Summary of Teaching and Curriculum Development (2012-2020) in Domestic Animal Anatomy for the Department of Biomedical Sciences (BMS) and Professional Veterinary Medicine (PVM) program at Colorado State University

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Table of Contents

Each section below links to a Summary of how these materials are relevant.

Course 1: BMS305 Domestic Animal Anatomy

Global Learning Objectives (pg 2)

Developed in response to the the BMS05 curriculum Map effort in 2019

Syllabus Spring 2012 (Frasier, Course Director)(pg 3-11)

Provided as a reference to course organization prior to change in directorship

Syllabus Spring 2020 Pre-COVID -19 (Magee, Course Director)(pg 12-24)

Specific course changes include increased formative assessments and course material

- laboratory quizzes and check-in quizzes
- short objectives to direct essential learning
- written "tours" for each of the laboratory exercises
- video "tours" and dissection videos for laboratory sessions

Syllabus Spring 2020 Post-COVID-19 (Magee, Course Director) (pg25-34)

Specific course changes were part of a move to online learning for Units 3 & 4

- all remaining course lectures were posted to Canvas on March 13th using Echo lectures and slides from 2019 with a new course schedule that would accommodate an April 10 return, or no return to RI instruction as was the case
- creation of new Canvas BMS305 Virtual Laboratory page for students, teaching assistants, and faculty to interact in Discussion Boards and provide resources for the Virtual laboratory sessions
- 46 hr/wk of Teaching Assistant hosted Virtual Animal Anatomy Open Laboratory
- laboratory quizzes were created as using new Canvas Quizzes program
- created guided quizzes (3 per unit) to integrate material (45 pts total)
- remaining Unit laboratory exams (50 pts ea) were eliminated from the course
- created new Unit exams using new Canvas Quizzes program

How to succeed in BMS305 (pg 35)

Data driven suggestions for student success in BMS305

- provided on the course Canvas page
- referenced by students and TAs as a source for student success strategies

BMS 305 Course Learning Objectives

Global Learning Objectives

- Apply directional or anatomical terms to accurately communicate anatomical structures
- Demonstrate an approach to learning by appreciating similarities and differences between regions of anatomy and/or the domestic animals studied in this course
- See body as a single unit with integrated systems to achieve basic physiologic functions
- Apply anatomical knowledge to clinical situations to solve a unique problem

Pelvic and Thoracic Limbs Learning Objectives

1. Describe and/or draw the major nerves in the canine thoracic and pelvic limbs. Include the major branches of these nerves, landmarks for locating the nerves, the muscles innervated, and their major functions.
2. Compare and contrast blood flow pattern to the equine distal thoracic vs. pelvic limb
3. Compare and contrast the nerve supply (motor and sensory) to the equine distal thoracic vs. pelvic limb
4. Compare and contrast the equine pelvic versus thoracic limbs, including function/weight-bearing joint stability and the functional significance of key apparatuses for each limb
5. Describe the anatomy of the hoof and include the parts of the hoof, sub-gross anatomy (dermis/epidermis) and the lamina. Describe how the distal phalanx is "suspended" within the hoof and the clinical relevance
6. Compare the stifle joint of the equine vs. canine pelvic limb and discuss the associated joints and ligaments, including the functional significance of this joint to weight support and generate thrust
7. Draw the afferent and efferent arms of a reflex arc and describe how a "nerve block" would alter this pathway

Thorax, Abdomen and Pelvis Learning Objectives

1. Compare the pathway of food through the digestive systems of the dog vs. horse vs. ruminant. Begin with structures associated with prehension, mastication and deglutition, be sure to describe individual chambers of the bovine stomach and the separate and unique parts of the large intestines of each species, end at the rectum
2. Describe the flow of blood through the equine heart and include descriptions of the anatomy of the heart
3. Compare the fibroelastic penis of the ox and musculoerectile penis of the horse and dog and explain the functional differences in the process of erection
4. Describe the peritoneum and the formation how these layers occur, including mesenteries and omentum. Describe the kidney, liver, and cranial mesenteric artery in relation to the peritoneum
5. Compare the inguinal canal in the male vs. the female, including its anatomy, structure and contents. In the intact male, continue the description to include how the inguinal canal contributes to the contents of the scrotum
6. Describe the anatomy of the canine liver and include associated structures, vascular anatomy, nutrient and portal blood flow, and formation and delivery of bile to the intestines

Head and Neck Learning Objectives

1. Describe each Cranial Nerve, including all its functions (motor/sensory), target organs, and basic anatomic pathway – origins, destinations and foramina of exit and entry. Include any ganglia associated with the nerve
2. Describe the blood supply to the brain, specifically the contributions to the cerebral arterial circle and the head
3. Describe the complete nerve supply to the tongue, including motor, general sensory, special sensory, and autonomic supply, if applicable
4. Compare mastication in the dog vs. the horse and include masticatory muscles (attachments/innervations), any pertinent bony features or articulations and dentition
5. Describe the diverticulum of the equine auditory tube, including pertinent anatomy, associated bones, nerves, vessels, and its presumed function. In addition, describe the approach to the diverticulum from the nasal cavity (endoscope) as well as the exterior (surgical)
6. Compare the nasal and paranasal cavities of the dog to that of the horse
7. Describe the larynx and include associated structures, muscles, innervations, and functions

BMS305
Domestic Animal Gross Anatomy
Spring 2011

COURSE INFORMATION AND LECTURE / LAB SCHEDULE

Mr. Mark Frasier, Associate Professor
W220 A/Z Bldg.
491-5554
Office hours: By appointment
frasier@lamar.colostate.edu

Mr. Casey Cooper
Graduate Teaching Assistant
W215, A/Z
Office Hours: By appointment
cclovisc@aol.com

Lecture: MWF - 1:00-1:50 pm – 104 Yates

Laboratory: W117 Anatomy/Zoology Bldg

Section 1:	R	Lab	1:00-2:50 pm
Section 2:	R	Lab	3:00-4:50 pm

Please anticipate that you may need additional time for laboratory study. The laboratory, W117 A/Z, will be open on Tuesday, Thursday and Fridays from 8:00 to 12:00 with teaching assistants available to help with your study.

Open Lab Hours: - T/R/F 8:00 am – 12:00

TEXTBOOKS and LEARNING RESOURCES

REQUIRED:
- Frasier/Giddings, Domestic Animal Anatomy Lecture Notes
- Frasier/Giddings, Domestic Animal Anatomy Laboratory Guide
- Whalen, R.L. Virtual Canine Anatomy - DVD

REQUIRED: **RamCT http://ramct.colostate.edu**

OPTIONAL:
- Frandson, R.D., Anatomy and Physiology of Farm Animals
- Ellenberger, W., An Atlas of Animal Anatomy for Artists
- Evans, H.E., Guide to the Dissection of the Dog
- Kainer, R.A., Horse Anatomy, a Coloring Atlas
- Kainer, R.A., Dog Anatomy, a Coloring Atlas
- Spurgeon, T.L., Spurgeon's Color Atlas of Large Animal Anatomy

COURSE INFORMATION

Prerequisites

Life102 or BZ 110

Course Description and Objectives

BMS305 presents the gross anatomy of the Carnivore (dog and cat), Ruminants (Ox, goat), and the Horse from a regional perspective, utilizing clinical applications as a basis for anatomical understanding. Other disciplines such as physiology, embryology, and histology will also be included when they assist in anatomical understanding.

The lecture portion of the course will include:

1. The skeletal, muscular, vascular, and nervous system components of the thoracic limb.
2. The skeletal, muscular, vascular, and nervous system components of the pelvic limb.
3. An overview of cranial nerves, the central nervous system and the musculature and vasculature of the head, neck and back.
4. The vascular, nervous and organ system components of the thorax, abdomen and pelvis.

The laboratory portion of the course includes:

1. The study of prosected animal cadavers
2. Computer facilitated study using animal anatomy software. Emphasis on identifying relationships and locations of anatomical structures as well as practicing anatomical vocabulary.

The lecture and laboratory are intimately correlated and inseparable.

Course Objectives:

Students will be able to describe and identify, as well as understand relationships between bones, muscles, vessels and nerves of the thoracic and pelvic limbs, the head and neck and the thorax, abdomen and pelvis.

The course has been designed to fit the needs of students in animal science, equine science and general biology, and for those preparing for careers in domestic animal care, pre-veterinary medicine, Bio-Education (Teachers!), as well as students simply interested in the physical construction of domestic animals.

BMS305
LECTURE AND LABORATORY SCHEDULE
SPRING 2011

UNIT 1 – THORACIC LIMB

W	1/19	Introduction / general body plan
R	1/20	**Lab**: **Ex 1** - **Bones of the thoracic limb**
F	1/21	Articulation Overview / synovial joints
M	1/24	Introduction to thoracic limb - Regions/Bones/Joints
W	1/26	Nervous system overview
R	1/27	**Lab: Ex 2 - Muscles of the thoracic limb**
F	1/28	Extrinsic muscles of the thoracic limb
M	1/31	Intrinsic muscles of the thoracic limb
W	2/2	Vessels of the thoracic limb
R	2/3	**Lab: Ex 3 - Vessels and nerves of the thoracic limb**
F	2/4	Nerves of the thoracic limb
M	2/7	Distal equine limb/stay apparatus
W	2/9	Review - Applied anatomy
R	2/10	**Lab: LECTURE / LAB EXAM - UNIT 1 – THORACIC LIMB**

UNIT 2 – PELVIC LIMB

F	2/11	Pelvic limb articulations
M	2/14	Thigh muscles of pelvic limb
W	2/16	Crural muscles of the pelvic limb
R	2/17	**Lab: Ex 4 & 5 - Bones and Muscles of the Pelvic Limb**

F	2/18	Vessels of the Pelvic limb
M	2/21	Nerves of the pelvic limb
W	2/23	Foot/Hoof
R	2/24	**Lab: Ex 6 - Vessels and nerves of the pelvic limb**
F	2/25	Knee and reciprocal apparatus
M	2/28	Gait
W	3/2	Review - Applied anatomy
R	3/3	**Lab: LECTURE / LAB EXAM – UNIT 2 – PELVIC LIMB**

UNIT 3 - HEAD AND NECK

F	3/4	Skull / Cranial nerve overview
M	3/7	Cranial nerve VII & superficial muscles of face
W	3/9	Cranial nerve V & muscles of mastication
R	3/10	**Lab: Ex 7 - Bones of the skull & Ex 8 – Superficial structures of head**
F	3/11	Brain
S-S	3/13 – 3/20	**SPRING BREAK!**
M	3/21	Blood supply to head & Brain
W	3/23	Meninges / Venous Sinuses / Blood return from brain
R	3/24	**Lab: Ex 8 – Deep structures of head & Ex 9 - Brain**
F	3/25	Ventricular system, & Cerebrospinal fluid production & circulation
M	3/28	Oral cavity & nasal cavities
W	3/30	Dentition
R	3/31	**Lab: Ex 10 – Neck, oral cavity, pharynx & larynx**
F	4/1	Neck, Pharynx & gutteral pouches

M	4/4	Larynx
W	4/6	Eye
R	4/7	**Lab: LECTURE / LAB EXAM – UNIT 3 – HEAD AND NECK**

UNIT 4 – THORAX, ABDOMEN AND PELVIS

F	4/8	Vertebral column
M	4/11	Muscles of the back
W	4/13	Spinal Cord
R	4/14	**Lab: Ex 11 - Vertebral column, back muscles, spinal cord**
F	4/15	Autonomic nervous system
M	4/18	Thorax / Lungs
W	4/20	Heart & great Vessels of heart – comparative anatomy
R	4/21	**Lab: Ex 12 - Thorax, heart and lungs**
F	4/22	Abdominal wall - blood supply and inguinal canal
M	4/25	Abdominal viscera
W	4/27	Blood supply and return of abdominal viscera
R	4/28	**Lab: Ex 13 - Abdominal wall, viscera and blood supply**
F	4/29	Ruminant stomach
M	5/2	Equine large intestine
W	5/4	Male reproductive tract
R	5/5	**Lab: Ex 14 – Pelvic cavity and viscera**
F	5/67	Female reproductive tract

FINALS WEEK

M 5/9 SECT. 2 – LECTURE / LAB EXAM: UNIT 4 2:00 – 4:00 Rm W106/W117 A/Z
M 5/9 SECT. 1 – LECTURE / LAB EXAM: UNIT 4 4:10 - 6:10 Rm W106/W117 A/Z

W 5/11 ALL SECTIONS - OPTIONAL COMP. FINAL 6:30 – 9:30 pm Rm W106 A/Z

EXAMINATION AND GRADING POLICIES

Lecture Exams: There will be four written unit exams and an optional final comprehensive exam all administered via RamCT. Each unit exam will emphasize the material in that unit. Each of the four exams will consist of 50 points. The optional final comprehensive exam, should you decide to take it, can replace any one of the four written unit exams. Questions on these written exams will be taken from lectures, handouts, and the course texts. There will be no make up exams. If for any reason you cannot take the lecture exams at the scheduled time, you must contact **MARK FRASIER, IN ADVANCE OF THAT EXAM.**

Lab Practicals: There will be four lab practicals, each emphasizing the material in that unit. Each lab practical will consist of 50 points. Questions will be largely identification of tagged structures on the specimens and questions pertaining to them. There will be no make-up lab exams. You cannot drop any of the lab exam scores.

The final grade will be computed from the grades of the four lecture exams (200 points), four lab practicals (200 points) for a total of 400 points. You can determine your overall grade at any time during the semester by dividing the actual points on your exams by the total points possible to that date. We anticipate that letter grades for the course will follow this format:

NOTE: The +/- grading system is NOT used in BMS305

90% -100%	=	A	=	360 points and above
80% - 89%	=	B	=	359 - 320
70% - 79%	=	C	=	319 - 280
60% - 69%	=	D	=	279 - 240
Below 60%	=	F	=	239 and below

- **REQUESTS FOR RE-GRADING OF ANY EXAM (LECTURE OR LAB) MUST BE MADE WITHIN 48 HOURS OF THE RETURN OF THE EXAMS**

- **GRADES ARE AN EVALUATION OF YOUR RESULTS, NOT OF YOUR EFFORTS**

- **GRADES ARE NOT NEGOTIABLE**

<u>Minimum Expectations in Class</u>:

Because this class is relatively large as enrollments go, it is especially important that an atmosphere which facilitates the maximum opportunity for learning is present at all times. Although attendance is an expectation for all students, it is not a requirement. We should remind you, however, <u>there is a positive relationship between class attendance and performance in the course</u>. We do expect all students present on a given day to be attentive, polite, and <u>not a source of distraction to the instructor or any other student</u>. Distracting behaviors such as private visitations (talking to your neighbor), reading newspapers, coming to class late and leaving early, or any other potentially disrupting behaviors are out of place. If the temptation arises, you are encouraged to absent yourself from class on that day(s). Questions and comments, of course, are always encouraged despite class size. Every effort will be made to make the classroom experience both profitable and enjoyable for all. If you feel you cannot live up to these minimum expectations, please exit the course now while you can still add another course of your choice. If you have questions, refer to the General Catalog - "Classroom Behavior."

<u>Student's Rights & Academic Honesty</u>:

It will be helpful to you, if you are familiar with your rights and responsibilities as a student, found in the Colorado State University General Catalog. Further, understanding the process regarding your educational records and the rights pertaining to those records are most valuable. Finally, please be reminded of the University policy on Academic Integrity found in the Colorado State University General Catalog. Please familiarize yourself with this policy, which applies to this class and all others at Colorado State.

<u>Schedule Changes</u>:

Last day to add: Wednesday, February 2, 2011
Last day to drop course without transcript record: Wednesday, February 2, 2011
Last day to take a "W": Monday, March 21, 2011

<u>"Incomplete" Grade</u>:

CSU General Catalog, " . . . a temporary grade of "I" may be given to a student who demonstrates the he/she could not complete the requirements of a course due to circumstances beyond the student's control and not reasonable foreseeable. A student must be passing a course at the time that an incomplete is requested…"

TRANSLATION: Please take responsibility for <u>your</u> education. This is not a grade designation to deal with an "F".

BMS305 LABORATORY

You will need:

- Your laboratory guide, lecture notes, and DVD.
- A blunt probe (called a “light mall probe” in bookstore)
- Exam gloves are required (available from local drug stores, bookstore and the CSU chemistry storeroom)
- A lab coat or other protective outer clothing is also very helpful
- Respect for animal donors

LABORATORY INFORMATION:

Radiographs, models and bones will be included in the lab and incorporated by mini-lectures, special demos, or your own observations.

All these materials may be on the lab practicals.

RULES:

1) NO FOOD OR DRINK IN LABS
2) NO ANATOMY MATERIAL LEAVES LABS
3) HANDLE BONES/MODELS WITH CARE - use pipe cleaners to point (not pencil or probe)
4) CLEAN UP AREA BEFORE LEAVING
5) DO NOT LEAVE LAB WITH GLOVES ON
6) WASH HANDS BEFORE LEAVING LAB ROOM
7) WIPE FEET BEFORE LEAVING LAB
8) NO VISITORS WITHOUT PERMISSION FROM THE COURSE INSTRUCTOR
9) NO PHOTOGRAPHS ARE ALLOWED TO BE TAKEN IN THE LAB

COLLEGE OF VETERINARY MEDICINE AND BIOMEDICAL SCIENCES

Guidelines for the Protection of Students From Environmental Hazards

A policy of the College of Veterinary Medicine and Biomedical Sciences (CVMBS) is maintained to identify, control or minimize environmental hazards associated with the work and study of undergraduate students, graduate students and veterinary medical students. It is the intent of this document to disclose potential risks so that students can make informed judgements about their participation in the college's curriculum and notify the college of any reasonable accommodations that may be required. Examples of potential health and safety hazards are: toxic drugs and chemical; inhalation anesthetics; physical agents such as ionizing and non-ionizing radiation; infectious biological agents; factors contributing to accidental injury; and stress and fatigue.

The CVMBS maintains environmental conditions, which provide adequate protection for the normal healthy student. The potential for human illness or injury increases when student or worker is pregnant, nursing an infant or temporarily disabled from any cause, i.e., broken leg, disease, etc.

The steps and procedures outlined in this document are designed to provide optimal protection to the student. These guidelines apply only to the CVMBS and are not to conflict with, or supersede University policy.

DEFINITIONS

1. Environmental Hazard: A condition or agent in the environment capable of adversely affecting the health and well-being of a student or unborn child.

2. Student: All persons formally enrolled in the CVMBS for the purpose of advancing their education. This includes: undergraduate, graduate, veterinary medical students, and post doctoral fellows.

3. Temporarily Disabled: Those students experiencing a transient condition that may make them more susceptible to potential environmental hazards.

RESPONSIBILITIES

1. Students are responsible for making decisions regarding their own health and/or the health of any unborn child or nursing infant and for evaluating the risks present in their academic programs.

2. The student is responsible for informing appropriate college personnel of a temporary disability and for requesting reasonable accommodation. Adequacy of protection is contingent upon following the prescribed procedures below.

THE TEMPORARILY DISABLED OR PREGNANT STUDENT SHOULD

1. Contact a physician immediately and receive recommendations for a plan to minimize exposure to the hazards possibly associated with a student's assignments.

2. Inform the Assistant Dean for Admissions and Advising of a temporary disability as early as possible in order that steps may be taken to provide reasonable accommodation.

AVAILABLE OPTIONS

1. Withdrawal as a student. The temporarily disabled student can consider withdrawing as a student and plan to be readmitted in the future. This option may minimize risks and reduce concerns regarding health and safety but has obvious impacts on the scheduled completion of academic work.

2. Continuation as regular student with schedule and assignment changes. This option may delay the time of graduation and may entail some risk.

BMS305 SYLLABUS
Domestic Animal Gross Anatomy
Spring 2020 - PreCOVID19

INSTRUCTORS/CONTACT INFORMATION

Christianne Magee, DVM, PhD, DipACT
Course Director, Assistant Professor
Office: 246 Physiology, 491-7371
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Kenny Ivie, BS, MS
Instructor
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Damon Mango, BA, MS
Graduate Teaching Assistant
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Damon.Mango@colostate.edu

Katie Juarez, BS, MS
Graduate Teaching Assistant
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Office hours: Weds 11-1pm
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COURSE INFORMATION

Prerequisites

Life102 or BZ110

Course Schedule

Lecture: Monday, Wednesday, Friday 1:00-1:50 pm – 104 Yates

Laboratory: W117 Anatomy/Zoology Building

Section 1: Thursday Lab 1:00-2:50 pm

Section 2: Thursday Lab 3:00-4:50 pm

Open Lab Hours: Monday, Tuesday 12-2 pm; Thursday, Friday 8 am-12 pm*
open labs are cancelled on Tuesday and Thursday of exam weeks for exam setup

Course Description and Objectives

BMS305 presents the gross anatomy of the carnivore (dog and cat), ruminant (ox, goat), horse and pig from a regional perspective, utilizing clinical applications as a basis for anatomical understanding. Other disciplines such as physiology, embryology, and histology will also be included when they assist in anatomical understanding.

The lecture portion of the course will include:

1. The skeletal, muscular, vascular, and nervous system components of the pelvic limb with an introduction to the nervous system.
2. The skeletal, muscular, vascular, and nervous system components of the thoracic limb.
3. The skeletal, muscular components of the neck and back; the vascular, nervous and organ system components of the thorax, abdomen and pelvis, including gastrointestinal, urinary, and reproductive organs.
4. An overview of cranial nerves, the central nervous system, skull, nasal and oral cavity, and neck.

The laboratory portion of the course includes:

1. The study of prosected animal cadavers
2. Computer facilitated study using Virtual Animal anatomy software. Emphasis on identifying relationships and locations of anatomical structures as well as practicing anatomical vocabulary.

The lecture and laboratory are intimately correlated and inseparable. ***Exams will integrate material from both lecture and laboratory sessions.***

For each hour (1 hr) of lecture or laboratory time, a student is expected to spend **2 additional hours** preparing for lecture/laboratory and/or reviewing the material. Please anticipate that you will need (on average ~4 hrs/week) dedicated laboratory study outside of the Thursday laboratory session. The laboratory, W117 A/Z, is shared by numerous courses but is available and staffed with Teaching Assistants for BMS 305 Open Lab on Monday and Tuesday from 12-2pm, and Thursday and Fridays from 8 am – 12 pm to help you with your study. *Historically, if you cannot attend any of these open lab sessions, your performance in the course may be jeopardized.*

TEXTBOOKS and LEARNING RESOURCES

REQUIRED: Canvas - https://colostate.instructure.com/
iClicker

OPTIONAL*: Dyce, Sack and Wensing. Textbook of Veterinary Anatomy.
Fails and Magee, Anatomy and Physiology of Farm Animals
Evans, H.E., Guide to the Dissection of the Dog
Spurgeon, T.L., Spurgeon's Color Atlas of Large Animal Anatomy

**We will discuss the merits of the optional texts on the first day of lecture. You only need the required resources for this course. If you use them correctly, you should not need any other resources.*

Course Objectives:

Students will be able to describe and identify, as well as understand relationships between bones, muscles, vessels and nerves of the thoracic and pelvic limbs, the head and neck and the thorax, abdomen and pelvis. Students will apply this knowledge to clinical cases and multi-species comparisons of anatomical features to categorize the importance of features within an animal or species.

The course has been designed to fit the needs of students in animal science, equine science and general biology, and for those preparing for careers in domestic animal care, pre-veterinary medicine, Bio-Education (Teachers!), as well as students simply interested in the physical construction of domestic animals.

EXAMINATION AND GRADING POLICIES

Laboratory Quizzes: There will be 7 laboratory quizzes. These will be worth 5 points each and there will be 2 in the first 3 units, and only 1 in the last unit. The course instructor will provide a reduced version of the laboratory objectives (20-30 terms/structures) from which the 5 quiz questions will be randomly selected. The quiz will be held during the regular laboratory session, with students rotating between the laboratory and quiz room and different questions asked during each quiz session. These are considered a practice for the laboratory exam. The lowest quiz score will be dropped (6 quizzes x 5 pts = 30 pts total). **There are no make-up Laboratory quizzes.**

Lecture Exams: There will be four written unit exams and an optional final comprehensive exam all administered on Canvas. Each unit exam will emphasize the material in that unit. Each of the four exams will consist of 50 points. The optional final comprehensive exam, should you decide to take it, can replace any one of the four written unit exams. Questions on these written exams will be taken from lectures, laboratory presentations, and handouts, and

	the required course texts. There will be no make-up exams. (4 lecture exams x 50 pts = 200 pts total) **If for any reason you cannot take the lecture exams at the scheduled time, you must contact Dr. Magee <u>IN ADVANCE</u> OF THAT EXAM.**
<u>Lab Practical Exams:</u>	There will be four lab practicals, each emphasizing the material in that unit. Each lab practical will consist of 50 points. You cannot drop any of the lab practical exam scores. Questions will be 75% identification of tagged structures on the specimens and 25% questions pertaining to them that will require integration of lecture material. These are entirely fill in the blank and unless indicated, accurate spelling is recommended, but not necessary. There will be no make-up exams. (4 lab practicals x 50 pts = 200 pts total) **If for any reason you cannot take the laboratory practical exam at the scheduled time, you must contact Dr. Magee, <u>IN ADVANCE</u> OF THAT EXAM.**
<u>Class Participation:</u>	There will be at least 11 class participation questions throughout the semester, each worth 1 point for the correct answer and 0.5 for an incorrect answer with attendance for a total of 10 points (allowing you to drop 1 question). These questions are open book and are designed to prepare you for lecture exams and test your knowledge of the material. The iClickers will be used for electronic submission of your answer. If you have not previously registered your iClicker, go to clicker.colostate.edu. If you have registered your iClicker before, you do not need to register it a second time. (10 iClickers x 1 pt = 10 pts total) **There are no make-up iClicker points.**
<u>Check-in Quizzes:</u>	There will be 11 weekly check-in quizzes. These will be worth 2.5 points each and there will be 3 in the first 3 units, and only 2 in the last unit. These are to test YOUR knowledge. They are open note, but preferably not open friend. The quiz will be available on Canvas from Monday to Monday each week. The lowest weekly check-in quiz score will be dropped (10 check-in quizzes x 2.5 pts = 25 pts total). **There are no make-up Check-in quizzes.**

The final grade will be computed from the grades of **<u>6 lab quizzes</u>** (30 points) **<u>four lecture exams</u>** (200 points), **<u>four lab practical exams</u>** (200 points), **<u>10 check-in quizzes</u>** (25 points), and **<u>10 iClicker questions</u>** (10 points) for a total of **<u>465 points</u>**. ***You*** can determine your overall grade at any time during the semester by dividing the actual points on your exams by the total points possible to that date. Partial credit (0.5 pt) is given for iClicker questions and weekly check-in quizzes only. No partial credit is given on exams, and exam scores are never "curved." Questions on lecture exams will always be evaluated for their validity and statistical measure before publishing exam scores.

Letter grades for the course will follow this format:

90% -100%	=	A	=	418.5 points and above
80% - 89%	=	B	=	372 - 418
70% - 79%	=	C	=	325.5 - 372.5
60% - 69%	=	D	=	279 - 325
Below 60%	=	F	=	278.5 and below

NOTE: The +/- grading system is NOT used in BMS305

- **REQUESTS FOR RE-GRADING OF ANY EXAM (LECTURE OR LAB) MUST BE MADE WITHIN 48 HOURS OF THE RETURN OF THE EXAMS**

- **LECTURE EXAMS ARE NOT MADE AVAILABLE IN CANVAS FOR YOU TO REVIEW, BUT YOU CAN MAKE AN APPOINTMENT WITH A GTA TO REVIEW YOUR LECTURE EXAMS**

- **GRADES ARE AN EVALUATION OF YOUR RESULTS, NOT OF YOUR EFFORTS**

- **GRADES ARE NOT NEGOTIABLE**

Student Accessibility:

The Department of Biomedical Science and the instructors of this course are dedicated to providing an environment conducive to learning for all students. Those students with learning differences or physical disabilities for which testing accommodation is needed must request those accommodations as early in the semester as possible and **no later than one week prior to the first LAB QUIZ.** For additional information, visit https://disabilitycenter.colostate.edu/. The Student Disability Center is located in room 121 of the TILT Building (west side of the Oval) and their phone # is (970) 491-6385 (V/TDD). The alternative laboratory practical exams will be held from 11:00 am-1:00 pm in W117 on the scheduled exam days. The lecture exams will be taken at the SDC at 1 pm OR 3pm after the laboratory exam has concluded. Accommodated quizzes will be held at 4 pm on quiz days during the second laboratory section (3-5 pm), so it is recommended that you register for the second lab section if you need accommodations.

Student's Rights & Academic Honesty:

It will be helpful to you, if you are familiar with your rights and responsibilities as a student, found in the Colorado State University General Catalog. Further, understanding the process regarding your educational records and the rights pertaining to those records are most valuable. Finally, please be reminded of the University policy on Academic Integrity found in the Colorado State University General Catalog. Please familiarize yourself with this policy, which applies to this class and all others at Colorado State. You are neither required to sign the **CSU Honor Pledge** before participating in the course, nor are you asked to write anything on your exams indicating your adherence to the Pledge. *Nonetheless, by participating in this course, you inherently demonstrate that you understand that because academic integrity, and the personal and social integrity of* *which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, that you will adhere to not giving, receive or using an unauthorized assistance during quizzes and/or examinations as part of this course.*

Minimum Expectations in Class:

This class is relatively large as enrollments go. Therefore, it is especially important that an atmosphere which maximizes learning opportunities is present at all times. Echo360 will be used to capture lectures and these videos will be provided on Canvas within 48 hours of the lecture, ***BUT there is no guarantee that there may be technical malfunction or that the lecturer may provide content in the the classroom (ie. on the whiteboard) that is no captured by the Echo360 system***. In addition to the points from class participation questions, there is a positive relationship between class attendance and performance in the course. We do expect all students present on a given day to be attentive, polite, and not a source of distraction to the instructor or any other student. Distracting behaviors such as private visitations (talking to your neighbor), reading newspapers, coming to class late and leaving early, or any other potentially disrupting behaviors are out of place. Please also leave your cell phones off or in your bags during class. **No phones or cameras are allowed in AZ W117**. Cell phones that are left on (and vibrate or ring!) during an exam will be confiscated by Dr. Magee and returned at the end of the day. Many students enjoy taking notes on personal computing devices (laptops, iPads, tablets, etc.). Please remember that if you are viewing material other than that which pertains to the class, so can the students and instructors sitting behind you. If the temptation arises, you are encouraged to absent yourself from class on that day(s). **Questions and comments, of course, are always encouraged despite class size.** Every effort will be made to make the classroom and laboratory experience both profitable and enjoyable for all. If you feel you cannot live up to these minimum expectations, please exit the course now while you can still add another course of your choice. If you have questions, refer to the CSU General Catalog - "Classroom Behavior."

Schedule Changes:

- Wednesday, February 5, 2020 - Registration closes. This is the last day to add/drop without a transcript record.
- Monday, March 23, 2020 - Last day to take a "W"

"Incomplete" Grade:

CSU General Catalog, " . . . a temporary grade of "I" may be given to a student who demonstrates the he/she could not complete the requirements of a course due to circumstances beyond the student's control and not reasonably foreseeable. A student must be passing a course at the time that an incomplete is requested..."

> **TRANSLATION:** Please take responsibility for your education. This is not a grade designation to deal with an "F".

BMS305
LECTURE AND LABORATORY SCHEDULE
SPRING 2020

UNIT 1 – PELVIC LIMB

Week 1:

W 1/22 Lecture 1: Introduction / general body plan - Magee

R 1/23 **Lab 1**: **Bones of the pelvic limb**
Laboratory Orientation and overview of bony landmarks
(Magee) *Bring Lecture Notes and Lab Guide for this first Laboratory*

F 1/24 Lecture 2: Introduction to bones, muscles, vessels & nerves: composition, strength, function – Madl

Week 2:

M 1/27 Lecture 3: Articulations - Garrett
iClicker questions will begin this week.
Week 1 Check-in Quiz due @ 8:00am

W 1/29 Lecture 4: Overview of Muscles of the Pelvic Limb: Regional anatomy of attachments, innervation, blood supply - Delcambre

R 1/30 **Lab 2 - Muscles of the pelvic limb**
Quiz 1: Lab 1

F 1/31 Lecture 5: Nervous system overview – Delcambre

Week 3:

M 2/03 Lecture 6: Vessels & nerves of the pelvic limb - Delcambre
Week 2 Check-in Quiz due @ 8:00am

W 2/05 Lecture 7: Articulation in the Pelvic Limb - Garrett
(***Note*** *– Registration closes, last day to add/drop the course)*

R 2/06 **Lab 3 - Vessels and nerves of the pelvic limb**
Quiz 2: Lab 2

F 2/07 Lecture 8: Stabilization of the Equine Pelvic Limb - Magee

Week 4:

M 2/10 Lecture 9: Comparative anatomy - Magee
Week 3 Check-in Quiz due @ 8:00am

W 2/12 Lecture 10: Review - Applied anatomy - Magee

R 2/13 Lab: LECTURE / LAB EXAM - UNIT 1 – PELVIC LIMB

UNIT 2 – THORACIC LIMB

F 2/14 Lecture 11: Thoracic limb bony landmarks & articulations – Garrett

Week 5:
M 2/17 Lecture 12: Extrinsic muscles of thoracic limb - Delcambre

W 2/19 Lecture 13: Intrinsic muscles of the thoracic limb - Delcambre

R 2/20 **Lab 4: Thoracic limb bones and musculature: bony landmarks and, intrinsic vs. extrinsic muscles**

F 2/21 Lecture 14: Vessels & nerves of the thoracic limb - Delcambre

Week 6:
M 2/24 Lecture 15: Features of the neck - Garrett
Week 5 Check-in Quiz due @ 8:00am

W 2/26 Lecture 16: Stabilization of the equine thoracic limb – Magee

R 2/27 **Lab 5: Vessels and nerves of the thoracic limb, Stabilization of the Equine Thoracic Limb**

Quiz 3: Lab 4

F 2/28 Lecture 17: Vertebral column & muscles – Garrett

Week 7:
M 3/02 Lecture 18: Spinal cord - Ivie
Week 6 Check-in Quiz due @ 8:00am

W 3/04 Lecture 19: Foot/Hoof – Madl

R 3/05 **Lab 6: Vertebral column bony features and musculature, spinal cord, features of the paw and hoof**

Quiz 4: Lab 5

F 3/06 Lecture 20: Gait – Magee

Week 8:
M 3/09 Lecture 21: Comparative anatomy - Magee

Week 7 Check-in Quiz due @ 8:00am

W 3/11 Lecture 22: Review - Applied anatomy - Magee

R 3/12 Lab: LECTURE / LAB EXAM – UNIT 2 – THORACIC LIMB

UNIT 3 – Trunk: Thorax, Abdomen, Pelvis (TAP)

F 3/13 Lecture 23: Thorax / Lungs – Garrett

SPRING BREAK 3/14-3/22

Week 9:

M 3/23 Lecture 24: Heart & great vessels of the heart – comparative anatomy – Ivie
(***Note*** *– last day to Withdraw from course is March 23rd*)

W 3/25 Lecture 25: Autonomic nervous system – Delcambre

R 3/26 **Lab 7: Thoracic wall, cavity, and viscera. Structures of the Autonomic Nervous System in the Thoracic Cavity**

F 3/27 Lecture 26: Abdominal wall - blood supply and inguinal canal – Garrett

Week 10:

M 3/30 Lecture 27: Abdominal viscera – Garrett
Week 9 Check-in Quiz due @ 8:00am

W 4/01 Lecture 28: Blood supply and return of abdominal viscera – Delcambre

R 4/02 **Lab 8: Abdominal wall, cavity, and viscera, including vascular structures and ANS structures in the abdomen.**
Quiz 5: Lab 7

F 4/03 Lecture 29: Equine large intestine - Magee

Week 11:

M 4/06 Lecture 30: Ruminant stomach - Mango
Week 10 Check-in Quiz due @ 8:00am

W 4/08 Lecture 31: Male reproductive tract - Magee

R 4/09 **Lab 9: Comparative GI. Overview of male/female reproductive organs. Pelvic cavity and viscera.**

Quiz 6: Lab 7

F 4/10 Lecture 32: Female reproductive tract – Magee

Week 12:
M 4/13 Lecture 33: Vessels & nerves of the pelvic cavity - Magee
Week 11 Check-in Quiz due @ 8:00am

W 4/15 Lecture 34: Clinical Cases and Review – Magee

R 4/16 Lab: LECTURE/LAB EXAM- UNIT 3 TAP

UNIT 4 – HEAD

F 4/17 Lecture 35: Skull & superficial features of the head – Juarez

Week 13:
M 4/20 Lecture 36: Cranial nerves & muscles – Ivie

W 4/22 Lecture 37: Cranial nerves & muscles – Ivie

R 4/23 **Lab 10: Bones of skull & structures of the head**

F 4/24 Lecture 38: Larynx, Pharynx - Magee

Week 14:
M 4/27 Lecture 39: Brain - Madl
Week 13 Check-in Quiz due @ 8:00am

W 4/29 Lecture 40: Vessels of head & Brain – Garrett

R 4/30 **Lab 11: Brain, Neck, Cavities, Pharynx, Larynx**
Quiz 7: Lab 10

F 5/01 Lecture 41: Oral cavity, nasal cavities, dentition – Garrett

Week 15:
M 5/04 Lecture 42: Eye, Ear - Garrett
Week 14 Check-in Quiz due @ 8:00am

W 5/06 Lecture 43: Clinical Cases and Review - Magee

R 5/07 Lab: LECTURE/LAB EXAM- UNIT 4 Head

F 5/08 Optional Lecture 44: The Neurologic Exam of the Dog – Whalen

BMS305 OPTIONAL COMPREHENSIVE FINAL EXAM (Lecture Content Only):

5/12 4:10-6:10 pm Meet in the AZ lobby at 4:00pm. Students will then be assigned to a computer laboratory for the exam, which will begin at 4:10 pm.

