BSc (Veterinary Biosciences)

Level 1

Comparative vertebrate morphology - 1 (2008-09)

10 Credits

Acting Course Co-ordinator: Dr Mike Purton

Position in Course: Year 1 Semester 2

Course prerequisites: None

Course corequisites:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 1 (402B) (Chemistry)</td>
<td>40</td>
</tr>
<tr>
<td>Biology 1A (Animal biology) (KNPU) (FBLS)</td>
<td>20</td>
</tr>
<tr>
<td>Biology 1B (Cell biology) (KNMU) (FBLS)</td>
<td>20</td>
</tr>
<tr>
<td>Animal Production and Management 1 (FVM)</td>
<td>10</td>
</tr>
<tr>
<td>Basic Mammalian Body Plan 1 (FVM)</td>
<td>10</td>
</tr>
<tr>
<td>Body Systems Physiology 1 (FVM)</td>
<td>10</td>
</tr>
</tbody>
</table>

Excluded courses or course combinations: None
Comparative vertebrate morphology
(Level 1: 10 credits)

Course Information Document
Faculty of Veterinary Medicine
2008-2009
Course aims and intended learning outcomes

The aims of the course are to:
- provide a stimulating insight into how different mammalian species have adapted the basic body plan to cope with their environmental and/or lifestyle requirements
- provide a basic introduction to the functional morphology of other vertebrate classes

Intended Learning Outcomes of the course:

On completion of the course you should be able to:
- describe how mammary glands are modified skin-associated glands
- describe how a horse holds its head up
- describe how cats can climb trees and dogs cannot
- describe the structure of the equine hoof
- describe the adaptations for weight bearing in both the forelimb and the hind limb of the horse
- explain the importance of the paranasal sinuses in domestic species, and understand how the respiratory system adapts to the different requirements of the animal at rest and during exercise
- explain how electron microscopy has contributed to our understanding of mammalian structure and function
- describe how the examination of a simple blood smear can provide vital clues to the health status of an animal
- explain how and why foetal circulation differs from the adult circulation
- discuss the ways in which the alimentary tract is adapted to lifestyle in a variety of domesticated mammalian species
- describe the basic body plan of lower vertebrate classes, viz. fish, amphibians, reptiles and birds.

Course Co-ordinator

tba

Lecturing Staff

tba

Course structure
This Level 1 course consists of a series of lectures, related laboratory work and self-directed learning assignments.

**Lectures**
The lecture component will comprise 2 lectures per week during the second semester. Attendance at lectures is compulsory, as it is only by attending lectures that you can learn a particular lecturer’s viewpoint and the emphasis given to a specific topic. Lectures function to provide you with the central facts of the subject, and act as a guide through the enormous quantity of published scientific literature in this area.

**Laboratory classes**
The laboratory classes are designed to reinforce the knowledge gained from lectures. The classes are organised primarily around demonstration material, although a number of hands-on practical labs will provide an opportunity for self-directed practical examination of cadaverous specimens, and allow the opportunity to continue to develop basic skills in anatomical techniques.

<table>
<thead>
<tr>
<th>Laboratory class</th>
<th>Nature of practical</th>
<th>Topic</th>
<th>Duration of class (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demonstration (cat,dog,horse)</td>
<td>Comparative features of mammalian musculoskeletal system</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Demonstration (ruminants &amp; horse)</td>
<td>Head &amp; neck</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Histology practical</td>
<td>Preparing a blood smear &amp; making a differential white blood cell count</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Demonstration (pig, ruminants &amp; horse)</td>
<td>Comparative viscera</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Histology practical</td>
<td>Body systems histology</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Demonstration (dog &amp; cat)</td>
<td>Applied aspects of topographical anatomy</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Dissection (fish)</td>
<td>Gross morphology of fish</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Dissection (bird)</td>
<td>Avian anatomy</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Dissection (rabbit &amp; rat)</td>
<td>Whole cadaver dissection</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Student-directed revision practical</td>
<td>Requested revision material</td>
<td>3</td>
</tr>
</tbody>
</table>

All laboratory classes are held in the Veterinary School, and are based around relevant laboratory guides or worksheets. Laboratory demonstration and dissection classes based on the examination of gross anatomical specimens will be held in Teaching Laboratory 1, whilst practical microscopy classes will be held in Teaching Laboratory 2.

