
3. **Fungal and Parasitic Infections**
    - Overview of fungal and parasitic diseases
    - Prevention and treatment
4. **Viral Infections**
    - Viral transmission routes
    - Vaccination strategies
5. **Personal Protective Equipment (PPE) and Sterile Techniques**
    - Proper use of PPE
    - Maintaining a sterile field
6. **Role of the Immune System**
    - Innate and adaptive immunity

- Inflammatory responses

Assessment Methods:

- Quizzes and exams
- Practical demonstrations
- Case studies
- Immune system assessment

Course Title: Animal Nutrition and Physiology (VWSNM4)

Course Description:

This course offers a comprehensive exploration of animal nutrition and physiological processes. It focuses on practical modules that provide essential knowledge in nutrient analysis, digestion physiology, and nutrient utilization in animals. Whether you're interested in livestock management or understanding the science of animal nutrition, this course covers key aspects relevant to both.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of animal nutrition.
2. Analyze nutrient requirements and utilization.
3. Explore digestive physiology across different animal species.
4. Apply practical skills related to nutrient analysis.

Course Outline:

1. **Introduction to Animal Nutrition**
   - Overview of nutrient classes
   - Nutrient requirements
2. **Digestive Physiology**
   - Comparative digestive systems
   - Absorption and metabolism
3. **Nutrient Analysis Techniques**
   - Methods for assessing nutrient content
   - Laboratory procedures
4. **Feeding Strategies and Formulations**
   - Balanced diets
   - Ration formulation
5. **Nutrient Utilization in Different Species**
   - Non-ruminant vs. ruminant animals
   - Companion animals and zoo species
6. **Practical Modules**
   - Hands-on nutrient analysis

- Digestive system dissections

Assessment Methods:

- Quizzes and exams
- Practical demonstrations
- Case studies

Course Title: Nutrient Dynamics (VWSNM5)

Course Description:

Nutrient Dynamics delves into the detailed understanding of nutrient uptake, utilization, and cycling in various ecosystems. Students will explore the quantitative aspects of nutrient flow, retention, and transfer over time and distance. The course emphasizes the interplay between nutrient availability, biological productivity, and ecological processes.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of nutrient dynamics.
2. Quantify nutrient uptake and cycling.
3. Analyze nutrient limitations and their impact on ecosystems.
4. Apply knowledge to real-world ecological scenarios.

Course Outline:

1. **Introduction to Nutrient Dynamics**
   - Definition and significance
   - Nutrient uptake pathways
2. **Nutrient Cycling Processes**
   - Retention and transfer mechanisms
   - Biogeochemical cycles (e.g., carbon, nitrogen, phosphorus)
3. **Quantitative Aspects of Nutrient Flow**
   - Mass balance equations
   - Stoichiometry of nutrient ratios
4. **Nutrient Limitations in Ecosystems**
   - Liebig's Law of the Minimum
   - Macronutrient and micronutrient constraints
5. **Ecosystem Productivity and Nutrient Availability**
   - Primary production and nutrient supply
   - Nutrient stoichiometry in aquatic and terrestrial systems
6. **Applied Nutrient Dynamics**
   - Soil nutrient management

- Restoration ecology

Assessment Methods:

- Quizzes and exams
- Nutrient cycling models
- Case studies

Course Title: Feed Technology (VWSNM6)

Course Description:

The Feed Technology course focuses on the production of animal feeds, emphasizing the preconditions necessary for feed manufacturing. Students will gain insights into improving the nutritional and physical quality of feeds through technological advancements.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of feed production.
2. Analyze feed quality and safety.
3. Explore technological methods for enhancing feed quality.
4. Apply knowledge to optimize animal nutrition.

Course Outline:

1. **Introduction to Feed Technology**
   - Importance of feed quality
   - Role of technology in feed production
2. **Feed Ingredients and Formulation**
   - Raw materials for feed
   - Nutrient composition
3. **Feed Processing Techniques**
   - Grinding, mixing, and pelleting
   - Extrusion and heat treatment
4. **Quality Assurance and Safety**
   - Regulatory requirements
   - Contaminant control
5. **Nutritional Enhancement**
   - Additives and supplements
   - Balanced feed formulations
6. **Practical Applications and Case Studies**
   - Industry best practices
   - Troubleshooting feed production issues

Assessment Methods:

- Quizzes and exams
- Feed formulation projects
- Quality control exercises

Course Title: Health Welfare and Management (VWSNM7)

Course Description:

The Health Welfare and Management course covers multidisciplinary aspects related to animal functioning. It focuses on selected themes within health, welfare, and management. Students will gain insights into various topics relevant to animal well-being and effective management practices.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of animal health and welfare.
2. Analyze management strategies for promoting animal well-being.
3. Explore interdisciplinary approaches to animal functioning.

Course Themes (Selected Topics):

1. **Animal Health and Welfare**
    - Health assessment
    - Welfare indicators
2. **Management Practices**
    - Nutrition and feeding
    - Housing and environmental enrichment
3. **Interdisciplinary Perspectives**
    - Ethical considerations
    - Legal frameworks

Course Title: Adaptation Physiology (VWSNM8)

Course Description:

The Adaptation Physiology course delves into specific mechanisms of physiological adaptation, exploring various aspects such as immunology, behavior, reproduction, and energy metabolism. Students will gain an in-depth understanding of how organisms adapt to their environment. The course also addresses social and ethical considerations related to adaptation.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of adaptation physiology.
2. Analyze specific physiological mechanisms related to adaptation.
3. Formulate scientific hypotheses based on literature review.
4. Apply knowledge to real-world scenarios.

