Salami, O. S
Onwuama, K. T
Kigir, E. S
Jaji, Z. A

Practical Manual
Of Gross anatomy

Osteology and Syndesmology

Workbook for Veterinary Undergraduates

Name of Student _____

Matriculation number_____

Authors:
Professor Salami, Olawoye Sulaiman
DVM, MSc, PhD

Dr. Onwuama, Kenechukwu Tobechulwu
DVM, MSc

Dr. Kigir, Esther Solomon
DVM, MVSc

Dr. Jaji, Alhaji Zubair
DVM, MVSc, PhD

Department of Veterinary Anatomy
Faculty of Veterinary Medicine
University of Ilorin, Ilorin, Nigeria

UNILORIN PRESS
Ilorin, Nigeria

PRACTICAL MANUAL OF GROSS ANATOMY

Copyright © 2018 by S. O. Salami, K. T. Onwuama, E. S. Kigir and Z. A. Jaji, Printed in Nigeria. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission by the authors.

CONTENTS

Introduction	----------	**4**
Osteology	----------	**5**
Section A	Axial Skeleton----------	**5**
Chapter I	The Skull----------	**6**
Chapter II	The Vertebral column----------	**16**
Chapter III	The Thorax----------	**25**
Section B	Appendicular Skeleton----------	**29**
Chapter IV	The thoracic limb----------	**30**
Chapter V	The Pelvic limb----------	**42**
Syndesmology	----------	**50**
Section A	Axial articulations----------	**50**
Chapter I	Articulations of the Skull----------	**51**
Chapter II	Articulations of the Vertebrae----------	**56**
Chapter III	Articulations of the Thorax----------	**60**
Section B	Appendicular articulations----------	**65**
Chapter IV	Articulations of the thoracic limb----------	**66**
Chapter V	Articulations of the Pelvic limb----------	**74**

INTRODUCTION

The study of Gross anatomy has proven over the years that visual anatomy is the best form of teaching anatomy and acquiring the basic knowledge towards being a veterinary surgeon. Therefore this practical manual is a massive step towards achieving this in osteology and syndesmology. Its compilation became imperative due to the comparative differences in the bones and joints of different species of animals which are of interest to veterinarians and students.

The unique aspect of this manual is that it is prepared as a practical workbook for veterinary students. In it, a student is expected to draw and identify prominent distinguishing features in an observed bone and joint, thereby ensuring better comprehension and revision of all practical sessions during examination periods. In this work book, the skeleton and its articulation are first divided into two broad sections – Axial Skeleton/articulations and appendicular skeleton/articulations. The first sections have three chapters (Skull, Vertebral column and Thorax) while the second sections have two chapters (Pectoral/fore limb and Pelvic/hind limb).

It is sincere hope that this workbook will enable an undergraduate student of gross anatomy achieve the objectives outlined in each chapter of this manual.

OSTEOLOGY

SECTION A

AXIAL SKELETON

Skull

Vertebral column

Thorax

CHAPTER I

THE SKULL

OBJECTIVES:

- To know the division of the bones of the Skull
  - Cranial bones
    - Occipital, Interparietal, Sphenoid, Ethmoid (Single)
    - Frontal and Temporal, Parietal (Paired)
  - Facial bones
    - Nasal, Premaxilla, Maxilla, Palatine, Pterygoid, Lacrimal, Malar, Turbinates (Paired)
    - Vomer, Mandible and hyoid (Single)

- Identify these bones with their peculiar features specifically in the bovine species and compare them with the equine, porcine and canine species.

DATE_____WEEK 1 (session 1)

EQUINE SKULL

Instruction: Pick up the Skull of the equine and identify the cranial and facial bones, sketch and label the dorsal view noting the following features:

- Nuchal eminence
- Cornual process
- Parietal bone
- Interparietal bone
- Frontal bone
- Supraorbital foramen
- Supraorbital groove
- Supraorbital process of frontal bone
- Supraorbital margin
- Lacrimal sac
- Nasal bone
- Lacrimal bone
- Malar bone
- Maxilla
- Infraorbital foramen
- Incissive or premaxillary bone
    - Nasal process
    - Palatine proc.
    - Body
- Incissive fissure
- Interincissive fissure

Dorsal view of the Equine Skull

DATE_____WEEK 1 (Session 1)

EQUINE SKULL

Instruction: Pick up the Skull of the equine and identify the cranial and facial bones, sketch and label the lateral view noting the following features:

Incissive bone; Nasal process of incisive bone; Nasal bone; Maxilla; Infraorbital foramen; Facial crest; Maxillary tuberosity; Alveolar boarder; Lacrimal bone; Lacrimal sac; Fossa of lacrimal sac; Lacrimal bulla; Zygomatic bone; Frontal; Parietal; Interparietal; Temporal (Squamous part); Temporal (Petrous part); Zygomatic process of temporal bone; Malar or temporal process of Zygomatic bone; Zygomatic or supraorbital process of frontal bone; Temporal fossa; Temporal line; Occipital; Palatine; Sphenoid; Pterygoid; Occipital condyle; Paracondylar or paramastoid process; External acoustic meatus; Supramastoid crest; Muscular process of Petrous temporal bone; Tympanic bulla; Pterygoid process of basisphenoid; Hamulus of the Pterygoid.

Lateral view of the equine Skull

DATE_____WEEK 1 (Session 1)

EQUINE SKULL

Instruction: Pick up the Skull of the equine and identify the cranial and facial bones, sketch and label the ventral view noting the following features:

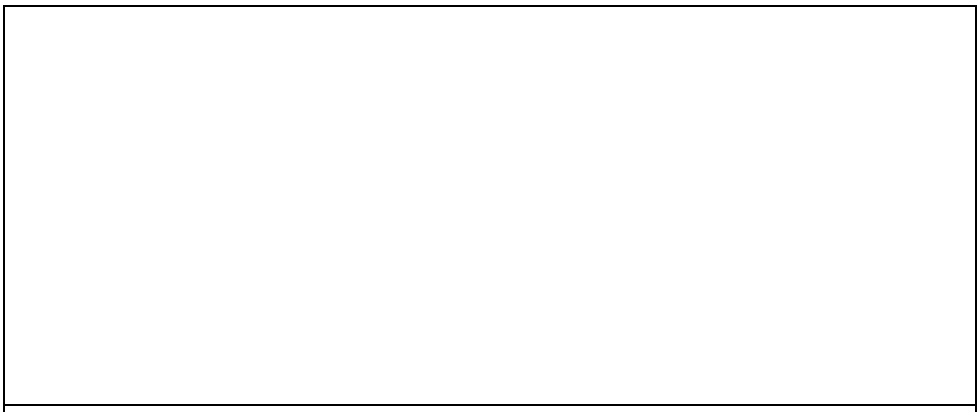
- Foramen magnum
- Occipital condyle
- Paracondylar process
- Mastoid or condyloid fossa
- Stylomastoid foramen
- External acoustic meatus
- Styloid process
- Tympanic bulla
- Jugular foramen
- Oval foramen
- Foramen lacerum
- Muscular process of petrous bone
- Articular tuberosity
- Basilar tubercle
- Sphenoid bone
- Palatine bone
- Pterygoid bone
- Vomer
- Perpendicular part of palatine
- Supraorbital canal
- Hamulus of the Pterygoid
- Lacrimal bulla
- Ethmoidal foramen
- Palatine foramen
- Horizontal part of palatine