BMS305 LABORATORY

You will need:

- Respect for animal donors
- Your laboratory guide, lecture notes, and the Virtual Animal Anatomy programs that will be made available to you for free through Canvas.
- A **blunt** probe (called a "light mall probe" in the bookstore)
- Personal Protective Equipment for the laboratory - these items will be donned upon entering the laboratory and removed at the time of exit. This includes moving from the laboratory examination to the computer-based lecture examinations.
  - o Exam gloves are absolutely essential (available from local drug stores, bookstore and the CSU chemistry storeroom; Nitrile gloves are recommended above Latex gloves as the chemicals used for specimen preparation can penetrate through the latex gloves)
  - o A lab coat or some form of dedicated outerwear (ex. coveralls) is required. Other protective or dedicated clothing, including scrubs and waterproof shoes are helpful.
  - o If you are sensitive to the odor in the lab or have additional concerns about the combination of formaldehyde, phenol, and alcohol used for embalming, a respirator for formaldehyde and/or organic vapors may be useful. Please contact Dr. Magee for further information.

LABORATORY INFORMATION:

Radiographs, models and bones will be included in the lab and incorporated by mini-lectures, special demos, or your own observations. It is ***highly recommended*** that you review the **weekly tours**, **Virtual Animal Anatomy** program, and the **laboratory demonstration videos** before coming to lab each week so that you are better prepared for the laboratory session. All these materials may be on the lab practicals. The Teaching Assistants are there to help you access and review content, please feel free to ask them for guidance and assistance.

RULES:

1. NO FOOD OR DRINK IN LABS
2. NO PHOTOGRAPHY AT ALL IN THE LABORATORY
3. NO ANATOMY MATERIAL LEAVES LABS
4. HANDLE BONES/MODELS WITH CARE - use pipe cleaners to point (not pencil or probe)

5. CLEAN UP AREA BEFORE LEAVING
6. DO NOT LEAVE THE LAB WITH GLOVES ON
7. WASH HANDS BEFORE LEAVING LAB ROOM
8. NO VISITORS WITHOUT PERMISSION FROM THE COURSE INSTRUCTOR
9. NO SHORTS, SKIRTS, OR SANDALS OF ANY TYPE

COLLEGE OF VETERINARY MEDICINE AND BIOMEDICAL SCIENCES

Guidelines for the Protection of Students from Environmental Hazards

A policy of the College of Veterinary Medicine and Biomedical Sciences (CVMBS) is maintained to identify, control or minimize environmental hazards associated with the work and study of undergraduate students, graduate students and veterinary medical students. It is the intent of this document to disclose potential risks so that students can make informed judgements about their participation in the college's curriculum and notify the college of any reasonable accommodations that may be required. Examples of potential health and safety hazards are: toxic drugs and chemical; inhalation anesthetics; physical agents such as ionizing and non-ionizing radiation; infectious biological agents; factors contributing to accidental injury; and stress and fatigue.

The CVMBS maintains environmental conditions, which provide adequate protection for the normal healthy student. The potential for human illness or injury increases when student or worker is pregnant, nursing an infant or temporarily disabled from any cause, i.e., broken leg, disease, etc.

The steps and procedures outlined in this document are designed to provide optimal protection to the student. These guidelines apply only to the CVMBS and are not to conflict with, or supersede University policy.

DEFINITIONS

1. Environmental Hazard: A condition or agent in the environment capable of adversely affecting the health and well-being of a student or unborn child.
2. Student: All persons formally enrolled in the CVMBS for the purpose of advancing their education. This includes: undergraduate, graduate, veterinary medical students, and post-doctoral fellows.
3. Temporarily Disabled: Those students experiencing a transient condition that may make them more susceptible to potential environmental hazards.

RESPONSIBILITIES

1. Students are responsible for making decisions regarding their own health and/or the health of any unborn child or nursing infant and for evaluating the risks present in their academic programs.
2. The student is responsible for informing appropriate college personnel of a temporary disability and for requesting reasonable accommodation. Adequacy of protection is contingent upon following the prescribed procedures below.

THE TEMPORARILY DISABLED OR PREGNANT STUDENT SHOULD

1. Contact a physician immediately and receive recommendations for a plan to minimize exposure to the hazards possibly associated with a student's assignments.
2. Inform the Assistant Dean for Admissions and Advising of a temporary disability as early as possible in order that steps may be taken to provide reasonable accommodation.

AVAILABLE OPTIONS

1. Withdrawal as a student. The temporarily disabled student can consider withdrawing as a student and plan to be readmitted in the future. This option may minimize risks and reduce concerns regarding health and safety but has obvious impacts on the scheduled completion of academic work.
2. Continuation as regular student with schedule and assignment changes. This option may delay the time of graduation and may entail some risk.

BMS305 SYLLABUS
Domestic Animal Gross Anatomy
Spring 2020 – COVID-19 update

INSTRUCTORS/CONTACT INFORMATION

Christianne Magee, DVM, PhD, DipACT
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COURSE INFORMATION

Prerequisites

Life102 or BZ110

Course Schedule

Lecture: Lectures and slides are posted in advance on the Canvas homepage

Virtual Open Laboratory: There is no longer in person laboratory sessions either as regular lab on Thursdays nor Open Lab. Instead, please use the BMS305 Laboratory Canvas page to access our Virtual Open Lab through Zoom. TA staffed Virtual Open Lab hours are posted in Canvas and the space is available for you to meet with TAs or your peers during the posted times. While the space is available for use at all times, the BMS531 students have priority use during non-BMS305 lab hours.

Course Description and Objectives

BMS305 presents the gross anatomy of the carnivore (dog and cat), ruminant (ox, goat), horse and pig from a regional perspective, utilizing clinical applications as a basis for anatomical understanding. Other disciplines such as physiology, embryology, and histology will also be included when they assist in anatomical understanding.

The lecture portion of the course will include:

1. The skeletal, muscular, vascular, and nervous system components of the pelvic limb with an introduction to the nervous system.
2. The skeletal, muscular, vascular, and nervous system components of the thoracic limb.
3. The skeletal, muscular components of the neck and back; the vascular, nervous and organ system components of the thorax, abdomen and pelvis, including gastrointestinal, urinary, and reproductive organs.
4. An overview of cranial nerves, the central nervous system, skull, nasal and oral cavity, and neck.

The laboratory portion of the course includes:

1. The study of prosected animal cadavers will be not available for the remainder of spring 2020 semester due to COVID-19 campus closure
2. Computer facilitated study using Virtual Animal Anatomy software. Emphasis on identifying relationships and locations of anatomical structures as well as practicing anatomical vocabulary.

The lecture and laboratory are intimately correlated and inseparable. ***Exams will integrate material from both lecture and laboratory sessions.***

For each hour (1 hr) of lecture or laboratory time, a student is expected to spend **2 additional hours** preparing for lecture/laboratory and/or reviewing the material. Please anticipate that you will need (on average ~6 hrs/week) dedicated laboratory study time working with your TAs and classmates in the Virtual Open Lab (via Zoom). *Historically, if you cannot attend any of these open lab sessions, your performance in the course may be jeopardized.*

TEXTBOOKS and LEARNING RESOURCES

REQUIRED: Canvas - https://colostate.instructure.com/

OPTIONAL: *Dyce, Sack and Wensing. Textbook of Veterinary Anatomy.
Fails and Magee, Anatomy and Physiology of Farm Animals
Evans, H.E., Guide to the Dissection of the Dog
Spurgeon, T.L., Spurgeon's Color Atlas of Large Animal Anatomy

*There are now an unlimited number of online copies of the Dyce text available through the CSU Library. Some pictures from this text may be used for lectures and Canvas based exams. All images or figures will have been used in the course prior to the exam.

Course Objectives:

Students will be able to describe and identify, as well as understand relationships between bones, muscles, vessels and nerves of the thoracic and pelvic limbs, the head and neck and the thorax, abdomen and pelvis. Students will apply this knowledge to clinical cases and multi-species comparisons of anatomical features to categorize the importance of features within an animal or species.

The course has been designed to fit the needs of students in animal science, equine science and general biology, and for those preparing for careers in domestic animal care, pre-veterinary medicine, Bio-Education (Teachers!), as well as students simply interested in the physical construction of domestic animals.

EXAMINATION AND GRADING POLICIES

Lab Practical Exams: Each lab practical will consist of 50 points. While we have done lab practical examinations for the first two units, **we will not perform lab practical exams for the last two units (head & TAP)**. You cannot drop any of the lab practical exam scores from the first two units. (2 lab practical exams x 50 pts ea = 100 pts total)

Written Exams: There will be a total of four written (or lecture) unit exams (administered through Canvas) and an optional final comprehensive exam (administered on ProctorU). Each unit exam will emphasize the material in that unit. Each of the four lecture exams will consist of 50 points. We have already done exams for units 1 and 2. **You may begin exams 3 and 4 anytime between 8am-8pm on the exam dates listed on the Canvas homepage. Once you start an exam, you will have only 2 hours to complete it. These exams are intended to be closed book, closed note, and closed friend (Please review the CSU Honor Pledge).** Questions on exams 3 and 4 will be taken from lectures, laboratory presentations, and handouts, and the Dyce Anatomy course text. They will look like a combination of the check-in and Canvas "lab" quizzes. The optional final comprehensive exam, should you decide to take it, can replace any one of the written exam scores from units 1 or 2, or it can replace the entire score for unit exams 3 or 4. Taking the comprehensive final (or not) cannot hurt your grade in any way. There will be no make-up exams. (4 written exams x 50 pts = 200 pts total) **If for any reason you cannot take the Written exams on those dates, you must contact Dr. Magee IN ADVANCE OF THAT EXAM.**

Laboratory Quizzes: There will be 10 laboratory quizzes each worth 5 points. We have already done 4 quizzes during the first two units on campus (pelvic and thoracic limbs). The remaining 6 "lab" quizzes will take place on Canvas. We have added a laboratory quiz for the semester so we will do 3 for the head unit, and 3 for TAP. Since they are now open book and open note, **there is no short lists of objectives for these quizzes**. We still encourage you to use the short lists to guide your study at first, but **anything from the previous exercises will be fair game on these lab quizzes**. You will have 30 minutes to complete the quiz and the remaining "lab" quizzes are **due at 8pm** on the due dates listed on the BMS305 Canvas homepage. The lowest lab quiz score will be dropped (9 quizzes x 5 pts = 45 pts total).

Check-in Quizzes: There will be 12 weekly check-in quizzes each worth 2.5 points. We have added an additional check-in quiz so there will be 3 for each of the 4 units, plus one additional syllabus quiz for the second half of the semester (also 2.5 points). The check-in quizzes are to test YOUR knowledge. They are open note, but preferably not open friend. The check-in quizzes will be **due at 8pm** on due dates listed on the Canvas homepage, and within the assignments tab. The weekly check-in quizzes will not always be due on Mondays. Please refer to the due dates listed on the Canvas homepage when planning for these check-in quizzes. You can still drop 1 check-in quiz (12 quizzes x 2.5 pts = 30 pts total). **There are no make-up Check-in quizzes.**

Guided Quizzes: There will be 6 guided quizzes, each worth 7.5 points. There will be 3 guided quizzes for unit 3, and 3 quizzes for unit 4. These are new opportunities intended to be guide you in your study and allow you to earn points not able to be obtain from lab exams for units 3 and 4. The guided quizzes follow a linear progression and are meant to provide you a mixture of instruction and knowledge assessment. **The 3 guided quizzes for each unit will be due all at once at 11:59pm the night before the respective unit**

exam dates. While the "lab" and check-in quizzes have individual weekly due dates, we wanted to give you more flexibility in finishing your guided quizzes. You will also have two opportunities to complete each guided quiz, but no more than 30 minutes per attempt (6 guided quizzes x 7.5 pts = 45 pts total)

Class Participation: There have been 9 iClicker questions asked in lecture throughout the semester so far with the anticipation of there being significanlty more than 10 more events to count for a total of 10 points. Without the ability to have in-class activities in an asynchronous environment for the remainder of the semester, all students are getting 10 points for their course participation.

The final grade will be computed from the grades of **2 lab practical exams** (100 points), 4 **written exams** (200 points), **lab quizzes** (45 points), **12 check-in quizzes** (30 points), **guided quizzes** (45 points) , and **Class Participation** (10 points) for a total of **430 points**. ***You*** can determine your overall grade at any time during the semester by dividing the actual points on your exams by the total points possible to that date. Partial credit (0.5 pt) is given for iClicker questions and weekly check-in quizzes only. No partial credit is given on exams, and exam scores are never "curved." Questions on lecture exams will always be evaluated for their validity and statistical measure before publishing exam scores.

Letter grades for the course will follow this format:

90% -100%	=	A	=	387 points and above
80% - 89% =	B	=	344 to 386.9	
70% - 79% =	C	=	301-343.9	
60% - 69% =	D	= 258-300.9		
Below 60%	=	F	=	less than 258 points

NOTE: The +/- grading system is NOT used in BMS305

- **REQUESTS FOR RE-GRADING OF ANY EXAM (WRITTEN OR LAB) MUST BE MADE WITHIN 48 HOURS OF THE RETURN OF THE EXAMS OR POSTING OF EXAM SCORES**

- **WRITTEN EXAMS ARE NOT MADE AVAILABLE IN CANVAS FOR YOU TO REVIEW, BUT YOU CAN MAKE AN APPOINTMENT WITH A GTA TO REVIEW YOUR WRITTEN EXAMS THROUGH MICROSOFT TEAMS**

- **GRADES ARE AN EVALUATION OF YOUR RESULTS, NOT OF YOUR EFFORTS**

- **GRADES ARE NOT NEGOTIABLE**

- ***CSU is implementing an S/U grading practice for both online and campus classes for spring 2020 only. Following the end of semester grade posting for spring semester 2020, students will be able to request a satisfactory/unsatisfactory grade rather than traditional letter grade up until June 5th for any course taken in this semester. The S/U policy applies to all spring 2020 undergraduate and graduate courses. Please note that students must receive a grade of C or better to receive a Satisfactory. You can learn more about S/U grading policies on CSU's grading policy website.***

Student Accessibility:

The Department of Biomedical ScienceS and the instructors for this course are dedicated to providing an environment conducive to learning for all students. Those students with learning differences or physical disabilities for whom testing accommodation is needed must request those accommodations as early in the semester as possible and **no later than one week prior to the first LAB QUIZ.** For additional information, visit https://disabilitycenter.colostate.edu/. The Student Disability Center is located in room 121 of the TILT Building (west side of the Oval) and their phone # is (970) 491-6385 (V/TDD). Additional time has provided for all students to accommodate both documented and unexpected needs during online testing. ***If a student anticipates requiring further additional time, please let Dr. Magee know of this request as soon as possible, but no later than 48 hours prior to an assessment due date/time.***

Student's Rights & Academic Honesty:

It will be helpful to you, if you are familiar with your rights and responsibilities as a student, found in the Colorado State University General Catalog. Further, understanding the process regarding your educational records and the rights pertaining to those records are most valuable. Finally, please be reminded of the University policy on Academic Integrity found in the Colorado State University General Catalog. Please familiarize yourself with this policy, which applies to this class and all others at Colorado State. You are neither required to sign the **CSU Honor Pledge: "I have not given, received, or used any unauthorized assistance"** before participating in the course, nor are you asked to write anything on your exams indicating your adherence to the Pledge. ***Nonetheless, by participating in this course, you inherently demonstrate that you understand that because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, that you will adhere to not giving, receive or using an unauthorized assistance during quizzes and/or examinations as part of this course.*** **Furthermore, we ask that no quiz or exam materials be obtained or disseminated by students so that we may maintain the integrity of the course for future students. An Academic Misconduct Incident Report will be submitted for any student(s) not adhering to CSU's Student Conduct Code and Academic Integrity Policies.**

Schedule Changes:

- Friday, May 8, 2020 – course withdrawal period ends (Last day to take a "W"),
- Friday, May 8, 2020 - Repeat/Delete requests due

"Incomplete" Grade:

CSU General Catalog, " . . . a temporary grade of "I" may be given to a student who demonstrates the he/she could not complete the requirements of a course due to circumstances beyond the student's control and not reasonably foreseeable. A student must be passing a course at the time that an incomplete is requested..."

TRANSLATION: Please take responsibility for your education. This is not a grade designation to deal with an "F".

Revised Spring Schedule due to COVID-19

UNIT 3 – HEAD & NECK (all lecture videos and slides are posted to Canvas)

Lecture 23: Skull & Superficial Features of the Head

Lecture 24: Autonomic Nervous System (ANS)

Lecture 25: Cranial Nerves

Laboratory manual ANS (Tour pg 86-87 and Objectives pg 104) and start Exercise 10

March 27th - Head/Neck Check-In Quiz 1 Due at 8pm (Lectures 23-25) - 2.5 points

March 30th - Canvas Head/Neck Lab Quiz 1 - ANS, Cranial Nerves, Skull Superficial Features. We are no longer using the short objectives as these are open resource quizzes, but the questions are directly from Lectures 23-25 and the material in the Virtual Animal Anatomy program. All subsequent Canvas Lab quizzes will follow this format **- 5 points**

Lecture 26: Cranial Nerves & Facial Muscles

Lecture 27: Larynx, Pharynx

Lecture 28: Brain

Finish Laboratory Exercise 10, Start Exercise 11

April 1st - Head/Neck Check-In Quiz 2 Due at 8pm (Lectures 26-28) - 2.5 points

April 3rd - Head/Neck Lab Quiz 2 Due at 8pm - Lectures 26-28 - 5 points

Lecture 29: Vessels of the Head and the Brain

Lecture 30: Oral Cavity, Nasal Cavities, Dentition

Lecture 31: Eye, Ear

Lecture 32: Clinical Cases and Review

Finish laboratory Exercise 11

April 6th - Head/Neck Check-In Quiz 3 Due at 8pm (Lectures 29-32) - 2.5 points

April 8th - Head/Neck Lab Quiz 3 Due at 8pm - Lectures 29-32 - 5 points

Guided Quizzes for this unit are DUE at 11:59pm April 8th

April 9th - Exam 3 - Canvas Exam - NOT OPEN BOOK (Honor code, please) - 50 points - This exam will look like a combination of the Check-in and Canvas Lab quizzes. It will be available to begin anytime between 8am-8pm, but you will only have 2 hours to complete the exam.

UNIT 4 – THORAX, ABDOMEN & PELVIS

Lecture 33: Thorax and Lungs

Lecture 34: Heart and Great Vessels of the Heart

Lecture 35: Abdominal Wall and Inguinal Canal

Exercises for Laboratory 7 (repeat ANS material, please)

April 17th - TAP Check-In Quiz 1 Due at 8pm (Lectures 33-35) - 2.5 points

April 20th - TAP Lab Quiz 1 Due at 8pm - Lectures 33-35 - 5 points

Lecture 36: Abdominal Viscera

Lecture 37: Blood Supply and Return of Abdominal Viscera

Lecture 38: Equine Large Intestine

Lecture 39: Ruminant Stomach

Exercise for Laboratory 8

April 24th - TAP Check-In Quiz 2 Due at 8pm(Lectures 36-39) - 2.5 points

April 27th - TAP Lab Quiz 2 Due at 8pm - Lectures 36-39 - 5 points
Lecture 40: Developmental Reproductive Anatomy & Urinary System

Lecture 41: Female Reproductive System

Lecture 42: Male Reproductive System

Lecture 43: Clinical Cases and Review

Exercises for Laboratory 9

May 1st - TAP Check-In Quiz 3 Due at 8pm (Lectures 40-43) - 2.5 points

May 4th - TAP Lab Quiz 3 Due at 8pm - Lectures 40-43 - 5 points

Guided Quizzes for this unit are DUE at 11:59pm May 6th

May 7th - Exam 4 - Canvas Exam - NOT OPEN BOOK (Honor code, please) - 50 points - This exam will look like a combination of the Check-in and Canvas Lab quizzes. It will be available to begin anytime between 8am-8pm, but you will only have 2 hours to complete the exam.

Optional Lecture 44: Neurological Exam of the Dog/ Cases Studies with Dr. Whalen

May 12th - BMS305 OPTIONAL COMPREHENSIVE FINAL EXAM (Lecture Content Only - can replace the lowest lecture exam score for Units 1 or 2, or the lowest score for Exam 3 or Exam 4) - Canvas Exam - NOT OPEN BOOK (Honor code, please) - 50 points

BMS305 VIRTUAL LABORATORY

Please join the BMS305 Laboratory Canvas page – this site will provide you with Discussion Board access to Teaching Assistants, the Virtual Laboratory hosted in Zoom, and additional resources.

What you will still need:

- Respect for animal donors – all previous social media policies apply in the virtual environment. Screen captures of course material may be created to post Discussion board questions and/or shared in the Zoom laboratory only. Sharing materials outside of the BMS305 learning environment is unacceptable. For the

CVMBS Media policy, please see http://csu-cvmbs.colostate.edu/Documents/cvmbs-social-media-policy.pdf

- Your laboratory guide, lecture notes, and the Virtual Animal Anatomy programs – these are still the foundation for this course. Use these materials simultaneously to ensure an integrated approach to your learning.
- Your “Classroom Behavior” in our online and virtual spaces remains a reflection of you as a professional learner. Every effort will be made to make the online experience both profitable and enjoyable for all, please do what you can to support your fellow students and TAs as we all navigate this new environment together. If you have any general policy questions, please refer to the CSU General Catalog - "Classroom Behavior."

Resources Available to you:

- **Discussion Boards** on the **BMS305 Laboratory Canvas** page. Feel free to post a question, answer a question, or use these questions to guide your study.
- Virtual Laboratory hosted in Zoom. Join the TAs at specific times posted on the **BMS305 Laboratory Canvas** page for guided study. While the Zoom space is theoretically always available for you to meet your peers to study, please note that BMS531 students will have priority study time during non-BMS305 study hours and that all activities in the Zoom room will be monitored by the teaching faculty to ensure a professional, academic environment.
    - When using Zoom, ensure that you have a school-appropriate background and attire before joining. You can also blur out the background on you video display.
    - Please join the session on mute and introduce yourself and any specific questions you may have when you via the “chat” portal when you join. Please also join with your video off to reduce server load for the session. You may be asked to turn your video on or screen share by the TA, so be sure that your computer screen desktop display is appropriate for sharing.

How To Do Well in BMS 305

- **Use the resources available to you**
  - Videos of the lab demos will be provided before lab – watch them to prepare for lab!
  - Attend lecture, and then watch the Echo360 version again to review the material

- **Attend open labs**
  - Your Thursday anatomy lab time is not enough to learn and identify all the objectives in your lab manual. Open Lab is staffed with TAs who are there to help you.
  - It extremely difficult to do well in this class if you do not dedicate A LOT of time to open lab.
  - Take time to study the special prep dissections. If they are not labeled in a way that you understand, ask Dr. Magee, Dr. Madl, Dr. Delcambre or a TA to explain them to you.
  - Look at the anatomical posters and diagrams hung on the walls drawn by Dr. Lee.
  - Pay attention to specific anatomical differences between the species (Horse vs. Dog. vs. Cow) and why these differences are important.

- **Study with your classmates**
  - Test each other in open lab, "What is this structure?", "What nerve innervates this muscle?", "What nerve passes through this foramen?"
  - Have your TA's test you during anatomy lab or during open labs.
  - The dog bones are available on reserve at the library. Use them with your VCA.

- **Study before and after each lecture**
  - For Example: If the lecture will be on bones of the thoracic limb, look over the VCA before class or lab. Now you will at least be familiar with the terms and concepts presented during lecture.
  - Practice relating what you learned in lecture and lab, you will notice that lecture questions will be integrated into the laboratory exams and vice versa.
  - Use the drawings in the lab guide to draw out muscle attachments, nerve and vessel branching/paths. If a diagram has been discussed in lecture, you will see it again.
  - Make flashcards. These often help with memorizing innervations, attachments and insertions for muscles.

- **Don't just memorize the material**
  - Try to relate each structure to its function, when finding a structure think back to what you learned in lecture about it.
  - Use your VCA and read the descriptions of each structure.

- **Practice writing out the names of the structures before exams**
  - If you've practiced spelling and writing out the names of the structures you'll be one step ahead for the exams.
  - Don't forget to name the specific bone, muscle, artery, vein, nerve, tendon etc, which accompanies each structure.

- **Create your own exam practice**
  - Have a friend or TA point to a structure and give yourself 60 seconds to write down the name of the structure on a piece of paper.
  - Have friends create lecture questions and test one another. The material highlighted in lecture will often come back as a multiple choice question or a laboratory exam question.

- **Go to Class and Office Hours**
  - Anatomy is a fast paced subject, and it builds on itself from Day 1. Don't wait if you have questions. Attend office hours, ask the GTA or TAs if you are confused about a concept.

Course 2: BMS305 Honors Breakout (BMS496D)

Course Proposal for CSU Honors Program (pg 37-43)

2014 course proposal

Syllabus Spring 2020 (Magee, Course Director) (pg 44-45)

Relatively seamless adaptation to online instruction in MicrosoftTeams. Students are unable to complete their skull articulations but have been given the option of completing them when we return for RI instruction.

NEW HONORS COURSE OR SECTION PROPOSAL

INSTRUCTOR: Christianne Magee, DVM, PhD

INSTRUCTOR POSITION OR APPOINTMENT: Assistant Professor of Biomedical Sciences

COURSE/SECTION TITLE: Honors: Domestic Animal Gross Anatomy

COURSE/SECTION SUBJECT & NUMBER (e.g., BZ 310): BMS495 SP15, BMS496D SP16

Description of Honors Course or Breakout Section:
This breakout session requires students to prepare and assemble anatomical specimens related to topics of study within BMS305. Students will also participate in clinical case studies in anatomy. This opportunity will not only reinforce their knowledge of anatomy but also their integration of physiology and other core pre-professional curriculum. Students will read, discuss and solve these case studies using a "flipped" classroom model, group study, and individual presentation of knowledge and/or experience related to the case. The co-requisite course, Domestic Animal Gross Anatomy (BMS 305) will provide the background information for students as they build their anatomical specimens, solve case studies, and complete their final reflection papers.

Written & Oral Communication: *Honors students are expected to retain and advance oral and written communication skills in their discipline. Formal writing assignments should involve a recursive process of draft, review, and revise. Oral communication involves a presentation to the class as an individual or group activity. You may want to use some class time for explaining assignments, peer reviews, comment on drafts, etc. Please provide a description of how you will require written and oral communication elements in your course or section.*
Written: Students will engage in written summaries related to the clinical cases, which they will present and use to solve the case orally with other groups (see below). Students are also required to write a short reflection paper regarding an anatomical feature, its clinical importance, and possible injury and repair.
Oral: In small groups, students will present information regarding the clinical cases. Each group will have been assigned a different part of the "puzzle" and will work together in the session to solve the clinical case using their various "pieces" of information. This will build teamwork and critical thinking skills in addition to oral communication skills. Students will also be orally challenged for the extent of their anatomical knowledge by the course director at the completion of each of their anatomical specimens regarding relevant features of the specimen. This is very similar to "rounds" that occurs in a professional medical setting, but without the additional challenge of an audience of peers.

Honors Competencies and Skills for Honors Studies ("PICC" feedback): *The CSU University Honors Program has prioritized four general competencies skills that should be addressed in each honors course. These skills include (1) **P**rofessionalism, interpersonal skills, and emotional intelligence; (2) **I**nterdisciplinary learning integrated with global and/or cultural viewpoints; (3) **C**ritical thinking; and (4) **C**reativity and problem solving. This is a two-stage process. First students complete a self-evaluation of these skills at the beginning of the semester. At the end of the semester instructors will provide feedback on individual student progress towards these competencies. The feedback is part of the University Honors Program; it is for advising purposes only and is confidential. It is not part of a student's grades or academic record. A standardized rubric (appended) is used to provide feedback for growth in these areas and to measure the Honors Programs progress in helping students to develop these skills through their academic career.*

PROFESSIONALISM: Students will be required to communicate effectively with laboratory coordinators for the assembly of 3 anatomical specimens. This requires coordinating schedules and specimen availability with the coordinators as well as attentiveness to the needs of other students conduction assembly (aka. "sharing" of assembly equipment/resources). Feedback in this area will be provided by the animal anatomy coordinators, Drs. Robert E. Lee and Jeremy Delcambre to Dr. Magee. Communication with course director during specimen evaluation and the guided oral knowledge challenge will be used to guide the student's ability to recall relevant information, integrate knowledge across the curriculum, and communicate in a manner that is informative. Students will be encouraged to remain calm, breathe, avoid becoming defensive, and use their analytical skills developed in the course to answer the questions. The groups sessions for clinical cases will provide an opportunity to foster a healthy group dynamic (equal participation, shared leadership, etc.) in addition to an individual's attentiveness and respect for others, both as a presenter to accept by appreciating the knowledge/opinion of others, as well as a listener who is able to provide constructive commentary. The final Pecha Kucha and reflection paper will provide opportunities for the students to demonstrate the spectrum of their professional communication skills. The student will be assessed by the following: 1) the ability to clearly communicate the relative importance of their anatomical feature or other discussion opinion in an unbiased way; 2) the student routinely seeks consensus during discussion, clarifies and articulates different points of view during discussion, keeps the discussion moving forward in the face of conflicting viewpoints.

Mastered: Student clearly communicates the relative importance of their anatomical feature or other discussion opinion in an unbiased way, seeks consensus during discussion, clarifies and articulates different points of view during discussion, keeps the discussion moving forward in the face of conflicting viewpoints.

Proficient: Student clearly communicates the importance of their anatomical feature or other discussion opinion, highlights relative importance with some level of bias, facilitates discussion without seeking consensus, acknowledges different points of view without clarifying or articulating them, usually keeps the discussion moving.

Developing: Student clearly communicates some but not all of the relevant anatomical features, highlights importance or lack there of various anatomic features while demonstrating some bias, acknowledges some but not all points of view, tries to keep the discussion moving with limited success.

Beginning: Student does not effectively communicate the importance of their anatomical feature or other discussion opinion, summarizes some aspects of anatomy without integration of importance to general function, passively listens to different points of view without acknowledging them, participates in the discussion without moving it forward.

INTERDISCIPLINARY LEARNING: Case studies in clinical medicine require integration of ideas from various fields of science. Each student has unique academic and personal histories that allow him or her to bring forward their distinctive knowledge. Whenever appropriate to the clinical cases or other topics, other relevant aspects (e.g.) social, global, etc.) will be included. The student will be assessed by the following: 1) the ability to independently formulate arguments and share conclusions; 2) the ability to integrate various aspects of anatomy while synthesizing the form and function of anatomical features covered in lecture, other articles read for this class, and knowledge gained outside of class.

Mastered: Student independently formulates arguments and draws conclusions by integrating various aspects of anatomy while synthesizing the form and function of anatomical features covered in lecture, other articles read for this class, and knowledge gained outside of class.

Proficient: Student independently draws conclusions about various aspects of anatomy and synthesizes it with some topics covered in lecture, other articles, or other knowledge.

Developing: Student, when prompted, draws simple conclusions about anatomy and relates them to other topics.
Beginning: Student, when prompted, can identify anatomical features without synthesizing them with other topics.

CRITICAL THINKING: Clinical cases allow students to develop critical thinking skills utilizing the SOAP (Subjective, Objective, Assessment, Problem) approach for development of analytical skills. With case-based teaching, students are able to incorporate and reflect on numerous experiences and didactic course work to apply that knowledge to the case being studied. Students will be assessed by the following: 1) the student's ability to critically analyze a clinical case and clearly identifying a problem list; 2) the ability to draw on other sources and organize thoughts in a highly logical way; 3) the ability to critically and logically develops an assessment and plan for the clinical case.

Mastered: Student critically analyzes clinical case clearly identifying a problem list, drawing on other sources and organizing thoughts in a highly logical way; student critically and logically develops an assessment and plan.
Proficient: Student forms conclusions about the clinical case, highlighting some of the problems, drawing on other sources and organizing thoughts in a mostly logical way; student critically and logically evaluates parts of the assessment and plan.
Developing: Student forms conclusions about the clinical case, highlighting few of the problems, and organizes thoughts in a somewhat logical way; student summarizes assessment and plan without much critical evaluation.
Beginning: Student forms very simple conclusions about the clinical case without highlighting problems; thoughts are not fully organized or logical; student does not provide assessment or plan for case.

CREATIVITY & PROBLEM SOLVING: *Assembly of a bony anatomical specimen requires patience, creativity, and some downright ingenuity. No two specimens are alike, many have pathology, and all require some degree of problem solving. Students are encouraged to use their specimens as study aides in BMS305 by enhancing their specimens with additional elements to represent muscles, muscular attachments, and/or neurovascular structures. Development of Pecha Kucha presentation requires selection of topics and demonstration of ideas that will require both some creativity and resolution of the final outcome.*

Students will be assessed by 1) their ability to devises alternative methods for achieving articulation of specimen; 2) thoughtful and logical assessment of importance of anatomical feature chosen for reflection; 3) the accuracy eloquence by which they describe their anatomical feature via PechaKucha and reflection paper; 4) the thoughtful and creative questions asked to stimulate discussion during breakout sessions.

Mastered: Student devises alternative methods for achieving articulation of specimen, thoughtful and logical assessment of importance of anatomical feature chosen for reflection, and PechaKucha and reflection paper accurately and eloquently describe anatomical feature; student asks thoughtful and creative questions to stimulate discussion during class discussion.
Proficient: Student devises alternative methods for achieving articulation of specimen with some prompting, logical assessment of importance of anatomical feature chosen for reflection, and PechaKucha and reflection paper accurately describe anatomical feature; some of the questions asked by the student are thoughtful and creative during class discussion.
Developing: Student rarely devises alternative methods for achieving articulation of specimen without prompting, assessment of importance of anatomical feature chosen for reflection, PechaKucha and reflection paper all

require some assistance in development; some of the questions asked by the student are thoughtful but lack creativity.

Beginning: Student unable to devises alternative methods for achieving articulation of specimen even with some prompting, unable to recognize importance of an anatomical feature for reflection; student asks straightforward or obvious questions.

Course/breakout section syllabus: *Please see attached syllabi. Please note that Weeks 14 and 15 of the breakout session are dedicated to communication via the final reflection papers and PechaKucha; however, written and oral communication will be assessed throughout the course.*

Course Timeline

Week 1: Course Organizational Meeting.

Objectives: 1) Assignment of specimens; 2) Tour of laboratory and facilities for specimen preparation; 3) Scheduling of meeting time with laboratory coordinator(s) to begin assembly; 4) Assignment of reading for Week 4 (average student work on specimen ~3hrs/week)

Week 2: Assembly of Thoracic Limb

Objectives: 1) Evaluation of student progress with assembly and group review of bony articulations of prepared specimens (average student work on specimen ~3hrs/week); 2) Students assigned PICC

Week 3: Assembly of Thoracic Limb

Objectives: 1) Evaluation of student progress with assembly and group review of bony articulations of prepared specimens; 2) Compare and contrast bony features of bony specimens (size of animal, species, breed, age, pathology, etc. (average student work on specimen ~ 3 hrs/week); 3) PICC student self-assessment due

Week 4: Final Assembly of Thoracic Limb

Objectives: 1) Evaluation of finished specimen and any additional enhancements; 2) oral anatomical feature “challenge” by course director outside of class time; 3) group discussion using enhanced specimens to related form and function of anatomical specimens; 4) Students schedule Pelvic Limb assembly start; 5) Discussion of reading Assigned from Week 1 (Topic related to thoracic limb locomotion and joint stability); 4) Student PICC self-assessment returned)

Week 5: Start Assembly of Pelvic Limb

Objectives: 1) Evaluation of student progress with assembly and group review of bony articulations of prepared specimens; 2) Assignment of reading for Week 8 (average student work on specimen ~3hrs/week)

Week 6: Assembly of Pelvic Limb

Objectives: 1) Evaluation of student progress with assembly and group review of bony articulations of prepared specimens; 2) Compare and contrast bony features of bony specimens (size of animal, species, breed, age, pathology, etc.)