Course Outline:

1. **Introduction to Adaptation Physiology**
    - Overview of physiological adaptations
    - Role of homeostasis
2. **Immunological Adaptations**
    - Immune responses to environmental challenges
    - Immunomodulation
3. **Behavioral Adaptations**
    - Behavioral plasticity
    - Social behaviors and survival strategies
4. **Reproductive Adaptations**
    - Reproductive strategies
    - Parental care and reproductive success
5. **Energy Metabolism and Nutrient Utilization**
    - Metabolic adaptations
    - Energy conservation
6. **Ethical and Social Aspects of Adaptation**
    - Balancing survival and well-being
    - Human impact on adaptation processes
7. **Scientific Work Plan and Hypothesis Development**
    - Literature review
    - Experimental design

Assessment Methods:

- Quizzes and exams
- Literature analysis projects
- Case studies

Course Title: Aquaculture Production Systems (VWSNM9)

Course Description:

The Aquaculture Production Systems course explores the intricate relationship between aquatic organisms (including algae, fish, crustaceans, and mollusks) and their environment. It covers both the immediate production space and the broader context in which aquaculture farms operate.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of aquaculture production.
2. Analyze the interactions between aquatic organisms and their surroundings.
3. Explore sustainable practices within aquaculture systems.

Course Outline:

1. **Introduction to Aquaculture Production Systems**
    - Overview of aquaculture practices
    - Environmental considerations
2. **Aquatic Organisms in Production**
    - Algae cultivation
    - Fish farming techniques
    - Crustacean and mollusk culture
3. **Production Space and Infrastructure**
    - Pond-based systems
    - Recirculating aquaculture systems (RAS)
    - Cage culture
4. **Water Quality Management**
    - Monitoring and control
    - Nutrient cycling
5. **Environmental Impact and Sustainability**
    - Biodiversity conservation
    - Waste management
6. **Case Studies and Best Practices**
    - Successful aquaculture models
    - Industry innovations

Course Title: Nutrition, Welfare, and Reproduction in Aquaculture (VWSNM10)

Course Description:

The Nutrition, Welfare, and Reproduction in Aquaculture course explores the intricate relationship between aquatic organisms (including algae, fish, crustaceans, and mollusks) and their environment. It covers both the immediate production space and the broader context in which aquaculture farms operate. Key topics include nutrition, animal welfare, and reproductive strategies.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of nutrition in aquaculture.
2. Analyze animal welfare considerations in aquaculture systems.
3. Explore reproductive strategies and their impact on aquaculture production.

Course Outline:

1. **Introduction to Aquaculture Nutrition**
    - Nutrient requirements
    - Feed formulation
2. **Animal Welfare in Aquaculture**
    - Welfare indicators
    - Husbandry practices
3. **Reproductive Strategies**
    - Breeding techniques
    - Broodstock management

4. **Environmental Considerations**
    - Water quality and reproductive success
    - Stress and reproductive performance
5. **Practical Applications and Case Studies**
    - Farm-specific challenges
    - Sustainable aquaculture practices

Assessment Methods:

- Quizzes and exams
- Case studies
- Practical assignments

Course Title: Human and Veterinary Immunology (VWSNM11)

Course Description:

The Human and Veterinary Immunology course aims to provide in-depth knowledge of the functioning of the immune system at both cellular and organ levels. It explores the evolutionary development of immune responses and their relevance to human and veterinary health.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of immunology.
2. Analyze immune mechanisms at the cellular and organ levels.
3. Explore the evolutionary basis of immune responses.
4. Apply knowledge to real-world health scenarios.

Course Outline:

1. **Introduction to Immunology**
    - Overview of the immune system
    - Immune cell types and functions
2. **Cellular Immunity**
    - T lymphocytes and antigen recognition
    - Immune response activation
3. **Humoral Immunity**
    - B lymphocytes and antibody production
    - Immunoglobulin classes
4. **Organ-Level Immune Responses**
    - Lymphoid organs (spleen, lymph nodes, thymus)
    - Immune cell trafficking
5. **Evolutionary Aspects of Immune System Development**
    - Comparative immunology
    - Coevolution with pathogens
6. **Clinical Applications and Case Studies**
    - Immunodeficiencies
    - Autoimmune diseases

Course Title: Sustainability Assessment of Animal Systems (VWSGS3)

Course Description:

The Sustainability Assessment of Animal Systems course focuses on core issues related to sustainable animal production. It equips students with the knowledge and skills to analyze and address complex problems within the context of animal systems. The course emphasizes sustainability principles and practical methodologies.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of sustainability in animal production.
2. Analyze the environmental, economic, and social aspects of animal systems.
3. Apply various assessment methods to evaluate sustainability.
4. Develop solutions for enhancing sustainable practices.

Course Outline:

1. **Introduction to Sustainability Assessment**
    - Defining sustainability
    - Triple bottom line (environmental, economic, social)
2. **Environmental Impact Assessment**
    - Life cycle assessment (LCA)
    - Carbon footprint and resource use
3. **Economic Viability of Animal Systems**
    - Cost-benefit analysis
    - Economic indicators
4. **Social Considerations and Stakeholder Engagement**
    - Social impact assessment
    - Community involvement
5. **Methodologies for Sustainability Assessment**
    - Multi-criteria decision analysis
    - Sustainability indices
6. **Case Studies and Practical Applications**
    - Farm-level assessments
    - Policy implications

Assessment Methods:

- Quizzes and exams
- Sustainability project reports
- Group discussions and presentations

Course Title: Future Livestock Systems (VWSGS4)

Course Description:

The Future Livestock Systems course encourages students to explore and envision potential scenarios for the future of livestock production. It delves into innovative approaches, emerging technologies, and sustainable practices that could shape the evolution of livestock systems.