Ventral view of the equine Skull

DATE_____WEEK 1 (Session 1)

EQUINE SKULL

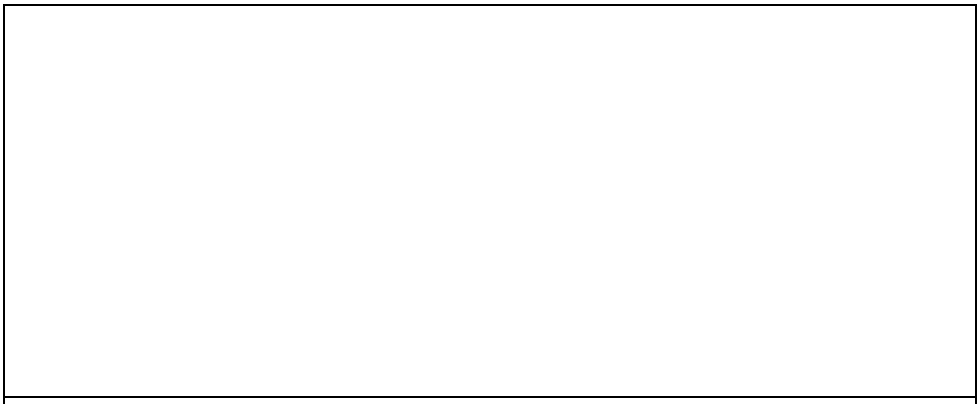
Instruction: Pick up the Skull of the equine and identify the cranial and facial bones, sketch and label the caudal view noting the following features: Frontal; Interparietal; Parietal; Occipital (Squamous, lateral and Basilar Parts); Occipital condyle; Paramastoid or Paracondylar process; Foramen magnum



Caudal view of Equine skull

BOVINE MANDIBLE

Instruction: Pick up the Equine Mandible. Study, sketch and label the lateral view noting the following features: Coronoid process; Mandibular notch; Mandibular foramen; Condyle or condylar process; Ramus of mandible; Masseteric fossa; Angle of mandible; Body of mandible (molar part); Alveolar boarder; Interalveolar margin or diastema; Mental foramen; Body of mandible (Incisive part).



Lateral view of the Equine Mandible

DATE_____WEEK 1 (session 1)

EQUINE SKULL (CROSS SECTION)

Instruction: Study the cross-sectional view of the equine skull, sketch and label the following features

Ethmoid bone; Frontal bone; Nasal bone; incisive bone; dorsal turbinate bone; Ventral turbinate bone; ethmoturbinate bone; dorsal nasal meatus; middle meatus; ventral nasal meatus; Frontal sinus; palatine sinus; Palatine bone; Nasopharyngeal meatus; Sphenoidal sinus; Ethmoidal fossa; Oval foramen; Chiasmatic sulcus; Cranium; Petrous part of temporal bone; Internal acoustic meatus; Jugular foramen; Hypoglossal canal.

Cross sectional view of Equine skull

DATE_____WEEK 1 (session 1)

COMPARATIVE ANATOMY

Instruction: Compare the major differences of some features in the bovine skull with other animals as shown below by placing + or – in the spaces provided:

Features	Bovine	Equine	Porcine	Canine
❖ Nuchal eminence				
❖ Ext. sagittal crest				
❖ Ext. occipital protuberence				
❖ Cornual process				
❖ Lacrimal sac				
❖ Supraorbital foramen and groove				
❖ Facial crest				
❖ Infraorbital foramen				
❖ Incissive bone				
❖ Incissive fissure				
❖ Styloid process				
❖ Tympanic bulla				
❖ Jugular foramen				
❖ Foramen lacerum				
❖ Oval foramen				
❖ Ethmoidal foramen				
❖ Foramen orbitortundum				
❖ Diastema				
❖ Horizontal plate of palatine bone				
❖ Masseteric fossa				
❖ Mandibular notch				

DATE_____WEEK 1 (session 1)

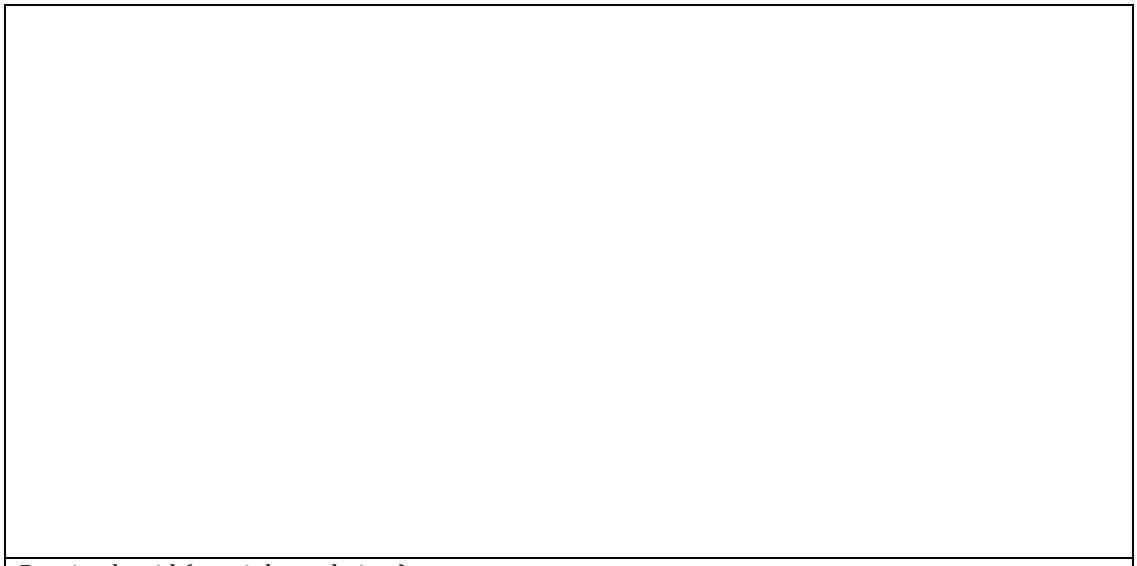
HYOID BONE

Instruction: Study the Hyoid bone of the bovine, equine, porcine and canine species. Sketch the craniolateral views in each animal. Note the following features:

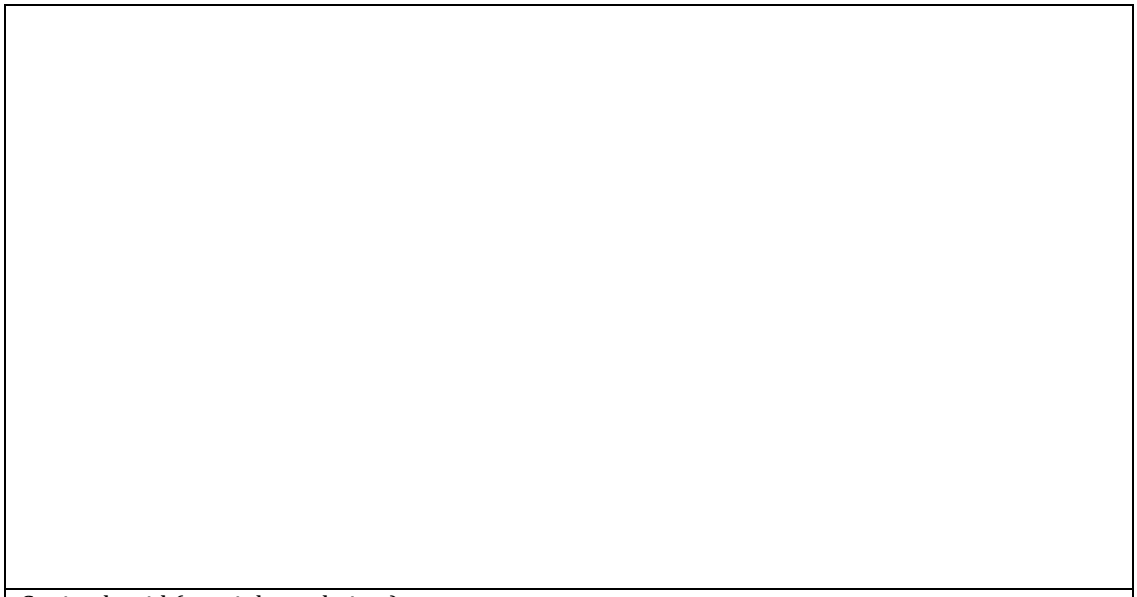
Tympanohyoid; Stylohyoid; Styloid angle; Epihyoid; Ceratohyoid; Basihyoid; lingual process; Thyrohyoid.

Bovine hyoid (Craniolateral view)

Equine hyoid (craniolateral view)



Porcine hyoid (craniolateral view)



Canine hyoid (craniolateral view)

DATE_____WEEK 1 (session 1)

COMPARATIVE ANATOMY

Instruction: Compare the presence or absence of the following features of the Hyoid bone in the Bovine, Equine, Porcine and Canine using the + or – where appropriate

Features	Bovine	Equine	Porcine	Canine
Tympanohyoid Stylohyoid; Styloid angle; Epihyoid; Ceratohyoid; Basihyoid; lingual process; Thyrohyoid.				

CHAPTER II

THE VERTEBRAL COLUMN

OBJECTIVES:

- Identify the bones of the vertebral column in the Bovine.
    - Cervical vertebra
    - Thoracic vertebra
    - Lumbar vertebra
    - Sacral vertebra
    - Caudal vertebra

- Identify the specific features of each segment of the column and their number
- Compare these features with that of the equine, porcine and canine
- Know the vertebral formula in each species and write them out species by species
- Note the characteristics of the typical and atypical vertebrae.

DATE_____WEEK 1 (session 2)

ATYPICAL VERTEBRAE

BOVINE ATLAS

Instruction: Study the Bovine atlas, then sketch and label the dorsal view. Features to note include:

Dorsal arch; dorsal tubercle; Alar foramen; wing; lateral vertebral foramen; caudal articular surface

Dorsal view of bovine atlas

BOVINE AXIS

Instruction: Study the Bovine axis, then sketch and label the lateral view. Features to note include:

Dens, lateral vertebral foramen; cranial articular surface; spinous process; caudal articular process; transverse process; transverse foramen

Lateral view of bovine axis

BOVINE TYPICAL CERVICAL VERTEBRAE

Instruction: Study the third Bovine cervical vertebra, then sketch and label the cranial view. Features to note include:

Body; arch; spinous process; caudal articular process and surface; vertebral foramen; transverse foramen; transverse process (dorsal and ventral part); ventral crest;

Cranial view of 3rd cervical vertebra

DATE_____WEEK 1 (session 2)

COMPARATIVE ANATOMY

Instruction: Compare the presence or absence of the following features of the Atlas, Axis and cervical vertebra in the Bovine, Equine, Porcine and Canine using the + or – where appropriate.

Features	Bovine	Equine	Porcine	Canine
Atlas				
❖ Dorsal arch ❖ Dorsal tubercle ❖ Alar foramen ❖ Wing ❖ Lateral vertebral foramen ❖ Caudal articular surface				
Axis				
❖ Dens ❖ Lateral vertebral foramen ❖ Cranial articular surface ❖ Spinous process ❖ Caudal articular process ❖ Transverse process ❖ Transverse foramen				
3rd cervical				
❖ Spinous process ❖ Caudal articular process and surface ❖ Vertebral foramen ❖ Transverse foramen ❖ Transverse process (dorsal and ventral part) ❖ Body ❖ Ventral crest				
Number of cervical vertebrae				

DATE_____WEEK 1 (session 2)

BOVINE THORACIC VERTEBRAE

Instruction: Study the Bovine thoracic vertebrae noting their differences from the first to the thirteenth, count them, then sketch and label the cranial view of the 4th and the lateral view of the 13th. Features to note include:

Long spinous process (4th thoracic); Short spinous process (13th thoracic); cranial articular process; transverse process; body (cranial extremity; cranial articular facet or fovea; mammillary process; ventral crest; vertebral foramen; caudal vertebral notch

Cranial view of 4th thoracic vertebra	Lateral view of 13th thoracic vertebra

DATE_____WEEK 1 (session 2)

COMPARATIVE ANATOMY

Instruction: Compare the presence or absence of the following features of the 4th, 13th and whole thoracic vertebrae in the Bovine, Equine, Porcine and Canine using the + or – where appropriate.

Features	Bovine	Equine	Porcine	Canine
4th thoracic				
❖ Spinous process ❖ Transverse process ❖ Cranial and caudal articular process ❖ Lateral vertebral foramen ❖ Mammillary process ❖ Cranial and caudal articular facet				
13th thoracic				
❖ Spinous process ❖ Transverse process ❖ Mammillary process ❖ Accessory process ❖ Caudal vertebral notch ❖ Lateral vertebral foramen				
Number of Thoracic vertebrae				

DATE_____WEEK 1 (session 2)

BOVINE LUMBAR VERTEBRAE

Instruction: Study the Bovine lumbar vertebrae noting their differences from the first to sixth, count them, then sketch and label the cranial view of the 1st and any of 2nd to 6th. Features to note include:

Long spinous process (Ist lumbar); Short spinous process (2nd to 6th lumbar); cranial articular process; Long transverse process (2nd to 6th lumbar); Short transverse process (1st lumbar); body (cranial extremity); mammillary process; ventral crest; vertebral foramen; lateral vertebral foramen; Vertebral arch.

Cranial view of 1st lumbar vertebra	Cranial view of 6th lumbar vertebra

DATE_____WEEK 1 (session 2)

COMPARATIVE ANATOMY

Instruction: Compare the presence or absence of the following features of the 1st, 6th and number of lumbar vertebrae in the Bovine, Equine, Porcine and Canine using + or – where appropriate.