Week 7: Assembly of Pelvic Limb

Objectives: 1) Evaluation of student progress with assembly and group review of bony articulations of prepared specimens; 2) Compare and contrast bony features of bony specimens (size of animal, species, breed, age, pathology, etc. (average student work on specimen ~ 3 hrs/week)

Week 8: Final Assembly of Pelvic Limb

Objectives: 1) Evaluation of finished specimen and any additional enhancements; 2) oral anatomical feature "challenge" by course director outside of class time; 3) group discussion using enhanced specimens to related form and function of anatomical specimens 4) Students schedule Head/Vertebral column assembly start; 5) Discussion of reading Assigned from Week 5 (Topic related to pelvic limb locomotion and joint stability)

Week 9: Embryology and Anatomy

Objectives: 1) Embryology lecture by Dr. Magee followed by discussion of embryology and how it can fail in normal anatomy, resulting in clinical disease; 3) Assignment of Clinical Case Study 1 (PDA)

Week 10: Clinical Case Study 1 - Work Session

Objectives: 1) Small Group Discussions of Clinical Case Study 1 Part A; 2) Class develops SO of SOAP

Week 11: Clinical Case Study 1 – Presentation Part A

Objectives: 1) Small Group Presentations of Clinical Case Study Part A; 2) Class develops AP of SOAP; 3) Assignment of Clinical Case 2

Week 12: Clinical Case Study 1 – Presentation Part B

Objectives: 1) Small Group Presentations of Clinical Case Study Part B (PDA case); 2) "solving" part B of Case 1; 3) Hand in worksheets from Case 1; 4) Assign Clinical Case Study 2 (Neurologic deficit); 5) Draft of reflection paper due

Week 13: Clinical Case Study 2

Objectives: 1) Class SOAP of patient; 2) Discussion of nerve blocks and their use in clinical cases;

Week 14: Mini Pecha Kucha of Reflection Papers

Objectives: 1) Reflection paper drafts returned

Week 15: Mini Pecha Kucha of Reflection papers

Objectives: 1) Reflection paper final draft due by 5pm May 5th

FEEDBACK RUBRIC

Assessment Category	Mastered	Proficient	Developing	Basic
1. Critical thinking: Student advances a position with specific theses or hypotheses & can conceptualize ideas or lines of thought. Conclusions and related outcomes acknowledge complexities of an issue (implications and consequences) and recognize differing points of view. Formulates & develops claims with sufficient support, including reasoning, evidence, & persuasive appeals, & proper attribution where necessary. Uses written and oral communication effectively in persuasive arguments.	Position is imaginative & takes into account the complexities of an issue. Limits of position are acknowledged & others' points of view are synthesized within position. Conclusions &/or outcomes are logical & reflect student's informed evaluation & ability to place evidence & perspectives discussed in priority order. Formulates & develops insightful claims with compelling reasoning, evidence, & persuasive appeals, using professional standards of attribution. Highly effective use of written and oral communication in persuasive arguments.	Position takes into account complexities of an issue; others' points of view are acknowledged. Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences & implications) are identified clearly. Formulates clear & coherent claims either directly (thesis statements) or indirectly, with sufficient reasoning & evidence, & with proper attribution where necessary. Effective use of written and oral communication in persuasive arguments.	Position acknowledges different sides of an issue. Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences & implications) are identified clearly. Identifies & appraises support provided for claims made by writers &/or speakers; understands conventions used in proper attribution. Adequate use of written and oral communication in persuasive arguments.	Position is stated, but is simplistic & obvious. Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences & implications) are oversimplified & not well developed. Identifies & understands claims made either directly (thesis statements) or indirectly by writers &/or speakers. Basic written and oral communication skills used in persuasive arguments.
2. Interdisciplinary learning integrated with global &/or cultural viewpoints: Integrates diverse knowledge, perspectives, &/or skills into arguments &/or strategies; is aware of and can clearly incorporate global &/or cultural perspectives to an argument or issue.	Independently creates whole arguments or strategies out of multiple parts (synthesizes) or draws conclusions by combining examples, facts, or theories from more than one field of study or disciplinary perspective & from a global or cultural perspective.	Independently connects examples, facts, or theories from more than one field of study or perspective in developing an argument or strategy. Provides a global or cultural perspective, but lacks sophistication or nuance.	When prompted, connects examples, facts, or theories from more than one field of study or perspective in an assignment aimed at argumentation. When prompted, can provide an appropriate global or cultural perspective to an argument or issue, but it may be oversimplified.	When prompted, connects examples, facts, or theories from more than one field of study or perspective as part of an argumentative work. Has only a basic or naïve understanding of global & cultural perspectives regarding a particular argument or issue.

FEEDBACK RUBRIC (CONTINUED)

3. Creativity & problem solving: Creatively applies discipline-based and/or cross-discipline-based knowledge to discover and design a variety of forms often using a problem-solving strategy.	The formation process reflects comprehensive & sophisticated familiarity with the discipline(s) & is well thought out, complex, & very applicable. Fully engaged in the creative process by designing a format for a project as a response to flexible guidelines & goals.	The formation process is adequate for the task, reflected by sufficient familiarity with the discipline(s), & is applicable & useful. Begins to experience the creative process by constructing a project within specific parameters for format & content.	The formation process is somewhat inadequate for the task, revealed gaps in knowledge central to the discipline(s), or is marginally applicable or useful. Encourages others to interact creatively by offering imaginative ideas in a group setting.	The formation process is clearly inadequate for the task, large gaps in knowledge central to the discipline is apparent, or is not applicable or useful. Demonstrates a creative approach by finding quick, clever solutions in class discussions & assignments.
4. Professionalism, interpersonal skills, & emotional intelligence: Acts ethically & positively to foster a supportive instructional or work environment. Has the emotional intelligence (ability to perceive, evaluate, & manage emotions) & interpersonal skills to work effectively with others.	Seeks consensus with others with differing points of view. Sees new & alternative options. Can handle complexity & ambiguity. Helps the group/class move forward by articulating the merits of alternative ideas or proposals. Resolves conflict in a way that strengthens group cohesiveness. Can manage & respond to emotions in a constructive way. Can put aside biases to relate to others.	Supports & assists in building consensus with others with differing points of view. Offers alternative solutions or courses of action that build on the ideas of others. Identifies & acknowledges conflict & stays engaged with it. Understands the meaning of emotions in others, but may not know how best to manage them. Aware of biases, but makes an effort to relate to others.	Mediates disagreements & understands other perspectives. Offers new suggestions to advance the work of the group or class. Redirects conflict toward task at hand. Understands how emotions promote thinking & cognitive activity; can interpret emotions, but does not always know the best way to respond. Aware of biases, but makes no effort to relate to others.	Can articulate wants & needs and participates in class discussions. Thinks dichotomously (black & white). Shares ideas but does not advance the work of the group or class. Avoids conflict; passively accepts alternate opinions. Perceives emotions in others, but cannot effectively interpret & respond to those emotions; lacks sympathy. Unaware of biases that affect how student relates to others.

G:\COURSES\FORMS\New Honors course proposal (04-24-14)

BMS305 Honors
Option SPRING 2020

Course Information

Christianne Magee, DVM, PhD, DipACT
Course Director
Office 246 Physiology
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Course Coordinator
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The BMS305 Honors option allows students to assemble the pelvic limb and thoracic limb of either a canine or equine specimen. This assembly occurs in parallel with the anatomical instruction in BMS305 Domestic Animal Anatomy for the Pelvic Limb (Unit 1) and Thoracic Limb (Unit 2) in the first 8 weeks of the Spring semester. In the last 8 weeks, students will focus on clinical case studies that parallel the Thorax, Abdomen and Pelvis (Unit 3) and Head and Neck unit (Unit 4) and the assembly of a skull with cervical vertebrae. Students are also required to write a short reflection paper regarding an anatomical feature, its clinical importance, and possible injury and repair.

This opportunity is available to all undergraduate students in the Colorado State University's Honors program as the Honors option (BMS305 section 201 and 1 credit of BMS496 Section 001). There is a limit of 20 participants in this option each year.

The CSU University Honors Program has prioritized four general competencies skills that should be addressed in this and all honors courses. These skills include (1) Professionalism, interpersonal skills, and emotional intelligence; (2) Interdisciplinary learning integrated with global and/or cultural viewpoints; (3) Critical thinking; and (4) Creativity and problem solving. The CSU University Honors Program rubric will be used to provide feedback in these areas. Student Learning Objectives for Course using Bloom's Taxonomy: Knowledge: Students will identify anatomical features of their assembled specimens for the course director. Comprehension: Students will describe an anatomical feature and its importance in veterinary medicine in their reflection paper. Application: Students will prepare both written and oral reports of their anatomical feature and apply the importance of this anatomical feature. Analysis: Students will analyze clinical cases to develop a patient SOAP (Subjective, Objective, Assessment, Plan). Synthesis: Students will assemble an articulated pelvic limb, thoracic limbs, and skull/C1-3. Evaluation: Students will relate the didactic information from BMS305 to the clinical case studies and discussion topics in this honors course.

Logistics:

All limbs are assembled in the anatomy prosection laboratory or adjacent rooms under the supervision of Drs. Lee and Magee. It is recommended that students spend approximately 2 hours each week working on their limb assembly. The course will meet at 9am on Thursdays for discussion related to case studies, but otherwise it is the responsibility of the student to ensure that enough time is being dedicated to the course work.

Grading: Standard 100 point scale (A ≥ 90, B ≥ 80, C ≥ 70, D ≥ 60, F ≤ 59 points). The grade will be applied to the BMS496 or BMS495 course.

- Pelvic Limb: 20 points
    - Assembly by BMS305 Exam 1: 10 points
    - Accuracy of Assembly: 10 points
- Thoracic Limb: 20 points
    - Assembly by BMS305 Exam 2: 10 points
    - Accuracy of Assembly: 10 points
- Skull/Cervical Vertebrae: 10 points (exempt COVID 2020)
    - Assembly by BMS305 Exam 4: 5 points
    - Accuracy of Assembly: 5 points
- Reflection paper: 30 points
    - Topic, accuracy, of information: 20 points
    - Writing style, grammar: 10 points
- Case Studies: 20 points
    - Thorax, Abdomen, Pelvis case: 20 points (2 parts)

Course Timeline - see Canvas page for due dates and course calendar

Skeletal Assembly:

Students are encouraged to use the Vesalius' Toolbox to aid in their assembly. Anatomical texts are provided in the laboratory as resources to ensure accurate assembly. It is the responsibility of the student to ensure accurate specimen preparation and assembly. For each day that the specimen has not been completed on time, 5 points will be removed from the available 15 points for timely limb assembly.

Reflection Paper/Pecha Kucha:

Topics for the reflection paper must be pre-approved by Dr. Magee by no later than April 15, 2015. Reflection papers should focus on an anatomical feature of interest, its clinical importance, including possible injury and repair. Papers must be 3-4 pages of original work that is typed, double-spaced, single sided, with one inch margins and Times New Roman 12 point font. At least two references from texts or refereed journals must be used and cited. Reflection papers are due no later than 5pm on the last Friday before Finals week.

Pecha Kucha: This is a presentation style in which 20 slides are shown for 20 seconds each (6 minutes and 40 seconds in total). We are going to modify this to 10 slides for no more than 20 seconds each (3 min 20 second presentation) with 1 minute and 40 seconds for questions afterwards. Slides need to be loaded on to Dr. Magee's computer the day BEFORE the scheduled presentation. Your objective is to creatively share with your peers what you have learned this semester and in your reflection paper.

Case Studies

Students will complete worksheets (10 pts each) for clinical case studies. Case information will be provided on Canvas at least one week before the worksheets are due. Students will be assigned to work in small groups to discuss their group's part of the case, but must complete their own worksheet. Students will be allowed to modify their worksheet at the time of submission as it will be returned. Modification is recommended to demonstrate integration of knowledge regarding the case.

Course 3: BMS531 Domestic Animal Anatomy Dissection

Syllabus Spring 2011 (Frasier, Course Director) (pg 47-55)

Provided as a reference to the previous course. No changes were made until 2013

Syllabus Spring 2020 (Magee, Course Director) (pg 56-61)

- *Specific course changes included major changes in assessment strategies*
  - shift in exams to represent distribution of species studied in the course
  - shift in exams to 75% higher order questions
  - modification of Table Checks to emulate "clinical rounds" with intense student questioning to develop students' verbal communication skills and confidence in knowledge retrieval and integration
  - expansion of course reading to include Dyce, Sack, Wenseng Veterinary Anatomy comparative anatomy text, provided for free by the CSU Library
  - addition of Canvas quizzes to ensure students are prepared each week for dissection and provide opportunity for formative assessment
  - introduction of special labs to integrate dissection knowledge with clinical application - including limb and head nerve blocks, bovine rumen palpation, equine farrier/lameness, veterinary ophthalmology, and diagnostic imaging

Syllabus Spring 2020 - COVID changes (Magee, Course Director) (pg 62-66)

- *Specific course changes for online learning without dissection for the last 2 units*
  - Redistribution of course points with greater emphasis on "live" Table Checks in Microsoft Teams and reduction of unit exam value
  - Creation of VoiceThread dissection group projects to create interrogative learning opportunities in the last 2 units
  - Bi-weekly (Mon/Fri 2h/each) faculty led "open lab" in Zoom

BMS531 Unit 1 Pelvic Limb Exam 2013 and 2020 (pg 67-75)

-Modification of exams from 2013 to 2020 are provided as an example of assessment changes to emphasize higher order integration of concepts structure & function relationships. and distribution of questions across species of interest

BMS531
DOMESTIC ANIMAL DISSECTION
SPRING 2011

TEACHING STAFF

Mark Frasier
Associate Professor
W220, A/Z

Mr. Casey Cooper
Graduate Teaching Assistant
W215, A/Z

TEXTBOOKS

Required:
- Frasier, M.B., Domestic Animal Anatomy Dissection Lab Guide
- Whalen, R.L. Virtual Canine Anatomy – DVD
- Evans, H.E., Guide to the Dissection of the Dog

Optional:
- Spurgeon,T.L.,Spurgeon's Color Atlas of Large Animal Anatomy
- Kainer, R.A., Dog Anatomy, A coloring Atlas
- Kainer, R.A., Horse Anatomy, A coloring Atlas
- Dyce, K.M., Textbook of Veterinary Anatomy
- Ellenberger W., An Atlas of Animal Anatomy for Artists

DISSECTION EQUIPMENT

Lab coat-washed weekly
Latex gloves-chemistry stockroom
#4 scalpel handle (blades will be provided)
Steel probe
Large rat-toothed forceps
Small scissors
Hemostat
Eye-protection (optional)
Patience

LABORATORY SCHEDULE

M/T 2:00 - 4:50 pm Room W117 A/Z

Please anticipate that you will need additional time for all dissections. The laboratory will be available on Mondays, 12-2; Tuesday, 12-2; Thursday, 8-12 & Friday 12 - 5 (BMS305 open labs will take precedence during their open lab times). Evening hours & weekends will also be available.

GRADING

Your grade for the Semester will be based on three criteria:

1. Four (4) laboratory practical exams-one for each region of study. Each laboratory practical exam will consist of 50 questions and each question is worth one point. = 200 points

2. Ten (10) table checks-The quality and thoroughness of your dissection will be determined by weekly table checks. There will be 11 administered throughout the semester (dropping the lowest score). Instructors will ask each dissector to show or demonstrate selected structures. = 50 points

3. Attendance-Overall attendance will affect your grade. Missing laboratory will endanger your relationship with your laboratory partners and make their workload heavier. = Instructor's subjective point scale +/-

TOTAL POINTS = 250

225 - 250= A
200 - 224 = B
175 - 199 = C
150 - 174 = D
<150 = F

You will be working in groups of 2 students per cadaver. **IT IS IMPORTANT THAT EACH OF YOU MAKE AN EFFORT AT GROUP COOPERATION AND GROUP LEARNING.** Part of the process of successful dissection is getting along with your partners. Therefore, part of your grade will be based on the success of these efforts. Your attendance is also critical to your group's success. Missing class hurts your dissection partners. Therefore, part of your grade will also be based on your attendance.

INTRODUCTION TO THE GROSS ANATOMY LABORATORY

The study of Gross Anatomy is the foundation for much, if not all, medical studies. The science and practice of medicine rely on our understanding the animal as an integrated whole.

Gross Anatomy is the study of structures, their relationships, and their functions. A useful knowledge of the structure of the animal body cannot be obtained from books, lectures and computer programs alone, although these are useful guides. To appreciate the interrelationships of the structures of the animal body, the student must obtain first hand information from seeing and handling actual structures. This is done by dissection, the art of removing surface coverings and exposing and separating body parts from one another. Dissection requires careful, accurate, and painstaking work, but is the best method of learning. Once structures are exposed, their identity can be verified by the aid of an atlas or textbook. Thus textbooks and atlases should be used in the dissecting laboratory as an aid, but not a substitute for the examination of the actual specimen. Observation of the structure in proper relation to its surrounding structures is more important than mere memorization of names.

Please bear in mind that although all animal bodies are constructed from the same architectural plan, no two animal bodies are identical. Minor and major variations on the overall plan are the rule rather than the exception and should be anticipated. Instructors should be notified when gross anomalies are found. The student should concentrate on normal anatomy in this course. Students are encouraged to examine all of the cadavers in the laboratory to appreciate such individual variations.

SUGGESTIONS:

This course belongs to YOU! The benefits derived from your dissection will be directly proportional to the efforts you put into your dissection.

Dissection is the basis of your learning. Therefore, if you put time into preparing for laboratory by reading your dissection manual prior to lab, you will get more out of each dissection.

Look up bold printed structures in your dissector so you know something about those structures. This will speed up procedures and enhance your learning experience.

Your lecture material from BMS305 should serve as a "knowledge base" for understanding your dissections.

The dissection schedule is geared so that all dissections will coincide with the lab material presented in BMS305. This means that your dissections will occur one week ahead of those in BMS305.

The quality of your dissections will have a <u>direct</u> effect on the students in BMS305. It is therefore critical that your dissections are clear and complete.

IT IS A GREAT PRIVILEGE TO DISSECT AN ANIMAL CADAVER - TREAT THEM WITH RESPECT - THEY ARE THE REAL INSTRUCTORS OF THE CLASS.

LABORATORY RULES

1. Casey Cooper is the Laboratory Graduate Teaching Assistant. Supplies provided by the course are available from Casey.

2. Unauthorized personnel are not allowed in the laboratory without the permission of the faculty. All visitors must be cleared through the course director. Authorized personnel include students currently enrolled in the course, the faculty and staff associated with the course and maintenance personnel.

3. When you have finished working on your cadaver, please ensure that the dissected region is damp and the cadaver is fully covered. Cadavers assigned to other students may be uncovered only by permission of those students, or by faculty.

4. No cameras are allowed in the laboratory without special permission.

5. No cadaver tissue can be taken from the laboratory at any time.

6. Smoking, eating, or drinking is not permitted in the laboratory.

7. At all times, please maintain a respectful attitude towards the cadavers. They have been donated for your benefit.

8. Please tidy up before you leave the laboratory. Do not leave paper towels or other pieces of trash on the floors or tables. Return tools to the appropriate drawers. Place used scalpel blades in the containers provided for this purpose.

9. Please wipe up any spills on the floor immediately, as the fluid makes the floor very slippery and hazardous.

10. Garments worn in the laboratory must be washed at frequent intervals. Shoes worn in the laboratory must adequately cover the top of the foot. Gloves must be worn by all persons handling cadavers. Protective eyewear is recommended.

11. Any injuries incurred in the laboratory should be reported immediately to staff members.

Thank you for your cooperation!!

COURSE OBJECTIVES

COMMON STRUCTURES AND WHAT YOU SHOULD KNOW AT THE END OF THE SEMESTER

For each of the four regions (Thoracic limb, Pelvic limb, head and neck, thorax abdomen and pelvis), you should be able to identify the following:

BONES:
- Borders, surfaces, angles, processes, fossae, foramina
- Articular surface contacts
- Areas of specific muscle attachments

MUSCLES:
- Location and position
- Attachments
- Function
- Innervation
- Blood Supply
- Relations to other muscles, vessels and nerves

ARTERIES:
- Origin
- Named branches
- Major anastomoses
- Relations to other structures
- Major structures they supply

VEINS:
- Named tributaries
- Relations to other structures
- Major structures and regions they drain

NERVES:
- Immediate origin-from other nerves, nerve trunks, spinal nerves etc.
- Named branches
- Relations to other structures during their course
- Nerve components-the functional types of nerves
- Structures they innervate

REGIONAL TRIANGLES:
- Margins
- Roofs, floors
- Relations to other structures
- Possible significance to surgery of physical diagnosis

JOINTS:
- Bones forming joint
- Capsule and associated ligaments
- Synovial membranes, extent and associated bursae
- Articular discs and other internal ligaments
- Types of joints

VISCERA:
- Location, size, shape
- Relationships and contacts
- Blood and nerve supply
- Parts-ducts, coats, etc.
- Function-secretions if any

LABORATORY - DISSECTION SCHEDULE

SECTION 1-THORACIC LIMB: EVANS – 6th ed.

WEEK 1: January 17 – 21 **Ex. 1 & 2 - 531 Dissection guide** pp 1-18, 19-31

M 1/17 Martin Luther King Jr. Holiday

T 1/18 Introduction to dissection
Canine, Equine and Bovine thoracic limb

WEEK 2: January 24 – January 28 **Ex. 2 & 3 - 531 Dissection Guide** pp 31-48

M 1/24 Canine, Equine and Bovine thoracic limb

T 1/25 Canine, Equine and Bovine thoracic limb
Table check 1

WEEK 3: January 31 – February 4 **Ex. 3 - 531 Dissection Guide** pp148-170

M 1/31 Equine thoracic limb dissection lab guide

T 2/1 Equine thoracic limb dissection, finish/review lab guide
Table Check 2

SECTION 2: PELVIC LIMB

WEEK 4: February 7 – 11 **Ex. 4 & 5 - 531 Dissection Guide**

M 2/7 Begin Pelvic Limb – canine, equine, bovine pp 50-61, 62-88

T 2/8 EXAM –Lab Practical – Thoracic limb

WEEK 5: February 14 - 18 **Ex. 5 & 6 – 531 Dissection Guide** pp 227-251

M 2/14 Pelvic limb

T 2/15 Pelvic limb
Table Check 3

WEEK 6: February 21 – 25 **Ex. 6 – 531 Dissection Guide**

M 2/21 Equine pelvic limb dissection lab guide

T 2/22 Equine pelvic limb dissection, finish/review lab guide

Table Check 4

WEEK 7: February 28 – March 4 **Ex. 7 & 8 – 531 Dissection Guide**

M	2/28	Begin head and neck – superficial head	pp 252-271 271-274 294-296
T	**3/1**	**EXAM – lab practical – pelvic limb**	

SECTION 3: HEAD and NECK

WEEK 8: March 7 -11 **Ex. 7 & 8 – 531 Dissection Guide**

M	3/7	Superficial head	pp 284-286
T	3/8	Begin deep head, arterial supply to head Table Check 5	pp 116-120 286-288

March 12 - March 20 - SPRING BREAK

WEEK 9: March 21 – 25 **Ex. 9 – 531 Dissection Guide**

M.	3/21	Finish deep head	pp 298-306
T	3/22	Brain and brain removal Table Check 6	lab guide

WEEK 10: March 28 - April 1 **Ex. 10 – 531 Dissection Guide**

M	3/28	Pharynx/larynx	pp 274-284
T	3/29	Head bisection, pharynx/larynx Table check 7	pp 274-284

SECTION 4: THORAX, ABDOMEN & PELVIS

WEEK 11: April 4 – 8 **Ex. 11 – 531 Dissection Guide**

M	4/4	Begin TAP – back muscles / laminectomy	pp 94-104 109-112
T	**4/5**	**EXAM – lab practical – head and neck**	

WEEK 12: April 11 -15 **Ex. 11 & 12 – 531 Dissection Guide**

M	4/11	Finish laminectomys, spinal cord begin thoracic wall	pp 338-344

T	4/12	Thoracic wall, heart and lungs Table Check 8	pp 120-122 123-142

WEEK 13: April 18 – 22 **Ex. 12 & 13 – 531 Dissection Guide**

M	4/18	Heart and lungs, mediastinum	pp 143-147
T	4/19	Abdominal wall, abdominal viscera Table Check 9	pp 104-109

WEEK 14: April 25 – April 29 **Ex. 13 & 14 – 531 Dissection Guide**

M	4/25	Abdominal viscera	pp 171-212
T	4/26	Split pelvis, reproductive viscera, Table Check 10	pp 212-226

WEEK 15: May 2 – May 6 **Ex. 14 – 531 Dissection Guide**

M	5/2	Reproductive viscera, finish/review Table Check 11	
T	**5/3**	**EXAM – lab practical - TAP**	

BMS531
DOMESTIC ANIMAL DISSECTION
SPRING 2020

TEACHING STAFF

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TEXTBOOKS

Required:
- BMS305/531 Lab Guide – Available through Canvas
- Virtual Animal Anatomy – Available through Canvas
- Evans, H.E., Guide to the Dissection of the Dog
- Dyce, Sack and Wensing. Textbook of Veterinary Anatomy – free digital copy available through CSU Libraries

Optional:
- Spurgeon,T.L.,Spurgeon's Color Atlas of Large Animal Anatomy
- Anatomy and Physiology of Farm Animals, 7th or 8th Edition

DISSECTION EQUIPMENT

- Lab coat (washed weekly!) Clothing dedicated for use in the lab is suggested
  - i.e. scrubs, coveralls, etc. in addition to water-resistant or waterproof shoes/boots.
- Nitrile gloves – available at the chemistry stockroom, do not use latex
- Dissection gloves (shoulder length) or “kitchen” type gloves (optional)
- #4 scalpel handle (blades will be provided)
- Steel blunt probe
- Large rat-toothed forceps
- Small scissors (optional)
- Hemostat (optional)
- Eye-protection (optional, but recommended if you wear contacts)
- Respirator with formaldehyde cartridges (optional)
- Patience! (Mandatory!)

LABORATORY SCHEDULE

Location: Room W117 A/Z
Regular Lab sessions Monday / Tuesday 2:00 - 4:50 pm
Open Lab Friday 2:00 - 4:50pm

Please anticipate that you will need additional time for all dissections. As a general rule, 1 hour of laboratory time typically requires 2 hours of preparation/dissection/review outside of the M/T laboratory sessions. The laboratory will be available on Mondays 7a-10a or 12p-2p; Tuesday 12p-2p; Wednesday 7a-10a or 12p-2p; Thursday 7a-1p; Friday 7a-5p. BMS305 open labs will take precedence during their open lab times M/Tu 12p-2p, Th/Fri 8a-12p, as will any other regular course scheduling as posted or indicated by the instructor. Please see the W117 schedule or Dr. Magee for more information or clarification. Evening hours and weekends may also be available if you have access to the A/Z building. Please recognize that if you use the laboratory after hours, you are solely responsible for your safety and for cleaning up after yourself. The specimens are heavy and accidents can happen, please do not study in the laboratory alone.

GRADING

Your grade for the Semester will be based on three criteria:

1. Four (4) laboratory practical exams - one for each region of study. Each laboratory practical exam will have approximately 50 questions and be worth 50 points = 200 points. Exams will occur from 4-5 pm on the appointed day (always a Tuesday). Exam days cannot be rescheduled. Exam questions will focus on anatomical relationships and features that are clinically relevant. It will be important to review your BMS305 notes when studying for an exam in order to recall this material. This material will not be different from BMS305, but it will not be reviewed in BMS531. Exam questions will be 75% higher order (structure function/attachment/innervation following ID), 25% first order (structure ID).

2. Ten (10) Table Checks - The quality and thoroughness of your dissection will be determined by weekly table checks, each worth 5 points. There will be at least 10 administered throughout the semester, for a total of 50 points (extras will be dropped). Instructors will ask each dissector to show selected structures. Table Checks will occur on the appointed day during the laboratory at a time that is convenient to the instructor and lab group. If necessary, Table Checks can be completed before the appointed day, but dissection of a cadaver should not proceed beyond what is necessary for BMS305 laboratory needs. If you have a time conflict during lab time, it is *your* responsibility to ensure *your* table check has occurred, not that of the instructor or teaching assistants.

3. Ten (10) Canvas Quizzes – The Canvas quizzes are designed to guide you in to the next week of dissection and help you focus your study for the Table Check. Quizzes will be due on the Sunday night before that week of dissection. There will be at least 10 administered throughout the semester, for a total of 50 points (extras will be dropped).

4. Attendance - Overall attendance will affect your grade. Missing laboratory will endanger your relationship with your laboratory partner and make their workload heavier. = Instructor's subjective point scale +/-

TOTAL POINTS = 300
270 - 300 = A
240 - 269 = B
210 - 239 = C
180 - 209 = D
<180 = F

You will be working in groups of 2-3 students per cadaver. **IT IS IMPORTANT THAT EACH OF YOU MAKE AN EFFORT AT GROUP COOPERATION AND GROUP LEARNING.** Part of the process of successful dissection is getting along with your partners. Therefore, part of your grade will be based on the success of these efforts. Your attendance is also critical to your group's success. Missing class hurts your dissection partners. Therefore, part of your grade will also be based on your attendance.

INTRODUCTION TO THE GROSS ANATOMY LABORATORY

The study of Gross Anatomy is the foundation for much, if not all, medical studies. The science and practice of medicine rely on our understanding the animal as an integrated whole.

Gross Anatomy is the study of structures, their relationships, and their functions. A useful knowledge of the structure of the animal body cannot be obtained from books, lectures and computer programs alone, although these are useful guides. To appreciate the interrelationships of the structures of the animal body, the student must obtain firsthand information from seeing and handling actual structures. This is done by dissection, the art of removing surface coverings and exposing and separating body parts from one another. Dissection requires careful, accurate, and painstaking work, but is the best method of learning. Once structures are exposed, their identity can be verified by the aid of an atlas or textbook. Thus textbooks and atlases should be used in the dissecting laboratory as an aid, but not a substitute for the examination of the actual specimen. Observation of the structure in proper relation to its surrounding structures is more important than mere memorization of names.

Please bear in mind that although all animal bodies are constructed from the same architectural plan, no two animal bodies are identical. Minor and major variations on the overall plan are the rule rather than the exception and should be anticipated. Instructors should be notified when gross anomalies are found. The student should concentrate on normal anatomy in this course. **Students are encouraged to examine all of the cadavers in the laboratory to appreciate such individual variations**.

SUGGESTIONS:

- This course belongs to YOU! The benefits derived from your dissection will be directly proportional to the efforts you put into your dissection.

- Dissection is the basis of your learning. Therefore, if you put time into preparing for laboratory by reading your dissection manual prior to lab, you will get more out of each dissection.

- Look up bold printed structures in your dissector so you know something about those structures. This will speed up procedures and enhance your learning experience.

- Your lecture material from BMS305 should serve as a "knowledge base" for understanding your dissections. Spring 2018 BMS 305 content, including video capture of lectures, will be made available to BMS 531 and all Teaching Assistants.

- The dissection schedule is geared so that all dissections will coincide with the lab material presented in BMS305. This means that your dissections will occur one week ahead of those in BMS305.

- The quality of your dissections will have a direct effect on the students in BMS305. It is therefore critical that your dissections are clear and complete.

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LABORATORY RULES

1. Supplies provided by the course (scalpels) are available from the Graduate Teaching Assistant.

2. Unauthorized personnel are not allowed in the laboratory without the permission of the faculty. All visitors must be cleared through the course director. Authorized personnel include students currently enrolled in the course, the faculty and staff associated with the course and maintenance personnel.

3. When you have finished working on your cadaver, please ensure that the dissected region is damp and the cadaver is fully covered. Cadavers assigned to other students may be uncovered only by permission of those students, or by faculty.

4. No cameras are allowed in the laboratory at any time without special permission.

5. No cadaver tissue can be taken from the laboratory at any time.

6. Smoking, eating, or drinking is not permitted in the laboratory.

7. At all times, please maintain a respectful attitude towards the cadavers. They have been donated for your benefit.

8. Please tidy up before you leave the laboratory. Do not leave paper towels or other pieces of trash on the floors or tables. Return tools to the appropriate drawers. Place used scalpel blades in the containers provided for this purpose.

9. Please wipe up any spills on the floor immediately, as the fluid makes the floor very slippery and hazardous.

10. Garments worn in the laboratory must be washed at frequent intervals. Shoes worn in the laboratory must adequately cover the top of the foot. Gloves must be worn by all persons handling cadavers. Protective eyewear is recommended.

11. Do not study in the laboratory by yourself.

12. Any injuries incurred in the laboratory should be reported immediately to staff members.

Thank you for your cooperation!!

COURSE OBJECTIVES

COMMON STRUCTURES AND WHAT YOU SHOULD KNOW AT THE END OF THE SEMESTER. For each of the four regions (pelvic limb, thoracic limb, thorax abdomen and pelvis, and head and neck), you should be able to identify the following:

BONES:
- Borders, surfaces, angles, processes, fossae, foramina
- Articular surface contacts
- Areas of specific muscle attachments
- Palpation of bony landmarks with "skin-on" condition

MUSCLES:
- Location and position
- Attachments
- Function
- Innervation
- Blood Supply
- Relations to other muscles, vessels and nerves

ARTERIES:
- Origin
- Named branches
- Major anastomoses
- Relations to other structures
- Major structures they supply

VEINS:
- Named tributaries
- Relations to other structures
- Major structures and regions they drain

NERVES:
- Immediate origin-from other nerves, nerve trunks, spinal nerves etc.
- Named branches
- Relations to other structures during their course
- Nerve components-the functional types of nerves
- Structures they innervate

REGIONAL TRIANGLES:
- Margins
- Roofs, floors
- Relations to other structures
- Possible significance to surgery of physical diagnosis

JOINTS:
- Bones forming joint and type of joint
- Capsule and associated ligaments
- Synovial membranes, extent and associated bursae
- Articular discs and other internal ligaments

VISCERA:
- Location, size, shape
- Relationships and contacts
- Blood and nerve supply
- Parts-ducts, coats, etc.
- Function-secretions if any

See Canvas for Dissection and Reading Schedules

BMS531
DOMESTIC ANIMAL DISSECTION
SPRING 2020 – COVID Update

TEACHING STAFF

Christianne Magee, DVM, PhD, DipACT
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TEXTBOOKS

Required:
- BMS305/531 Lab Guide – Available through Canvas
- Virtual Animal Anatomy – Available through Canvas
- Evans, H.E., Guide to the Dissection of the Dog
- Dyce, Sack, Wensing. Textbook of Veterinary Anatomy – free unlimited digital copies available through CSU Libraries

Optional:
- Spurgeon,T.L.,Spurgeon's Color Atlas of Large Animal Anatomy
- Anatomy and Physiology of Farm Animals, 7th or 8th Edition

VIRTUAL LABORATORY SCHEDULE

Open Lab (Zoom)

Location: Zoom - https://zoom.us/j/5195399252
Password – BMS305
Host Key – 305531
Time: the meeting room is always open day and night

While you are free to use this zoom meeting room to study BMS531 material, keep in mind that it will frequently be occupied by BMS305 TAs and students who are using the meeting room for their open lab as well. **If you are working as a BMS305 TA, please keep in mind that the needs of BMS305 students take precedence over your own study needs during their open lab times.**

Regular Lab (Microsoft Teams)

Location: Microsoft Teams
Time: Monday & Friday 2:00 - 4:00 pm

During these times, members of the teaching team will be available to address your questions and help guide your study. You do not have to participate, but we will be there for you if you need us.

GRADING

Your grade for the Semester will be based on three criteria:

1. **NEW Group Projects** - You and your dissection partner will be responsible for a group project for each remaining dissection unit (Head & Neck, TAP). This is your chance to dive into anatomy and show us what you know. These will be worth a total of 10 points each. The project instructions and rubric are linked on the Canvas home page. (2 group projects x 10 pts = 20 pts total) completed using VoiceThreads

2. Four (4) laboratory practical exams - **Exams 3 and 4 will be hosted on Canvas** and are intended as closed note, closed book, closed friend. You will have two hours to complete the exam once you start it, but it will be open to you all day on the designated exam day. Questions will be similar to Table Check for structure ID with images from VAA, BMS305 lecture content, and your new Group Projects. Higher order questions will account for the majority of those asked on the exams (i.e. not just simple gross identification questions). Exams 1 and 2 are still worth 50 points each while **exams 3 and 4 will be worth 20 points each.** (2 exams x 50 pts + 2 exams x 20 pts = 140 pts).

3. Ten (10) Table Checks – We will be holding **Table Checks on Tuesdays between 8am-**

4pm via Microsoft Teams. You will still take your table check in groups with your dissection partner(s), being led by a faculty person just like in regular lab. We will show you structures/images from VAA or the lecture content, ask you to identify items, and then ask you follow up questions. As you study, use the rotatable objects in the VAA as this is what we will predominantly use. **You and your group will sign up for a 1 hour timeslot on the designated Table Check dates listed on Canvas for us to meet via Microsoft Teams. Please don't be late!** The first 5 table checks are still worth 5 pts each while **the remaining 5 table checks will be worth 15 points each.** (5 table checks x 5 pts + 5 table checks x 15 pts = 100 pts total)

4. Eleven (11) Canvas Prelab Quizzes – The Canvas prelab quizzes are designed to guide you into the next week of dissection and help you focus your study for the Table Check. Each prelab quiz is worth 5 points. **Quizzes are due at 11:59pm on due dates. Quiz due dates have changed. Please check Canvas to ensure you submit these on time.** Your lowest score will be dropped. (10 prelab quizzes x 5 pts = 50 pts total)

4. Attendance - Overall attendance will affect your grade. Missing laboratory will endanger your relationship with your laboratory partner and make their workload heavier. = Instructor's subjective point scale +/-

TOTAL POINTS = 310
279 - 310 = A
248 - 278 = B
217 - 247 = C
186 - 216 = D
<186 = F

- ***CSU is implementing an S/U grading practice for both online and campus classes for spring 2020 only. Following the end of semester grade posting for spring semester 2020, students will be able to request a satisfactory/unsatisfactory grade rather than traditional letter grade up until June 5th for any course taken in this semester. The S/U policy applies to all spring 2020 undergraduate and graduate courses. Please note that students must receive a grade of C or better to receive a Satisfactory. You can learn more about S/U grading policies on CSU's grading policy website.***

IT IS IMPORTANT THAT EACH OF YOU MAKE AN EFFORT AT GROUP COOPERATION AND GROUP LEARNING.

What you will still need:

- Respect for animal donors – all previous social media policies apply in the virtual environment. Screen captures of course material may be created to post Discussion board questions and/or shared in the Zoom laboratory only. Sharing materials outside of the BMS305 learning environment is unacceptable. For the CVMBS Media policy, please see http://csu-cvmbs.colostate.edu/Documents/cvmbs-social-media-policy.pdf

- Your laboratory guide, BMS305 lecture notes, Dyce and Evans anatomy texts, and the Virtual Animal Anatomy programs – these are still the foundation for this course. Use these materials simultaneously to ensure an integrated approach to your learning.

- Your “Classroom Behavior” in our online and virtual spaces remains a reflection of you as a professional learner. Every effort will be made to make the online experience both profitable and enjoyable for all, please do what you can to support your fellow students and TAs as we all navigate this new environment together. If you have any general policy questions, please refer to the CSU General Catalog - "Classroom Behavior."

INTRODUCTION TO THE GROSS ANATOMY LABORATORY

The study of Gross Anatomy is the foundation for much, if not all, medical studies. The science and practice of medicine rely on our understanding the animal as an integrated whole.

- This course still belongs to YOU!