Learning Objectives:

By the end of this course, students will be able to:

1. Analyze future trends in livestock production.
2. Evaluate opportunities and challenges for sustainable livestock systems.
3. Develop forward-thinking strategies for enhancing animal agriculture.

Course Outline:

1. **Introduction to Future Livestock Systems**
    - Importance of anticipating change
    - Global context and drivers
2. **Technological Innovations**
    - Genetics and breeding advancements
    - Precision farming and automation
3. **Sustainable Practices**
    - Climate-smart livestock production
    - Circular economy approaches
4. **Social and Ethical Considerations**
    - Consumer preferences and animal welfare
    - Policy implications
5. **Scenario Building and Visioning**
    - Envisioning alternative futures
    - Strategic planning for livestock systems

Course Title: Aquaculture Production Systems (VWSGS5)

Course Description:

The Aquaculture Production Systems course explores the intricate relationship between aquatic organisms (including algae, fish, crustaceans, and mollusks) and their environment. It covers both the immediate production space and the broader context in which aquaculture farms operate.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of aquaculture production.
2. Analyze the interactions between aquatic organisms and their surroundings.
3. Explore sustainable practices within aquaculture systems.

Course Outline:

1. **Introduction to Aquaculture Production Systems**
    - Overview of aquaculture practices

    - Environmental considerations
2. **Aquatic Organisms in Production**
    - Algae cultivation
    - Fish farming techniques
    - Crustacean and mollusk culture
3. **Production Space and Infrastructure**
    - Pond-based systems
    - Recirculating aquaculture systems (RAS)
    - Cage culture
4. **Water Quality Management**
    - Monitoring and control
    - Nutrient cycling
5. **Environmental Impact and Sustainability**
    - Biodiversity conservation
    - Waste management
6. **Case Studies and Best Practices**
    - Successful aquaculture models
    - Industry innovations

Course Title: Sustainability in Fish and Seafood Production (VWSGS6)

Course Description:

The Sustainability in Fish and Seafood Production course delves into the economic, ecological, and managerial aspects of sustainable fish capture and aquaculture. Students will explore the complexities of balancing environmental impact, economic viability, and responsible management practices within the seafood industry.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of sustainability in fish and seafood production.
2. Analyze the environmental and socio-economic impacts of different fishing practices.
3. Explore innovative approaches to enhance sustainability in aquaculture.
4. Develop strategies for responsible seafood production.

Course Outline:

1. **Introduction to Sustainability in Fish and Seafood Production**
    - Defining sustainability
    - Triple bottom line considerations
2. **Ecological Impacts of Captured and Farmed Fish/Seafood**
    - Ecosystem effects
    - Biodiversity conservation
3. **Managerial Dimensions of Sustainability**
    - Business economics in the seafood sector
    - Stakeholders and value chain analysis
4. **Economic Sustainability and Decision Making**
    - Cost-benefit analysis
    - Economic indicators
5. **Innovations and Challenges in Fish Farming and Aquaculture**

    - Welfare considerations
    - Species selection and health management
6. **Developing Sustainable Solutions**
    - Innovation development
    - Feasibility assessment

Assessment Methods:

- Quizzes and exams
- Case studies
- Sustainability project development

Course Title: Quantitative Veterinary Epidemiology (VWSGS7)

Course Description:

The Quantitative Veterinary Epidemiology course focuses on understanding the occurrence and transmission of diseases within populations. It explores risk factors contributing to disease occurrence (epidemiology) and quantifies their significance. Students will gain essential skills in analyzing and interpreting epidemiological data.

Learning Objectives:

By the end of this course, students will be able to:

1. Understand the principles of veterinary epidemiology.
2. Analyze disease patterns and risk factors.
3. Apply quantitative methods to assess disease impact.
4. Develop evidence-based strategies for disease prevention.

Course Outline:

1. **Introduction to Veterinary Epidemiology**
    - Epidemiological concepts
    - Disease surveillance
2. **Study Designs and Data Collection**
    - Cross-sectional studies
    - Case-control and cohort studies
3. **Risk Factors and Associations**
    - Identifying risk factors
    - Odds ratios and relative risks
4. **Quantitative Methods in Epidemiology**
    - Statistical modeling
    - Population-attributable risk
5. **Disease Impact Assessment**
    - Disease burden calculations
    - Economic consequences
6. **Evidence-Based Strategies for Disease Prevention**
    - Vaccination programs

- Biosecurity measures

Course Title: Management of Infectious Diseases in Animal Populations

Course Description:

This course focuses on the preventive management of infections and diseases in animals. Veterinary epidemiology plays a crucial role in disease control, including monitoring and surveillance.

Learning Objectives:

- Understand the fundamental concepts of veterinary epidemiology.
- Learn effective surveillance and monitoring techniques.
- Explore infection control measures and biosecurity protocols.
- Investigate disease outbreaks using epidemiological methods.
- Gain insights into zoonotic diseases and the One Health approach.