**Course work assignments**
In mid-course, and again at the end of the lecture course, you will be required to complete a specified essay assignment (essay assignments 1 & 2). Formal instruction, in tutorial form, will be provided before undertaking these assignments. You will then be expected to undertake independent self-directed research of a selected topic in your own time, and submit a written essay on this topic by the closing date for submission. Essays will be marked by the lecturing staff, with the mark contributing to the overall course mark, as detailed below. The deadlines for submission of coursework will be listed in the timetables and posted on Moodle.
Summary of course structure

<table>
<thead>
<tr>
<th>Course component</th>
<th>Hours per student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>18</td>
</tr>
<tr>
<td>Practicals</td>
<td>23</td>
</tr>
<tr>
<td>Tutorials</td>
<td>2</td>
</tr>
<tr>
<td>Self directed learning &amp; course assessments</td>
<td>57</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Items of summative assessment

Your overall performance will be based on your performance in the coursework assignments (as detailed above) and the end-of-course examination.

Contribution made by coursework assignments
The two coursework assignments (essay assignments 1 & 2) will together account for 30% of your final overall course mark. Your coursework marks will also count towards your final grade should you have to resit the end-of-course examination. Consequently, it is vital for you to obtain a decent grade for your coursework, which means you must hand in all the required assignments.

End-of-course examination
The end-of-course examination will account for 70% of your final mark, and will consist of a one-hour written paper covering all course topics (accounting for 45% of your total mark) and a 30 minute spot practical exam (accounting for 25% of your total mark). The formats will be provided in advance, and you will have an opportunity to practise example questions. Normally you must sit the end-of-course examination at the first set (diet) of examinations following the end of the course. For Comparative Vertebrate Morphology, the first diet of examinations will be held in the May / June examination period. Examination timetables are published on the Registry website.

<table>
<thead>
<tr>
<th>Item of assessment</th>
<th>Completed during (teaching week)</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essay assignment 1</td>
<td>Week 17</td>
<td>15%</td>
</tr>
<tr>
<td>Essay assignment 2</td>
<td>Week 21</td>
<td>15%</td>
</tr>
<tr>
<td>End-of-course examination:</td>
<td>May diet</td>
<td>70% (in total):</td>
</tr>
<tr>
<td>Written (1 hour duration)</td>
<td></td>
<td>45% (written)</td>
</tr>
<tr>
<td>Practical spot test (30 mins duration)</td>
<td></td>
<td>25% (practical)</td>
</tr>
</tbody>
</table>

External Examiner
tba
Study Guide

For each lecture, make sure that you have taken down a useful and accurate set of lecture notes. Identify points that are not clear, and use the recommended textbooks to source any additional information you need. Ask the lecturer if you need help.

You are encouraged to read around each topic, and for this reason a list of recommended textbooks is provided. In addition, as both the anatomical and veterinary sciences represent fast moving disciplines in which advances are constantly being made, you are also encouraged to get into the habit of reading original research papers and review articles in the scientific journals. Evidence of wider reading will be taken into account when course assignments are submitted for marking, and where appropriate in the written exam.

Recommended General Texts

There are no specific books that need to be purchased for this course. However, you may find it useful to refer to one or more of the following books during the course:

Useful general text on lecture note taking, writing essays and practical reports, CVs etc.

Kierzenbaum, A.L. Histology and Cell Biology: An Introduction to Pathology.
Although fairly detailed, this book provides an excellent integrated approach to the subject matter, linking together histological, physiological and biochemical aspects of the relevant topics.

Saunders, 2002.
An excellent introduction to gross veterinary anatomy in a readable form!

This book is well worth searching out. It provides a really good introduction to the central concepts of cell biology. And how could you not love a book that includes sections entitled “Cells can be used to make money” and “Genetic engineering of cells can make even more money”!

An interesting and useful account of the principles of functional vertebrate morphology from an evolutionary viewpoint.

Although last published in 1981, this is still a good account of selected aspects of vertebrate biology based on a strong emphasis on the underlying biomechanical principles involved.

Excellent photographs covering examples of all vertebrate classes, accompanied by a limited but useful text.
Intended Learning Outcomes and Lecture Synopses

Integumentary system
tba

Lecture 1  Mammary glands are modified sweat glands!