- Dissection was the basis of your learning until the COVID-19 pandemic and we will strive to make it happen in the virtual environment. You must still put time into preparing for our virtual laboratory sessions by reading your dissection manual prior to our sessions and you will still learn a great deal.

- Look up bold printed structures in your dissector so you know something about those structures. This will enhance your learning experience.

- Your lecture material from BMS305 should serve as a "knowledge base" for understanding your dissections. Spring 2018 BMS 305 content, including video capture of lectures, will be made available to BMS 531 and all Teaching Assistants.

- The schedule has been modified so that BMS531 now functions as its own course.

IT IS A GREAT PRIVILEGE TO DISSECT AN ANIMAL CADAVER - TREAT THEM WITH RESPECT - THEY ARE THE REAL INSTRUCTORS OF THE CLASS.

Thank you for your cooperation!!

COURSE OBJECTIVES

COMMON STRUCTURES AND WHAT YOU SHOULD KNOW AT THE END OF THE SEMESTER. For each of the four regions (pelvic limb, thoracic limb, thorax abdomen and pelvis, and head and neck), you should be able to identify the following:

BONES:
- Borders, surfaces, angles, processes, fossae, foramina
- Articular surface contacts
- Areas of specific muscle attachments
- Palpation of bony landmarks with "skin-on" condition

MUSCLES:
- Location and position
- Attachments
- Function
- Innervation
- Blood Supply
- Relations to other muscles, vessels and nerves

ARTERIES:
- Origin
- Named branches
- Major anastomoses
- Relations to other structures
- Major structures they supply

VEINS:
- Named tributaries
- Relations to other structures
- Major structures and regions they drain

NERVES:
- Immediate origin-from other nerves, nerve trunks, spinal nerves etc.
- Named branches
- Relations to other structures during their course
- Nerve components-the functional types of nerves
- Structures they innervate

REGIONAL TRIANGLES:
- Margins
- Roofs, floors
- Relations to other structures
- Possible significance to surgery of physical diagnosis

JOINTS:
- Bones forming joint and type of joint
- Capsule and associated ligaments
- Synovial membranes, extent and associated bursae
- Articular discs and other internal ligaments

VISCERA:
- Location, size, shape
- Relationships and contacts
- Blood and nerve supply
- Parts-ducts, coats, etc.
- Function-secretions if any

See Canvas for Dissection Schedule

BMS 531 Exam - Unit Pelvic Limb 2013

Which two muscles attach at this bony feature?	Long and lateral digital extensor mm. (extensor process P3 equine)
What is the **anatomical** name for this structure?	(Bovine limb – special prep – dew claw - Pick one)
What nerve passes through this structure?	Obturator n. (obturator foramen)
What is the **horseman's name** for this anatomical feature?	Point of the hip (tuber coxae, horse)
What is the **anatomical** name of the indicated joint?	Proximal intertarsal joint (canine VCA)
What is the ***functional*** purpose of the indicated anatomical feature?	Patellar lock (equine medial trochlear ridge – VEA)
What is the **common** name for the indicated structure?	Splint bone (equine MT2 or 4)
Name the anatomical feature and the bone.	Femoral trochlea (canine VCA)
Name the anatomical feature and the bone	Third trochanter of the femur bone
Name the anatomical feature and the bone.	Lateral malleolus of the fibula bone (bovine tarsus standing limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Iliopsoas m. (dog - femoral n visible)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Gastrocnemius m. (dog - tibial n. visible)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Lateral digital extensor m. (dog – can see

	insertion
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Tensor fascia latae m. (dog – mostly intact hind limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Cranial cruciate ligament (canine stifle joint)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Quadratus femoris m. (dog limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Popliteal ln. (dog limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Semitendinosus m. (hanging horse)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Middle gluteal m. (hanging horse)
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Cunean tendon (of the cranial tibial m.) horse limb
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Medial head of the DDF m.
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Cranial tibial a. (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Lateral plantar digital n. (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Medial plantar n. (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Dorsal MTIII a. (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Femoral v.

Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Proximal caudal femoral a.
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Popliteus m. (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Peroneus longus m. (hanging bovid)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	DDF m. (bovine special prep)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Gluteobiceps m. (hanging bovid)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Peroneus longus m. (dog)
What nerve innervates this muscle? Be specific.	Deep br of common fibular n. (cranial tibial m. dog)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Lateral collateral ligt. (canine stifle)
What nerve innervates this muscle?	Obturator n (Gracillus m.)
What nerve innervates this muscle?	Saphenous n. /Femoral n. (Sartorius m.)
Name one action of this muscle?	Flexion digits, extension hock (SDF m.)
Name one action of this muscle?	Adduct limb, extend hip (adductor m dog)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Suspensory ligt (horse limb)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Peroneus tertius m (horse limb)

Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Cr. Br. Of the med saphenous v. (horse VEA)
Where does this muscle originate? Be sure to name the anatomical feature and the bone.	Extensor fossa (long digital extensor m. horse limb)
Where does this muscle insert? Be sure to name the anatomical feature and the bone.	Tibial tuberosity (quadriceps femoris m. dog or horse)
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Saphenous a (dog leg, branch along thigh)
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Common fibular n. (or horse limb, over m. gastrocs.)
Identify the structure. Be sure to give organ/tissue type (m., n., v., a., etc.).	Intermediate patellar ligt – horse stifle
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Ligament of the head of the femur – horse leg
Identify the structure. Be specific. Be sure to give organ/tissue type (m., n., v., a., etc.).	Lateral saphenous v. (dog)
Several muscles insert here. What is the name of the structure that attaches here?	Common calcaneal tendon
Where does this muscle originate? Be specific.	Sacrotuberous ligt or ischiatic tuberosity (m. biceps femoris)
E.C. Name one type of "catastrophic" injury in the horse.	Any loss to the suspensory apparatus or stabilization of the limb – SL, Prox sesamoids, etc.

531 Exam 1 - February 11, 2020

Question:	
1	Q: Name two muscles that attach to this bony landmark. A: gemelli m., external obturator m., internal obturator m. (need ⅔) Specimen: highlighted image of trochanteric fossa of femur b. from VCA (1)
2	Q: Identify the structure. Be specific. Be sure to give organ/tissue type. A: cranial branch of medial saphenous vein Specimen: VEA image(s) (2)
3	Q: Name a nerve that innervates the indicated muscle? Include tissue type. A: femoral (n.) OR lumbar spinal (nn.) Specimen: iliopsoas m. tag on K9 cadaver
4	Q: What passes through the indicated bony feature? Be specific and indicate tissue type. A: tendon of long digital extensor m. or long digital extensor m. Specimen: tag on extensor groove of tibia bone
5	Q: What type of joint is this? ((cartilaginous, fibrous, or synovial) A: cartilaginous Specimen: tag on a pelvic symphysis
6	Q: Name a muscle innervated by the tagged nerve. A: pectineus (m.) / adductor (m.) / gracilis (m.) / external obturator (m.) Specimen: obturator nerve tagged on K9 cadaver
7	Q: Name the species. Sound the animal makes is okay too. A: bovine / cow / moo Specimen: bovine femur (large cow femur - not sheep/goat) (has no third trochanter)
8	Q: The tagged nerve is a direct branch of which nerve? A: sciatic (n.) Specimen: tibial n. tagged on K9 crus - deep limb!
9	Q: Name an anatomical structure that attaches at the indicated bony feature? Include tissue type. A: middle gluteal m. OR deep gluteal m. OR piriformis m. (not superficial gluteal m.) Specimen: tag on greater trochanter of femur b. - canine
10	Q: Name the indicated structure. Include tissue type. A: dorsal metatarsal artery of III (digit III okay too) or great metatarsal a. Specimen: tagged on eq limb

11	Q: Name the indicated structure *at the level of the tag*. A: (common) fibular n. Specimen: tagged on eq limb
12	Q: What nerve passes through this structure? A: obturator (n.) Specimen: tag on pelvis
13	Q: Name the tagged palpable bony feature. A: wing of ilium (or tuber coxae) Specimen: tag on skin-on K9 specimen
14	Q: What is the **layman's term** for the indicated structure. A: hooks Specimen: tuber coxae on bovid **full skeleton**
15	Q: What is the anatomical name of the indicated joint? (no abbreviations of joint name) A: metatarsophalangeal (joint) Specimen: highlighted image from VCA (3)
16	Q: What are the distal attachments for the indicated structure? Include tissue type. A: proximal sesamoid bones (or extensor process P3 and long digital extensor tendon) Specimen: suspensory ligament on eq limb
17	Q: What is one action of the indicated muscle? A: flex tarsus OR outward rotation of pes Specimen: tibial cranial m. tagged on K9 cadaver
18	Q: Identify the indicated structure. Be complete in your response and include tissue type. A: lateral collateral ligament of the stifle Specimen: special prep (+ K9 cadaver)
19	Q: What is the innervation of the indicated muscle? A: tibial (n.) Specimen: DDF m. tagged on eq limb
20	Q: Name a muscle innervated by this nerve. A: middle gluteal (m.) / deep gluteal (m.) / tensor fascia latae (m.) Specimen: cranial gluteal n. tagged on K9 cadaver
21	Q: What are the distal attachments of the tagged muscle? Be specific. A: plantar aspects of P1 and P2 (need both) Specimen: superficial digital flexor m. tagged on eq limb

22	Q: Name one action of the tagged muscle. A: extend hip / extend hock / flex stifle Specimen: semitendinosus m. tagged on K9 cadaver
23	Q: These structures are direct continuations of which nerve? A: tibial (n.) Specimen: medial and lateral plantar nn. eq limb
24	Q: Name the indicated structure. Include tissue type. A: proximal caudal femoral a. Specimen: tagged on K9 cadaver
25	Q: The indicated structure is a direct continuation of what? Include tissue type. A: femoral a. Specimen: popliteal a. tagged on K9 cadaver
26	Q: Name one attachment of the indicated structure. A: transverse processes of 3rd sacral and 1st caudal vertebrae OR ischiatic tuberosity OR sacrum Specimen: sacrotuberous ligament on hanging bovid
27	Q: Identify the structure. Be sure to give organ/tissue type. A: gluteobiceps m. Specimen: tag on hanging bovine
28	Q: What is the innervation of the indicated structure? A: tibial (n.) Specimen: popliteus m. tagged on EQ limb
29	Q: What nerve would be blocked if injected at the indicated location? Be specific. A: lateral plantar metatarsal (n.) Specimen: syringe at lateral button - skin on EQ limb
30	Q: What are the actions of this muscle? Name all actions. A: flex digit AND extend hock Specimen: deep digital flexor m. (only the medial head) tagged on Hanging EQ
31	Q: Several muscles attach here. What is the name of the structure they form? A: (common) calcaneal tendon Specimen: Calcaneus bone
32	Q: What is/are the distal attachment(s) of the tagged structure? A: extensor process of P3 or (coffin b. ?) Specimen: EQ limb – long digital extensor
33	Q: Which digit does this vestigial structure represent? A: (digit) 2

	Specimen: Bovid special prep
34	Q: Which of the tagged structure(s) is/are a part of the reciprocal apparatus of the horse? A: “B” and “D” (MUST HAVE BOTH) Specimen: hanging horse – tagged structures A-F (SDF / fibularis tertius = B / D)
35	Q: Name one of the muscles that “locks” this anatomical feature. A: gracilis m. / sartorius m. / vastus medialis m. (no other quadriceps muscles) Specimen: Equine patella
36	Q: What is the innervation of this structure? A: cranial gluteal (n.) Specimen: Dog cadaver-- tensor fascia latae m.
37	Q: Name the indicated structure. Be specific and complete including the name of the bone. A: lateral malleolus of the fibula (bone) Specimen: Bovid – bony limb
38	Q: Name the artery in this region of the equine limb. A: medial digital (a.) Specimen: VEA image (4)
39	Q: What are A and B in this image.This image is of arteries in the equine limb. We know your equine limb didn’t look like this. A: cranial tibial (a.) and caudal tibial (a.) Specimen: image from Dyce + equine limb for reference
40	Q: Name one form of musculotendinous support specific for this joint. A: suspensory apparatus (suspensory ligament, distal sesamoidean ligaments), SDF m., DDF m. Specimen: Bovid – distal limb PIP joint
41	Q: What nerve innervates this muscle? A: fibular (n.) Specimen: lateral digital extensor m. - Hanging K9 cadaver
42	Q: Identify the structure. Be sure to give organ/tissue type and be specific. A: cranial cruciate ligament (cannot be “anterior” or abbreviate) Specimen: Fresh canine limb +/- special prep
43	Q: Identify the anatomical structure. Give tissue type. A: tibial nerve Specimen: EQ limb
44	Q: Name one action of this muscle. Be sure to indicate the joint.

	A: extension or lateral rotation of the coxofemoral (hip) joint Specimen: quadratus femoris m. - K9 cadaver
45	Q: Where does this muscle attach proximally? A: ischiatic tuberosity Specimen: semimembranosus m. - K9 cadaver
46	Q: Characterize this joint by type AND by movement. A: synovial AND gliding or sliding Specimen: VCA image (5)
47	Q: Identify the structure. Be sure to give organ/tissue type. A: popliteal lymph node Specimen: Hanging K9 cadaver
48	Q: Identify the structure. Be sure to give organ/tissue type. A: ligament of the head of the femur Specimen: EQ limb
49	Q: Identify the structure. Be specific. Be sure to give organ/tissue type. A: cunean t. or medial tendon (of insertion) of cranial tibial m. (name either) Specimen: EQ limb
50	Q: Identify the structure. Be sure to give organ/tissue type. A: femoral vein Specimen: K9 cadaver
EC1	Q: What are all of the borders of the femoral triangle? A: caudal parts of sartorius m., pectineus m., inguinal ligament (or abdominal mm.), iliopsoas m. (deep), +/- vastus medialis m.
EC2	Q: Name the "order" from which this specimen was derived. A: artiodactyla Specimen: camel? limb

1st order (15 questions): 15
2nd order (35 questions): 35

Canine tags (11 total): 12
Equine limb tags (11 total): 11 (+1 to go with Dyce image)
Hanging equine (2 tags): 2
Hanging bovine (2 tags): 2
Hanging canine (2 tags): 2
Skin-on specimen: 2
Bone/special preps tags: 13 (+ 1 for E.C.)
Virtual images: 5 (+1 from Dyce)

Course 4: BMS633 Animal Anatomy Case Studies

Syllabus Spring 2012 (Magee, Course Director) (pg 77-83)

First year of teaching, no changes from previous course

Syllabus Spring 2020 (Magee, Course Director) (pg 84-87)

- *Specific course changes included modification of assessments and cases used in the course*
    - redistribution of course points with greater emphasis on individual work
    - new Group Case (ununited anconeal process)
    - rubric implementation for group and individual feedback for Group Case Reports
    - numerous modifications to other cases based on personal clinical experience and continuing education
    - assessments now include a Comprehensive Exam question to facilitate exam preparation and an emphasis on cross-sectional anatomy (see quizzes below)
    - *no major course changes COVID online learning except that the course now meets in Microsoft Teams and assessments are handled via Canvas LockDown Browser with active Zoom proctoring*

Thoracic Limb Unit Quizzes for 2011 and 2020 (pg 88-92)

Head and Neck Unit Quizzes for 2011 and 2020 (pg 93-98)

-Modification of quizzes from 2011 to 2020 are provided as an example of assessment changes

BMS633
DOMESTIC ANIMAL GROSS ANATOMY – CASE STUDIES
SPRING 2012

Dr. Christianne Magee
Special Assistant Professor
240B Physiology

Dr. Anna Fails
Assistant Professor
232 Physiology

Recitation: Wednesdays 3:00 – 4:50
MRBSC 109

Textbook: Textbook of Veterinary Anatomy; Dyce, Sack and Wensing

Course Objectives: The objective of this class is to review domestic animal gross anatomy from a clinical standpoint utilizing a series of cases that illustrate some of the important concepts in anatomy. Study will include clinical cases that best illustrate relevant anatomical relationships necessary for a clinician to provide a coherent clinical diagnosis. The class will also emphasize functional correlates of anatomy that are not addressed in BMS531, and provide students an opportunity to gain critical writing and oral presentation skills.

Course format: The course will be divided into four regions of study: thoracic limb, pelvic limb, head and neck, and thorax abdomen and pelvis. We will spend approximately four weeks for each region, paralleling the regional time frame in BMS531, Domestic animal dissection.

Each region of study will include introductory lectures; individual worksheets as a basis for class discussion covering a single clinical case; group presentations covering group assigned clinical cases, and a quiz.

SEMESTER SCHEDULE

Jan. 18 – Class introduction and orientation

Jan. 25 – Lecture #1: Thoracic limb overview. Thoracic limb class case study posted.

Feb. 1– Class discussion over Thoracic limb class case study.

Feb. 8 – **Thoracic limb quiz**: covers Thoracic Limb lecture; Thoracic limb class case study. **Group "warm up" presentations.**

Feb. 15 – Lecture #2: Pelvic limb overview. Pelvic limb class case study posted.

Feb. 22 – Class discussion over Pelvic limb class case study. Pelvic limb group case studies posted.

Feb. 29 – **Group presentations of Pelvic Limb case studies**.

March 7 – **Pelvic limb quiz**: covers Pelvic Limb lecture; Pelvic limb class case study & Head & Neck group presentations.

March 14 – SPRING BREAK

March 21 – Lecture #3: Cranial Nerves. Head & Neck class case study posted.

March 28 – Class Discussion over Head & Neck class case study. Head & Neck group case studies posted.

April 4 – **Group Presentations of Head & Neck case studies.**

April 11 – **Head & Neck quiz**: covers Head & Neck Lecture; Head & Neck class study and Head & Neck group presentations.

April 18 – Lecture #4: Autonomic nervous system. Thorax, abdomen & pelvis class case study posted.

April 25 – Class discussion over TAP class case study. TAP group case studies posted.

May 2 – **Group presentations of TAP case studies.**

TBD– 4:10 - **TAP quiz**: covers TAP lecture, TAP class case study and TAP group presentations.

CASE BASED LEARNING

There will be four class clinical case-based studies and three group clinical case-based studies during the semester. These studies allow students the opportunity to conduct independent research on selected areas of anatomy that have clinical relevance and to discuss their findings in a small group setting. Through this process, students should improve their ability to communicate specific and detailed anatomical information by using appropriate scientific language in written and spoken forms. Your cases should be written to an audience of fellow graduate students, your instructors and future employers.

Cases are stories – real or simulated – that illustrate some important features of a field of study. In this course, we will analyze a selection of cases that illuminate important concepts of animal anatomy. A case study will generally involve a case history – the description of the symptoms and the progression of a medical disorder. The knowledge that we have gained in studying animal anatomy should be used to address the situation or problem.

In approaching the cases you must keep the following issues in mind:

1. What is the normal anatomy? How do these structures work normally?

2. What problem must be solved? What specific situation must be addressed?

3. On the basis of your interpretation of the situation, what solution could be proposed?

The foundation of all conclusions drawn in this class should be demonstrable domestic animal anatomy. It is not the purpose of this class to train clinicians. The purpose is to enhance your understanding of animal anatomy by using a clinical case based study approach. The specific information and experiences that all members of the class bring to the discussions make learning more enjoyable and are always encouraged. After all information has been presented and discussed, all conclusions should be related to the foundation of animal anatomy to finalize the concepts for further study and examination purposes.

CLASS CASE STUDY PROCEEDURE

1. Individual clinical case study assignments, including pertinent discussion questions will be posted on Ram CT.

2. Outside of class, you will answer the discussion questions on the clinical case study. You are free to work in groups, but must turn in your own clinical case study assignment. The textbook, atlas and dissector are good sources of information to begin answering the questions. At least one other reference text (such as Evans or Sisson and Grossman) must be used. Internet sources may also be used, but should be rigorously evaluated for accuracy and relevance and do not substitute for texts. You are encouraged to be creative in your search for knowledge. Personal accounts and interviews may also be great resources. Just remember that all sources must be cited appropriately as described in the citation formats section of this document. You will receive written evaluation and feedback concerning assignment content and writing skills. These assignments not only serve to hone your anatomical knowledge, but also serve for you to develop writing skills and as a precursor to your Master's comprehensive written final examination in May.

3. Clinical case study assignments are due the following week. Hand written answers are strongly discouraged. The preferred answer format is a document from a word processing program, double-spaced with 12 point or greater font. Drawings and/or diagrams are encouraged when appropriate, labeled correctly and thoroughly cited if not original work.

4. On the day the written answers are due, and after they are turned in, the case will be discussed in class and you will be required to demonstrate a mastery of the material required to analyze the case study.

GROUP CASE STUDY / PRESENTATION PROCEEDURE

A. A description of each case study including pertinent questions will be posted on Ram CT for each group. Each group will have a different case study.

B. Outside of class your group will answer the series of questions about each case. Suggestions for and restrictions on your sources of information from which to answer the questions are the same as the Class Case Studies. At least two reference texts must be used and all sources must be cited in the appropriate format. The week following receipt of the assignment, three things are required for successful completion of the assignment.

1. Each group will produce a uniform document containing in-depth answers to the case study questions. The questions may be divided among group members and answered individually, however, all members must participate and the final document must be produced in a uniform format from a word processing program. The document should be double-spaced using 12 point or larger font. The document should be in narrative form with an introduction, specific question answers and a conclusion. The use of figures is encouraged. Two copies of this document should be turned in to the instructors at the beginning of class. All group member names and the group number should be on the first page.

2. Each group will produce a written summary of the case and the answers to the specific questions, which will be handed out to class members the beginning of class. These summaries are designed to be the study guide for your classmates regarding your group case. The summary should include the directed questions from the case study, be in bullet/outline form, no more than two pages long, summarizing all major points, leaving room for written notes to be taken during the oral presentation and subsequent discussion.

3. Each group will produce and perform an oral presentation of their case study findings to the class. These presentations must include ALL members of the group. Presentations are to be no more than 20 minutes long with an additional 5 minutes for questions from the class and/or instructors. The presentation must be in Power point (or similar) format. The instructors will provide the equipment necessary (lap top computer and computer projector) to conduct these presentations

You will be working in groups of four students for your presentations. **It is important that each of you make a concerted effort at group cooperation and group learning.**

QUIZZES

There will be a 25 point quiz covering each of the four regional units of study. Each quiz will cover the lecture given for that region – 9 points; the class case study worksheet – 8 points; and all of the group case study presentations – 8 points (2 points/groups case study).

GRADING

Grade evaluation will be based on:

- Class case studies: 25 points each, 4X = 100 pts
- Group presentations: 25 points each, 4X = 100 pts
- Group presentation summary worksheets: 25 points each, 3X = 75 *
- Quizzes: 25 points each, 4X = 100pts

* There are no group presentation summary worksheets for Unit #1

TOTAL POINTS = 375

A = 336 – 375

B = 298 – 335

C = 261 – 297

D = 223– 260

CITATION FORMATS

Use the parenthetical style (Author, date) in the body of your document. References should be listed alphabetically by author's last name under the heading Works Cited or similar. Please use the following formats as a guide:

Texts: Moore, K.L. 1999. Clinically Oriented Anatomy, 4th ed. Baltimore: Lippincott Williams & Wilkins. pp 263-271.

For texts with editors, use the same format but insert the word "editor(s)" after the name(s).

Journal Articles: Wenz JF, Gurkan I, Jibodh SR. 2002 October. Mini-Incision Total Hip Arthroplasty: A Comparative Assessment of Perioperative Outcomes. Orthopedics 25 (10): 1031-1043.

Internet Source: [Abbreviated Name of Corporate Author, if appropriate] Name of Corporate Author. Year of Publication. TITLE OF MONOGRAPH [monograph online]. Place of Publication: Publisher; [Update Information, if appropriate]. Availability Information. Date of Access.

Example: 1UPHealth. 2002. Carotid Artery Surgery. [monograph online]. A.D.A.M. Inc. Review Date: 7/23/2002. Reviewed By: Julie A. Miller, M.D., Department of Surgery, Royal Melbourne Hospital, Melbourne, Australia. Review provided by VeriMed Healthcare Network. http://www.1uphealth.com/health/carotid_artery_surgery_info.html. Accessed 2003 June 27.

More information on citations can be found on the CSU Writing Center's web page: http://writing.colostate.edu/references/sources/cbe/pop5c.cfm

BMS633 – 2020 Syllabus from Canvas

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Dr. Anna Fails
Assistant Professor
232 Physiology
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Meeting time/place: Wednesdays 2:30 - 4:30, Anatomy Zoology W106
Required: Canvas
Recommended Text: Textbook of Veterinary Anatomy. Dyce, Sack and Wensing

Course Objectives: The objective of this class is to review domestic animal gross anatomy from a clinical standpoint utilizing a series of cases that illustrate some of the important concepts in anatomy. Study will include clinical cases that best illustrate relevant anatomical relationships necessary for a clinician to provide a coherent clinical diagnosis. The class will also emphasize functional correlates of anatomy that are not addressed in BMS531, and provide students an opportunity to gain critical writing and oral presentation skills.

Course format: The course will be divided into four regions of study: pelvic limb, thoracic limb, thorax abdomen and pelvis, and head and neck. We will spend approximately four weeks for each region, paralleling the regional time frame in BMS531, Domestic Animal Dissection. Each region of study will include introductory lectures; individual worksheets as a basis for class discussion covering a single clinical case; group presentations covering group assigned clinical cases, and a quiz.

SEMESTER SCHEDULE

Jan. 18 Class introduction and orientation. Determine time/date for Final Exam.
Jan. 25 Lecture #1: Pelvic limb overview. Begin Pelvic limb class case study.
Feb. 1 Class discussion over Pelvic limb class case study.
Feb. 8 **Pelvic limb quiz**: Covers Pelvic Limb lecture; Pelvic limb class case study. **Group "warm up" presentations.**
Feb. 15 Lecture #2: Thoracic limb overview. Begin Thoracic limb class case study
Feb. 22 Class discussion over Thoracic limb class case study. Begin Pelvic/Thoracic limb group case studies.
Mar. 1 **Group presentations of Thoracic/Pelvic Limb case studies.**
Mar. 8 **Thoracic limb quiz**: covers Thoracic Limb lecture; Thoracic limb class case study & Pelvic/Thoracic group presentations.
Mar. 15 SPRING BREAK
Mar. 22 Lecture #3: Autonomic Nervous System (FAILS). Begin Thorax, abdomen & pelvis class case study
Mar. 29 Class discussion over TAP class case study. Begin TAP group case studies.
April 5 Group presentations of TAP case studies.
April 12 **TAP quiz**: Covers TAP lecture, TAP class case study and TAP group presentations.
April 19 Lecture #4: Cranial Nerves. Begin Head & Neck class case study.
April 26 Class Discussion over Head & Neck class case study: Monkey (FAILS). Head & Neck group case studies.
May 3 Group Presentations of Head & Neck case studies.

May10*   Head & Neck quiz: ***** TBD **** Covers Head & Neck Lecture; Head & Neck class study and Head & Neck group presentations.
*There is no University appointed time for a Final Exam in this course. The class will determine a time for this quiz during the first week of class.

CASE BASED LEARNING

There will be four class clinical case-based studies and three group clinical case-based studies during the semester. These studies allow students the opportunity to conduct independent research on selected areas of anatomy that have clinical relevance and to discuss their findings in a small group setting. Through this process, students should improve their ability to communicate specific and detailed anatomical information by using appropriate scientific language in written and spoken forms. Your cases should be written to an audience of fellow graduate students, your instructors and future employers. Be sure to get in the habit of using **BOLD** text to highlight important structures or concepts in any of your work, including group case write-ups or class cases. This will help you to prepare for the MS-B Comprehensive Exams if you are taking them.

Cases are stories – real or simulated – that illustrate some important features of a field of study. In this course, we will analyze a selection of cases that illuminate important concepts of animal anatomy. A case study will generally involve a case history – the description of the symptoms and the progression of a medical disorder. The knowledge that we have gained in studying animal anatomy should be used to address the situation or problem.

In approaching the cases you must keep the following issues in mind:
1. What is the normal anatomy? How do these structures work normally?
2. What problem must be solved? What specific situation must be addressed?
3. On the basis of your interpretation of the situation, what solution could be proposed?

The foundation of all conclusions drawn in this class should be demonstrable domestic animal anatomy. It is not the purpose of this class to train clinicians. The purpose is to enhance your understanding of animal anatomy by using a clinical case based study approach. The specific information and experiences that all members of the class bring to the discussions make learning more enjoyable and are always encouraged. After all information has been presented and discussed, all conclusions should be related to the foundation of animal anatomy to finalize the concepts for further study and examination purposes.

CLASS CASE STUDY PROCEDURE

1. Individual clinical case study assignments, including pertinent discussion questions will be posted on Canvas
2. Outside of class, you will answer the discussion questions on the clinical case study. You are free to work in groups, but must turn in your own clinical case study assignment. If you do work in groups, be rigorous in your efforts to ensure that your conclusions are correct and that you understand them. You will see this material again on a quiz. The textbook, atlas and dissector are good sources of information to begin answering the questions. At least one other reference text (such as Evans or Sisson and Grossman) must be used. Internet sources may also be used, but should be scrupulously evaluated for accuracy and relevance and do not substitute for texts. You are encouraged to be creative in your search for knowledge. Personal accounts and interviews may also be great resources. Just remember that all sources must be cited appropriately as described in the citation formats section of this document. You should use at *least two references* for an assignment and **BOLD** all important structures/concepts.

You will receive written evaluation and feedback concerning assignment content and writing skills. These assignments not only serve to hone your anatomical knowledge, but also serve for you to develop writing skills and as a precursor to your Master's comprehensive written final examination in May.

3. Clinical case study assignments are due the following week. Hand written answers are NOT accepted. The preferred answer format is a document from a word processing program, double-spaced with 12 point or greater font. Drawings and/or diagrams are encouraged when appropriate, labeled correctly and thoroughly cited if not original work. Drawings and diagrams are encouraged to be original work or a compilation of class diagrams with original work and may be labeled by hand.

4. On the day the written answers are due, and after they are turned in, the case will be discussed in class and you will be required to demonstrate a mastery of the material required to analyze the case study.

GROUP CASE STUDY / PRESENTATION PROCEDURE

A. A description of each case study including pertinent questions will be posted on Canvas for each group. Each group will have a different case study.

B. Outside of class your group will answer the series of questions about each case. Suggestions for and restrictions on your sources of information from which to answer the questions are the same as the Class Case Studies. At least two reference texts must be used and all sources must be cited in the appropriate format. The week following receipt of the assignment, three things are required for successful completion of the assignment.

1. Each group will produce a uniform document containing in-depth answers to the case study questions. The questions may be divided among group members and answered individually, however, all members must participate and the final document must be produced in a uniform format from a word processing program. The document should be double-spaced using 12 point or larger font. The document should be in narrative form with an introduction, specific question answers and a conclusion. The use of figures is encouraged. Two copies of this document should be turned in to the instructors at the beginning of class. All group member names and the group number should be on the first page. Do not forget your references - you should use at least 2.

2. Each group will produce a written summary of the case and the answers to the specific questions, which will be handed out to class members the beginning of class. These summaries are designed to be the study guide for your classmates regarding your group case. The summary should include the directed questions from the case study, be in bullet/outline form, no more than two pages long, summarizing all major points, leaving room for written notes to be taken during the oral presentation and subsequent discussion.

3. Each group will produce and perform an oral presentation of their case study findings to the class. These presentations must include ALL members of the group. Presentations are to be no more than 15 minutes long with an additional 5 minutes for questions from the class and/or instructors. The presentation must be in Powerpoint (or similar) format. The instructors will provide the equipment necessary (lap top computer and computer projector) to conduct these presentations. Be sure to answer the case questions (and include case images/diagrams) in your presentation. A rubric will be used for group and individual assessment.

You will be working in groups of 4-5 students for your presentations. It is important that each of you make a concerted effort at group cooperation and group learning. Each member of the group will be asked to rate their group member's participation on a scale of 1-5 (1 poor, 5 excellent) and this will be averaged to determine your participation for each group process.

QUIZZES

There will be a 25 point quiz covering each of the four regional units of study. Each quiz will cover the lecture given for that region (~8 points), the class case study worksheets (~8 points), and all of the group case study presentations (2 points/groups case study).***Quizzes will be given no more than 30 minutes to complete***. Be prepared to practice at least ONE of the MSB comprehensive exam questions on each of your quizzes. The goal of these quizzes is to demonstrate your mastery and integration of this material with rapid recall and delivery. *If you require RDS accommodations, your quiz will begin at 2 pm so that everyone has completed their quiz by 3 pm.*

GRADING

Grade evaluation will be based on:
Class case studies: 20 points each, 4X = 80 pts
Group presentations and participation/group reflection: 15 points for presentation, 5 points for participation/reflection, 20 pts 4X = 80 pts
Group reports and worksheets: 10 points each, 3X = 30 pts *
Quizzes: 25 points each, 4X = 100 pts
* There are no group presentation summary worksheets for Unit #1

TOTAL POINTS = 290
A (A >90%) = 262-290
B (80% < B < 90%) = 232-261
C (70% < C < 80%) = 203-231
D (60% < D < 70%) = 174-202
The +/- scale is not used in this course. There is no rounding, bumping, scaling, or curving to this course.

CITATION FORMATS

Use the parenthetical style (Author, date) in the body of your document. References should be listed alphabetically by author's last name under the heading Works Cited or similar. Please use the following formats as a guide:

Texts: Moore, K.L. 1999. Clinically Oriented Anatomy, 4th ed. Baltimore: Lippincott Williams & Wilkins. pp 263-271.

For texts with editors, use the same format but insert the word "editor(s)" after the name(s).

Journal Articles: Wenz JF, Gurkan I, Jibodh SR. 2002 October. Mini-Incision Total Hip Arthroplasty: A Comparative Assessment of Perioperative Outcomes. Orthopedics 25 (10): 1031-1043.

Internet Source: [Abbreviated Name of Corporate Author, if appropriate] Name of Corporate Author. Year of Publication. TITLE OF MONOGRAPH [monograph online]. Place of Publication: Publisher; [Update Information, if appropriate]. Availability Information. Date of Access.

Example: 1UPHealth. 2002. Carotid Artery Surgery. [monograph online]. A.D.A.M. Inc. Review Date: 7/23/2002. Reviewed By: Julie A. Miller, M.D., Department of Surgery, Royal Melbourne Hospital, Melbourne, Australia. Review provided by VeriMed Healthcare Network. http://www.1uphealth.com/health/carotid_artery_surgery_info.html. Accessed 2003 June 27.

More information on citations can be found on the CSU Writing Center's web page: http://writing.colostate.edu/references/sources/cbe/pop5c.cfm

BMS633
SPRING 2011

QUIZ 1 – THORACIC LIMB

1. In the antebrachium of the thoracic limb, the craniolateral muscles are generally considered to be _________________ (action) of the carpus and digits, and innervated by the __________________ nerve. 2pts.

2. The principle blood supply to the manus is the ________________ artery, which is a direct continuation of the _______________ artery. 2pts.

3. Intravenous injections given in the cranial antebrachial region of the thoracic limb can generally be given into the ______________ vein. 1pt.

4. In the distal equine limb, the medial palmer artery splits into medial and lateral digital arteries just proximal to the ______________________ joint. 1pt.

5. In the equine limb, all nerves distal to the antebrachium are **motor/sensory** (circle one) 1pt.

6. As a general rule, flexors of the carpus and digits receive their motor innervation from the ____________________ nerve(s) and arise from the ___________________________ of the humerus. 2pts.

7. When weight is loaded onto the appendicular skeleton, the equine shoulder joint has a tendency to collapse into **flexion / extension** ?(circle 1) What muscle and unique muscle modifications prevent this from occurring? ____3pts.

8. When weight is loaded onto the appendicular skeleton, the equine metacarpal-phalangeal (fetlock) joint has a tendency to collapse into **flexion** / **hyperextension**? (circle 1) 1pt.

9. Under normal conditions and weight bearing, what structure prevents the distal interphalangeal (coffin) joint from going into hyperextension? What unique feature of this structure makes this function possible? 2pts

10. The suspensory apparatus is composed of the suspensory ligament, the ___________________ and the __________________________. 2pts.

11. **Name two additional structures**, beyond the actual suspensory apparatus, that help prevent collapse of the metacarpophalangeal joint. 2pts.

12. The neurovascular bundle (medial & lateral palmar arteries / veins + the medial and lateral palmar nerves) found in the metacarpus of the horse can be found between the ____________________ ligament and the ___________________________ tendons. 2pts.

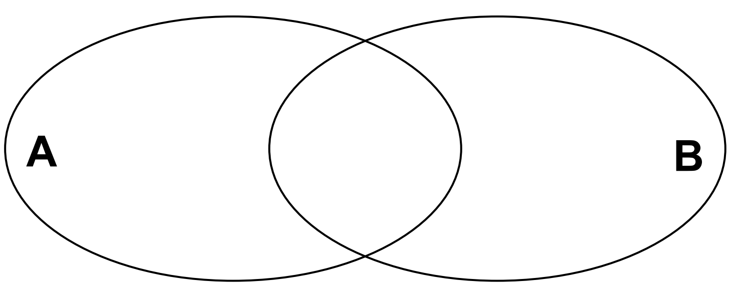
13. Name one evolutionary adaptation the horse has made in order to run fast? (hint: consider the physics of a pendulum) 1pt.

14. Explain the difference between "**median**" and "**medial**". 1pt.

15. What major nerve in the Canine thoracic limb is responsible for weight bearing on that limb?

    a) median
    b) ulnar
    c) radial
    d) musculocutaneous

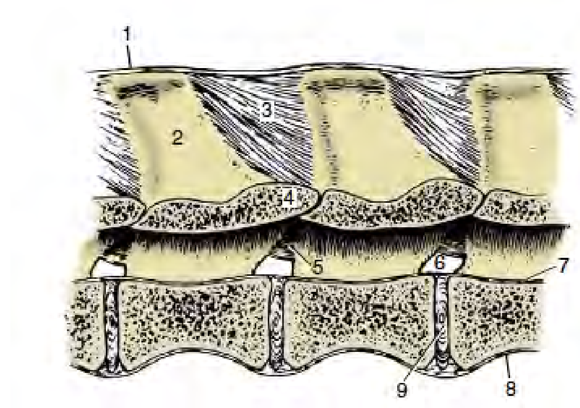
16. Assume A and B are sensory cutaneous nerves. Indicate with an "X" the specific portion of this figure that represents nerve B's autonomous zone. 1pt



BMS633 **Name**______________________

QUIZ 2 – THORACIC LIMB

1. In the image of the vertebral column to the right, identify the following ligamentous structures (1, 3, 7, 8) as they are numbered below (1 pt ea, 4 pt total)



1.