Topics Covered:

- Introduction to veterinary epidemiology
- Types of surveillance (active, passive, syndromic)
- Biosecurity and quarantine procedures
- Vaccination strategies
- Outbreak investigation steps
- Epidemiological models (SIR model, transmission dynamics)
- Zoonotic diseases and One Health
- Real-world case studies

Assessment and Grading:

- Assignments, quizzes, and exams
- Participation in case study discussions
- Final project or research paper

Course Title: VWSGS9 Global and Sustainability Practicum in Animal Production

Course Description: This course explores approaches to animal production that extend beyond the individual animal level. It emphasizes the interconnectedness between the production sector and the socio-economic environment. The specialization in Global and Sustainable Production integrates knowledge from various disciplines, including animal sciences, economics, and social sciences. The overarching goal is to ensure a responsible and sustainable food supply for humanity while preserving culture and the environment.

Learning Objectives:

- Understand the global context of animal production systems.
- Analyze sustainability challenges and opportunities.
- Apply interdisciplinary approaches to address complex issues.

- Explore practical solutions for sustainable animal systems.

Topics Covered:

- Global trends in animal production
- Socio-economic factors influencing production
- Environmental impact assessment
- Sustainable practices (resource use, waste management)
- Case studies from different regions
- Cultural considerations in animal production

Assessment and Grading:

- Participation in fieldwork or practicum experiences
- Research projects on sustainable practices
- Presentations and discussions
- Written reflections on cultural and environmental aspects

Course Title: VWSA10 Animal Nutrition and Physiology

Course Description:

This course is designed to provide students with fundamental knowledge in animal nutrition and physiology. It focuses on three practical modules:

1. **Nutrient Analysis:**
    - Introduction to essential nutrients (carbohydrates, proteins, lipids, vitamins, minerals)
    - Nutrient requirements for different animal species
    - Methods for nutrient analysis (proximate analysis, energy content)
2. **Digestion Physiology:**
    - Anatomy of the digestive system
    - Enzymatic digestion and absorption
    - Rumen fermentation (for ruminants)
    - Hindgut fermentation (for non-ruminants)
3. **Physiology of Nutrient Utilization:**
    - Nutrient metabolism (anabolism and catabolism)
    - Energy balance and utilization
    - Hormonal regulation of nutrient uptake
    - Factors affecting nutrient utilization (age, health, environment)

Assessment and Grading:

- Practical exercises (nutrient analysis, dissection)
- Quizzes and exams
- Research projects related to animal nutrition

Course Title: VWSAB5 Health, Welfare, and Management

Course Description:

This multidisciplinary course explores various aspects of animal functioning, with a focus on specific themes related to health, welfare, and management.

Learning Objectives:

- Understand the interplay between animal health and overall well-being.
- Explore management practices that promote optimal health and welfare.
- Analyze ethical considerations in animal care and management.

Themes Covered:

1. **Animal Health:**
    - Common diseases and preventive measures
    - Veterinary care and diagnostics
    - Nutrition and health
2. **Animal Welfare:**
    - Five freedoms (freedom from hunger, discomfort, pain, fear, and distress)
    - Housing and environmental enrichment
    - Behavioral indicators of welfare
3. **Management Practices:**
    - Biosecurity protocols
    - Handling and transportation
    - Record-keeping and monitoring

Assessment and Grading:

- Quizzes and exams
- Case studies on health and welfare
- Practical exercises (e.g., facility design, health assessments)

Course Title: VWSAB6 Adaptation Physiology

Course Description:

This course delves deeper into the specific mechanisms of adaptation physiology. It covers various aspects, including immunology, behavior, reproduction, and energy metabolism. Additionally, social and ethical considerations are explored. Students will develop a scientific work plan based on a hypothesis derived from a literature review.

Learning Objectives:

- Understand the physiological adaptations that enable organisms to thrive in diverse environments.
- Analyze the interplay between genetic, cellular, and systemic responses to environmental challenges.
- Explore ethical implications related to adaptation and well-being.

Units:

1. **Immunological Adaptations:**
    - Immune system components and responses
    - Immunomodulation under stress
    - Immune trade-offs
2. **Behavioral Adaptations:**
    - Behavioral plasticity
    - Foraging strategies
    - Social behaviors and communication
3. **Reproductive Physiology:**
    - Reproductive strategies (e.g., semelparity, iteroparity)
    - Hormonal regulation of reproduction
    - Parental care and investment
4. **Energy Metabolism and Homeostasis:**
    - Metabolic pathways (glycolysis, Krebs cycle, oxidative phosphorylation)
    - Thermoregulation
    - Endocrine control of metabolism
5. **Social and Ethical Aspects:**
    - Impact of adaptation on ecosystems
    - Ethical considerations in wildlife management
    - Conservation implications

Assessment and Grading:

- Literature review and hypothesis development
- Research proposal
- Presentations and discussions
- Practical exercises (field observations, experiments)

Course Title: VWSAB7 Applied Animal Behaviour and Welfare

Course Description:

This course bridges the gap between animal behavior concepts and welfare considerations in contemporary livestock and companion animal husbandry. Students will explore how behavior impacts animal well-being and learn practical strategies for promoting positive welfare.

Learning Objectives:

- Understand the fundamental principles of animal behavior.
- Analyze the relationship between behavior and welfare.
- Apply evidence-based practices to enhance animal welfare.