Features	Bovine	Equine	Porcine	Canine
1st lumbar				
❖ Spinous process ❖ Transverse process ❖ Cranial and caudal articular process ❖ Lateral vertebral foramen ❖ Accessory process ❖ Vertebral arch ❖ Mammillary process				
6th lumbar				
❖ Spinous process ❖ Transverse process ❖ Mammillary process ❖ Accessory process ❖ Vertebral arch ❖ Lateral vertebral foramen				
Number of lumbar vertebrae				

DATE_____WEEK 2 (session 1)

BOVINE SACRUM

Instruction: Study the Bovine sacral vertebrae by identifying its peculiarity, count it, then sketch and label the dorsal and ventro-lateral views. Features to note include:

Wing; auricular surface; cranial articular process; dorsal sacral foramina; ventral sacral foramina; vertebral foramen; vertebral arch; median sacral crest; lateral or intermediate sacral crest; spinous process; cranial extremity of body; Promontory.

Dorsal view of Sacrum	Ventro-lateral view of Sacrum

DATE_____WEEK 2 (session 1)

COMPARATIVE ANATOMY

Instruction: Compare the presence or absence of the following features of the Sacrum and number of sacral vertebrae in the Bovine, Equine, Porcine and Canine using +or – where appropriate.

Features	**Bovine**	**Equine**	**Porcine**	**Canine**
❖ Wing ❖ Auricular surface ❖ Cranial articular process ❖ Dorsal sacral foramina ❖ Vertebral foramen ❖ Vertebral arch ❖ Median sacral crest ❖ Lateral or intermediate sacral crest ❖ Spinous process ❖ Cranial extremity of body ❖ Promontory ❖ Interarcuate space				
Number of sacrum				

Cranial view of 1st caudal vertebra
Cranial view of 12th caudal vertebra

BOVINE CAUDAL VERTEBRAE

Instruction: Study the Bovine caudal vertebrae noting their differences from the first to the last, count them, then sketch and label the cranial view of the 1st and the 12th. Features to note include:

Transverse process; cranial articular process; caudal articular process; body; vertebral foramen; hemal arch

CHAPTER III

THE THORAX

OBJECTIVES:

- Identify the components of the thorax
  - Thoracic vertebrae
  - Ribs (Sternal and asternal)
  - Sternum

- Know and identify the boundaries of the
  - Cranial thoracic inlet
    - First thoracic vertebra
    - First pair of ribs
    - Manubrium cartilage and sterni
  - Caudal thoracic outlet
    - Last thoracic vertebra
    - Coastal arch
    - Xyphoid cartilage

- Identify the features of the rib and sternum of the Bovine and compare these features with that of the Equine, Porcine and Canine.

DATE_____WEEK 2 (session 1)

COMPONENT OF THE THORAX

Instruction: Take a quick but serious look at the mounted skeleton of the bovine, equine, porcine and canine species, study the components and arrangement of the thoracic cavity taking note of the boundaries of the cranial thoracic inlet and the caudal thoracic inlet, the sternal and asternal ribs, floating ribs, sternum and coastal cartilages. Identify each bone; sketch and label the boundary of the cranial inlet in each species.

Bovine thoracic inlet	Equine thoracic inlet
Porcine thoracic inlet	Canine thoracic inlet

DATE_____WEEK 2 (session 1)

RIBS

Instruction: Study a pair of the rib (pick any one) of each animal (bovine, equine, porcine and canine); sketch the lateral surface of one rib and note the following features:

Coastal tubercle; head of rib; neck of rib; cranial border, caudal border; coastal groove; Shaft of rib; caudal extremity

Bovine rib (Lateral surface)	Equine rib (Lateral surface)
Porcine rib (Lateral surface)	Canine rib (Lateral surface)

DATE_____WEEK 2 (session 1)

STERNUM

Instruction: Study the sternum of each animal (bovine, equine, porcine and canine); count the sternebrae and sketch the dorsolateral view of each animal sternum noting the following features:

Manubrium cartilage; Manubrium sterni; sternebra; sternal crest; Xyphoid process and cartilage

Bovine sternum (dorsolateral)	Equine sternum (dorsolateral)
Porcine sternum (dorsolateral)	Canine sternum (dorsolateral)

SECTION B
APPENDICULAR SKELETON

Pectoral (Thoracic/Fore limb)
Pelvic (Hind limb)

CHAPTER IV

THE FORE LIMB

OBJECTIVES:

- Identify the bones of the forelimb
    - Scapula
    - Humerus
    - Radio-ulna
    - Carpal
        - Proximal carpals
        - Distal carpals
        - Accessory carpal
    - Metacarpal
    - Digits or Phalanges
        - First phalanx
        - Second phalanx
        - Third phalanx

- Identify the features and number of each bone
- Compare these features and number in the bovine, equine, porcine and canine species

DATE_____WEEK 2 (session 2)

SCAPULA

Instruction: Study the Scapula bone of the bovine, equine, porcine and canine species; sketch and label the lateral and medial views of each species. Take note of the following features on each view of each species:

Bovine Scapula

Scapula cartilage; dorsal border; cranial border; caudal border; cranial angle; caudal angle; scapula spine; supraspinous fossa; infraspinous fossa; acromion process; supraglenoid tubercle; neck of scapula; coracoid process; subscapular fossa; glenoid angle; glenoid cavity

Lateral view of bovine scapula	Medial view of bovine scapula

DATE_____WEEK 2 (session 2)

Equine Scapula

Scapula cartilage; dorsal border; cranial border; caudal border; cranial angle; caudal angle; scapula spine; scapula tuber; supraspinous fossa; infraspinous fossa; supraglenoid tubercle; neck of scapula; coracoid process; subscapular fossa; glenoid angle; scapula notch; glenoid cavity; facies serrate.

Lateral view of equine scapula	Medial view of equine scapula

DATE_____WEEK 2 (session 2)

Porcine scapula

Scapula cartilage; dorsal border; cranial border; caudal border; cranial angle; caudal angle; scapula spine; scapula tuber; supraspinous fossa; infraspinous fossa; supraglenoid tubercle; neck of scapula; coracoid process; subscapular fossa; glenoid angle; scapula notch; glenoid cavity; facies serrata.

Lateral view of porcine scapula	Medial view of porcine scapula

Canine scapula

Scapula cartilage; dorsal border; cranial border; caudal border; cranial angle; caudal angle; scapula spine; supraspinous fossa; infraspinous fossa; supraglenoid tubercle; neck of scapula; coracoid process; subscapular fossa; glenoid angle; scapula notch; glenoid cavity; facies serrata.

Lateral view of canine scapula	Medial view of canine scapula

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the features in the scapula of the bovine, equine, porcine and canine species using + for presence and – for absence.