3.

7.

8.

2. The neurovascular bundle (medial/lateral palmar v.a.n.) found in the metacarpus of the horse can be found between the ______________ ligament and the _______________ tendons. (1 pt).

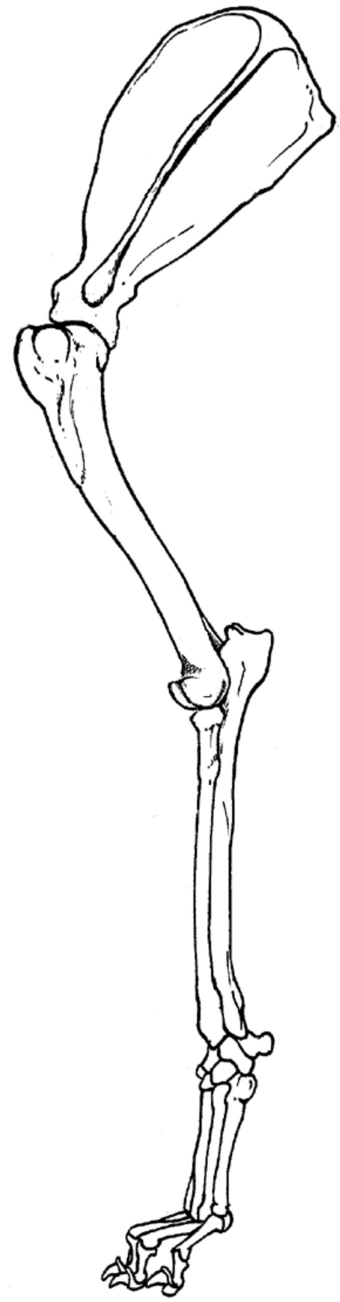
3. Neurovascular structures that pass through the carpal canal are the ____________________. (1 pt)

4. How is the distal phalanx is "suspended" within the hoof. How is this clinically relevant? (2 pts)

5. ***Briefly*** describe a ***dysplastic*** process of the forelimb or hindlimb in small or large animals (1 pt) that requires anatomical correction/intervention (1 pt, describe intervention).

/10 pts page 1

6. DESCRIBE AND DRAW the path of the radial nerve in the K9 thoracic limb. Be sure to include major branches of this nerve, significant landmarks for locating this nerve, the muscles this nerve innervates, and the cutaneous distribution of this nerve. Be sure to include any significant features noted with dysfunction of this nerve. 11 points



/11 pts page 2

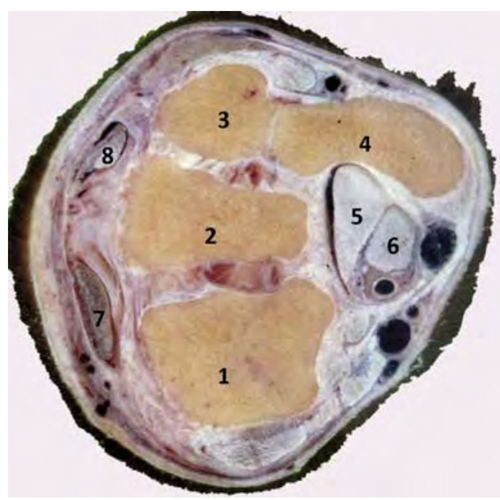
7. List the muscles must be cut in order to amputate a canine thoracic limb (1/2pt each, 4 pts)

1.
2.
3.
4.
5.
6.
7.
8.

Extra Credit 2 points – Cross section equine carpus

Identify structures 1-8 (hint 1-4 are bones, 5-8 are tendons)

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________



/6 pts page 3

BMS 633
SPRING 2011

HEAD AND NECK QUIZ

1. Name one cranial nerve that has motor, sensory and autonomic functions. ______________________________ 1 pt.

2. List one cranial nerve that provides motor innervation to extraocular muscles of the eye. ________________________1 pt.

3. List one cranial nerve that only has sensory functions. __________________________________ 1pt.

4. The ___________________________ nerve (name a cranial nerve) supplies taste innervation to the rostral 2/3rds of the tongue. 1pt.

5. Name two cranial nerves that have an autonomic function. ____ 2pts.

6. The motor cell bodies (nuclei) for cranial nerves that have motor functions are located in the __________. 1pt.

a. cerebrum
b. brainstem
c. peripheral ganglia
d. cerebellum

7. The sensory limb of the corneal reflex (touching the cornea followed by blinking) is the _________________ __________branch (a specific nerve) of the _______________ ____________nerve (name a cranial nerve), and the motor limb of this reflex is the ______________________ nerve (name a cranial nerve) 3pts.

8. The somatic motor component of the facial nerve exits the cranial vault via the ______________________________, enters the facial canal located in the petrous portion of the temporal bone, and then exits the skull thru the ____________________________ foramen. 2pts.

9. Severe atrophy of the temporalis and masseter muscles may indicate damage to the ____________________division of the _____________________________ nerve (a cranial nerve). 2pts

10. The majority of laryngeal muscles act to close the rima glottidis. **T / F**. 1pt.

11. The ________________ nerve is responsible for the motor supply to nearly all of laryngeal muscles and is sensory below the vocal folds. 1pt

12. The equine guttural pouch is really a diverticulum of the ____ 1pt.

12. Which of the following is/are an important structure(s) with close proximity to the equine guttural pouch and can be damaged by severe guttural pouch infections. 1pt.
    a. vagus n.
    b. glossopharyngeal n.
    c. internal carotid a.
    d. all of the above

14. In horses, all paranasal sinuses on one side, empty into the nasal cavity through a single nasomaxillary opening. **T / F** 1pt.

15. In horses, the roots of upper (maxillary) cheek teeth are associated with the ____________________________ paranasal sinus. 1pt.

16. A cat presents to you with right-sided 1) decreased tear production, 2) flaccidity of the commissure of the lips and 3) flaccid whiskers. These are suggestive of dysfunction of what cranial nerve? _____________________1pt.

17. Identify two different sensory functions of the 8th cranial nerve. ____2pts

18. The motor function of which cranial nerve is responsible for drawing the eye caudad and producing the passive sweep of the third eyelid across the anterior globe?"____________________ .1pt.

19. Following a neurological exam of a brainstem troubled kitty, you notice the animal can still lick her lips. You therefore conclude that the ___________________nerve (cranial nerve) is functioning normally.1pt

BMS 633 NAME:__________________

SPRING 2018 – NO GROUP CASES

HEAD AND NECK QUIZ

1. Name ONE cranial nerve that has motor, sensory and parasympathetic functions and describe each of those functions. (3 pts)

   Cranial Nerve: ____

   Motor:

   Sensory:

   Parasympathetic:

2. Autonomics to the eye include pre-ganglionic sympathetics that synapse at the ___________________ before the post-ganglionic sympathetics travel through the ____________________(something related to the ear) on their way to the eye. (1pt)

3. The palpebral reflex (touching the cornea of the eye followed by blinking/closing of the palpebral fissure) consists of one CN providing the sensory limb and another CN the motor response. The sensory limb is the ______________________ (nerve), and the motor limb of this reflex is the _________________________ (nerve). (2pts)

4. The somatic motor component of the facial nerve exits the cranial vault via the _____________________ along with the ______________________ (Hint: a CN), then enters the facial canal located in the petrous portion of the temporal bone, and then exits the skull from the __________________________ foramen. (3pts)

5. The ________________________nerve (be specific) is responsible for the motor supply to the lateral cricoarytenoid m. (1pt)

6. A cat presents to you with right-sided 1) decreased tear production, 2) flaccidity of the commissure of the lips and 3) flaccid whiskers. These are suggestive of dysfunction of what cranial nerve? ______________________.(1pt)

7. The motor function of which cranial nerve is responsible for drawing the eye caudad and producing the passive sweep of the third eyelid across the anterior globe?__________________________ .(1pt)

Page 1 /12pts

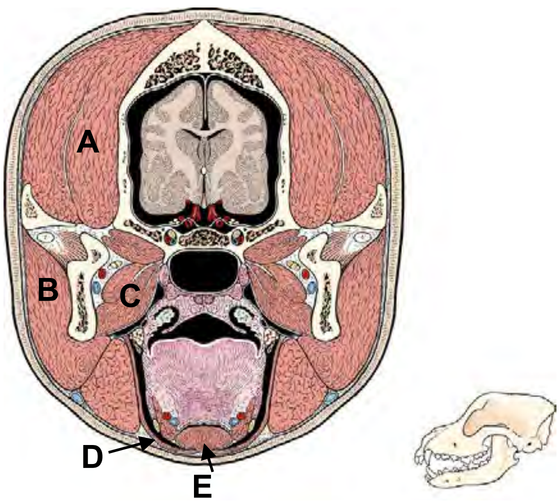
NAME:________________

9. Describe Cranial Nerve X. Include all of its functions - motor sensory, autonomic, its target organs and its basic anatomic pathway - origins, destinations, foramina of exit/entry. If there are other nerve fibers that are associated with this nerve, please include these details as well as any ganglia associated with this nerve. (8 pts)

Page 2 /8 pts

NAME:_______________

10. Identify the following (A-E) structures (1/2pt each):



A. ______________________________

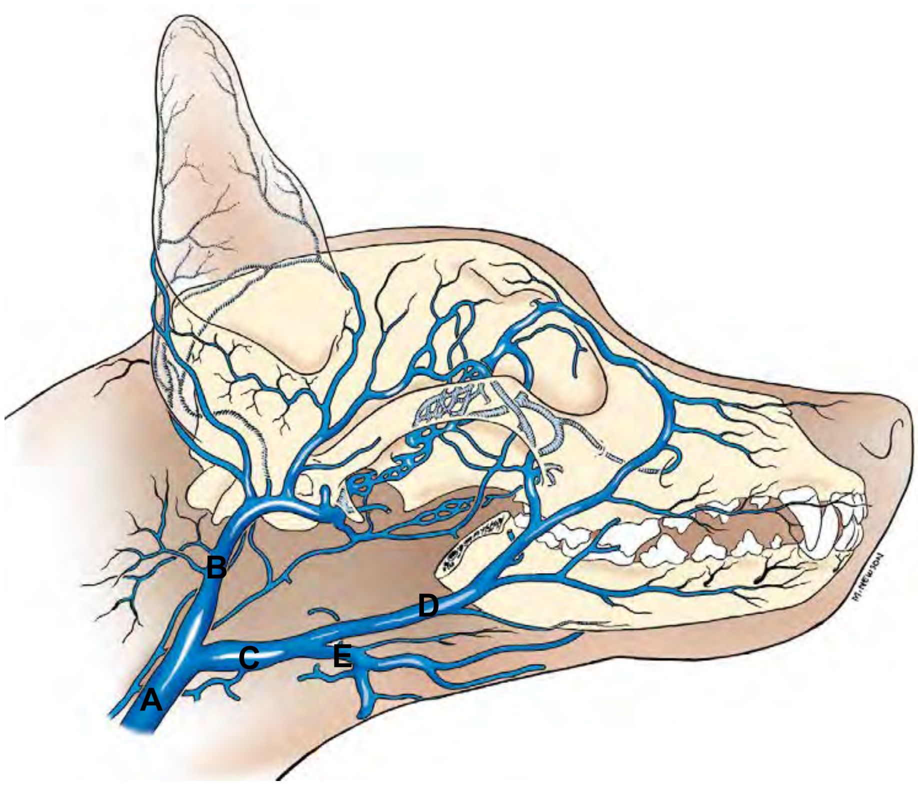
B. ______________________________

C. ______________________________

D. ______________________________

E. ______________________________

11. Identify the following (A-E) structures (1/2pt each):



A. __________________

B. __________________

C.__________________

D.__________________

E. __________________

Page 3 /5 pts

NAME:__________________

EC. 1. What is the function of CN XI? (1pt)

EC. 2. Describe in detail one nerve block associated with the head that can be used in clinical practice. Include details such as anatomical landmarks, foramen, nerve fiber types (motor/sensory), branching of parent nerves if appropriate, indications and risks to the procedure. (Max 2 pts)

Page 4 /3pts

Courses 5 and 6: BMS384/684 Supervised College Teaching
Domestic Animal Anatomy

Syllabus BMS384 for BMS305 Spring 2012 (Magee, Course Director) (pg 100-101)
- *First year of teaching, no changes from previous course*

Syllabus BMS684 for BMS531 Spring 2012 (Magee, Course Director) (pg 102-103)
- *First year of teaching, no changes from previous course*

Syllabus BMS384 for BMS305 Spring 2020 (Magee, Course Director) (pg 104-105)
- *Specific changes included a weekly TA meeting and introduction of tours during 305 Labs*
  - -Redistribution of course points with greater emphasis on knowledge via quizzes and teaching evaluations by instructors and students
  - -Weekly meetings provide an opportunity for student assessment and ensure content accuracy during regular and open laboratory sessions. Specific instruction for teaching strategies, opportunities to provide support and trouble shoot, as well as team building also occur.

Syllabus BMS684 for BMS531 Spring 2020 (Magee, Course Director) (pg 106-107)
- *Specific changes included the weekly TA meeting and assessment of dissection of large animal specimens*
  - -Redistribution of course points with greater emphasis on _nnjga_rgml md i l mujcbec for prosected specimens for the course

Syllabus BMS384/684 for BMS305/531 Spring 2020 - COVID changes (pg 108-111)
- *Specific changes facilitated the move to online Virtual Anatomy Lab*
  - -All teaching assistants provide 2 hours of TA time via Zoom for a total of 46 virtual hrs
  - -Weekly TA meeting each week in Teams with content review, questions, and feedback
  - -TAs work in pairs to develop test questions to be used for BMS305 online exams - this replicates the efforts during exams to set up test questions and proctor lab exams
  - -TAs voluntarily provide "expert hours" in Virtual Lab and VoiceThreads of specific content for distribution to BMS305 following faculty approval - this replicates assigned tours in normal BMS305 laboratory sessions

BMS684/384 - Supervised College Teaching

Course Information for
Teaching Assistants in BMS305 – Domestic Animal Gross Anatomy
Spring 2012

Christianne Magee, DVM, PhD, DipACT
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Mr. Andrew Eitzer
Graduate Teaching Assistant
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Office hours: Tues/Wed 10-11am
or by appointment
Andrew.Eitzer@colostate.edu

BMS684/384 TEACHING ASSISTANT GRADING POLICY

Grades will be based on **360 points total**.
Traditional letter grades will be assigned based on a 90, 80, 70, 60 percent scale.

Quizzes

There will be at least 12 quizzes available on RamCT. There will be a quiz each week except those weeks of BMS305 exams. Each quiz will be worth 10 points and consist of approximately 10 questions covering the lab material assigned in The BMS305 lab guide for that week. Quizzes must be completed by NOON on Thursdays before BMS305 lab. The lowest quiz grade will be dropped. No makeups.

110 points possible

BMS305 Laboratory Attendance

Attendance and punctuality at the assigned lab section are required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused) and 5 points will be subtracted for each tardy. 1 credit hour is at least 2 hours of BMS305 laboratory attendance as a TA.

100 points possible

Open Laboratory Attendance

Attendance at the assigned lab section is required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused). 1 credit hour is at least 2 hours of BMS Open Laboratory attendance as a TA.

100 points possible

Student Evaluations

Each TA will be evaluated by the students in her/his lab section at the middle and end of the semester. The students will evaluate each TA on a scale of 1 (poor) to 5 (good) in three areas; contact, prompt and accurate answers, and helpfulness and enthusiasm.

Instructor Evaluation

Overview of total lab performance, instructor's subjective scale

50 points possible

Total of 360 points possible

BMS684/384: TAs for BMS305: 2 Credits

DUTIES:

1. Be prepared for lab.

2. Read the assignment in The BMS305 lab guide before lab. Find difficult structures in atlases and on cadavers during open lab or other lab sections.

3. Put appropriate models or bones out (ask lab instructor).

4. Immediate responsibility for SECURITY of specimens, bones and models, atlases.

5. Immediate responsibility for lab clean-up (done by students, including floor).

6. Wear clean lab coat with name tag.

7. If you don't know it, don't say it - ask someone else, or use a reference book.

8. Volunteer to help proctor exams.

9. At end of semester, help with disposition of cadavers and clean-up.

10. Remember: Respect for our specimens, no gloves outside of the lab, and no pictures, please.

LAB PREPARATION:

General preparation for each lab should include the following:

1. Read and review lab information. Be familiar with locations and identification of all items included in lab. This includes revisions to the lab exercises.

2. Review your dissection prior to lab.

3. Review X-rays, charts, and models.

4. Despite all your expertise and preparation you still may run into some "gray" areas...Don't drive alone in the dark!!! Be a good Anatomy student and ask for some light to be shed on the matter before you lead others into the darkness!!!

5. Have a GOOD TIME!!!

<u>BMS684/384 - Supervised College Teaching</u>

Course Information for
Teaching Assistants in BMS531 – Domestic Animal Dissection
Spring 2012

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<u>BMS384 TEACHING ASSISTANT GRADING POLICY</u>
Grades will be based on **150 points total**.
Traditional letter grades will be assigned based on a 90, 80, 70, 60 percent scale.

<u>BMS531 Laboratory Attendance</u>
Attendance and punctuality at the assigned lab section are required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused) and 5 points will be subtracted for each tardy. Each 1 hour of credit requires at least 2 hours of laboratory attendance.

100 points possible

<u>Instructor Evaluation</u>
Overview of total lab performance, instructor's subjective scale

50 points possible

Total of 150 points possible

BMS684/384: TAs for BMS531:

DUTIES:

1. Be prepared for lab.

2. Read the assignment in The BS531 lab guide before lab. Find difficult structures in atlases and on cadavers during open lab or other lab sections.

3. Put appropriate models or bones out (ask lab instructor).

4. Immediate responsibility for SECURITY of specimens, bones and models, atlases.

5. Immediate responsibility for lab clean-up (done by students, including floor).

6. Wear clean lab coat with name tag.

7. If you don't know it, don't say it - ask someone else, or use a reference book.

8. Volunteer to help proctor/grade exams.

9. At end of semester, help with disposition of cadavers and clean-up.

10. Remember: Respect for our specimens, no gloves outside of the lab, and no pictures, please.

LAB PREPARATION:

General preparation for each lab should include the following:

1. Read and review lab information. Be familiar with locations and identification of all items included in lab. This includes revisions to the lab exercises.

2. Review your dissection prior to lab.

3. Review X-rays, charts, and models.

4. Despite all your expertise and preparation you still may run into some "gray" areas...Don't drive alone in the dark!!! Be a good Anatomy student and ask for some light to be shed on the matter before you lead others into the darkness!!!

5. Have a GOOD TIME!!!

BMS684/384 - Supervised College Teaching 2020

Course Information for
Teaching Assistants in BMS305 – Domestic Animal Anatomy

Christianne Magee, DVM, PhD, DipACT
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OBJECTIVES AND ORGANIZATION

Your objective for the semester is to further your knowledge of comparative animal anatomy while acting as an educational resource to the students in BMS305. Prosected specimens will be completed (Monday Tagging (TA) Quiz) prior to completion of dissection in BMS531 (Tuesday Table Check) and the BMS305 TA meeting (Tuesdays, 4:30pm W117), which is ahead of BMS305 (Thursday Laboratory). In the BMS305 Laboratory session, TAs will rotate between proctoring quizzes and giving anatomical tours to BMS305 students.

BMS684/384 TEACHING ASSISTANT GRADING POLICY

Grades will be based on **200 points total.**
Traditional letter grades will be assigned based on a 90, 80, 70, 60 percent scale.

Weekly Assessments (TA Quiz)

There will be 11 quizzes available on Canvas. There will be a quiz each week except those weeks of BMS305 exams. Each quiz will be worth 10 points and consist of approximately 10 questions covering the lab material assigned in the Lab Guide for that week. Quizzes must be completed by midnight on Wednesday before BMS305 lab. The lowest quiz grade will be dropped. No makeups. **50 points possible**

BMS305 Laboratory/Open Laboratory Attendance

Attendance and punctuality at the assigned lab section are required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused) and 5 points will be subtracted for each tardy. 1 credit hour is 3 hours of BMS305 laboratory attendance as a TA. **100 points possible**

Student/Instructor Evaluations

Each TA will be evaluated by the students in her/his lab section at the middle and end of the semester. The students will evaluate each TA on a scale of 1 (poor) to 5 (good) in three areas; contact, prompt and accurate answers, and helpfulness and enthusiasm. **25 points possible**

Instructor Evaluation

Overview of total lab performance, instructor's subjective scale. Factors that will be taken into consideration may include your interaction with BMS531 instructors/students, and assistance and accuracy when setting up, proctoring, or grading BMS305 exams. **25 points possible**

<u>**BMS684/384: TAs for BMS305: 1-2 Credits**</u>

DUTIES:

1. Be prepared for lab. This includes attending the weekly TA meeting at 4:30pm on Tuesdays in W117. The anatomical tours for BMS305 are on your Canvas page. Be prepared to give any of the tours on Tuesday. You will be assigned to proctor the quiz or give a "tour" that week in the laboratory session.
2. Read the assignment in the lab guide and review the lecture/laboratory presentations before lab. Review material in the Virtual Animal Anatomy (VAA) programs if appropriate. Find difficult structures in atlases and on cadavers during open lab or other lab sections.
3. Familiarize yourself with the appropriate models or bones out. Do NOT go searching for specimens to put out - ask the lab instructor or GTAs first.
4. Immediate responsibility for SECURITY of specimens, bones and models, atlases as well as students. No uninvited/unapproved guests.
5. Immediate responsibility for lab clean-up (done by students, including floor).
6. Wear clean lab coat with name tag.
7. If you don't know it, don't say it - ask someone else, or use a reference book.
8. Help set up, proctor, and grade exams. Exam set-up begins at 8am on BM305 Exam days and exams are graded that day/evening.
9. At end of semester, help with disposition of cadavers and clean-up. This will be a deep clean of W117.
10. Remember: Respect for our specimens, no gloves outside of the lab, and no pictures, please.

LAB PREPARATION:

General preparation for each lab should include the following:

1. Read and review lab information. Be familiar with locations and identification of all items included in lab. This includes revisions to the lab exercises and knowledge of the weekly tours.
2. Review your dissection, hanging/prosected specimens, and virtual programs.
3. Review radiographs, charts, and models if appropriate.
4. Despite all your expertise and preparation you still may run into some "gray" areas...Don't drive alone in the dark!!! Be a good Anatomy student and ask for some light to be shed on the matter before you lead others into the darkness!!!
5. Have a <u>GOOD TIME</u>!!!

BMS684/384 - Supervised College Teaching

Course Information for Teaching Assistants in BMS531 – Domestic Animal Dissection

Christianne Magee, DVM, PhD, DipACT
Course Director
Office: 240 Physiology
Office phone: 491-7371
Office hours: By appointment
Christianne.Magee@colostate.edu

OBJECTIVES AND ORGANIZATION

Your objective for the semester is to further your knowledge of comparative animal anatomy while acting as an educational resource to the students in BMS531. Dissection each week will focus on staying ahead (Monday Tagging (TA) Quiz) of BMS531 (Tuesday Table Check), which is ahead of BMS305 (Thursday Laboratory). The dissection plan for the week and the objectives for the following Monday will also be discussed. You are directly responsible for the specimen that you and your partner are dissecting each week, but should be familiar with all of the structures being identified in the laboratory and should assist with the care of all specimens. TAs will rotate between dissection (Can, Eq, Bov specimens) and providing assistance to BMS531 students, including Table Checks each week.

BMS384 TEACHING ASSISTANT GRADING POLICY

Grades will be based on **200 points total**.
Traditional letter grades will be assigned based on a 90, 80, 70, 60 percent scale.

BMS531 Laboratory Attendance

Attendance and punctuality at the assigned lab section are required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused) and 5 points will be subtracted for each tardy. Each 1 hour of credit requires at least 3 hours of laboratory attendance. **100 points possible**

Tagging (TA) Quiz: Specimen Dissection and Tagging

Each Monday, the laboratory objectives that are to be used for Table Check in BMS531 and the BMS305 Laboratory will be given to the dissectors/TAs to be labeled on the specimen that they have dissected during the previous week. There are weekly Table Checks in BMS531, therefore there will be weekly Tagging (TA) Quizzes that will require specimen tagging. Ten features will be labeled and require tagging by the TA pair, each worth 0.5 pts for a Quiz worth 5 pts each week. **50 points possible**

Instructor Evaluation

Overview of total lab performance, instructor's subjective scale. Factors that will be taken into consideration include quality of dissection, accuracy of labeling features other than those used for the TA Quiz, interaction with BMS531 instructors/students, and assistance and accuracy when setting up BMS531 exams. **50 points possible**

<u>BMS684/384: TAs for BMS531:</u>

DUTIES:

1. Be prepared for lab.

2. Read the assignment in the BMS305/531 lab guide before lab. Read the assigned section in Evans and deLahunta Guide to the Dissection of the Dog as well as the equine dissection guide provided by Dr. Magee. Additional review of anatomical features in Dyce or other resources (VCA, VEA) is strongly recommended.

3. Find difficult structures in atlases and on cadavers during open lab or other lab sections. Put appropriate models or bones out (ask lab instructor or GTA).

4. Immediate responsibility for SECURITY of specimens, bones and models, atlases, and students. No uninvited/unapproved guests.

5. Immediate responsibility for lab clean-up (done by students, including floor).

6. Wear clean lab coat with name tag.

7. If you don't know it, don't say it - ask someone else, or use a reference book.

8. Help set up, proctor, and grade exams if needed.

9. At end of semester, help with disposition of cadavers and clean-up. This includes a total lab clean-up (deep clean) at the end of the semester.

10. Remember: Respect for our specimens, no gloves outside of the lab, and no pictures, please.

LAB PREPARATION:

General preparation for each lab should include the following:

1. Read and review lab information. Be familiar with locations and identification of all items included in lab. This includes revisions to the lab exercises.

2. Review your dissection as well as those completed by other TAs prior to lab.

3. Review X-rays, charts, and models if appropriate.

4. Despite all your expertise and preparation you still may run into some "gray" areas...Don't drive alone in the dark!!! Be a good Anatomy student and ask for some light to be shed on the matter before you lead others into the darkness!!!

5. Have a GOOD TIME!!!

BMS684/384 - Supervised College Teaching (COVID update)
Course Information for
Teaching Assistants in BMS305 – Domestic Animal Anatomy

Christianne Magee, DVM, PhD, DipACT
Course Director
Office: Microsoft Teams
Office hours: By appointment
Christianne.Magee@colostate.edu

OBJECTIVES AND ORGANIZATION

Your objective for the semester is to further your knowledge of comparative animal anatomy while acting as an educational resource to the students in BMS305. During these trying times, please know that we need and appreciate your support and engagement now more than ever. Transitioning to fully online interactions is going to be hard for all of us, but we are sure that we will adapt and persevere.

WEEKLY TA MEETING (Microsoft Teams – Tuesdays, 4:30-5:30pm)

Our weekly TA meeting will now be held via Microsoft Teams. You don't need a Microsoft account to use Teams. Simply click the "Join Microsoft Teams Meeting" link in the invite emailed to you. This will open a webpage that gives you the option to either download the Teams desktop app, or "join on the web instead". If you join on the web, you can use either Microsoft Edge or Google Chrome (for Mac users). Microsoft Teams is not supported on Internet Explorer, Firefox, or Safari. **These meetings will be recorded and posted to Canvas. If you are uncomfortable being recorded during these meetings, you have the option of not sharing your webcam or microphone feed and can interact solely through the chat window.**

VIRTUAL OPEN LABORATORY

Zoom Meeting Room

Instead of holding regular BMS305 lab on Thursdays, we will hold Virtual Open Laboratory throughout the week using Zoom. **You must be signed up for 2 hours of virtual open lab time per TA credit hour**. Virtual open lab assignments are posted on the BMS684/384 Canvas homepage. Treat this virtual open lab like your open lab time previously in the semester, with the same respect and professionalism that you used in the AZ W117 lab. This Zoom meeting room is accessible 24 hours per day and students can use it to study with classmates without a TA supervision.

Zoom Meeting URL: https://zoom.us/j/5195399252

Meeting ID: 519-539-9252

Password: BMS305

Host Key (needed to Claim Host): 305531

Zoom Breakout Rooms: As the host you can also manage breakout rooms and may be asked to create a breakout room by students who wish to study without you as the TA. To do this, click on the Breakout Room icon on the bottom of your navigation toolbar. You can then assign students to the breakout rooms. If you want to join them to check in, you can manage the breakout rooms and move between rooms. This may allow you to take care of a larger group of students if the Zoom sessions are very busy, or split up as TAs for a session. The default time for a breakout room is 30 minutes and then all students are reloaded into the main room. You can change this or extend them in the session as the host if you know the students will need more time in their breakout room. Once you create a breakout room, you don't have to worry about closing it.

Virtual Lab Canvas Page

In addition to the BMS684/384 Canvas page, a new Canvas page has been created as a shared space for students to post questions, study, and interact with you through the "Discussions" tab. Please take a look at what the students are asking and help us guide questions to post here based on what students might need help with when you are in the Zoom sessions.

BMS684/384 TEACHING ASSISTANT GRADING POLICY

Grades will be based on **300 points total**. Traditional letter grades will be assigned based on a 90, 80, 70, 60 percent scale.

Weekly Assessments (TA Quiz)

There will be 11 quizzes available on Canvas. There will be a quiz each week except those weeks of BMS305 exams. Each quiz will be worth 10 points and consist of approximately 10 questions covering the lab material assigned in the Lab Guide for that week. Quizzes must be completed by midnight (11:59pm) on Tuesdays. The lowest quiz grade will be dropped. No makeups. **100 points possible**

Question Groups

Working in small teams, you will write three questions for each remaining unit (head/neck & TAP) and submit them via email to Damon (damon.mango@colostate.edu). Each team will be assigned to a specific lecture from each unit. The questions should be multiple choice, fill in the blank, matching or categorization. Feel free to get creative but remember these will be incorporated into the exams for BMS305, so the difficulty should reflect this. You will submit these questions through the Assignments tab in the BMS 384/684 Canvas page. Feedback from the teaching staff will be provided during TA meeting after questions are due. You must submit one image/ID question from VAA programs, one image-based question from a lecture PowerPoint, and one written question. Question group assignments, as well as instructions on how to create labeled screen captures from the VAA programs can be found on the BMS 384/684 Canvas homepage.

Head & Neck questions – Due 3/31 by 4:30pm - 25 points
TAP questions – Due 4/21 by 4:30pm - 25 points

Guided Quizzes - no points

To provide additional material for you to study from, we have created 6 Guided Quizzes for you to reference as we work through the head and TAP units. These quizzes follow a linear progression and are meant to provide you a mixture of instruction and knowledge assessment. These are strictly intended to be opportunities for you study while simultaneously testing your knowledge. **No points are assigned to these quizzes and they are entirely optional.** These quizzes will be available to you through the BMS384/684 Canvas page and are open to unlimited attempts.

BMS305 Laboratory/Open Laboratory Attendance

Attendance and punctuality at your assigned Virtual Open Lab (Zoom) time is required. Each TA will start the semester with 100 attendance points. 10 points will be subtracted for each absence (unexcused) and 5 points will be subtracted for each tardy. 1 credit hour is 3 hours of BMS305 laboratory attendance as a TA. **100 points possible**

Student/Instructor Evaluations

Each TA will be evaluated by the students in her/his lab section at the middle and end of the semester. The students will evaluate each TA on a scale of 1 (poor) to 5 (good) in three areas; contact, prompt and accurate answers, and helpfulness and enthusiasm. **25 points possible**

Instructor Evaluation

Overview of total lab performance, instructor's subjective scale. We will primarily take into consideration your interactions with BMS305 instructors/students. **25 points possible**

BMS684/384: TAs for BMS305: 1-2 Credits

DUTIES:

1. Be prepared for lab. This includes attending the weekly TA meeting at 4:30pm on Tuesdays in W117. We will no longer assign TA's to put on anatomical "tours" as we did for regular BMS305 lab on Thursdays. You must now be comfortable with all content covered during each week.

2. Read the assignment in the lab guide and review the lecture/laboratory presentations before lab. Review material in the VCA/VEA if appropriate. Find difficult structures in atlases and on cadavers before attending your virtual open lab time.

3. Reach out to your instructors and GTAs for help finding additional resources if you're having a difficult time conveying concepts to students.

4. Immediate responsibility for SECURITY of students in Virtual Open Lab (Zoom). **No uninvited/unapproved guests are allowed in the open lab zoom meeting room without prior instructor approval.** If you observe inappropriate behavior at any time in the Zoom meeting room, contact a course instructor as soon as possible.

5. If you choose to share your webcam feed while holding Virtual Open Lab (Zoom), please be presentable and avoid capturing anything inappropriate in the background.

6. If you don't know it, don't say it - ask someone else, or use a reference book.

7. Submit BMS305 exam questions as part of your Question Groups assignment.

8. All previous social media policies apply in the virtual environment. Screen captures of course material may be created to post Discussion board questions and/or shared in the Zoom laboratory only. Sharing materials outside of the BMS305 learning environment is unacceptable. For the CVMBS Media policy, please see http://csu-cvmbs.colostate.edu/Documents/cvmbs-social-media-policy.pdf

VIRTUAL OPEN LAB PREPARATION:

General preparation for open lab should include the following:

1. Read and review current week's information. Be familiar with locations and identification of all items included in lab.

2. Review your virtual programs, lab manual, and textbooks. There are now an unlimited number of online copies of the Dyce text available through the CSU Library. Some pictures from this text may be used for BMS305 lectures and Canvas based exams.

3. Despite all your expertise and preparation, you still may run into some "gray" areas...Don't drive alone in the dark!!! Be a good Anatomy student and ask for some light to be shed on the matter before you lead others into the darkness!!!

4. Have a GOOD TIME!!!

Course 7: VM795-004 Large Animal Anatomy and Dissection

-**VM795-004 Course Syllabus 2020 (Magee, Course Director) (pg 113-114)**

-launched in 2015, a with several major changes in 2019 and 2020

- -addition of several applied clinical sessions, including passing of a nasogastric tube and equine dentistry, nerve blocks, farrier lab, and a trip to the sale barn for "applied" anatomy
- -addition of applied case studies in 2020 with the goal of creating an outreach elective for undergraduate and DVM anatomy students to be deployed at CSU VTH Open House other programs/events including National Western Center. *Dissection Spring 2020 was not completed due to the online transition and lack of virtual anatomy resources for bovine head/neck and abdomen, but students have since completed their case studies in the online environment.*
- -formal approved of this course as a separate DVM elective has been delayed in order to incorporate these activities in DVM Curriculum Renewal goals

-**CVMBS Strategic Plan Goal - Enhancing Diversity in Anatomical Instruction (pg 115)**

-subgoals constructed prior to 2014 have been achieved including incorporating UG/G students in to the course as part of other independent study mechanisms. Development of teaching resources related to bovine anatomy (Virtual Bovine Anatomy) are still needed and USDA HEC grant support has been repeatedly pursued

VM795-004 (CRN 26792) – Independent Study in Large Animal Anatomy

Overview

Students in the first year DVM class have demonstrated in interest in continued large animal anatomy/dissection experience. The UG/G courses in domestic animal anatomy offered in Spring (BMS305/531) offer a unique opportunity to provide experience as there are additional equid and ruminant specimens dissected for these courses. Practical, clinical experiences will be emphasized as much as possible in additional to clinically relevant anatomical features.

Instructors

Christianne Magee, DVM, PhD
Jeremy J. Delcambre, MS, DVM

Eligible Students

Anyone who has completed VM616 with a B or higher as a final grade and is not concurrently registered for the Exotics Animal Anatomy Elective, will be provided with an automatic override. Other students will require override approval from Dr. Magee.

Course Objectives

To allow students with an interest in large animal anatomy to apply knowledge acquired in VM616 to with dissection of the horse, cow, pig

Specific Learning Objectives

- Specific learning objectives for anatomical structures will follow those of BMS305/531, which is similar to that of VM616 without the embryology content and greater reproductive anatomy content. Please see course schedule for BMS305 and BMS305/531 Lab Guide for specific items.
- The primary learning objective of the applied anatomy case study is to provide students with an opportunity to apply their anatomical knowledge of anatomy, physiology, and disease processes from a species that they may be familiar with (ie. equids, canids, felids), and apply that knowledge to a food or fiber production animal in a manner that increases their overall knowledge and capacity for application

Credits/Assessment

Students will register for 1 credit with an expected 3 hours of dissection or work time each week.

Students will be assessed using the following criteria:

- A-F grading scale, per DVM grading schedule
- Attendance: 30 points – for a 16 week semester, students are expected to provide 30 hours of total dissection time, with an average of 2 hours per week. For each unexcused absence (< 2 hours/week), students will lose 3 points for each absence.

- Applied Anatomy Case Study – 20 points - students will select a disease and describe the anatomy and or physiology that is clinically relevant to that disease. The report will be no shorter than 1 page (~600 words), and no longer than 3 pages (~2,000 words). The purpose of the case study is to discover the anatomy that is relevant for discussing the disease with a producer or other interested party to describe the importance of anatomy in development of the disease. Pictures (not part of the page limit) are strongly encouraged.
    - Potential topics for the case study will be provided for the students and topics will be selected before spring break.
    - Drafts of the case study are due 2 weeks after spring break and feedback will be provided within 1-2 weeks. The final case report is due finals week.
    - Case Study Rubric
        - 5 points - writing – Is the case study clearly written? Are the anatomical terms used correctly? Could a lay person understand this?
        - 10 points – anatomy/physiology – is the anatomy is the case accurate? Could a lay person understand this?
        - 5 points – disease process – is the pathophysiology of the disease accurate? Could a lay person understand this?