Units:

1. **Introduction to Animal Behavior:**
    - Ethology and behavioral ecology
    - Innate vs. learned behaviors
    - Observational techniques
2. **Behavioral Needs and Welfare Assessment:**
    - Five freedoms framework
    - Assessing behavioral indicators of welfare
    - Identifying stressors and enrichment opportunities

3. **Species-Specific Behavior:**
    - Livestock behavior (cattle, poultry, pigs)
    - Companion animal behavior (dogs, cats, horses)
    - Behavioral adaptations in different environments
4. **Applied Welfare Strategies:**
    - Housing design and environmental enrichment
    - Handling and transport practices
    - Pain management and stress reduction
5. **Ethical Considerations:**
    - Balancing production goals with welfare
    - Cultural perspectives on animal use
    - Legal and ethical frameworks

Assessment and Grading:

- Behavior observation assignments
- Case studies on welfare interventions
- Group projects related to practical applications

Course Title: VWSAB10 Functional Zoology

Course Description:

This course aims to provide students with both theoretical foundations and practical experience in the quantitative analysis of animal functioning. It explores various aspects related to animal physiology, behavior, and adaptation.

Learning Objectives:

- Understand the fundamental principles of animal physiology.
- Apply quantitative methods to study animal functions.
- Analyze adaptations in response to environmental challenges.

Units:

1. **Animal Physiology:**
    - Cellular processes (metabolism, respiration, circulation)
    - Nervous system and sensory functions
    - Endocrine regulation
2. **Quantitative Analysis:**
    - Statistical methods for data interpretation
    - Experimental design and hypothesis testing
    - Field measurements and laboratory techniques
3. **Functional Adaptations:**
    - Energetics and thermoregulation
    - Reproductive strategies
    - Behavioral adaptations (feeding, locomotion)
4. **Case Studies:**
    - Examining specific animal groups (mammals, birds, reptiles)
    - Comparative analyses of physiological traits

Assessment and Grading:

- Practical exercises (data collection, analysis)
- Research projects on functional adaptations
- Quizzes and exams

Course Title: VWSAB11 Developmental Biology of Animals

Course Description:

This course provides a comparative overview of early development in various animal species. It explores cellular and molecular mechanisms underlying developmental processes. A solid understanding of basic principles in molecular and cellular biology is required.

Topics Covered:

1. **Introduction to Developmental Biology:**
    - Historical context and key discoveries
    - Stages of embryonic development
    - Model organisms for studying development
2. **Cellular Processes in Development:**
    - Cell division and differentiation
    - Cell signaling pathways
    - Tissue morphogenesis
3. **Genetic Regulation:**
    - Transcriptional control
    - Epigenetic modifications
    - Homeotic genes and body patterning
4. **Comparative Embryology:**
    - Early development in vertebrates (fish, amphibians, birds, mammals)
    - Invertebrate development (e.g., Drosophila, C. elegans)
    - Evolutionary aspects
5. **Experimental Techniques in Developmental Biology:**
    - Microscopy (confocal, super-resolution)
    - Genetic manipulation (transgenesis, CRISPR)
    - Functional assays (gene expression analysis)
6. **Ethical Considerations:**
    - Animal welfare in research
    - Ethical guidelines for experimentation

Assessment and Grading:

- Examinations on developmental processes
- Laboratory exercises (observation of embryos)
- Research project or literature review

Course Title: VWSAB12 Sustainability Assessment of Animal Systems

Course Description:

This course provides an overview of various methods used to assess the consequences of innovations in animal production systems worldwide. It focuses on their impact on three key aspects:

1. **Environment:**
    - Efficient resource use
    - Emissions (air, water, soil)
2. **Livelihood:**
    - Farm income
    - Employment
    - Food security
3. **Animal Welfare:**
    - Behavior
    - Health

Learning Objectives: After completing this course, students are expected to:

- Calculate environmental impact indicators for animal production systems.
- Understand environmental indicators from a farm or life cycle perspective.
- Compare and interpret tools for assessing animal welfare.
- Analyze innovations' economic consequences in animal production.
- Evaluate the overall impact on environment, livelihood, and animal welfare.
- Identify trade-offs and synergies among sustainability aspects.

Activities:

- Lectures
- Working group activities (addressing different issues weekly)
- Short presentations and discussions

Assessment:

- Written test with open questions (70%)
- Essay (30%)

Course Title: VWSMF3 Development & Heavy Aging

Course Description:

This course explores three interconnected areas of science relevant to both development and healthy aging. Students will delve into the following topics:

1. **Muscle Origin and Function:**
    - Anatomy and physiology of skeletal muscle
    - Muscle fiber types and their roles
    - Age-related changes in muscle mass and strength
2. **Energy Homeostasis:**
    - Metabolic processes (glycolysis, Krebs cycle, oxidative phosphorylation)
    - Hormonal regulation of energy balance
    - Nutrient utilization during aging
3. **Immunology:**

- Immune system components (cells, antibodies, cytokines)
- Immunosenescence (age-related changes in immune function)
- Strategies to enhance immune health in older adults

Assessment and Grading:

- Quizzes and exams
- Research projects related to muscle function, metabolism, or immunology

Course Title: VWSMF5 Integrated Neuroendocrinology

Course Description:

This course provides an in-depth exploration of the interrelationships between the brain, endocrine systems, and behavior. Students will delve into various aspects of neuroendocrinology, including sleep, emotion, stress, homeostasis, and digestive behavior.