Features	Bovine	Equine	Porcine	Canine
❖ Rhomboid shape ❖ Acromion process ❖ Coracoid process ❖ Supraglenoid tubercle ❖ Curved spinal tubercle ❖ Suprahamatus process ❖ Triangular shape ❖ Thick scapular spine ❖ Scapular cartilage ❖ Deep subscapular fossa				

DATE_____WEEK 3 (session 1)

HUMERUS

Instruction: Study the Humerus of the bovine, equine, porcine and canine species; sketch and label the cranial and caudal views of each species. Take note of the following features on each view of each species:

Bovine Humerus

Head, neck, Greater tuberosity; Lesser tuberosity; Bicipital groove; teres major; deltoid tuberosity; Shaft (diaphysis); Musculospiral groove; radial fossa; lateral condyle; medial condyle; Olecranon fossa; lateral epicondyle; medial epicondyle

Cranial view	Caudal view

Equine Humerus

Head, neck, Greater tuberosity (cranial and caudal part); Lesser tuberosity; Intermediate tuberosity; Bicipital groove; teres major; deltoid tuberosity; Shaft (diaphysis); Musculospiral groove; radial fossa; lateral condyle; medial condyle; Olecranon fossa; lateral epicondyle; medial epicondyle

Cranial view	Caudal view

Porcine Humerus
Head, neck, Greater tuberosity (cranial and caudal part); Lesser tuberosity; Bicipital groove; teres major; deltoid tuberosity; Shaft (diaphysis); Musculospiral groove; radial fossa; lateral condyle; medial condyle; Olecranon fossa; lateral epicondyle; medial epicondyle

Cranial view	Caudal view

Canine Humerus
Head, neck, Greater tuberosity; Lesser tuberosity; Bicipital groove; teres major; deltoid tuberosity; Shaft (diaphysis); Musculospiral groove; radial fossa; Supratrochlear foramen; lateral condyle; medial condyle; Olecranon fossa; lateral epicondyle; medial epicondyle

Cranial view	Caudal view

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the features in the humerus of the bovine, equine, porcine and canine species using + for presence and – for absence.

Features	Bovine	Equine	Porcine	Canine
❖ Double bicipital groove ❖ Cranial and caudal greater tuberosity ❖ Intermediate tuberosity ❖ Deep musculo-spiral groove ❖ Shallow musculo-spiral groove ❖ Supratrochlear foramen				

RADIOULNA

Instruction: Study the Radioulna of the bovine, equine, porcine and canine species; sketch and label the lateral view of each species. Take note of the following features on each view of each species:

Olecranon tuber; olecranon; anconeal process; trochlea notch; coronoid process; radial articular facet; head of radius; neck of radius; Interosseous space; shaft of radius; shaft of ulna; styloid process of ulna; styloid process of radius; transverse crest; radial trochlea.

Bovine (lateral view)	Equine (lateral view)	Porcine (lateral)	Canine (lateral view)

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the features in the radioulna of the bovine, equine, porcine and canine species using + for presence and – for absence.

Features	Bovine	Equine	Porcine	Canine
❖ Two interosseous space ❖ One small interosseous space ❖ Extensive interosseous space ❖ Styloid process of ulna ❖ Styloid process of radius ❖ Twisted appearance				

DATE_____WEEK 3 (session 2)

CARPUS

Instruction: Study the position and arrangement of carpal bones in mounted skeleton of the bovine, equine, porcine and canine species; sketch and label the dorsal view of each species.

Bovine carpus	Equine carpus	Porcine carpus	Canine carpus

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, identify the number of bones in the carpus of the bovine, equine, porcine and canine species

	Bovine	Equine	Porcine	Canine
Number of carpal bones				

METACARPAL BONE

Instruction: Study the metacarpal of the bovine, equine species; sketch and label the dorsal and palmar views of each species. Take note of the following features on each view of each species:

3rd, 4th and 5th metacarpal Metacarpal groove, intertrochlear notch		2nd, 3rd and 4th metacarpal Trochlea; Splint bones	
Bovine (dorsal view)	Bovine (palmar view)	Equine (dorsal view)	Equine (palmar view)

DATE_____WEEK 3 (session 2)

METACARPAL BONE

Instruction: Study the metacarpal of the porcine and canine species; sketch and label the dorsal view of each species. Take note of the following features on each view of each species:

2nd, 3rd, 4th and 5th metacarpal

1st, 2nd, 3rd, 4th and 5th metacarpal

Porcine metacarpal (dorsal view)	Canine metacarpal (dorsal view)

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the following in the metacarpals of the bovine, equine, porcine and canine species

Features	Bovine	Equine	Porcine	Canine
❖ Number of metacarpal ❖ Fused metacarpal ❖ Vascular groove				

DATE_____WEEK 3 (session 2)

PHALANGES AND SESSAMOIDS

Instruction: Study the phalanges of the bovine, equine, porcine and canine species; sketch and label the dorsal and palmar views of the bovine and equine. Take note of the following features on each view of each species

1st, 2nd, 3rd phalanx; Navicular bone; extensor process; coronary border; dorsal border; solear border; Proximal sessamoid; solar surface; solar foramen; crena.

Bovine (dorsal view)	Bovine (palmar view)

Equine (dorsal view)	Equine (palmar view)

CHAPTER V

THE HIND LIMB

OBJECTIVES:

- Identify the bones of the hind limb
    - Pelvis bone
    - Femur
    - Tibio-fibula
    - Tarsal
        - Fibula farsal
        - Tibio tarsal
        - Centriquarta
    - Metatarsal
    - Digits or Phalanges
        - First phalanx
        - Second phalanx
        - Third phalanx

- Identify the features and number of each bone
- Compare these features and number in the bovine, equine, porcine and canine species

DATE_____WEEK 4 (session 1)

PELVIC BONE

Instruction: Study the Pelvic bone of the bovine, equine, porcine and canine species; sketch and label the dorsal and ventral views of the bovine. Take note of the following features on each view:

Coxal tuberosity; wing of ilium; iliac crest; sacral tuber; auricular surface; body of ilium; ischialtic spine; acetabulum; obturator foramen; pubic symphysis; pectin of pubis; cranial branch of pubis; caudal branch of pubis; iliopubic eminence; body of ischium; ischial tuber; ischiatic symphysis; ischial arch.

Dorsal view of bovine pelvic bone	Ventral view of bovine pelvic bone

DATE_____WEEK 4 (session 1)

FEMUR

Instruction: Study the femur of the bovine, equine, porcine and canine species; sketch and label the cranial and caudal views of each species. Take note of the following features on each view of each species:

Head of femur; fovea of head; greater trochanter (cranial and caudal); neck of femur; lesser trochanter; trochanteric fossa; trochanteric plane; trochanter tertius; shaft of femur; nutrient foramen; supracondyloid fossa; fabella articular surface; suprapatella fossa; trochlea of femur; lateral condyle; medial condyle; lateral epicondyle; medial epicondyle; intercondylar fossa.

Bovine (cranial view)	Bovine (caudal view)

Equine (cranial view)	Equine (caudal view)

Porcine (cranial view)	Porcine (caudal view)	Canine (cranial view)	Canine (caudal view)

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the following features in the femur of the bovine, equine, porcine and canine species using + for presence and – for absence.