- Accuracy/Identification: 50 points – accuracy of dissection and structure identification will be evaluated each week by the instructors (Magee/Delcambre). Students will initial structures in the lab guide that they personally dissected/labeled each week and for each structure identified incorrectly and/or carelessly destroyed during dissection, students will lose 0.5 point. Students are welcome to seek faculty guidance prior to labeling structures.

BMS/DVM Strategic Planning Goals

Goal: **Diversity in Anatomical Instruction** Development of food animal anatomical resources and a food animal anatomy ele course				**Owner**: Anna Dee Fails
Success Defined: Virtual Bovine Anatomy program with head, pelvic and thoracic limb musculosk and neurovascular anatomy; Enrollment of students in Food Animal Anatomy Elective – Spring 2018				**Planning Area**: Dr. Magee will oversee the development of the Virtual Bovine Anatomy program and Dr. Fails will oversee curriculum for an elective course
Measurement What are all relevant measurements? Primary: Enrollment of PVM students in Food Animal Anatomy Elective Secondary: Enrollment of UG/graduate students in Honors break-out section of course Does the data currently exist or will it need to be created				
Start Date:July 2014			**Due Date**: January 2017	
Related CVMBS Strategic Goals: S-1, S-2, S-3, S-4, S-5, O-3, O-4, C-1, C-2, C-3, C-4				
Related CVMBS Values:				
Project Steps	**Start Dat**	**Due Dat**	**Who is Responsibl**	**Resources Needed**
I. Dissection of bovine specimens for ima apture/overlay -	Summer 2015	Spring 20	Dr. Magee	Support funding ($300,000) similar to Virtual Equine Anatomy program. Require 3D image capture system, student dissectors, faculty/staff summer salary support, and support for programming.
II. Develop curriculum for food animal an lective –	Summer 2014	Spring 20	Dr. Fails	Summer salary support for curriculum development. Monies for procuring and embalming food animal cadavers (sheep/goats, number depending on enrollment)
A. Enrollment Goal: 20-25 PVM students. nterest across existing classes: would upp lassmen want to take this elective?	Summer 2014	Fall 2014	Dr. Fails	Survey Monkey (or other on-line polling mechanism)
B. Design course (e.g., 4 cr = 2 hrs lecture ab/week)	Fall 2014	Fall 2014	Fails, Delcambre, M	Assess availability of gross lab & lecture hall in spring semester.
C. Design syllabus	Fall 2014	Fall 2015	Fails, Delcambre, M	Have food animal clinical faculty review existing VM616 objectives and offer suggestions
D. Incorporate outside resources for in-cl nstruction and field trips (clinical and ind	fall 2015	ongoing	Fails, Delcambre, M	Investigate contacts already in place through clinical faculty
E. Expand and improve Anatomy Teachi Collection 1. develop "wants/needs" list 2. begin preparation of specimens	fall 2015	ongoing	Delcambre, Fails	Supplies for embalming of animals for class; preparation and plastination of specimens spe food animal instruction
F. Once class is successfully launched for tudents, evaluate ability to expand enroll or qualified UG/graduate students (e.g., H	spring 20		Fails, Delcambre, M	

Appendix 2 - Supplement1: Lab Guides for Domestic Animal Anatomy

Frasier/Giddings, Domestic Animal Anatomy Lecture Notes, 2012 (pg 117-201)
-Copyright held by Frasier/Giddings for images and text
Frasier/Giddings, Domestic Animal Anatomy Laboratory Guide, 2012 (pg 202-267)
-Copyright held by Frasier/Giddings for images and text

Domestic Animal Gross Anatomy Lecture and Laboratory Manual, 5th Ed, 2020 (pg 268-488)
-Copyright held by Giddings/Frasier prevented modification of the previous manuals and guides. In 2012, the course laboratory objectives and diagrams were reviewed, updated, and used to create the current manual. Significant changes included:

- The "tours" are my written guides for the students to use in conjunction with the virtual programs and lecture material for an overview of the gross specimens. They are also used to assign TAs as content experts during the regular BMS305 laboratory sessions.
- Short Objectives were introduced to provide students with a focused area of study each week in preparation for the BMS305 laboratory quizzes. They represent the minimal knowledge necessary to provide continued understanding of the scaffolded curriculum. All structures in the unit objectives are used in the laboratory examination.

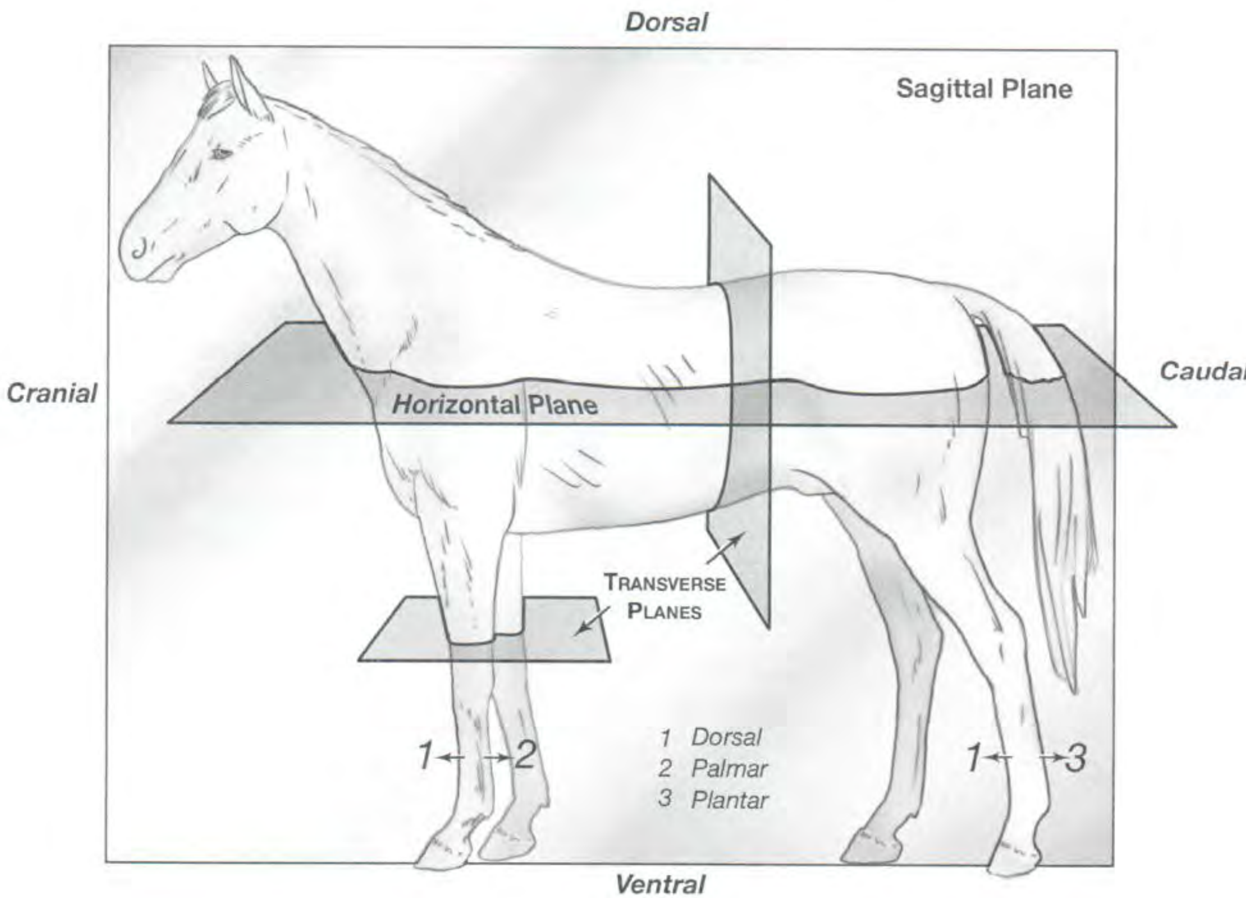
-**Frasier/Giddings, Domestic Animal Anatomy Lecture Notes, 2012**

(green cover removed)

Topographical Planes

Anatomical structures are frequently described and illustrated from a sectional prospective. There are three basic topographical planes: Sagittal, Frontal and Transverse:

- Sagittal plane:
  Divides the long axis of the body into right and left sections.
  A sagittal plane along the midline is the midsagittal or median plane.
- Transverse plane:
  Divides the body into cranial and caudal sections.
- Frontal (horizontal) plane:
  Divides the long axis of the body into dorsal and ventral sections.



DIRECTIONAL TERMS

caudal
contralateral
cranial
deep
distal
dorsal
ipsilateral
lateral
medial
median
palmer
plantar
proximal
rostral
superficial
ventral

Articulation Review

1. Marks on bones

a. Tubercle - small rounded process - strong singular point of attachment
b. Tuberosity - broad process - larger than a tubercle
c. Ridge & line - broad attachment
d. Line - narrow ridge (often imaginary connecting different landmarks)
e. Spine - thorn like process
f. Sulcus - linear groove
g. Foraminae - foramen - hole
h. Fossae - fossa - depression
i. Condyle - rounded projection at the end of a bone articulates with another bone
j. Epicondyle - an eminence above a condyle
k. Facet - small plane surface that articulates with another bone

2. Axial & Apendicular skeleton

1. Axial - skull, vertebral column, sternum, ribs
2. Appendicular - bones of the limbs (appendages) & girdles

Articulations

Juncturae Ossium - "the joining of bones" or joints

Classify Articulations - by material joining the bones and available movement

A. **fibrous** - typically Immovable. - sutures/teeth
B. **cartilaginous**- typically slightly movable. - intervertebral disc
C. **synovial** - typically freely movable - elbow, shoulder

Synovial or freely movable joints

Components of synovial joints

Articular cartilage (hyaline)
Fibrous joint capsule (ligament blend)
Synovial lining or membrane
Joint "cavity "(potential space)

Movements of synovial joints:

Flexion - decrease the angle between bones
Extension - increase the angle between bones
Abduction - move away from the midline
Adduction - move toward the midline
Circumduction - all 4 above movements
Rotation - turning about the axis
Supination - turning the paw cranial
Pronation - turning the paw caudal

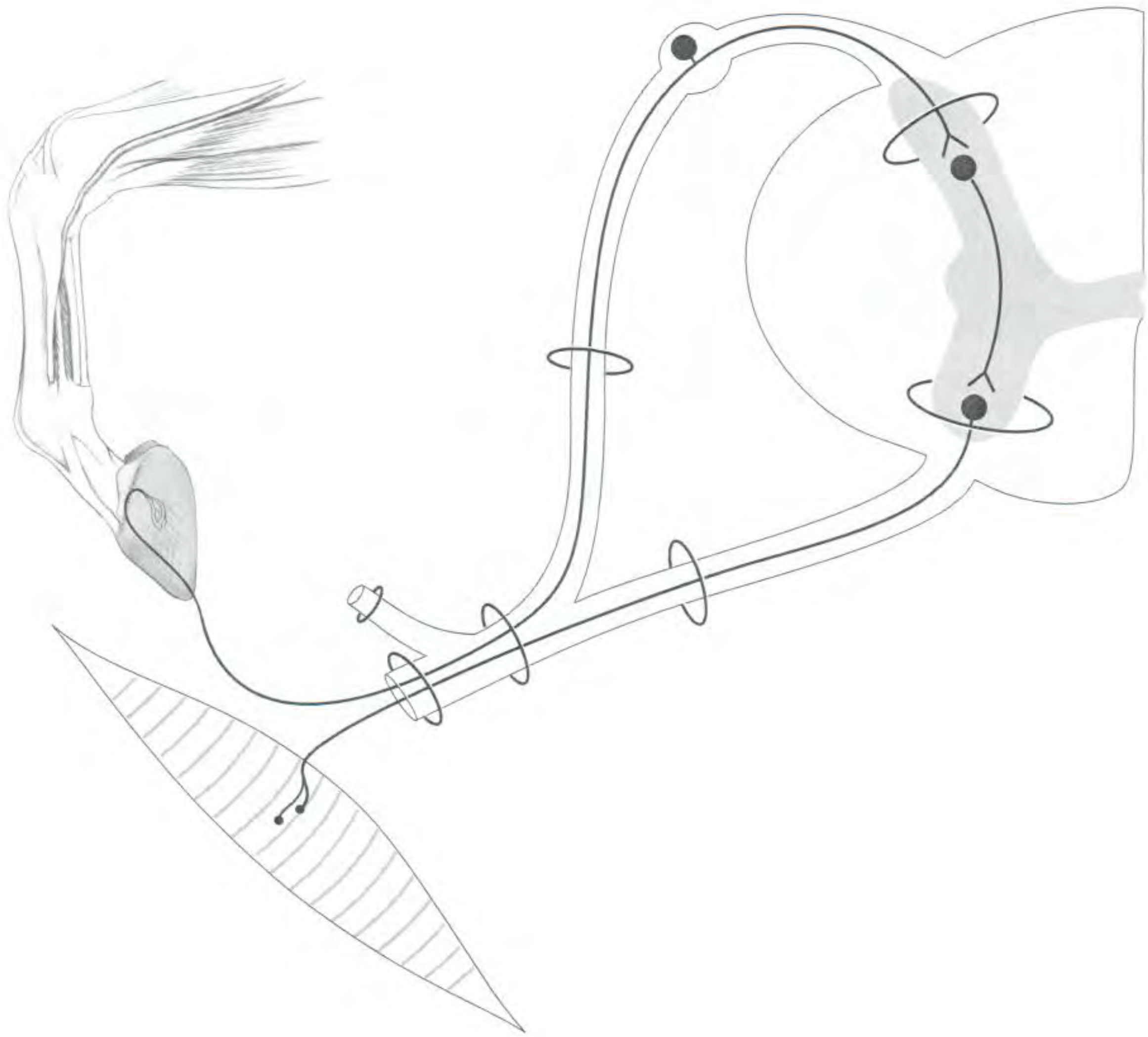
Types of Synovial Joints

1. *Uniaxial* - 1 axis of movement
   a. Hinge - flexion and extension - e.g. Elbow
   b. Pivot - rotation - e.g. C1/C2, radius & ulna
2. *bi-axial* - 2 axes of movement
   a. Condyloid - flexion & extension / abduction & adduction - cicumduction- e.g. radiocarpal jt.
   b. Ellipsoid - flexion & extension / abduction & adduction - cicumduction - e.g. metatarsaophalangeal jt.
3. *multiaxial* - 3 or more axes - 3 or more movements
   a. Ball and socket - flexion and extension; abduction/adduction; rotation - e.g. shoulder
   b. Saddle - opposition - eg. distal interphalangeal
4. *Non axial* - gliding - e.g. Midcarpal, carpometacarpophalangeal

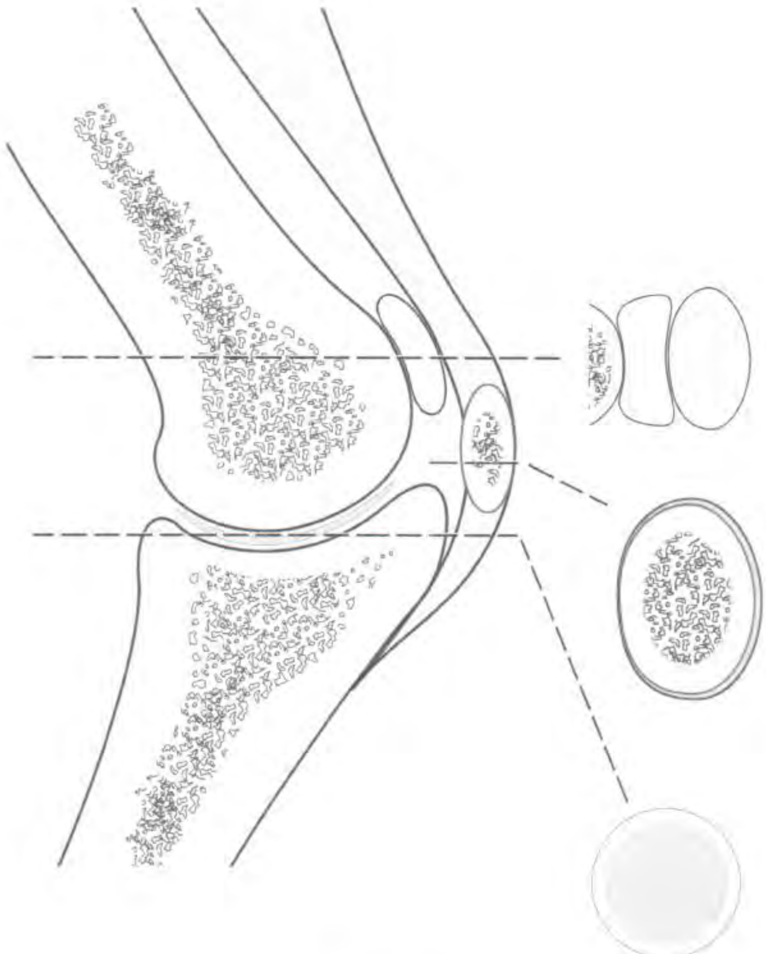
CLASSIFICATION OF SYNOVIAL ARTICULATIONS

	ARTICULATION	AXES OF MOVEMENT	ARTICULATION TYPE
		THORACIC LIMB	
1.	SHOULDER	MULTIAXIAL	BALL & SOCKET
2.	ELBOW	UNIAXIAL	HINGE
3.	RADIOCARPAL	BIAXIAL	CONDYLOID
4.	MIDCARPAL	NONAXIAL	PLANE
5.	CARPOMETACARPAL	NONAXIAL	PLANE
6.	METACARPOPHALANGEAL	BIAXIAL	CONDYLOID
7.	INTERPHALANGEAL	UNIAXIAL	HINGE
		PELVIC LIMB	
1.	HIP	MULTIAXIAL	BALL & SOCKET
2.	KNEE	BIAXIAL	CONDYLOID
3.	ANKLE (TALO TIBIO FIBULAR)	UNIAXIAL	HINGE
5.	TARSOMETATARSAL	NONAXIAL	PLANE
6.	METATARSOPHALANGEAL	BIAXIAL	ELLIPSOID
7.	INTERPHALANGEAL	UNIAXIAL	HINGE
		AXIAL SKELETON	
1.	ATLANTO-OCCIPITAL	BIAXIAL	ELLIPSOID
2.	ATLANTOAXIAL	UNIAXIAL	PIVOT

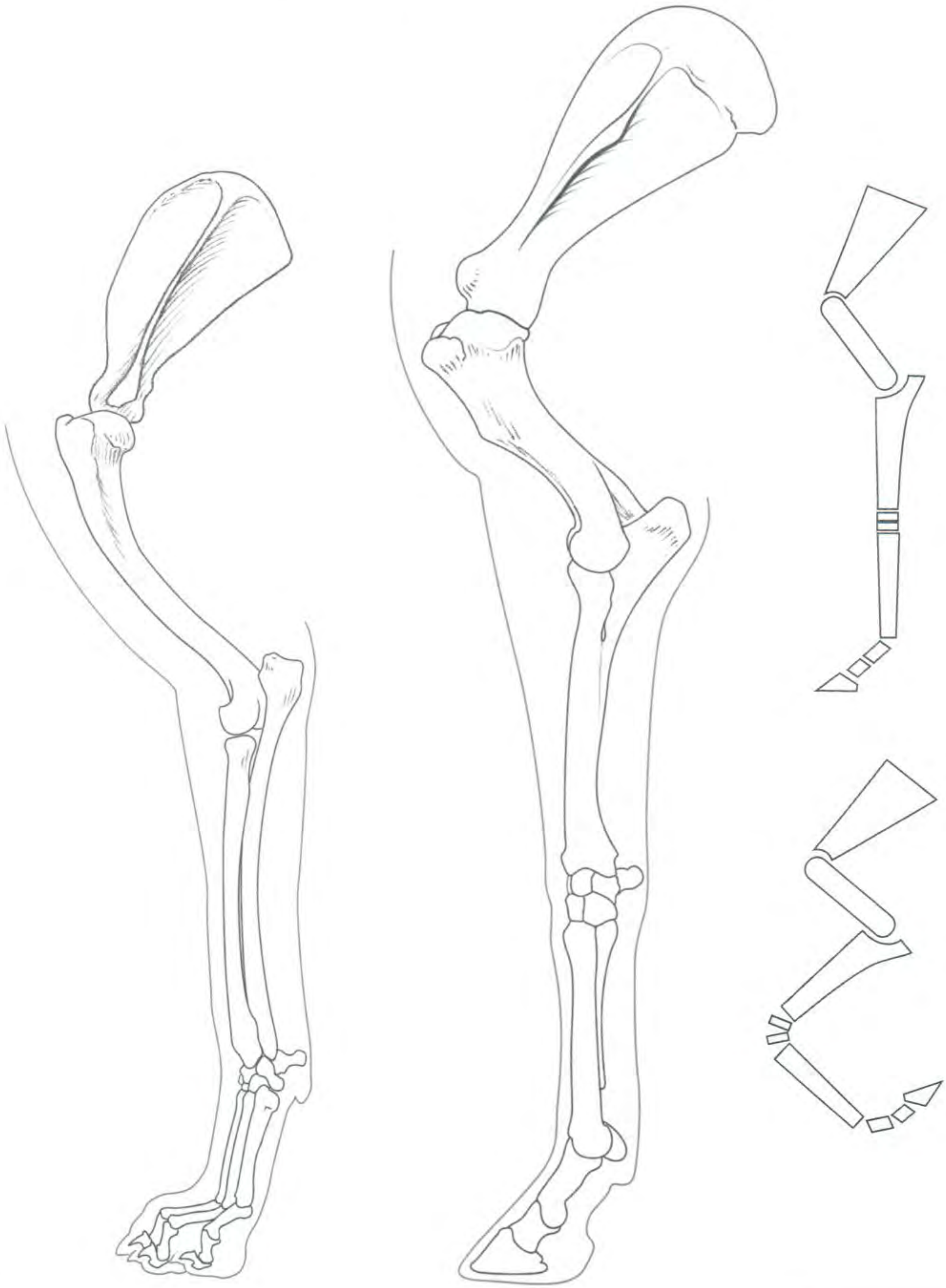
REFLEX ARC



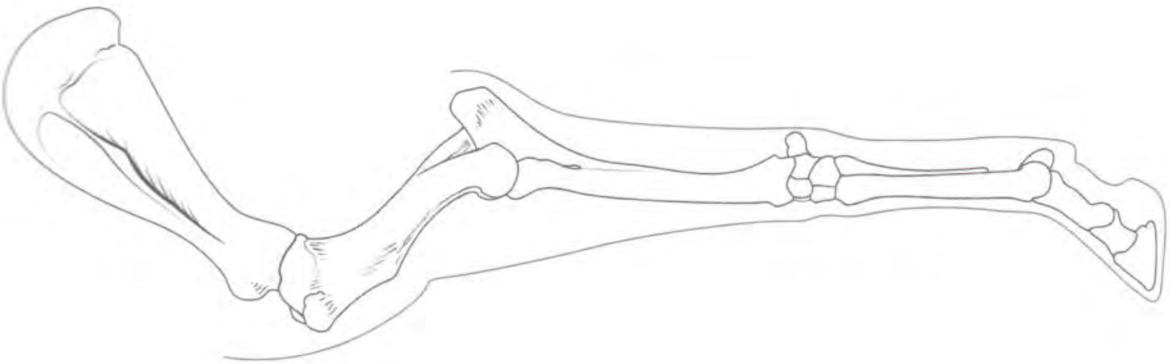
ARTICULATION OVERVIEW

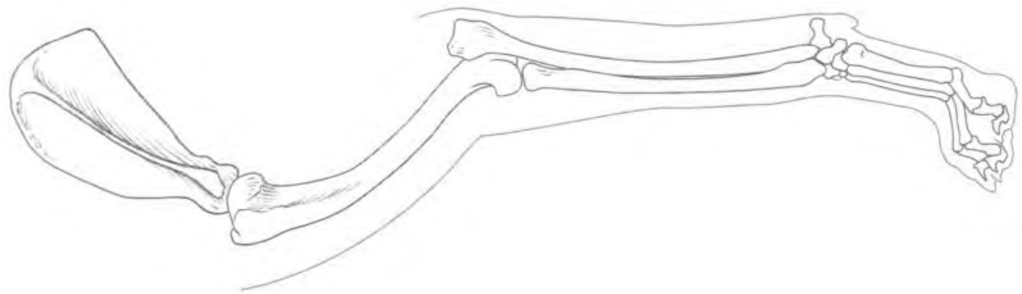


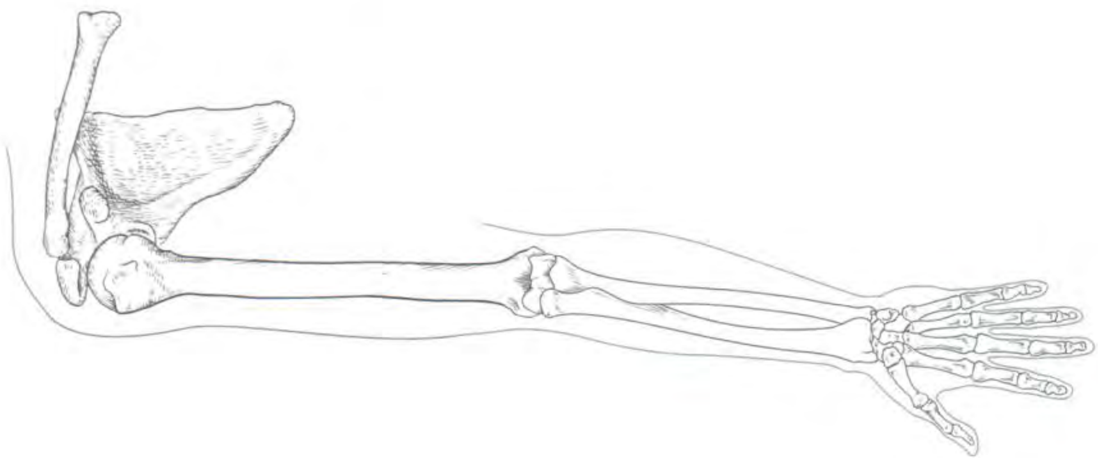
ARTICULATION MOVEMENT



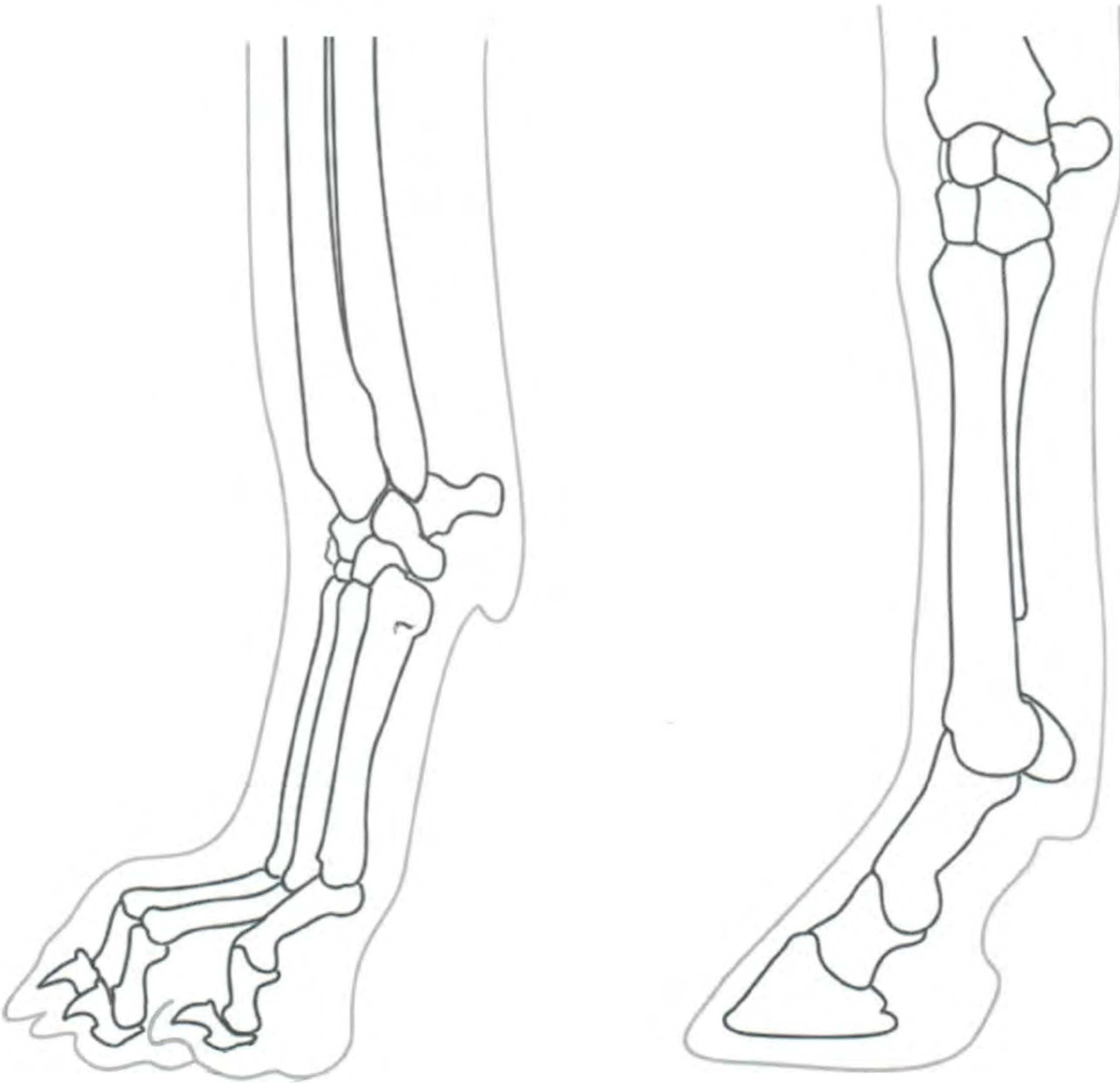
COMPARATIVE THORACIC LIMB



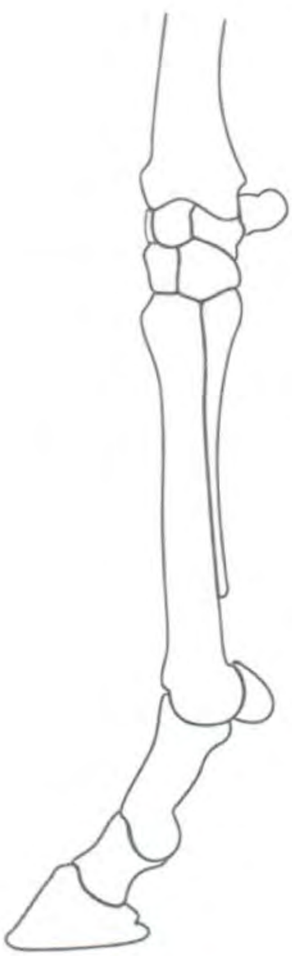


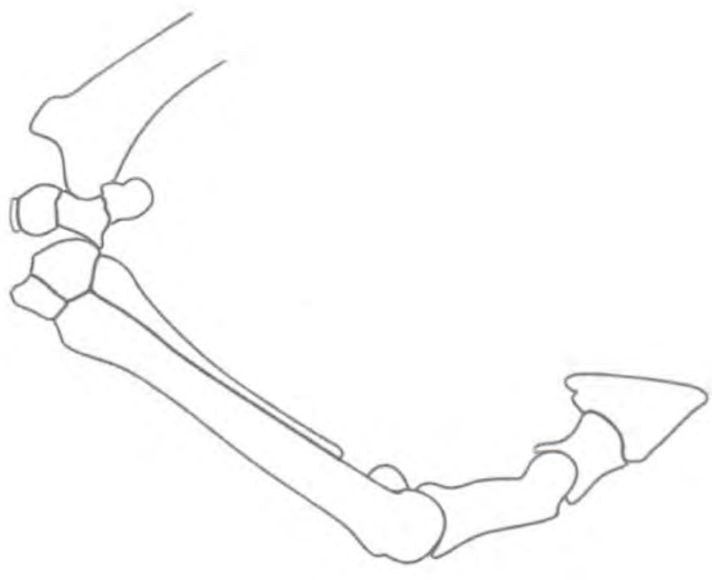


DISTAL LIMB



CARPAL FLEXION





MUSCLES OF THE THORACIC LIMB

Extrinsic Muscles

Latissimus dorsi
A thoracolumbar fascia (deep fascia)
B: proximal humerus
Action: flex shoulder
Innervation: thoracodorsal n.

Brachiocephalicus
cleidobrachialis
A: clavicular tendon
B: distal 1/3 cranial humerus
Action: extend shoulder - advance limb
Innervation: axillary n.

cleidocephalicus
A: clavicular tendon
B: dorsal median raphe of neck, mastoid process of skull
Action: advance limb, extend shoulder
Innervation: cervical & accessory nn.

Rhomboids
A: occipital bone of skull,
midline raphe cervical region, SP T_1-T_7
B: dorsal border of scapula
Action: elevate limb, draw scapula to trunk
Innervation: cervical & thoracic spinal nn.

Serratus ventralis
A: TP C_2-C_8 & ribs 1-7
B: dorsomedial 1/3 scapula
Action: support trunk
Innervation: long thoracic n.

Omotransversarius
A: spine of scapula
B: transverse process of atlas
Action: advance limb, flex neck laterally
Innervation: accessory n.(CN-XI)

Trapezius
A: dorsal midline raphe C_3-T_9 connective tissue
B: spine of scapula
Action: elevate/abduct limb
Innervation: accessory n. (CN-XI)

Superficial Pectoral
A: cranial sternum
B: greater tubercle, humerus
Action: adduct limb, prevent abduction
Innervation: cranial pectoral n.

Deep pectoral
A: middle & caudal sternum
B: greater & lesser tubercle, humerus
Action: draw limb caudad, draw trunk craniad

Innervation: caudal pectoral n.

Intrinsic Muscles

Shoulder Muscles

Deltoideus
A: spine and acromial process of scapula
B: deltoid tuberosity of humerus
Action: flexion of shoulder
Innervation: axillary n.

Infraspinatus
A: infraspinous fossa of scapula
B: greater tubercle of humerus
Action: flexion/ lateral rotation of shoulder
Innervation: suprascapular n.

Supraspinatus
A: supraspinous fossa of scapula
B: greater tubercle of humerus
Action: extension of shoulder
Innervation: suprascapular n.

Teres Major
A: caudal edge of scapula
B: proximal lateral humerus
Action: medial rotation & flexion of shoulder
Innervation: axillary n.

Subscapularis
A: subscapular fossa of scapula
B: lesser tubercle of humerus
Action: adduction & extension of shoulder
Innervation: subscapular n.

Brachial Muscles

Tensor fascia antebrachii
A: fascia of lat.dorsi
B: olecranon process
Action: extension of elbow
Innervation: radial n.

Ticeps brachii
A: long head - caudal border scapula
lateral head – tricipital line, humerus
medial head – lesser tubercle
accessory head – neck of humerus
B: olecranon process
Action: all heads extension of elbow
Innervation: radial n.

Biceps brachii
A: supraglenoid tubercle
B: ulnar & radial tuberosities
Action: flexion of elbow, extension of shoulder
Innervation: musculocutaneous n.

Brachialis
A: proximal humerus
B: ulnar & radial tuberosities
Action: flexion of elbow
Innervation: musculocutaneous n.

Antebrachial Muscles

Craniolateral group

Extensor carpi radialis
A: lateral supracondylar crest
B: dorsal proximal metacarpals II & III
Action: extension of carpus
Innervation: radial n.

Common digital extensor
A: lateral epicondyle of humerus
B: dorsal distal phalanges, digits II – V
Action: extension of carpus and digits II – V
Innervation: radial n.

Lateral digital extensor
A: lateral epicondyle of humerus
B: proximal ends all phalanges, digits III – V
Action: extension of carpus and digits III - V
Innervation: radial n.

Extensor Carpi Ulnaris
A: lateral epicondyle of humerus
B: lateral, proximal metacarpal V
& accessory carpal bone
Action: flexion & abduction of carpus
Innervation: radial n.

Caudomedial group

Pronator teres
A: medial epicondyle of humerus
B:medial proximal radius
Action: pronation & flexion of elbow
Innervation: median n.

Flexor carpi radialis
A: medial epicondyle of humerus
B: palmar, proximal metacarpals II & III
Action: flexion of carpus
Innervation: median n.

Superficial Digital flexor
A: Medial epicondyle of humerus
B: palmar middle phalanges digits II – V
Action: flexion of carpus, MP & proximal IP jts, digits II – V
Innervation: median n.

Flexor carpi ulnaris
A: ulnar head – olecranon process
humeral head – medial epicondyle of humerus
B: accessory carpal bone
Action: flexion of carpus
Innervation: ulnar n.

Deep digital flexor
A: medial epicondyle of humerus, radius & ulna
B: palmar distal phalanx, digits I – V
Action: flexion of carpus, MP & all IP jts.
Innervation: median & ulnar nn.