Units:

1. **Introduction to Neuroendocrinology:**
   - Overview of hormonal signaling in the body and brain
   - Role of neuroendocrine pathways in maintaining homeostasis
2. **Sleep and Circadian Rhythms:**
   - Sleep stages and their regulation
   - Impact of hormones (melatonin, cortisol) on sleep-wake cycles
3. **Emotion and Hormonal Responses:**
   - Neurotransmitters and hormones involved in emotional states
   - Stress response and the hypothalamic-pituitary-adrenal (HPA) axis
4. **Homeostasis and Energy Balance:**
   - Regulation of appetite and feeding behavior
   - Leptin, ghrelin, and insulin signaling
5. **Digestive Behavior and Gut-Brain Axis:**
   - Gut hormones (e.g., cholecystokinin, peptide YY)
   - Brain-gut communication and its impact on behavior

Assessment and Grading:

- Quizzes and exams
- Research projects related to specific neuroendocrine pathways

Course Title: VWSMF6 Molecular Regulation of Health and Disease

Course Description:

This course explores the intricate regulatory mechanisms at the molecular, biochemical, and cellular levels that play a central role in both human and animal health. Students will delve into the following topics:

Topics Covered:

- **Genetic Regulation:**
  - Transcriptional control (promoters, enhancers, transcription factors)
  - Epigenetic modifications (DNA methylation, histone modifications)
  - Non-coding RNAs (microRNAs, long non-coding RNAs)
- **Cell Signaling Pathways:**
  - Receptor-mediated signaling (hormones, growth factors)
  - Intracellular cascades (MAPK, PI3K-Akt)
  - Crosstalk between pathways
- **Metabolism and Homeostasis:**
  - Energy metabolism (glycolysis, Krebs cycle)
  - Hormonal regulation (insulin, glucagon)
  - Cellular stress responses (oxidative stress, autophagy)
- **Immune System Regulation:**
  - Innate and adaptive immunity
  - Cytokines and chemokines
  - Immunomodulation in health and disease

Assessment and Grading:

- Quizzes and exams assessing understanding of molecular mechanisms
- Research projects or case studies related to specific health conditions
- Participation in discussions and seminars

Course Title: VWSMF7 Genomics

Course Description:

This course delves into the structure and function of genomes across various living organisms, spanning all kingdoms. It is a compulsory course designed for students interested in molecular genetics.

Topics Covered:

- **Genome Organization:**
  - Chromosomes, genes, and non-coding regions
  - Structural variations (duplications, deletions, inversions)
  - Comparative genomics
- **Functional Genomics:**
  - Gene expression (transcription, translation)
  - Regulation of gene activity (promoters, enhancers)
  - Epigenetics (DNA methylation, histone modifications)
- **Applications of Genomics:**
  - Personalized medicine
  - Functional annotation of genomes
  - Genomic variation and disease susceptibility

Laboratory Techniques:

- DNA sequencing methods (Sanger, NGS)
- Bioinformatics tools for genome analysis
- Functional assays (gene expression profiling)

Ethical Considerations:

- Privacy and data sharing
- Genetic counseling and informed consent
- Societal implications of genomics

Assessment and Grading:

- Examinations on genomic concepts
- Practical assignments (genome analysis)
- Group discussions on ethical dilemmas

Course Title: VWSMF8 Modern Statistics for the Life Sciences

Course Description:

This course introduces students to statistical models and associated methods used in the life sciences. It focuses on practical applications in quantitative genetics and epidemiology.

1. **Topics Covered:**
   - **Introduction to Statistical Models:**
     - Descriptive statistics (mean, variance, standard deviation)
     - Probability distributions (normal, binomial, Poisson)
     - Hypothesis testing and confidence intervals
   - **Linear Models:**
     - Simple linear regression
     - Multiple regression
     - Analysis of variance (ANOVA)
   - **Generalized Linear Models (GLMs):**
     - Logistic regression
     - Poisson regression
     - Model selection and interpretation
   - **Applications in Genetics and Epidemiology:**
     - Genome-wide association studies (GWAS)
     - Risk assessment and disease modeling
     - Population genetics
2. **Practical Exercises:**
   - Data analysis using statistical software (R, Python)
   - Case studies and real-world examples
3. **Assessment and Grading:**
   - Quizzes and exams
   - Data analysis projects
   - Participation in discussions and workshops

Course Title: VWSMF9 Microbial Disease Mechanics

Course Description:

This course explores the intricate mechanisms underlying microbial interactions with hosts, both in health (human microbiome) and disease (pathogens). Students will delve into the molecular aspects of bacterial and viral virulence, as well as the host immune response. The goal is to develop a deep understanding of infectious disease etiology and the advantages conferred by the human microbiome.

Topics Covered:

- **Microbiome and Health:**
  - Human microbiome composition and function
  - Mutualistic interactions between microbes and hosts
  - Role of commensals in maintaining health
- **Pathogen Virulence Mechanisms:**
  - Bacterial virulence factors (toxins, adhesins)
  - Viral replication strategies
  - Evasion of host defenses
- **Host Immune Response:**
  - Innate immunity (phagocytes, complement system)
  - Adaptive immunity (T cells, B cells)
  - Immunopathology and inflammation
- **Etiology of Infectious Diseases:**
  - Transmission routes (direct, indirect, vector-borne)
  - Case studies of specific pathogens (bacteria, viruses, fungi)
  - Epidemiology and outbreak investigations
- **Microbiome-Based Therapies:**
  - Fecal microbiota transplantation (FMT)
  - Probiotics and prebiotics
  - Microbiome-targeted drug development

2. **Assessment and Grading:**
   - Quizzes and exams on microbial mechanisms
   - Research projects on specific pathogens or microbiome-related topics
   - Participation in discussions and seminars

Course Title: VWSMF10 Commensal and Pathogen Host-Microbe Interactions in the Intestine

Course Description:

This course delves into the intricate science of host-microbe interactomics, specifically focusing on the intestinal tract. The highly diverse and dense microbial population in the gut plays a crucial role in host health and disease. Over recent years, research has expanded significantly, uncovering the molecular basis of these interactions and their impact on various aspects of host physiology, including metabolism, immunity, and behavior. The course aims to explore model systems and cutting-edge technological approaches used in this field.