Features	Bovine	Equine	Porcine	Canine
❖ Greater trochanter ❖ Lesser trochanter ❖ Trochanter tertius ❖ Oblique trochanteric crest ❖ Straight trochanteric crest ❖ Supracondyloid fossa ❖ Fabella articular surface				

DATE_____WEEK 4 (session 2)

TIBIA AND FIBULA

Instruction: Study the tibia and fibula of the bovine, equine, porcine and canine species; sketch and label the cranial and caudal views of each species. Take note of the following features on each view of each species:

Intercondyloid eminence; cranial intercondyloid area; caudal intercondyloid area; lateral condyle; medial condyle; Tibial tuberosity; groove of tuberosity; extensor groove; popliteal notch; popliteal line; muscular line; nutrient foremen; Head of fibula; Shaft of fibula; shaft of tibia; lateral malleolus; medial malleolus; cochlea; Interosseous space.

Bovine (cranial view)	Bovine (caudal view)

Equine (cranial view)	Equine (caudal view)

Porcine (cranial view)	Porcine (caudal view)	Canine (cranial view)	Canine (caudal view)

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the following features in the Tibia and fibula of the bovine, equine, porcine and canine species using + for presence and – for absence

Features	Bovine	Equine	Porcine	Canine
❖ Popliteal line ❖ Muscular lines ❖ Incomplete fibula ❖ Comma shaped fibula ❖ Extensive interosseous space				

DATE_____WEEK 4 (session 2)

TARSUS

Instruction: Study the position and arrangement of tarsal bones in mounted skeleton of the bovine, equine, porcine and canine species; sketch and label the dorsal view of each species.

Bovine tarsus	Equine tarsus	Porcine tarsus	Canine tarsus

COMPARATIVE ANATOMY

Instruction: From the diagrams you have sketched and labeled, compare the tarsal bones of the bovine, equine, porcine and canine species using + for presence and – for absence.

Bones	Bovine	Equine	Porcine	Canine
❖ First tarsal ❖ Second tarsal ❖ Third tarsal ❖ Fourth tarsal ❖ Third and fourth fused ❖ Centroquarter ❖ Fibula tarsal ❖ Tibiotarsal				

SYNDESMOLOGY

SECTION A

AXIAL ARTICULATIONS

Articulations of the skull

Articulations of the vertebrae

Articulations of the thorax

CHAPTER I

ARTICULATIONS OF THE SKULL

OBJECTIVES:

- Identify the various articulations of the Skull
    - Fibrous junctions
        - Sutures
    - Principal synchondroses
        - Spheno-occipital
        - Intersphenoid
        - Intraoccipital
        - Intermandibular
    - Temporomandibular articulation
    - Hyoid articulation
        - Temporohyoid
        - Stylohyoid-ceratohyoid
        - Ceratohyoid-basihyoid
- Identify the type, components and movement of the joints specifically in the bovine species and compare them with the equine, porcine and canine species.

DATE_____WEEK 5 (session 1)

SUTURES

Instruction: Pick up the bovine skull and study all its views, identifying all the sutures. Sketch the dorsal view of the bovine skull and label the following sutures.

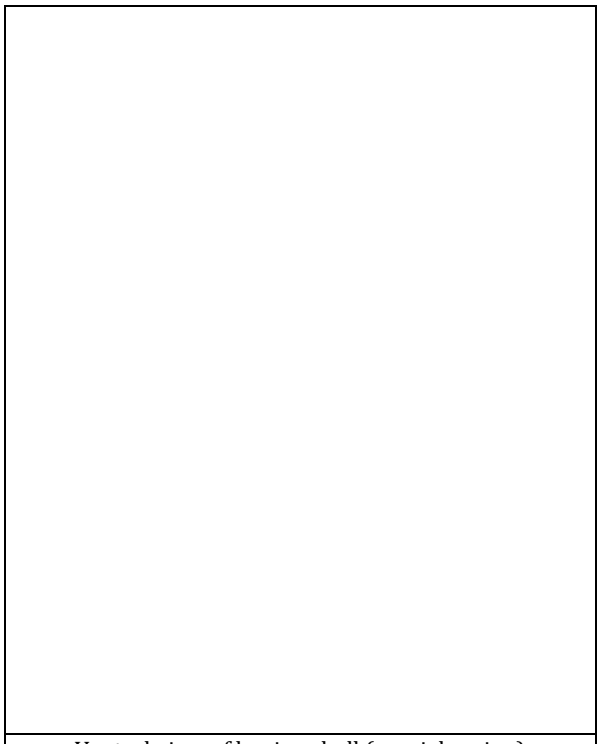
- Coronal suture
- Interfrontal suture
- Frontolacrimal suture
- Frontonasal suture
- Lacrimozygomatic suture
- Zygomaticomaxillary suture
- Nasolacrimal suture
- Lacrimomaxillary suture
- Nasomaxillary suture
- Maxilloincissive suture

Dorsal view of the Bovine skull

PRINCIPAL SYNCHONDROSES

Spheno-occipital
Intersphenoid

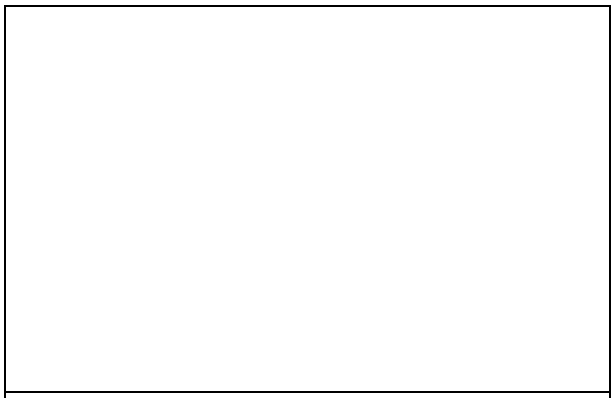
Instruction: Study and Sketch the cranial region of the ventral view of the bovine skull and label the Synchondroses listed above.



Ventral view of bovine skull (cranial region)

Squamolateral
Basilateral
Intraoccipital

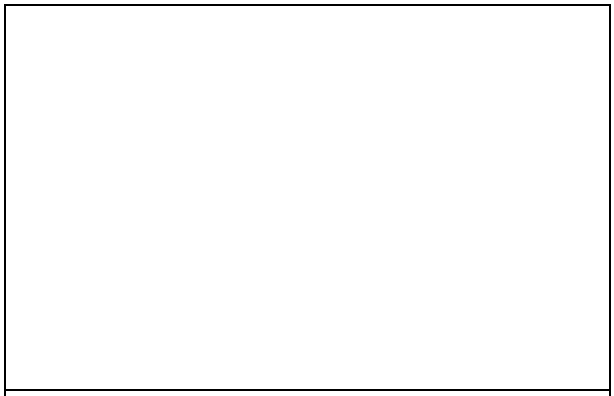
Instruction: Study and Sketch the caudal view of the bovine skull and label the Synchondroses listed above.



Caudal view of the bovine skull

Intermandibular

Instruction: Study and Sketch the cranial region of the dorsal view of the bovine mandible and label the Synchondroses listed above.



Intermandibular synchondrosis

TEMPOROMANDIBULAR ARTICULATION

Instruction: Study the articulation of the mandibular condyle with the temporal fossa of the squamous part of the temporal bone in the bovine. Sketch the lateral view of this joint and indicate the positions of the following ligaments:
Lateral ligament, caudal ligament.
Also move the joint to indicate the type of movement observed.