ARTERY EQUINE WORKSHEET

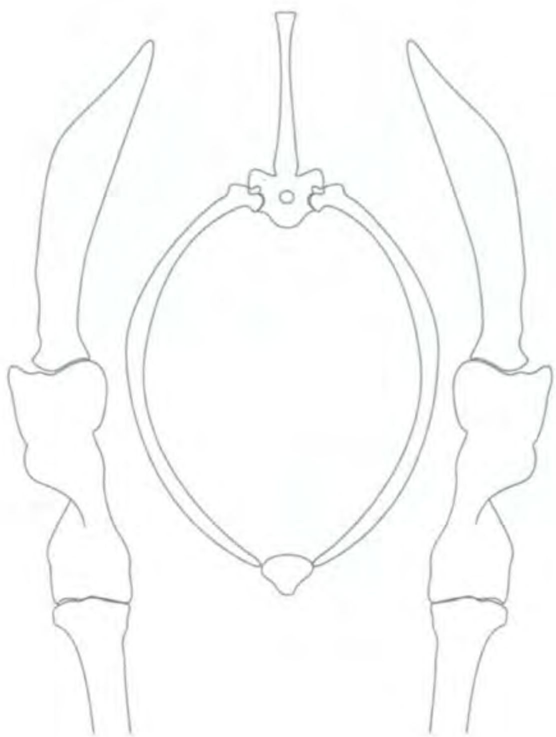
Left caudal thoracic limb

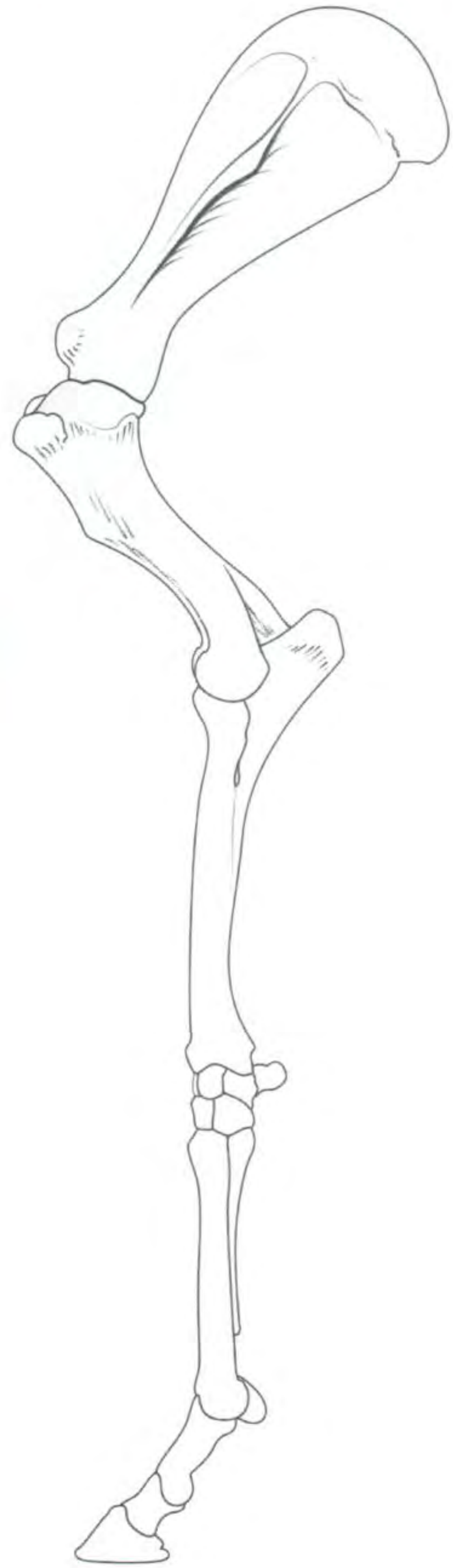
EQUINE NERVE WORKSHEET

Left thoracic limb

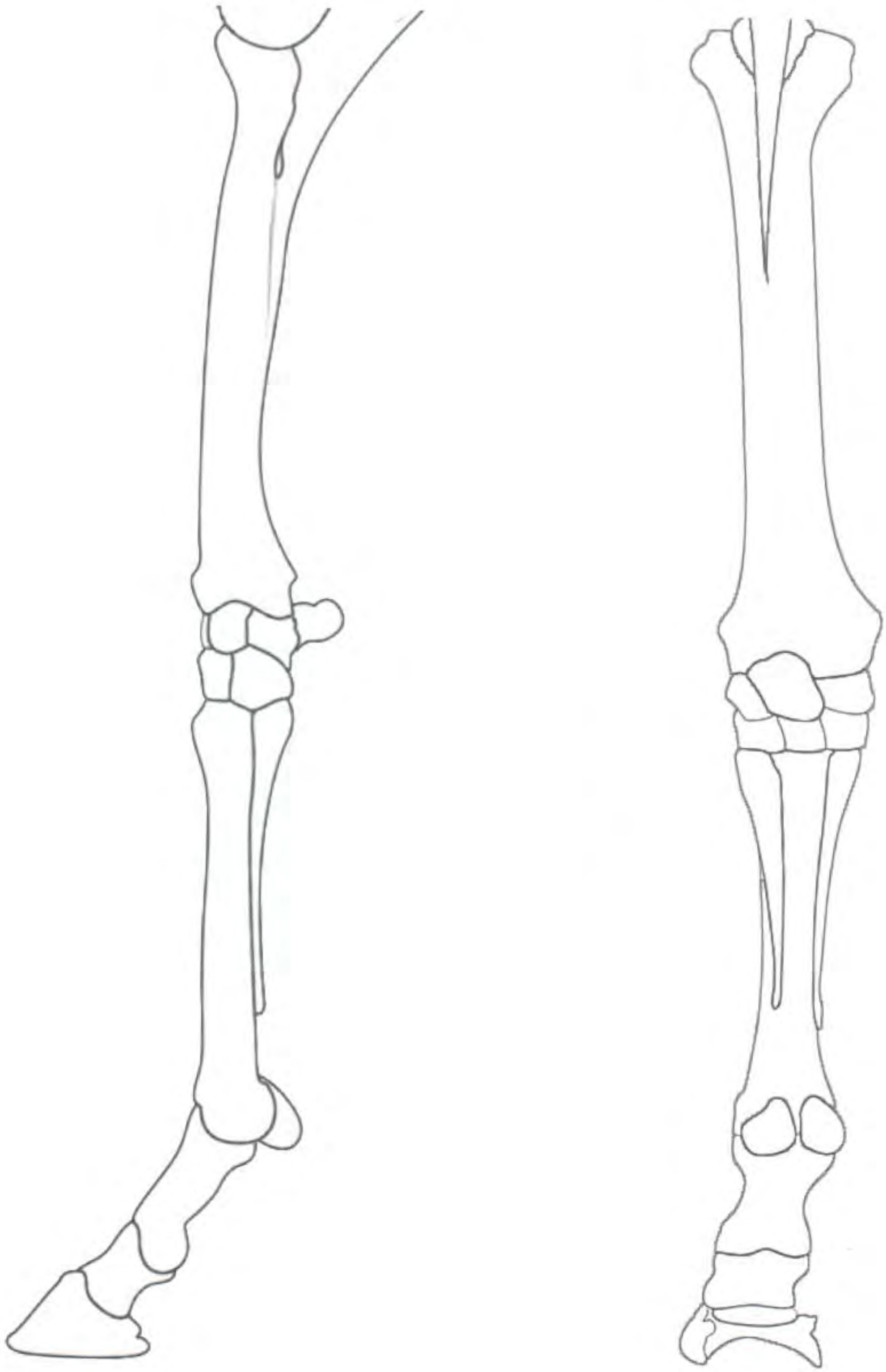
SUPERFICIAL VENOUS DRAINAGE

STAY APPARATUS

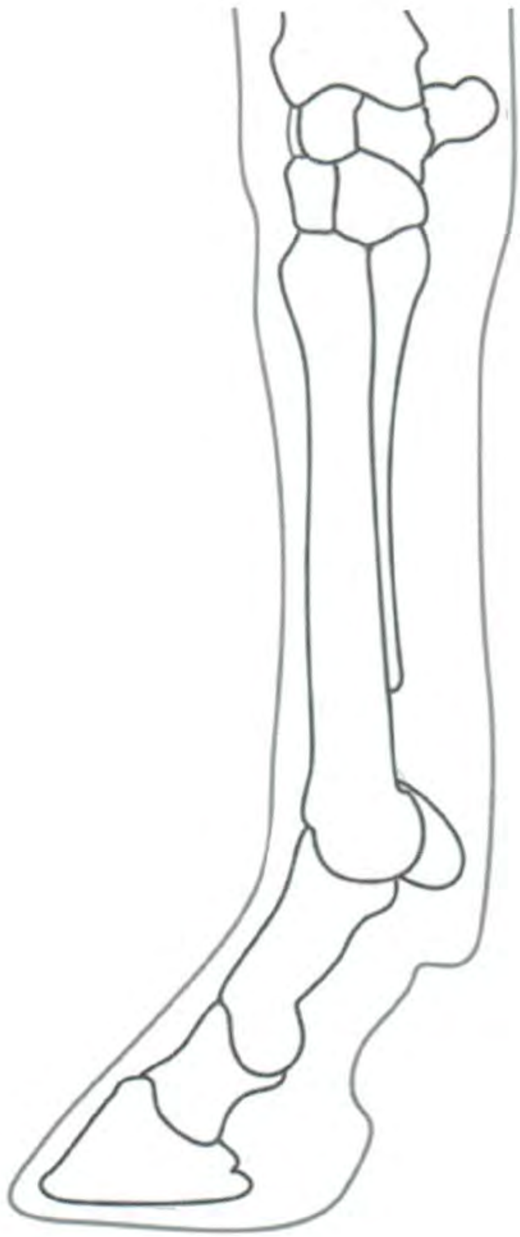




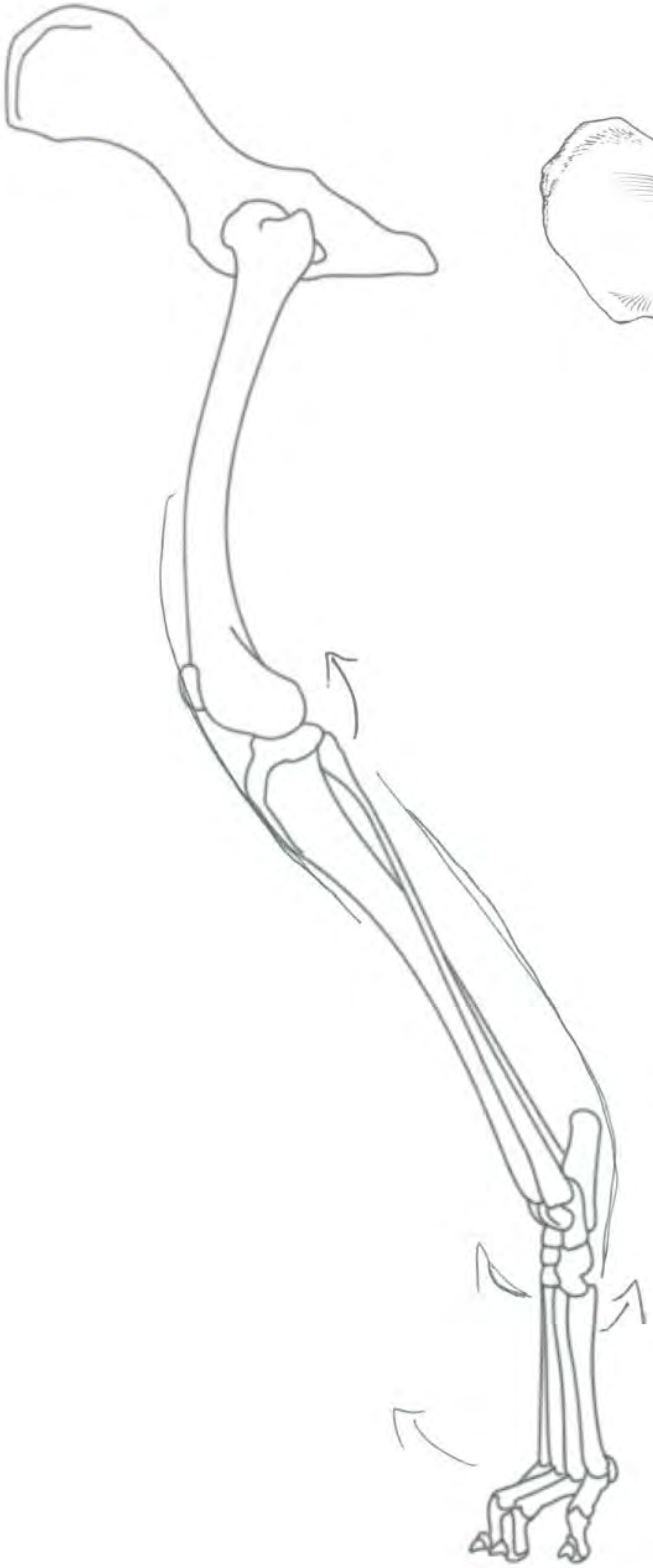
SUSPENSORY APPARATUS



NERVE BLOCKS



BONES & JOINTS OF THE PELVIC LIMB



MUSCLES OF THE PELVIC LIMB

Medial thigh

Gracilis
A: Pubic symphysis
B: Cranial tibia and calcaneal tendon
Action: Adduct/extend hip, extend hock
Inn: Obturator n.

Pectineus
A: Pubic bone
B: Mid caudal femoral shaft
Action: Adduct hip
Inn: Obturator n.

Adductor
A: Pubic symphysis
B: Caudal surface or femur
Action: Adduct/extend hip
Inn: Obturator

Sartorius
A: Cranial head - Iliac crest
A: Caudal head – cranial, ventral iliac spine
B: Cranial head – Patella with rectus femoris
B: Caudal head – cranial tibia with gracilis
Action: Both heads - flex hip,
cranial head – extend stifle
caudal head – flex stifle
Inn: femoral n.

Iliopsoas
A: Lumber Vertebrae
B: Lesser trochanter
Action: Hip flexion
Inn: Femoral n.

Obturator Externus
A: Ventral pubis/ischium
B: Trochanteric fossa
Action: Lateral rotation of hip
Inn: Obturator

Cranial thigh (Quadriceps)

Rectus femoris
A: cranial ilium
B: Tibial tuberosity
Action: Flex hip, extend stifle
Inn: Femoral n.

Vastus Medialis
A: proximal femur
B: tibial tuberosity
Action: Extend stifle
Inn: Femoral n.

Vastus Lateralis
A: proximal femur
B: tibial Tuberosity
Action: Extend stifle
Inn: Femoral n.

Vastus intermedius
A: proximal femur
B: tibial tuberosity
Action: Extend Stifle
Inn: Femoral n.

Lateral hip – Gluteal mm.

Superficial gluteal
A: Lateral sacrum, sacrotuberous lig.
B: 3rd trochanter
Action: Extend/abduct hip
Inn: Caudal gluteal n.

Middle Gluteal
A: crest of ilium
B: Greater trochanter
Action: Extend/abduct hip
Inn: Cranial gluteal n.

Deep Gluteal
A: Body of ilium
B: Greater Trochanter
Action: Extend/abduct hip
Inn: cranial gluteal n.

Tensor fascia latae
A: Tuber coxae
B: Fascia lata
Action: Flex hip/ extend stifle
Inn: cranial gluteal n.

Lateral hip – Deep mm.

Piriformis
A: sacral &1st caudal vertebra
B: Greater trochanter
Action: Extend hip
Inn: caudal gluteal n.

Obturator Internus
A: pubic symphysis
B: Caudal proximal femur
Action: Lateral rotation of hip
Inn: Sciatic n.

Gemilli
A: Ischium
B: Trochanteric fossa
Action: Lateral rotation of hip
Inn: Sciatic n.

Quadratus Femoris
A: Ventral caudal ilium
B: Intertrochanteric crest
Action: Extend/lateral rotation hip
Inn: Sciatic n.

Caudal thigh

Biceps femoris
A: ischial tuberosity sacrotuberous lig
B: Patellar ligament / calcaneal tuber
Action: Extend hip,stifle,(stance phase) hock
Flex stifle in swing phase
Inn: Sciatic n.

Semitendenosus
A: Ischial tuberosity
B: Cranial tibia / calcaneal tuber
Action: Extend hip/hock, flex stifle
Inn: Sciatic n.

Semimembranosus
A: Ischial tuberosity
B: Distal caudal femur, proximal caudal tibia
Action: Extend hip, flex stifle
Inn: Sciatic n.

Calcaneal Tendon

Flexor digitorum superficialis*
Gastrocnemius*
Semitendinosus
Biceps femoris
Gracilis

* most important contributors

MUSCLES OF THE PELVIC LIMB

Craniolateral crus

Cranial tibial
A: cranial proximal tibia
B: Plantar surface metatarsals I & II
Action: Flex tarsus
Inn: Peroneal n.

Peroneus longus
A: Lateral proximal tibia & fibula
B: Plantar surface all metatarsals
Action: Flexion of tarsus
Inn: Peroneal n.

Long digital extensor
A: Extensor fossa femur
B: Distal phalanges, digits II -V
Action: Extend digits, flex tarsus
Inn: Peroneal n.

Lateral digital extensor
A: proximal 1/3 fibula
B: Tendon of extensor digitorum longus
Action: Extend digit V
Inn: Peroneal n.

Caudal crus

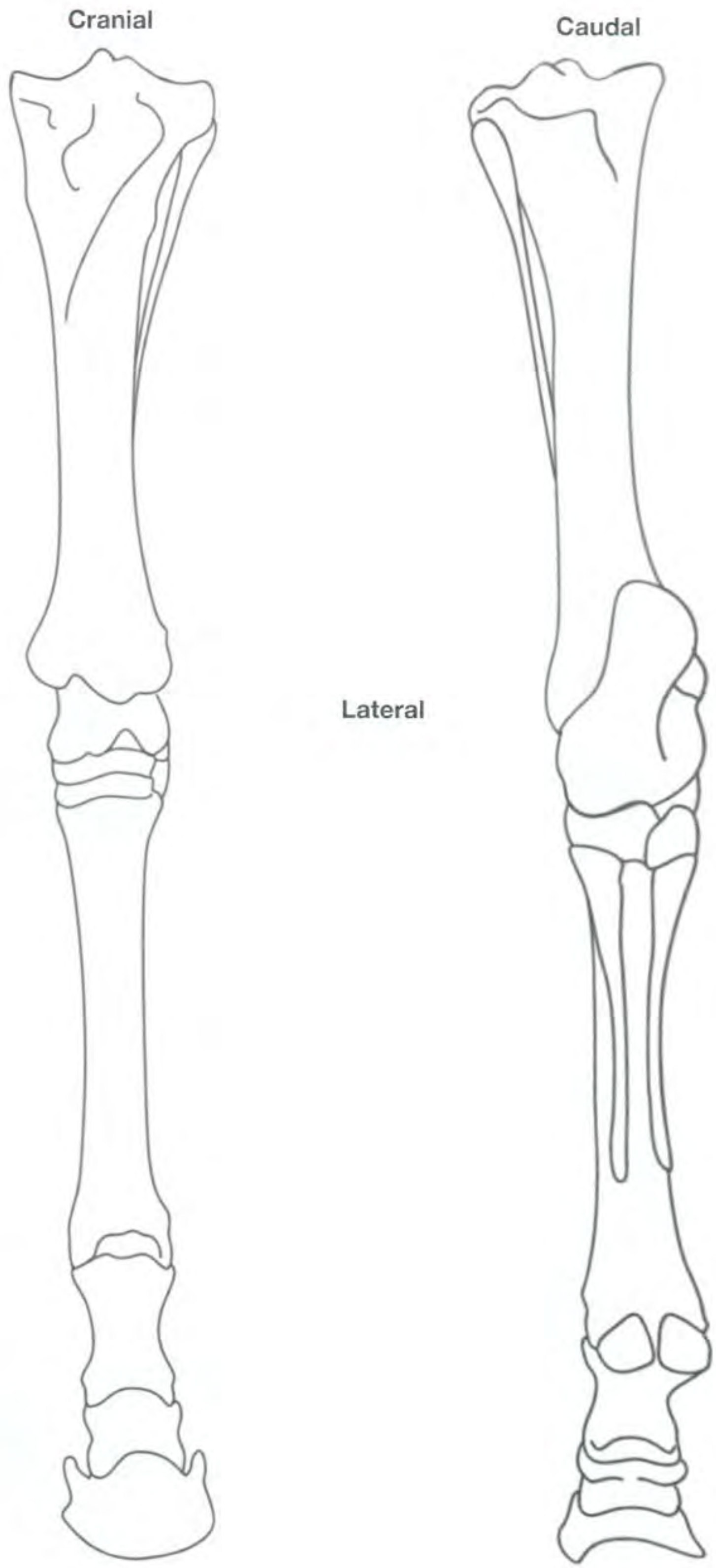
Gastrocnemius
A: Medial & lateral supracondylar areas of femur
B: calcaneal tuber
Action: Flex stifle, extend hock
Inn: Tibial n.

Flexor digitorum superficialis
A: Lateral supracondylar areas of femur
B: calcaneal tuber, proximal & middle phan-langges of digits II-V
Action: Extend hock, flex proximal IP jts. - digits II-V
Inn: Tibial n.

Flexor digitorum profundus
A: Proximal tibia, fibula
B: Distal phalanges – digits II-V
Action: Flex all IP jts. – digits II-V
Inn: Tibial n.

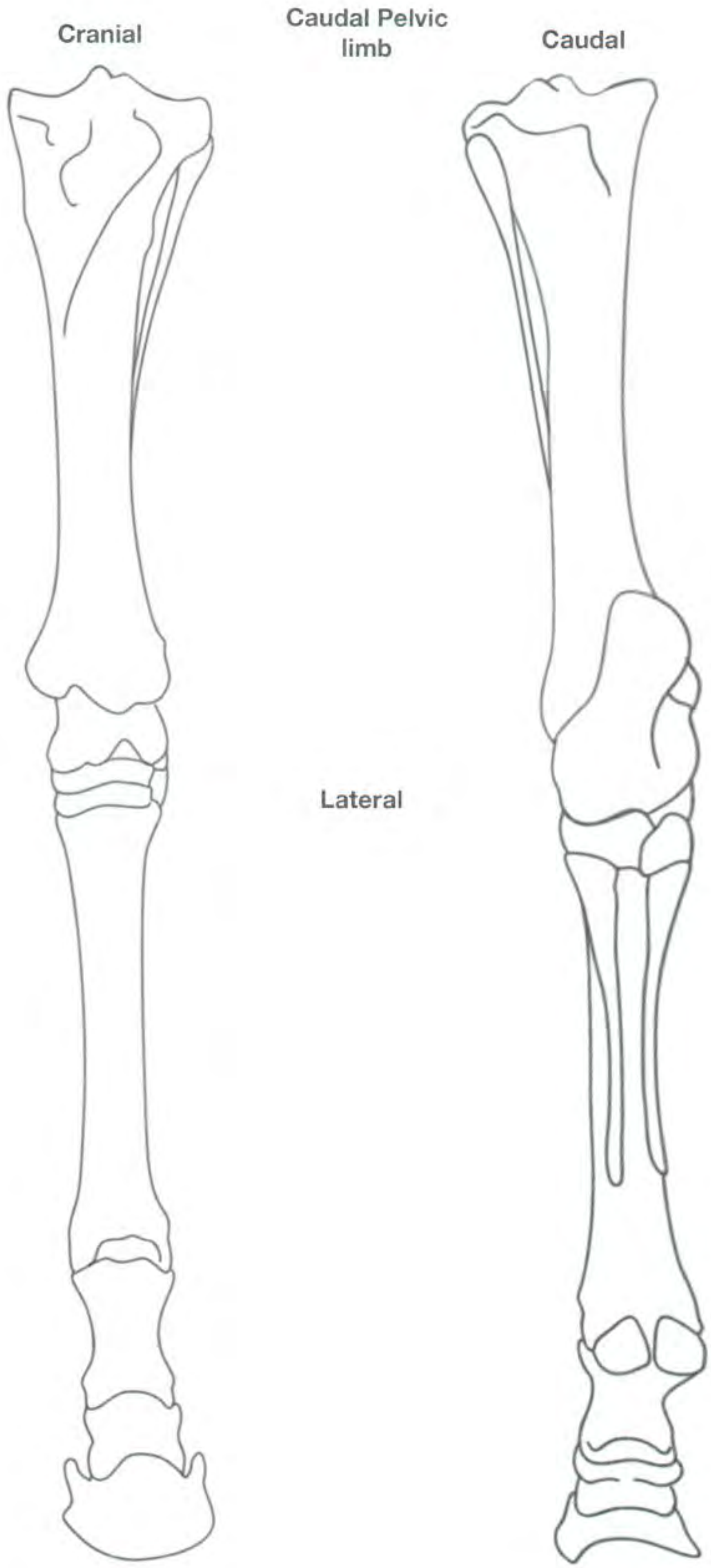
Popliteus
A: Lateral distal femur
B: Proximal caudal tibia
Action: stabilize stifle – propriocetion for stifle
Inn: Tibial n.

EQUINE NERVE WORKSHEET

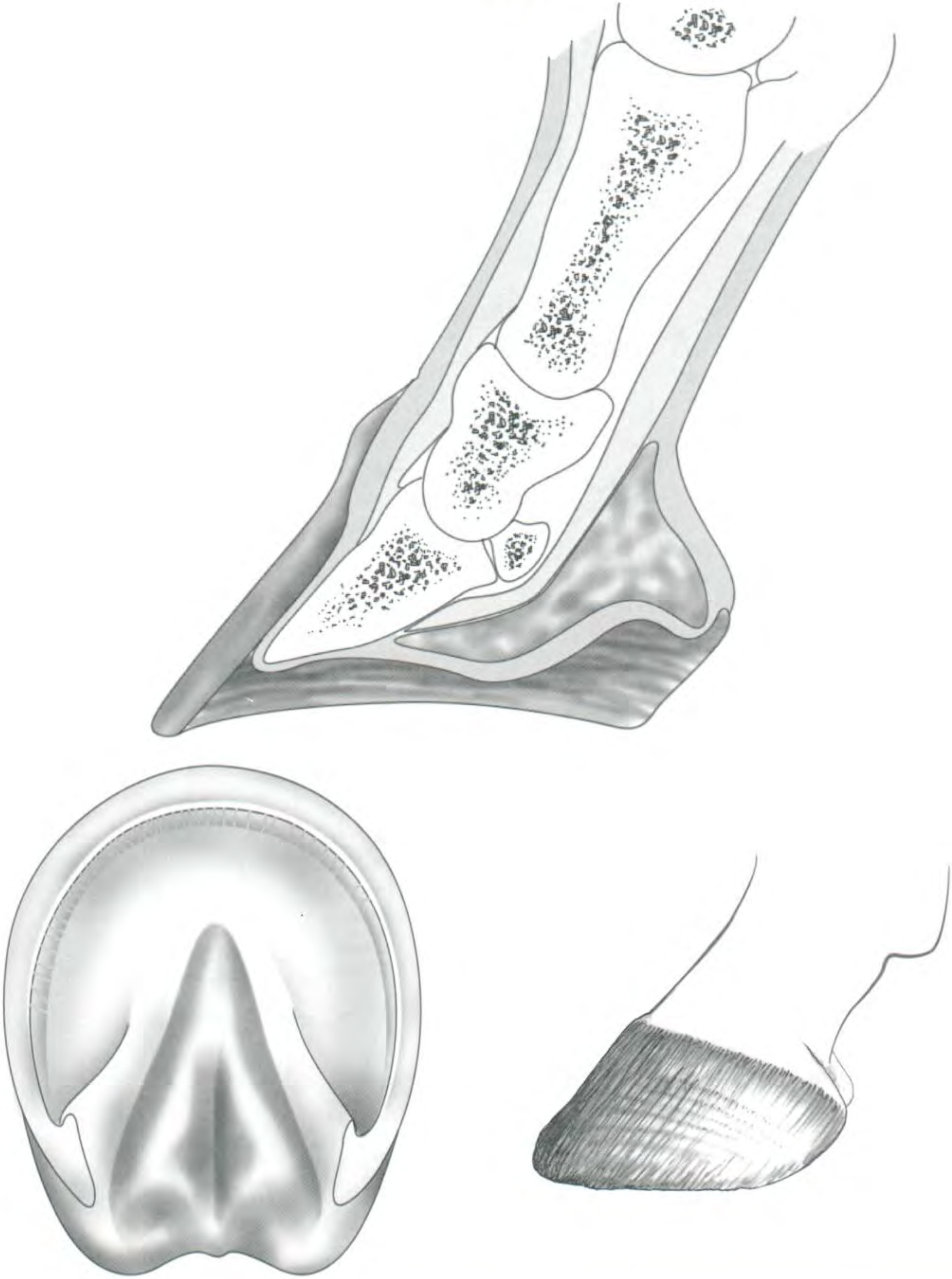


EQUINE ARTERY WORKSHEET

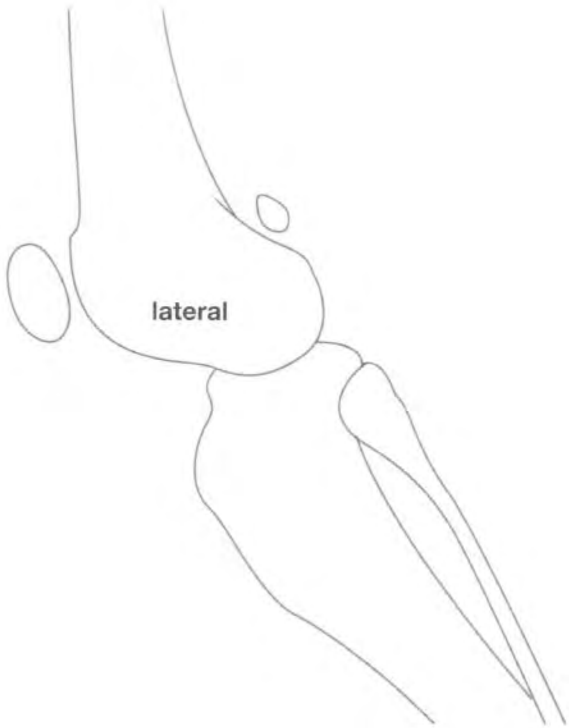
Left pelvic limb

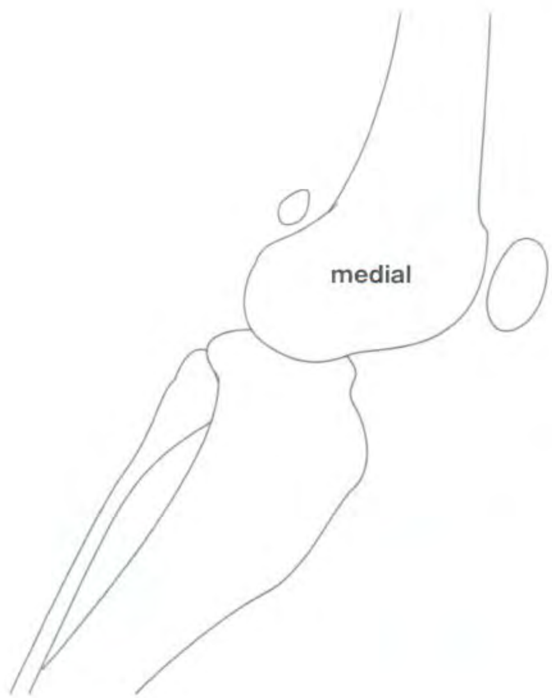


HOOF

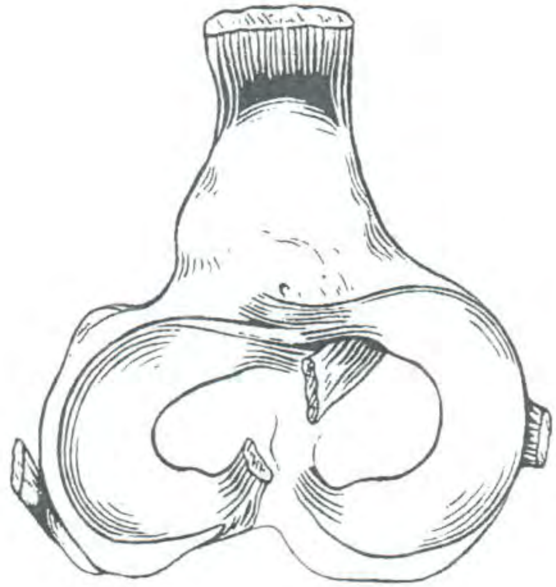


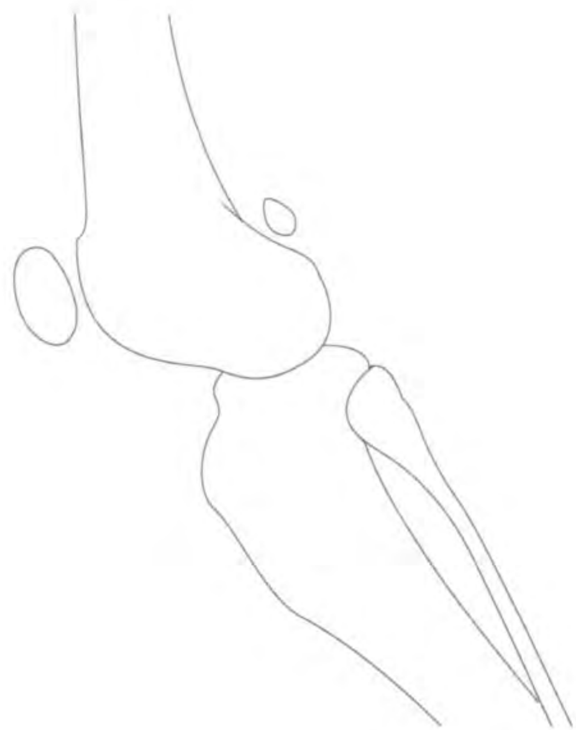
CANINE STIFLE





CANINE STIFLE
(left limb)





RECIPROCAL APPARATUS

INTRODUCTION TO NATURAL GAITS

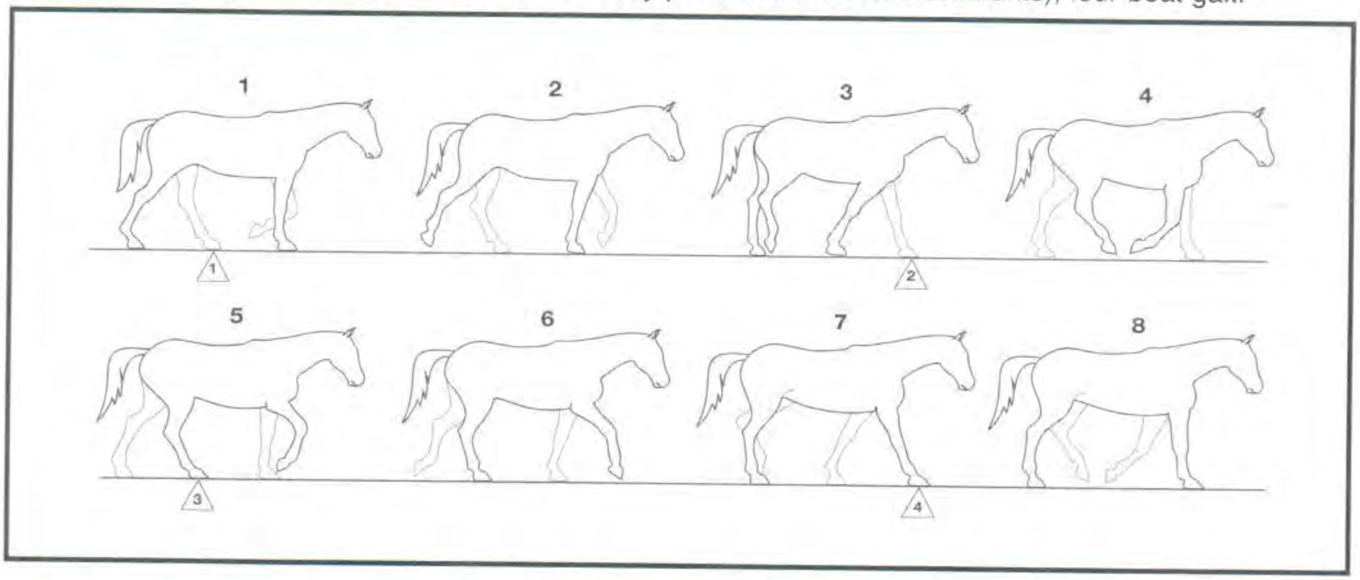
"Natural" gaits are those that an animal adopts without training. For most domestic animals, these will include the walk, trot (alternatively, the pace), and the gallop. The canter (also called lope) is in actuality a slow version of the gallop, and its footfall pattern will be nearly the same. Gaits are described as two-, three-, or four-beat, as dictated by the number of separate foot-strikes in one cycle of the gait. For a given limb, the gait is characterized by a support (or extension) phase and a swing (or flexion) phase.

Variations:

Some species (e.g., the camel), certain breeds of horses, and the occasional individual in other domestic species will naturally pace rather than trot. "Gaited" breeds of horses have been created through selective breeding to exhibit gaits that are not normally seen in the wild. These gaits have usually been developed for their "showy," exaggerated action and/or smoothness (for the rider). You will not be expected in this class to recognize these so-called "artificial" gaits.

WALK

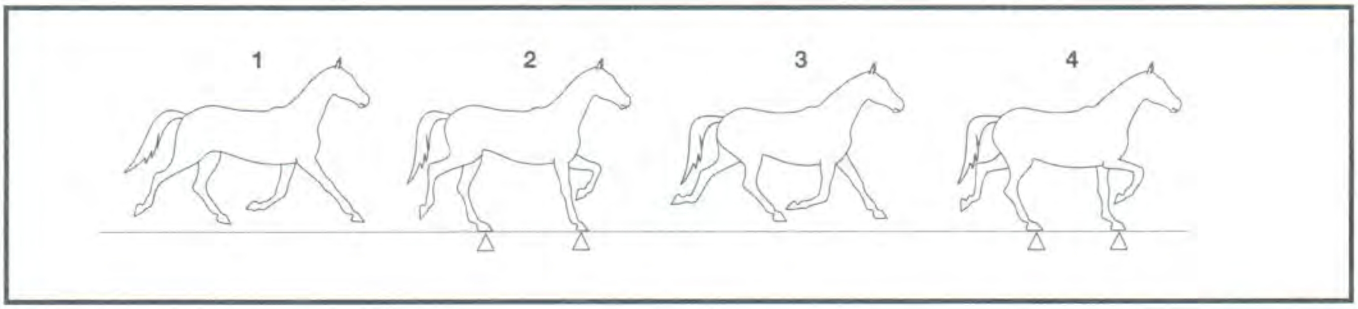
The walk is a symmetrical (both sides of the body perform the same movements), four-beat gait.