Topics Covered:

- **Introduction to Host-Microbe Interactions:**

        - Overview of commensal and pathobiont microbes
        - Role of the intestinal microbiota in health and disease
        - Co-evolution and adaptation
    - **Model Systems:**
        - Germ-free animal models
        - Human volunteer models
        - Comparative analysis
    - **Technological Approaches:**
        - Omics-based methods (genomics, metagenomics, proteomics)
        - Mechanistic studies using molecular markers
        - Imaging techniques (high-throughput microscopy)
    - **Case Studies and Research Proposals:**
        - Small group work on specific research questions
        - Proposal development addressing relevant scientific inquiries
2. **Assessment and Grading:**
    - Participation in case studies
    - Research proposal submission
    - Quizzes and exams on course content

Course Title: VWSAE3 Marine Resources Management

Course Description:

This course focuses on the sustainable management of marine resources, considering both direct and indirect impacts. It explores the complex interactions between human activities, marine ecosystems, and habitats. Students will gain insights into fundamental concepts related to fisheries, marine ecology, and environmental economics.

Topics Covered:

- **Introduction to Marine Resources:**
    - Importance of marine ecosystems
    - Biodiversity and ecosystem services
    - Anthropogenic impacts (fishing, pollution, coastal development)
- **Fisheries Management:**
    - Sustainable fishing practices
    - Stock assessment methods
    - Quotas and regulations
- **Marine Ecology:**
    - Trophic interactions
    - Habitat conservation
    - Ecosystem-based approaches
- **Environmental Economics:**
    - Valuation of marine resources
    - Cost-benefit analysis
    - Economic incentives for conservation

2. **Fieldwork and Case Studies:**
    - Site visits to observe marine habitats and fishing practices
    - Analysis of real-world management scenarios
    - Guest lectures from industry experts
3. **Assessment and Grading:**
    - Exams on course content

- Group projects related to resource management strategies
- Participation in discussions and seminars

Upon completion of this course, students will be equipped to address the challenges facing marine ecosystems and contribute to sustainable resource management.

Course Title: VWSAE4 Fisheries Ecology

Course Description:

This course focuses on the ecological dynamics of fishes and other aquatic organisms in the context of their exploitation and management. We will explore the intricate interactions between aquatic ecosystems, fish populations, and human activities.

Topics Covered:

- **Introduction to Fisheries Ecology:**
  - Importance of fisheries in food security and livelihoods
  - Historical perspectives on fishing practices
  - Ecological principles underlying fisheries management
- **Fish Population Dynamics:**
  - Growth, mortality, and recruitment
  - Age and size structure
  - Stock assessment methods
- **Ecosystem-Based Approaches:**
  - Trophic interactions
  - Habitat requirements
  - Biodiversity and ecosystem health
- **Human Impacts and Sustainability:**
  - Overfishing and its consequences
  - Bycatch and discards
  - Conservation measures
- **Case Studies and Field Trips:**
  - Real-world examples of fisheries management
  - Site visits to observe fishing practices

2. **Assessment and Grading:**
   - Exams on fisheries concepts
   - Group projects related to sustainable fishing practices
   - Participation in discussions and seminars

Course Title: VWSAE5 Life History of Aquatic Organisms

Course Description:

This course delves into the biology and ecology of aquatic organisms, with a specific focus on life history theory. Students will explore the diverse life strategies and adaptations of aquatic species, considering their reproductive patterns, growth, survival, and interactions with the environment.

Topics Covered:

- **Life History Theory:**
  - Concepts of life history strategies
  - Trade-offs between growth, reproduction, and survival
  - Evolutionary perspectives
- **Reproductive Ecology:**
  - Reproductive modes (oviparity, viviparity, etc.)
  - Mating systems and sexual selection
  - Parental care
- **Growth and Development:**
  - Ontogenetic changes (larval stages, metamorphosis)
  - Growth rates and size at maturity
  - Environmental influences on growth
- **Survival Strategies:**
  - Senescence and aging
  - Predator-prey interactions
  - Habitat selection
- **Case Studies and Field Observations:**
  - Life history variations across taxa
  - Adaptations to specific aquatic environments

2. **Assessment and Grading:**
   - Exams on life history concepts
   - Research projects related to specific aquatic organisms
   - Participation in discussions and seminars

Course Title: VWSAE6 Marine Animal Ecology

Course Description:

This course focuses on understanding the ecological dynamics of marine animals in their natural environment. It explores their interactions with the surrounding ecosystem, resilience to environmental changes, and overall health. Additionally, the course emphasizes the connection between marine animal ecology and the management of biodiversity and sustainable use of marine resources.