Temporomandibular articulation
Movement:

Hyoid articulation
Type of movement:

HYOID ARTICULATION

Instruction: Study the articulations of the hyoid bone in the bovine. Sketch the cranio-lateral view of the joint.
Also move the joints to indicate the type of movement observed.

COMPARATIVE ANATOMY

Instruction: Identify and study all the skull articulations in equine, porcine and canine species. State the differences (if any) you observed in each species in the table below.

Articulations	Bovine	Equine	Porcine	Canine
Temporomandibular Temporohyoid				
Hyoid articulations				
Sutures Spheno-occipital Intersphenoid Intraoccipital Intermandibular				

CHAPTER II

ARTICULATIONS OF THE VERTEBRAE

OBJECTIVES:

- Identify the various articulations of the vertebrae
    - Intercentral articulation
    - Interneural articulation
    - Atlanto-occipital articulation
    - Atlanto-axial articulation
    - Intertransverse articulation
    - Sacral articulation
    - Caudal articulation

- Identify the ligaments associated with each articulation
- Compare these articulations in the bovine, equine, porcine and canine species

DATE_____WEEK 5 (session 2)

INTERCENTRAL ARTICULATION

Instruction: Study the articulations of the bodies of the bovine vertebrae, sketch the lateral view of 3rd to 6th thoracic vertebrae and indicate the positions of the intervertebral disc, ventral and dorsal longitudinal ligaments

Intercentral articulation (lateral view)
Movement:

INTERNEURAL ARTICULATION

Instruction: Study the articulations of the arches of the bovine vertebrae, sketch the lateral view of 3rd to 6th thoracic vertebrae and indicate the positions of the following ligaments. Ligament flava, Supraspinous ligament and Interspinous ligament.

Interneural articulation (lateral view)
Movement:

ATLANTO-OCCIPITAL ARTICULATION

Instruction: Study this articulation in the mounted skeleton of the bovine, equine, porcine and canine species. Move the joint to identify the type of movement and sketch the lateral view of the bovine.

Atlanto-occipital articulation of the bovine (lateral view)
Movement:

ATLANTO-AXIAL ARTICULATION

Instruction: Study this articulation in the mounted skeleton of the bovine, equine, porcine and canine species. Move the joint to identify the type of movement and sketch the lateral view of the bovine.

Atlanto-axial articulation of the bovine (lateral view)
Movement:

INTER TRANSVERSE ARTICULATION

Instruction: Study this articulation formed by the transverse processes of the 5th and 6th lumbar vertebrae and between the latter and wings of the sacrum in the equine. Move the joint to identify the type of movement and sketch the dorsolateral view.

Intertransverse articulation of the equine (dorsolateral view)
Movement:

SACRAL ARTICULATIONS

Instruction: Study the sacrum of the bovine, equine, porcine and canine species. Sketch the dorsolateral view of the equine.

Sacral articulations of the equine (dorsolateral view)
Movement:

CAUDAL ARTICULATIONS

Instruction: Study the articulations formed by the bodies of the caudal vertebra. Move the vertebra as a whole to identify the type of movement and sketch the lateral view of the first five vertebra in the bovine indicating the intervertebral discs.

Caudal articulations of the bovine (lateral view)
Movement:

CHAPTER III

ARTICULATIONS OF THE THORAX

OBJECTIVES:

- Identify the various articulations of the Thorax
    - Costovertebral articulation
        - Articulation of the head of ribs
        - Costotransverse articulation
    - Costochondral articulation
    - Sternocostal articulation
    - Sternal articulation

- Identify the types of joints
- Compare these articulations in the bovine, equine, porcine and canine species

DATE_____WEEK 6 (session 1)

COSTOVERTEBRAL ARTICULATION

Instruction: Study the articulation of the head of the rib with the concave facet on the vertebral bodies and also the articulation of the facet on the rib tubercle with the transverse processes of the vertebrae on mounted skeletons of the bovine, equine, porcine and canine species. Sketch the cranial view of this articulation on the first thoracic vertebrae of any species indicating the costotransverse ligament.

Costovertebral articulation of the first thoracic vertebrae (cranial view)
Type of joint:

COSTOCHONDRAL, STERNOCOSTAL AND STERNAL ARTICULATION

Instruction: Study the articulation formed by the caudal concave end of the rib with convex end of the cartilage (Costochondral), the articulation formed by the cartilage of the true ribs and the sternum (Sternocostal) and the articulation formed by the each sternebrae (Sternal) on mounted skeletons of the bovine, equine, porcine and canine species. Sketch and label the ventral view of any.

Costochondral, Sternocostal and sternal articulations (ventral view)
Type of joint:

SECTION B
APPENDICULAR ARTICULATIONS

Articulations of the thoracic limb
Articulations of the pelvic limb

CHAPTER IV

ARTICULATIONS OF THE THORACIC LIMB

OBJECTIVES:

- Identify the various articulations of the Thoracic limb
    - Humeral (shoulder) joint
    - Elbow (cubital)joint
        - Humeroradial joint
        - Humeroulnar joint
        - Proximal radioulnar joint
    - Carpal joint
        - Antebrachiocarpal joint
        - Middle carpal joint
        - Intercarpal joint
        - Carpometacarpal joint
    - Intermetacarpal joint
    - Metacarpophalangeal joint
    - Proximal interphalangeal joint
    - Distal interphalangeal joint

- Identify the ligaments associated with each joint
- Compare these articulations in the bovine, equine, porcine and canine species

DATE_____WEEK 6 (session 1)

HUMERAL JOINT

Instruction: Study the joint between the glenoid cavity on the scapula and the large convex head of the Humerus on the mounted skeleton of the bovine, equine, porcine and canine species. Sketch and label the cranial view of the equine and the lateral view of the canine indicating the position of the glenohumeral ligaments.

Equine humeral joint	Canine humeral joint

ELBOW JOINT

Instruction: Study the joint between the trochlea of the humerus and the head of radius (Humeroradial) and the joint between the trochlea of the humerus and the trochlea notch of the ulna (Humeroulnar) in the mounted skeleton of the bovine. Sketch the lateral and medial views indicating the positions of the lateral and medial collateral ligaments.

Bovine elbow joint (lateral view)	Bovine elbow joint (medial view)

Instruction: Study the joint between the trochlea of the humerus and the head of radius (Humeroradial) the joint between the trochlea of the humerus and the trochlea notch of the ulna (Humeroulnar) and the joint between the proximal part of the radius and the radial notch of the ulna (proximal radioulnar joint) in the mounted skeleton of the canine. Sketch and label the lateral and cranial views indicating the positions of the lateral and medial collateral ligaments, annular ligaments and oblique ligament.

Canine elbow joint (lateral view)	Canine elbow joint (cranial view)

DATE_____WEEK 6 (session 2)

CARPAL JOINT

Instruction: Study the joint between the distal extremities of the radius and ulna and the proximal row of carpal bones (antebrachiocarpal), the joint between the proximal and distal rows of carpal bones (middle carpal), the joint between the carpal bones of each row (intercarpal) and the joint between the distal row of carpal bones and proximal ends of metacarpal bones (carpometacarpal) on the mounted skeleton of bovine, equine, porcine and canine species.