*Intended learning outcomes*
- describe the anatomy and histology of the lactating udder of the milking cow
- understand the defence mechanisms presented by the lactating udder to microbiological infection
- describe the blood supply to and from the lactating udder
- appreciate age related variations in udder structure and blood supply

*Synopsis*

Musculoskeletal system
tba

Lecture 2  The integrity of the vertebral column
Lecture 3  The distal limb of the carnivore
Lecture 4  The distal limb of the horse

*Intended learning outcomes*
- describe the structure of a generalised vertebra
- understand the regional variations in vertebral structure
- describe the joints and ligaments maintaining the integrity of the vertebral column
- knowledge of the structure and function of the nuchal ligament in the domesticated species
- understand the counterbalancing effects of major muscle groups acting on limb joints in the carnivore
- appreciate the functional anatomy of the radius and ulna in the dog and cat
- describe the functional anatomy of the canine paw
- understand the structure and importance of the support mechanisms in the forelimb and hind limb of the horse
- understand the functional morphology of the horse’s hoof

*Synopsis*
Discussion of the functional anatomy of the vertebral column in the carnivore and horse. The functional anatomy of the forelimb and hind limb in the carnivore. Examination of the stay apparatus in the forelimb and hind limb of the horse. Description of the functional anatomy of the paw in carnivores and of the hoof in the horse.

Respiratory system
tba
Lecture 5       Comparative and applied aspects of the upper respiratory tract of the domesticated mammalian species

Lecture 6       The microscopic structure of the lung: the peribronchial sheath and the blood-gas barrier

Intended learning outcomes
- understand what is meant by a paranasal sinus system
- appreciate the organisation of the paranasal sinus system in the domesticated mammalian species
- awareness of selected clinical and practical aspects of the paranasal sinus system in the domesticated species
- knowledge of the basic structure of the mammalian larynx
- understanding of the formation of the glottis, and an appreciation of its functional role
- describe the distribution and microscopic structure of the peribronchial sheath in the mammalian lung
- understanding of the functional implications of peribronchial sheath morphology
- appreciate how scanning and transmission electron microscopy have contributed to our understanding of structure and function, as evidenced by study of the blood-gas barrier

Synopsis
Consideration of the functional and practical morphology of the paranasal sinus system in the domesticated mammalian species. An account of the functional anatomy of the mammalian larynx. A study of the microscopic anatomy of the peribronchial sheath and blood-gas barrier in the mammalian lung as an example of the importance and application of histological and ultrastructural methodology in improving our knowledge and understanding of function.

Cardiovascular system

Lecture 7       Differential cell counts: a study in blood
Lecture 8      The foetal circulation: changes at birth

Intended learning outcomes
- awareness of the component constituents of mammalian blood
- name and identify the cellular components of mammalian blood
- understand the general functions of each of these cellular elements
- appreciate the usefulness of a differential cell count
- knowledge of the preparation of a blood smear, and how to carry out a differential cell count
- knowledge of the differences that occur in the relative proportions of the cellular elements in the blood of the domesticated species
- awareness of how and why these proportions may change in disease
- describe the vascular adaptations exhibited by the established mammalian foetal circulation, and be aware of the functional reasons for such adaptations
- describe the changes occurring to the foetal circulation at the time of birth, and be aware of the functional reasons for such changes

Synopsis
A description of the composition of mammalian blood. An account of the functional morphology of the cellular elements of blood. The differential cell count and its usefulness. The functional morphology of the established mammalian foetal circulatory system, and a consideration of the changes occurring within this system at birth.

**Digestive system**

**Lecture 9**  Dental adaptations  (something to chew over!)
**Lecture 10**  The use of microbes: the ruminant stomach and equine large intestine

*Intended learning outcomes*
- appreciate the usefulness of the dental formula
- name and identify individual teeth in the domesticated species
- describe how the teeth of the carnivores, ruminants and horses are adapted to their feeding habits
- understand how tooth structure may be used to age animals
- appreciate how adaptations of the temporomandibular joint and masticatory muscles are relevant to the feeding habits of the domesticated species
- appreciate the principles underlying the specialised structure of the ruminant stomach and the equine large intestine
- name the component parts of the ruminant stomach and appreciate the functions of each
- name the component parts of the equine large intestine and know the functions of each

*Synopsis*
Functional accounts of the dentition of the domesticated mammalian species. A consideration of selected applied and clinical aspects of dentition. Descriptions of the functional morphologies of the ruminant and equine gastrointestinal tracts.