Topics Covered:

- **Introduction to Marine Ecosystems:**
  - Overview of marine habitats (coastal, pelagic, benthic)
  - Biotic and abiotic factors influencing marine animal distribution
  - Ecological niches and adaptations
- **Marine Animal Behavior:**
  - Foraging strategies
  - Reproductive behaviors
  - Migration patterns
- **Population Dynamics:**

        - Population growth models
        - Density-dependent and density-independent factors
        - Life history strategies
    - **Resilience and Health:**
        - Responses to environmental stressors (pollution, climate change)
        - Disease dynamics
        - Conservation implications
    - **Biodiversity Management:**
        - Marine protected areas
        - Sustainable fishing practices
        - Restoration efforts
2. **Assessment and Grading:**
    - Exams on marine animal ecology concepts
    - Fieldwork and data collection
    - Research projects related to specific marine species

Course Title: VWSAE7 Ecological Methods

Course Description:

This course equips students with the necessary skills to analyze hypothesis-centered ecological field research projects related to plants, animals, and their environment. Emphasis is placed on selecting and applying appropriate statistical techniques for the analysis of ecological data.

Topics Covered:

- **Introduction to Ecological Methods:**
    - Overview of ecological research design
    - Hypothesis formulation and testing
    - Sampling techniques
- **Data Collection and Measurement:**
    - Field sampling protocols
    - Instrumentation and data recording
    - Quality control and validation
- **Statistical Techniques:**
    - Descriptive statistics (mean, variance, standard deviation)
    - Parametric and non-parametric tests
    - Regression analysis
    - Multivariate methods (PCA, NMDS)
- **Experimental Design:**
    - Randomized block design
    - Factorial experiments
    - Control vs. treatment groups
- **Case Studies and Practical Applications:**
    - Real-world examples of ecological studies
    - Hands-on exercises in data analysis

2. **Assessment and Grading:**
    - Exams on ecological methods and statistical techniques
    - Research projects applying learned methods
    - Participation in fieldwork and discussions

Course Title: VWSAE8 Disease Ecology

Course Description:

The course aims to provide a current and comprehensive understanding of the causes and consequences of infectious diseases across various ecological levels, including individuals, populations, communities, and ecosystems. Students will explore the intricate dynamics of disease transmission, host-pathogen interactions, and the ecological context in which diseases occur.

Topics Covered:

- **Introduction to Disease Ecology:**
  - Overview of disease dynamics
  - Historical perspectives on disease outbreaks
  - Ecological factors influencing disease spread
- **Host-Pathogen Interactions:**
  - Transmission modes (direct, indirect, vector-borne)
  - Immune responses and resistance
  - Coevolution between hosts and pathogens
- **Population-Level Effects:**
  - Disease impact on population dynamics
  - Epidemiological models (SIR, SEIR)
  - Disease-induced mortality and reproduction
- **Community and Ecosystem Consequences:**
  - Trophic cascades and disease effects
  - Biodiversity and disease resilience
  - Emerging infectious diseases
- **Case Studies and Research Proposals:**
  - Real-world examples of disease ecology
  - Group projects addressing specific disease-related questions

2. **Assessment and Grading:**
   - Exams on disease ecology concepts
   - Research proposals related to disease dynamics
   - Participation in discussions and seminars

Course Title: VWSAE9 Applied Animal Behaviour and Welfare

Course Description:

This course focuses on the practical application of animal behavior concepts to address welfare issues in modern livestock and companion animal husbandry. Students will explore the intricate interactions between behavior, management practices, and animal well-being.

Topics Covered:

- **Introduction to Animal Behavior and Welfare:**
  - Overview of animal behavior principles
  - Ethical considerations in animal care

        - Linking behavior to welfare outcomes
    - **Behavioral Assessment and Observation:**
        - Methods for assessing animal behavior
        - Identifying stressors and abnormal behaviors
        - Developing behavioral enrichment strategies
    - **Species-Specific Considerations:**
        - Livestock behavior (cattle, pigs, poultry)
        - Companion animal behavior (dogs, cats, horses)
        - Adaptations to different environments
    - **Management Practices and Welfare Enhancement:**
        - Housing design and environmental enrichment
        - Handling techniques
        - Pain management and stress reduction
    - **Case Studies and Practical Applications:**
        - Real-world examples of welfare challenges
        - Group projects addressing specific species or scenarios
2. **Assessment and Grading:**
    - Exams on behavior and welfare concepts
    - Research projects related to practical applications
    - Participation in discussions and seminars

Course Title: VWSAE10 Thesis or Project

Course Description:

This course involves individual research or special problem projects supervised by a faculty member. It provides students with the opportunity to delve into a specific subject matter, develop content, and earn credit hours based on their agreed-upon project.

Topics Covered:

- **Project Proposal and Approval:**
    - Students propose a research topic or project idea.
    - Faculty members review and approve the proposal.
- **Literature Review:**
    - Conduct a thorough review of existing research related to the chosen topic.
    - Identify gaps, research questions, and objectives.
- **Data Collection and Analysis:**
    - Collect relevant data (fieldwork, experiments, surveys, etc.).
    - Apply appropriate research methods and statistical techniques.
- **Writing and Presentation:**
    - Organize findings into a coherent thesis or project report.
    - Prepare presentations for faculty and peers.
- **Evaluation and Defense:**
    - Defend the thesis or project during an oral examination.
    - Receive feedback and assessment from faculty.

Assessment and Grading:

- Evaluation of the final thesis or project document.
- Assessment of the oral defense and presentation.

- Faculty feedback on research quality and contribution.

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