Sketch and label the dorsal and palmar views of the equine carpal joint indicating the positions of the following ligaments: medial and lateral collateral ligaments; proximal, middle and distal ligaments of the accessory carpal bone; dorsal intercarpal ligaments and dorsal carpometacarpal ligaments.

Equine carpal joint (dorsal view)	Equine carpal joint (palmar view)

Instruction:

Sketch and label the dorsal and palmar views of the canine carpal joint indicating the positions of the following ligaments: Medial collateral ligament; Radioulnar ligament; Dorsal radiocarpal ligament; Lateral collateral ligament. Palmar view – medial collateral ligament; Palmar radiocarpal ligament; Palmar ulnarcarpal ligament.

Canine carpal joint (dorsal view)	Canine carpal joint (palmar view)

INTERMETACARPAL JOINT

Instruction: Study the joint between the various metacarpal bones on the mounted skeleton of the bovine, equine, porcine and canine species. Sketch the dorsal view of the species studied indicating the positions of the interosseus metacarpal ligaments in each species.

Equine	Bovine	Porcine	Canine

METACARPOPHALANGEAL JOINT
PROXIMAL INTERPHALANGEAL JOINT
DISTAL INTERPHALANGEAL JOINT

Instruction: Study these joints in the mounted skeleton of the bovine, equine, porcine and canine species. Sketch the dorsal and lateral view of the bovine and equine species, indicating the positions of the following ligaments: lateral collateral ligament of coffin joint; collateral ligament of navicular bone; lateral collateral ligament of fetlock joint; lateral collateral ligament of sessamoid bones; oblique sessamoidean ligament; straight sessamoidean ligament.

Equine (dorsal view)	Equine (palmar view)	Bovine (dorsal view)	Bovine (palmar view)

STAY APPARATUS OF THE THORACIC LIMB OF THE EQUINE

Instruction: Study and sketch the stay apparatus (lateral view) of the horse forelimb indicating the following components.

- Serratus ventralis muscle
- Biceps brachii muscle
- Lateral collateral ligament of the elbow
- Lacertus fibrosus
- Extensor carpi radialis
- Accessory ligament of the carpus
- Superficial digital flexor
- Deep digital flexor
- Suspensory ligament
- Superficial sessamoidean ligament
- Common digital extensor

Equine forelimb stay apparatus (lateral view)

CHAPTER V

ARTICULATIONS OF THE PELVIC LIMB

OBJECTIVES:

- Identify the various articulations of the Pelvic limb
    - Sacroiliac joint
    - Pelvic symphysis
    - Coxofemoral joint
    - Stifle joint
        - Femoropatellar articulation
        - Femorotibial articulation
        - Femorofabellar articulations of dog
        - Proximal tibiofibular articulation
    - Tarsal (Hock) joint
        - Tarsocrural (talocrural)
        - Proximal intertarsal
        - Distal intertarsal
        - Tarsometatarsal

- Identify the ligaments associated with each joint
- Compare these articulations in the bovine, equine, porcine and canine species

DATE_____WEEK 7 (session 1)

SACROILIAC JOINT

Instruction: Study the articulation of the sacrum with the ilia of the ossa coxarum in the bovine, equine, porcine and canine species. Sketch the ventral view of the bovine indicating the position of the ventral sacroiliac ligaments.

Sacroiliac joint of the bovine (ventral view)

SACROILIAC JOINT

Instruction: Study the articulation of the sacrum with the ilia of the ossa coxarum in the bovine, equine, porcine and canine species. Sketch the lateral view of the equine indicating the position of the broad sacrotuberal ligament.

Sacroiliac joint of the equine (lateral view)

COXOFEMORAL JOINT

Instruction: Study the articulation of the head of the femur with the acetabulum of the Os coxae of the bovine, equine, porcine and canine species. Sketch the dorsal and ventral view of the bovine indicating the position of the round ligament.

Bovine coxofemoral joint (dorsal view)	Bovine coxofemoral joint (ventral view)

DATE_____WEEK 7 (session 2)

STIFLE JOINT

Instruction: Study the various articulations of the stifle joint between the trochlea of the femur and the articular surface of the patella (femoropatella), the condyle of the femur and the condyles of the tibia (femorotibial) in the bovine, equine and porcine species. Sketch the cranial, lateral and caudal views of the equine indicating the following ligaments:

Medial and lateral collateral (femorotibial) ligaments; Meniscal ligaments; cruxiate ligaments; Medial and lateral femoropatellar ligaments; lateral, middle and medial patellar ligaments.

Equine Stifle joint (cranial)	Equine Stifle joint (lateral)	Equine stifle joint (caudal)

STIFLE JOINT

Instruction: Study the various articulations of the stifle joint between the trochlea of the femur and the articular surface of the patella (femoropatella), the condyle of the femur and the condyles of the tibia (femorotibial), the facets on the femoral epicondyle and the lateral and medial fabellae (femorofabella), the head of the fibula and the facet below the lateral condyle of the tibia (Proximal tibiofibular) in the canine species. Sketch the cranial, lateral and caudal views of the equine indicating the following menisci and ligaments:

Medial meniscus; medial collateral ligament; lateral femoropatella ligament; lateral collateral ligament; caudal cruxiate ligament; cranial cruxiate ligament; lateral meniscus; meniscofemoral ligament.

Canine stifle joint (cranial)	Canine stifle joint (lateral)	Canine stifle joint (caudal)

TARSAL JOINT

Instruction: Study the various articulations of the tarsal joint between the tibia trochlea and the trochlea of the talus (tibiotarsal or tarsocrural); the talus and calcaneus proximally and the central and fourth tarsal bones distally (proximal intertarsal); the central tarsal bone proximally, fourth tarsal bone laterally and the first, second and third tarsal distally (distal intertarsal); the distal row of tarsal bones and the metatarsal bones (tarsometatarsal) in the bovine, equine, porcine and canine species.

Sketch the cranial and lateral views of the equine species indicating the positions of the following ligaments: medial collateral ligament; lateral collateral ligament; long plantar ligament and dorsal ligament.

Equine tarsal joint (cranial view)	Equine tarsal joint (lateral view)

STAY APPARATUS OF THE PELVIC LIMB OF THE EQUINE

Instruction: Study and sketch the stay apparatus (lateral view) of the horse pelvic limb indicating the following components.

- Tensor fasciae latae
- Fibrous band
- Fibularis tertius
- Flexor digitorum superfacialis
- Accessory ligament of flexor digitorum profundus
- Flexor digitorum profundus
- Interossueus or suspensory ligament
- Extensor digitorum longus

Stay apparatus of the Equine pelvic limb

NOTE:

THIS PRACTICAL MANUAL MUST BE SUBMITTED FOR GRADING AT THE END OF EACH WEEK OF PRACTICAL SESSION TO THE PRACTICAL CO-ORDINATOR.

Practical Coordinator's signature

_____