**Urogenital system**

**Lecture 11**  Castrations and spays: applying your knowledge of topographical anatomy

*Intended learning outcomes*
- understand the meaning and usefulness of topographical anatomy
- revise the component parts of the male reproductive tract of the dog and the tomcat
- describe the position and structure of the testis and penis in the dog and tomcat in relation to external landmarks
- know the main histological features of the mammalian testis
- list the constituents of the spermatic cord
- understand the anatomical basis of open and closed castration
- understand the topographical anatomy of the female reproductive tract in the bitch and queen, and how these features determine the approaches to spaying in these two species
- potential complications associated with these surgical procedures

*Synopsis*
Consideration of the topographical anatomy of the male and female reproductive tracts in the dog and cat. Discussion of the application of topographical knowledge to clinical and/or practical situations.

**Comparative vertebrate anatomy**

**Lecture 12  A fishy life: a summary of functional piscine morphology**

*Intended learning outcomes*
- describe the body plan of a generalised teleost fish
- knowledge of the structure of the piscine integument
- describe the functional anatomy of external respiration in a fish
- discuss the anatomical basis of osmoregulation in fish
- appreciate the wide range of body forms and functional adaptations exhibited by fish

*Synopsis*
The basic body plan of a teleostean fish. Review of functional variations to the basic body plan. Consideration of the applied anatomy of respiration and osmoregulation in fish.

**Lecture 13  A double life: aspects of amphibian anatomy**

*Intended learning outcomes*
- knowledge of the basic anatomy of an anuran amphibian
- knowledge of the structure of amphibian skin
- describe the functional anatomy of respiration in an anuran amphibian
- describe the functional anatomy of osmoregulation in an anuran amphibian
- appreciate the factors imposing a ‘double life’ on amphibians

*Synopsis*
What is an amphibian? The basic anatomy of an anuran amphibian. The functional morphology of amphibian respiration and osmoregulation.

**Lecture 14  A terrestrial life: reptilian adaptations**

*Intended learning outcomes*
- knowledge of basic reptilian features
- ability to relate anatomical knowledge of reptiles to functional considerations of lifestyle
- describe the general morphological features of a snake and a lizard
- describe the generalised morphological features of a tortoise

*Synopsis*
Discussion of functional reptilian characteristics. Consideration of the basic body plans of squamate and chelonian reptiles.

**Lecture 15  The constraints of flight: essentials of avian anatomy**
Intended learning outcomes

- ability to discuss the anatomical adaptations required for flight in birds
- describe the functional anatomy of the avian respiratory system
- awareness of applied aspects of avian topographical anatomy

Synopsis

Lecture 16 Which came first: the chicken or the egg?

Intended learning outcomes

- understanding of egg formation in the domestic fowl
- understand the role of the egg as an incubation chamber
- appreciate commercial egg production as the manipulation of a biological system

Synopsis
Description of the female reproductive tract in the domestic fowl. Discussion of egg formation and chick development. Consideration of environmental and genetic factors in the production of the table egg.

Lecture 17 Small mammal morphology: the laboratory situation. tba
I: The rabbit

Intended learning outcomes

- describe the external features of the domestic rabbit
- knowledge of the anatomy of the skull and dentition
- appreciation of applied and clinical aspects of dentition in the rabbit
- describe the topographical anatomy of the gastrointestinal tract
- appreciation of functional and clinical aspects of gastrointestinal morphology
- ability to restrain and sex a rabbit, and take blood samples

Synopsis
Selected aspects of the functional anatomy of the domestic rabbit. Consideration of the applied and clinical anatomy of the rabbit.

Lecture 18 Small mammal morphology: the laboratory situation. tba
II. Rodents

Intended learning outcomes

- describe the external features of the rat and mouse
- knowledge of the external features of hamster and guinea pig
- describe the dentition of rodents, indicating species differences
- describe the gastrointestinal tract of rodents, indicating species differences
• appreciation of general features of rodent reproductive system
• ability to restrain and sex rodents, and take blood samples

Synopsis
Generalised account of specific rodent features. The anatomical basis of sexing rodents. Species differences in dentition and gastrointestinal morphology.