This figure depicts the walk. Numbered triangles denote the foot-strikes; notice that there are four-one for each foot-in the course of one full cycle of the walk. For most animals, three feet are always on the ground, except for an extremely brief moment when the forefoot is lifted and the advancing hind foot is placed on or near the site vacated by the fore (see frames 4 and 8).

TROT

The trot is a symmetrical, two-beat gait. Limbs are diagonally paired—right fore works in synchrony with left hind, and left fore works with right hind. These paired limbs strike the ground together so that the full cycle of the trot consists only of two beats.

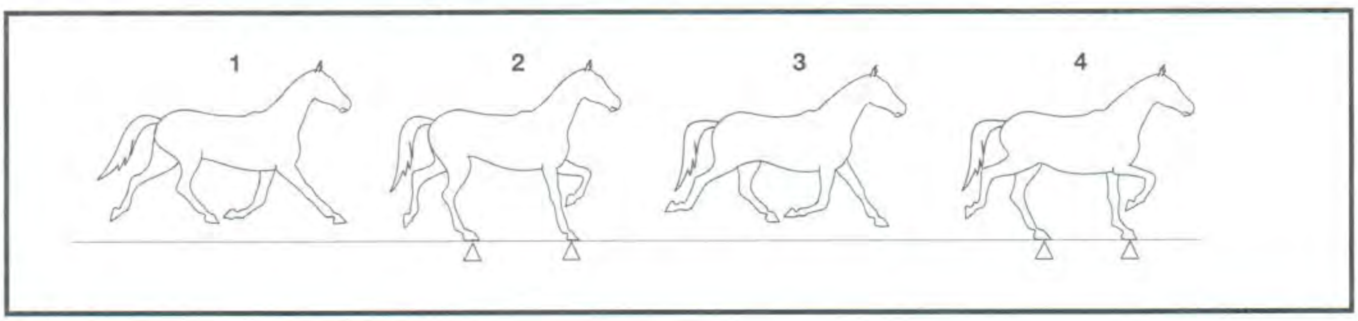


This figure depicts the trot. Between each paired foot-strike is a brief moment of suspension (no feet on the ground).

PACE

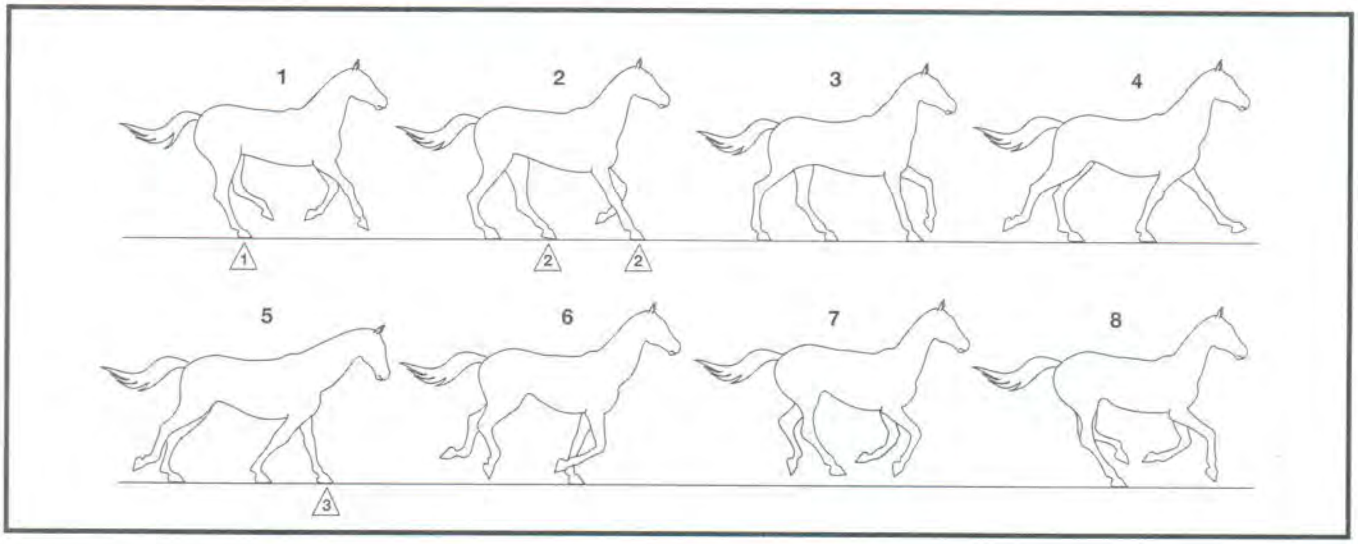
The pace is similar to the trot, in that it is a two-beat, symmetrical gait. The difference is that limbs on the same side of the body are paired (left fore and hind, right fore and hind).

Like the trot, there is a brief moment of suspension between foot-strikes.



CANTER or LOPE

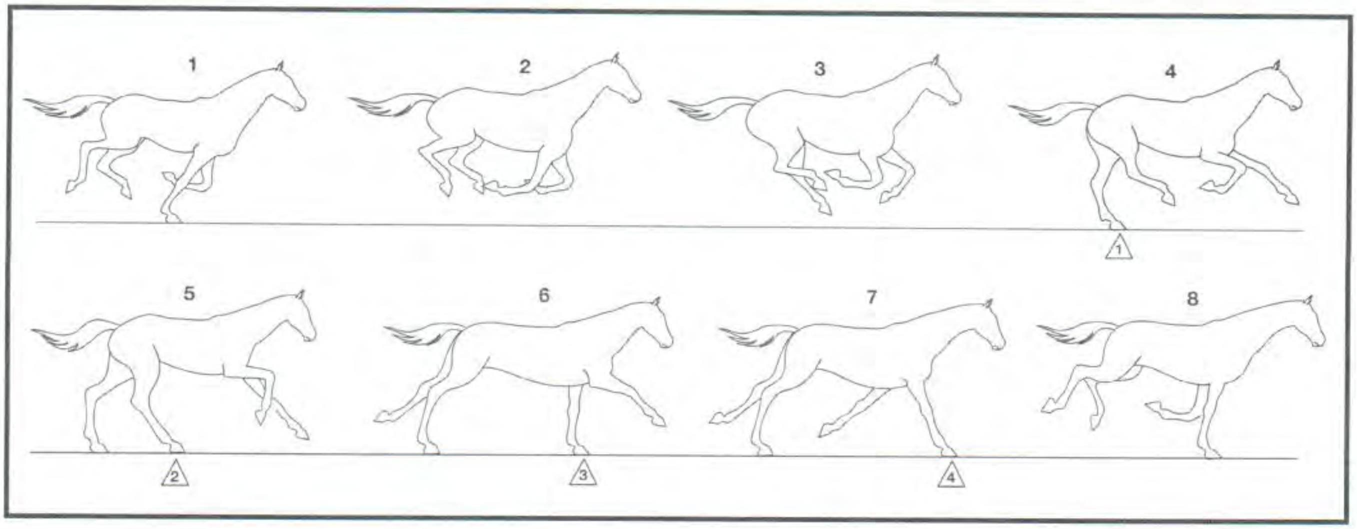
For our purposes, you may regard these as two terms for the same gait. The canter is really a slow gallop. This is a three-beat asymmetrical gait, meaning that each side of the body is performing different movements. In the canter (and the gallop, see below) one pair of diagonal limbs works together (striking the ground together) while the other fore- and hindlimb operate independently, striking the ground at different times. This creates the characteristic "three beats" of this gait.



In this depiction of the canter, notice how the right hind hits the ground first (triangle 1). The second "beat" occurs when the left hind and right fore strike the ground together (triangles 2). The third (and last) beat comes when the left fore strikes the ground; there is generally a very noticeable downward bob of the head as this "leading" forelimb is placed. This point is followed by a period of suspension (7), then the right hind foot strikes the ground and the cycle is repeated. The horse in this figure is depicted as cantering on the "left lead." An animal cantering on the right lead would produce movements in mirror-image to these. To decide which lead a horse is in, identify which forelimb hits the ground during the head bob just before suspension (it's easier than you think). Animals are able to turn most effectively when they are on the lead inside the turn (e.g., can turn strongly and sharply to the left when on the left lead).

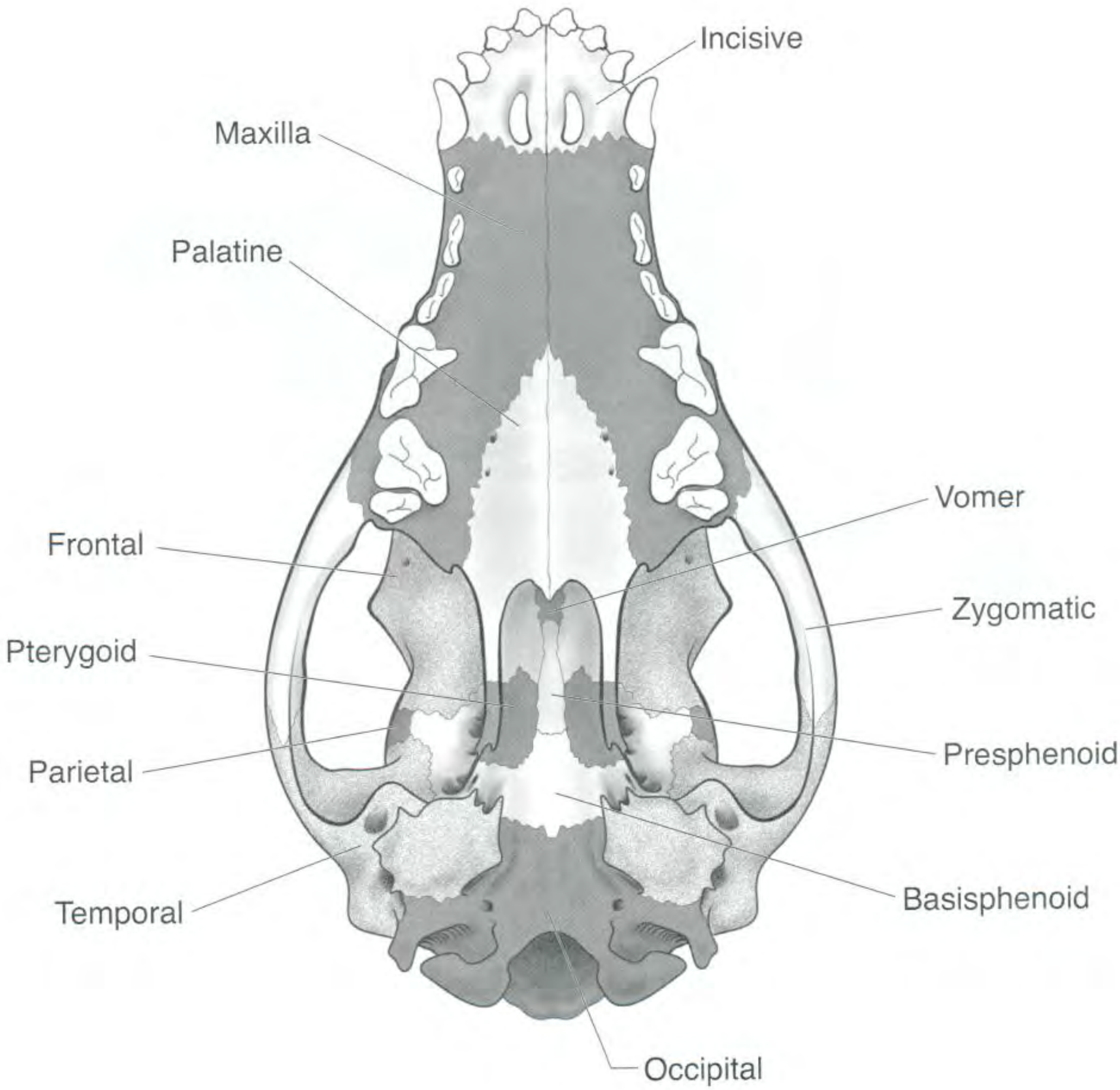
GALLOP or RUN

The gallop (more usually called "running" in small animals) is a faster, more extended version of the canter, and its pattern of movements is likewise asymmetrical. In the gallop, however, the diagonal limbs that were paired for the canter strike the ground at slightly different times, so the gallop becomes four-beat.

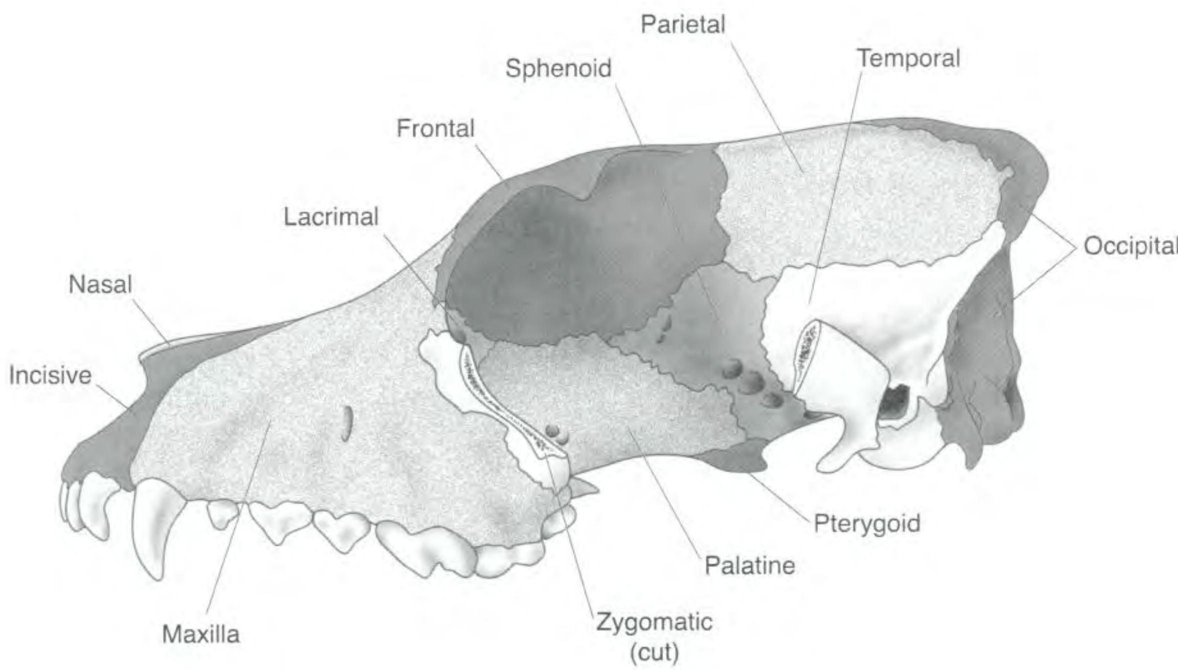


The horse here is depicted as galloping on the left lead. Notice that the right hind- and right forelimb (which would have been paired in a canter) strike the ground at different times (triangles 2 and 3).

Canine Skull
Ventral View

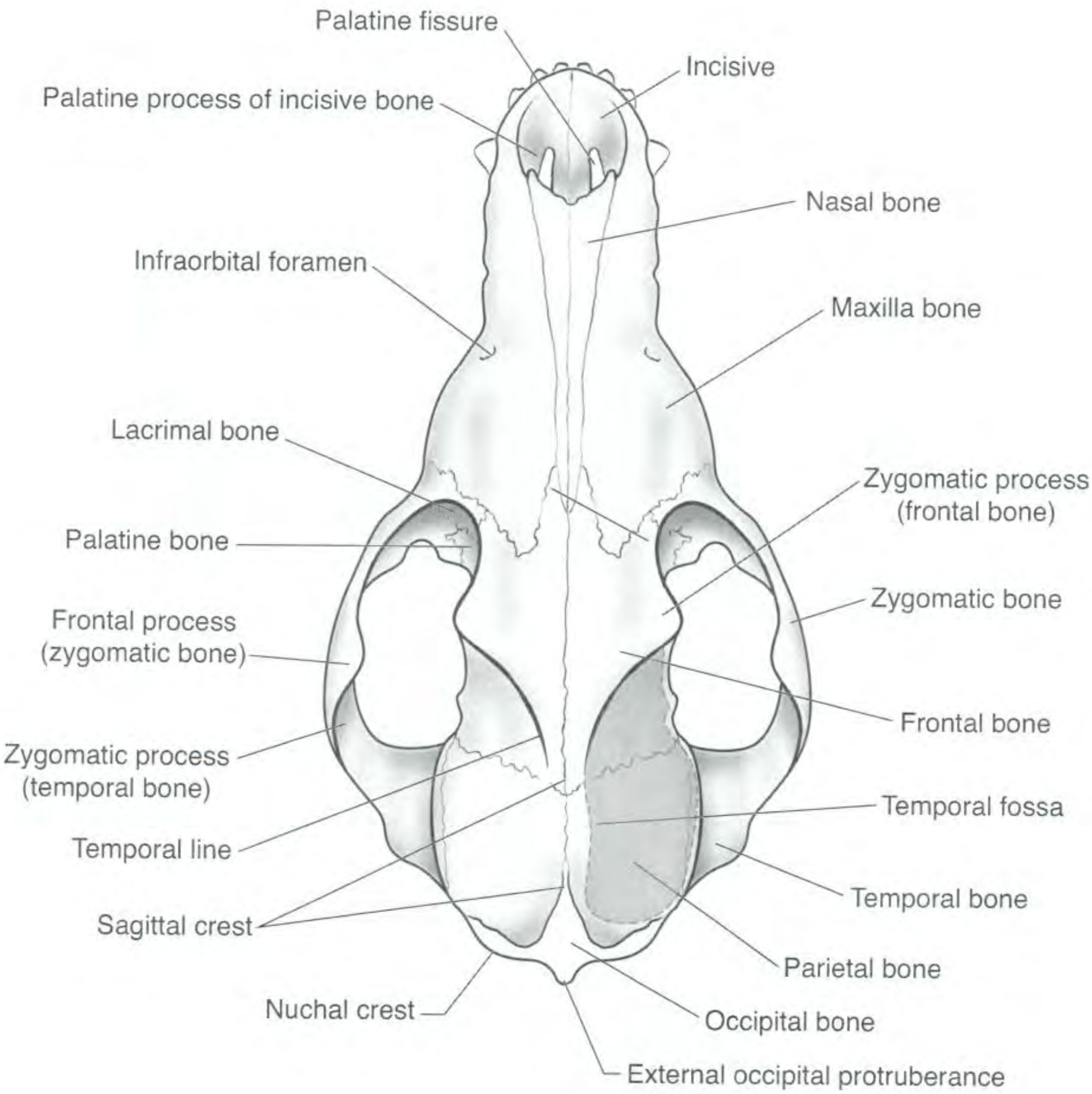


Canine Skull
Lateral View



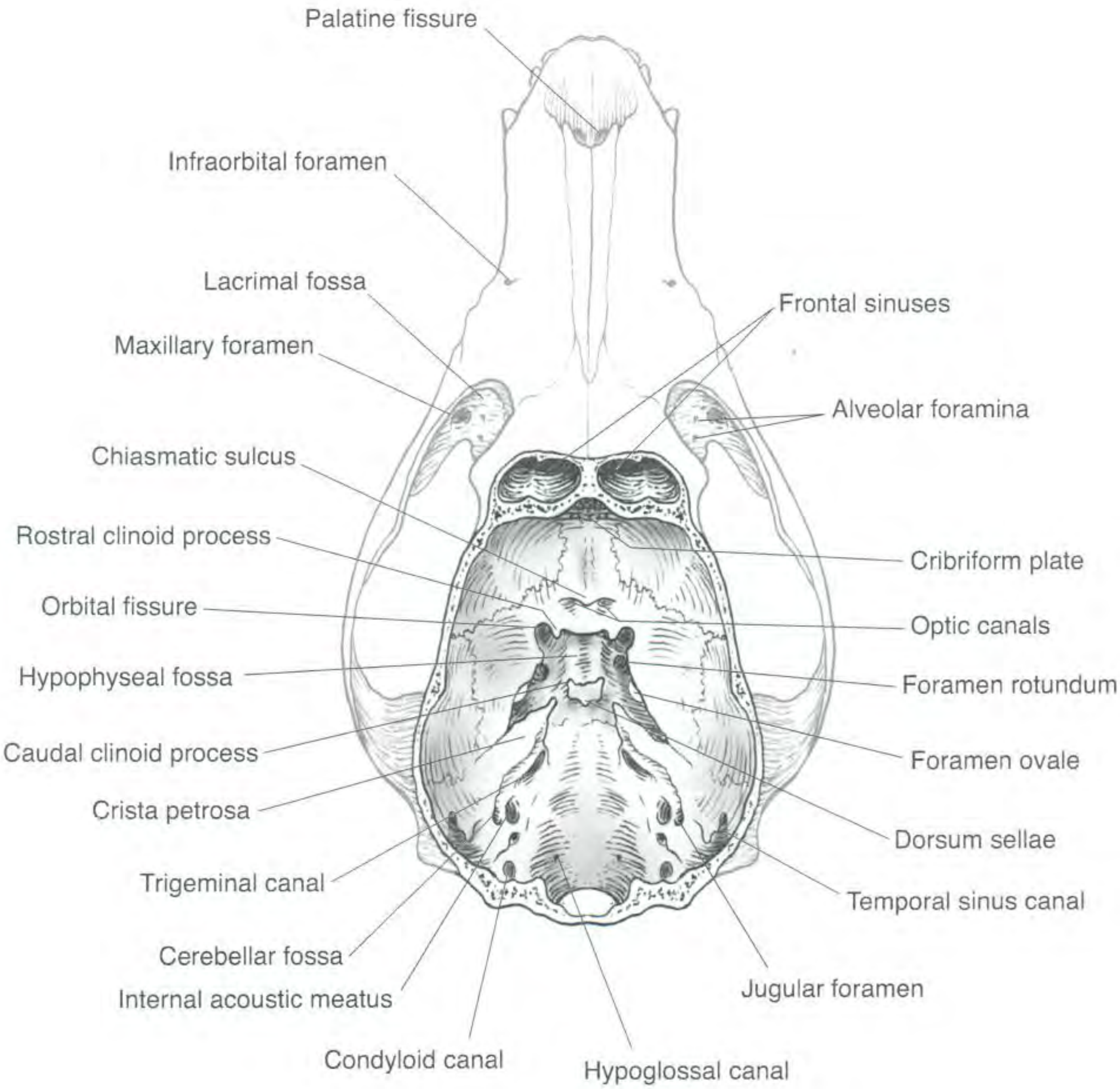
Canine Skull

Dorsal View

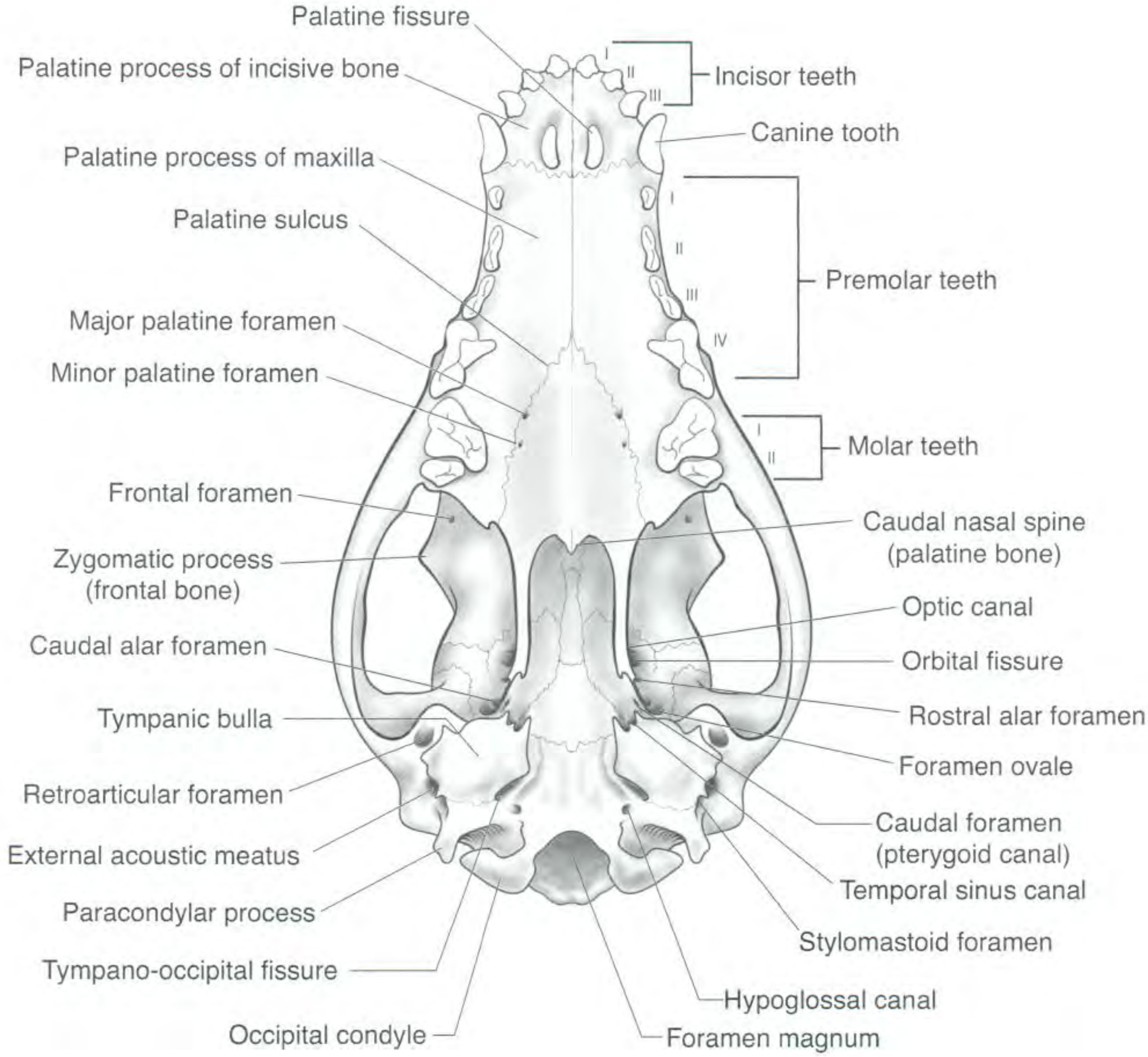


Canine Skull Foramina

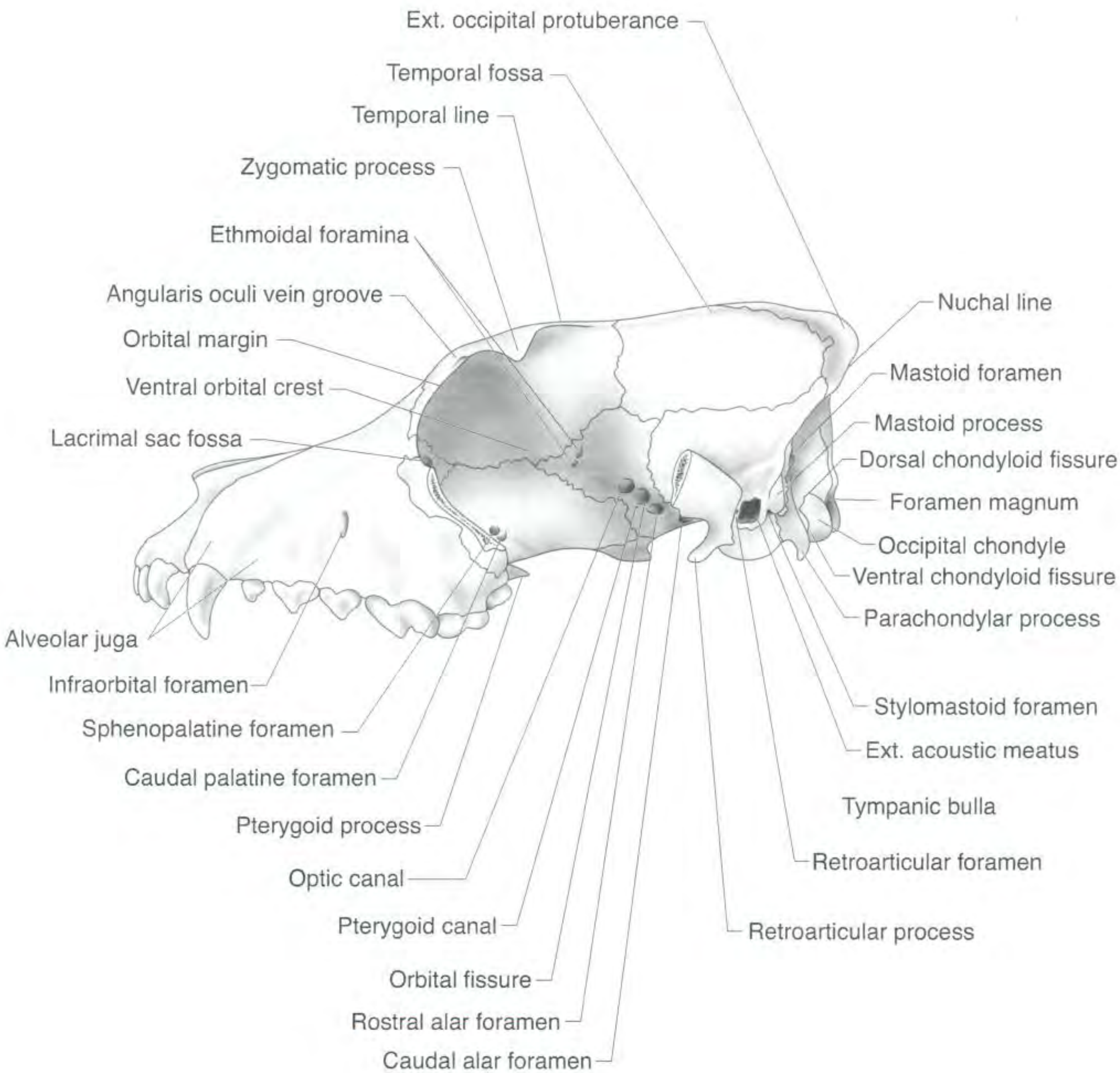
Dorsal View
(calvaria removed)



Canine Skull Foramina
Ventral View



Canine Skull Foramina
Lateral View



CRANIAL NERVES

I. **Olfactory n.** - sensory, smell (cribiform plate)

II. **Optic n.** - sensory, sight (optic canal)

III. **Oculomotor n.** - motor to mm. that move the eye
- Parasympathetic to pupil constriction (orbital fissure)

IV. **Trochlear n.** - motor to m. that moves the eye (orbital fissure)

V. **Trigeminal n.**

Ophthalmic br. - sensory to eye - cornea (orbital fissure)

Maxillary br. - sensory to nose and upper maxilla (rostral alar foramen)

Mandibular br. - sensory to nose and rostral 2/3 of tongue;
- motor to mm. of mastication (oval foramen)

VI. **Abducent n.** - motor to mm. that move the eye (orbital fissure)

VII. **Facial n** - motor to mm. of facial expression (stylomastoid foramen)
- sensory to pinna, taste to rostral 2/3 of toungue
- parasympathetic to lacrimal and salivary glands

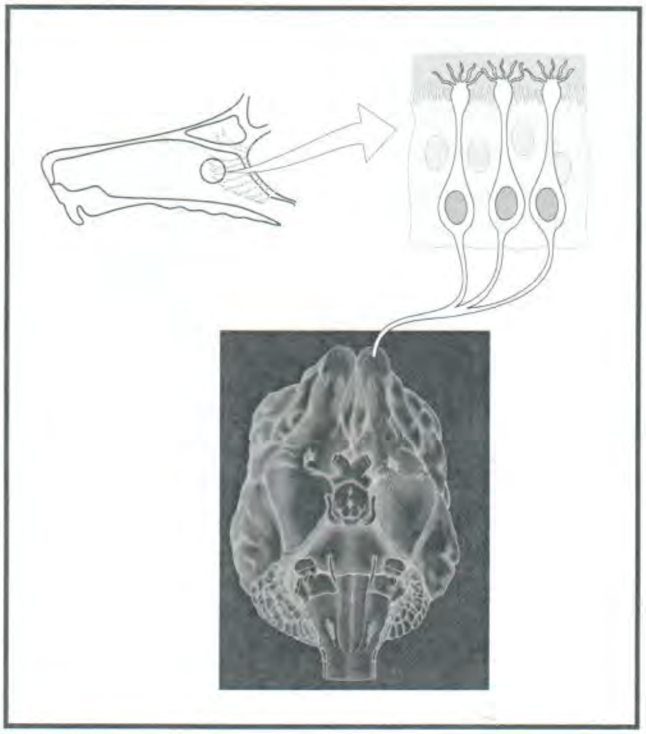
VIII. **Vestibulocochlear n.** (internal acoustic meatus)
vestibular - sensory, equilibrium
cochlear - sensory, hearing

IX. **Glossopharangeal n.**
- motor to swallowing mm.
- sensory to pharynx
- sensory, taste to caudal 1/3 of tongue
- parasympathetic to salivary glands (tympano-occipital fissure)

X. **Vagus n.** - motor to swallowing mm. and larynx
- parasympathetic to thoracic and abdominal organs (tympano-occipital fissure

XI. **Accessory n.** - motor to neck mm. (tympano-occipital fissure)

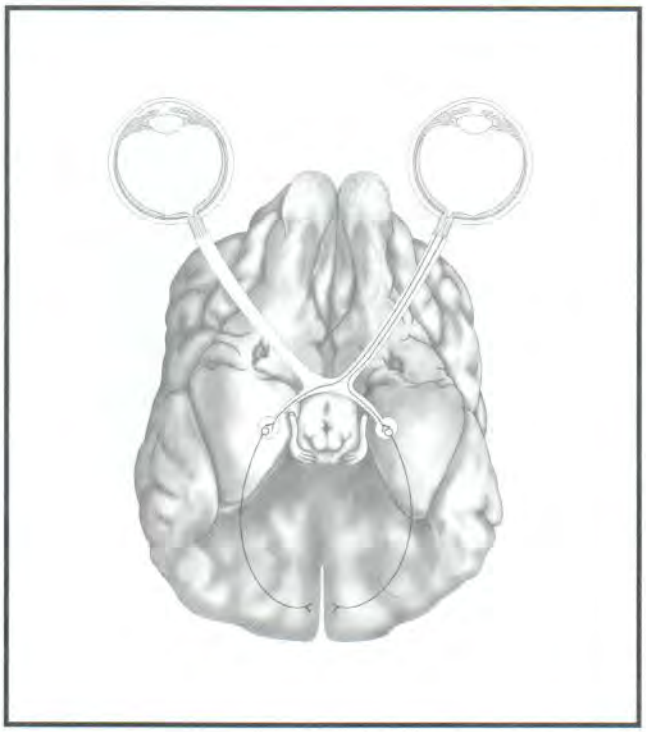
XII. **Hypoglossal n.** - motor to tongue mm. (hypoglossal canal)



Olfactory Nerve: Cranial Nerve I:

FUNCTION: The olfactory nerve is a special sensory nerve that is involved only in smell. The cell bodies of the olfactory cells (present in the lining of the caudal nasal cavity) send their axons through the cribriform plate of the ethmoid bone into the cranial cavity where they terminate by synapsing on neurons in the olfactory bulbs. In the olfactory bulbs, the stimuli are transferred to second-order neurons that course caudad as the common olfactory tract.

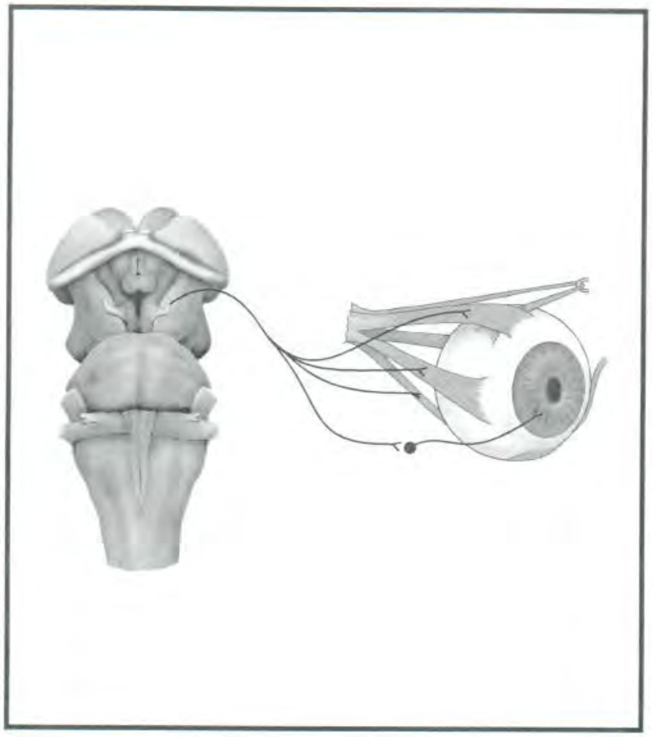
CRANIAL EXIT: Foramina of ethmoid bone (cribriform plate).



Optic Nerve: Cranial Nerve II:

FUNCTION: The optic nerve (CN II) is a special sensory nerve that provides vision. The cell bodies of the optic nerve are in the retina of the eye with the axons combining to form the optic nerve (CN II). The optic nerve courses in the orbit to the optic canal, where it passes through the skull into the cranial cavity. The right and left optic nerves join at the optic chiasm where most of the fibers cross over (decussate) to the opposite side (degree of decussation is species-specific).

CRANIAL EXIT: Optic canal

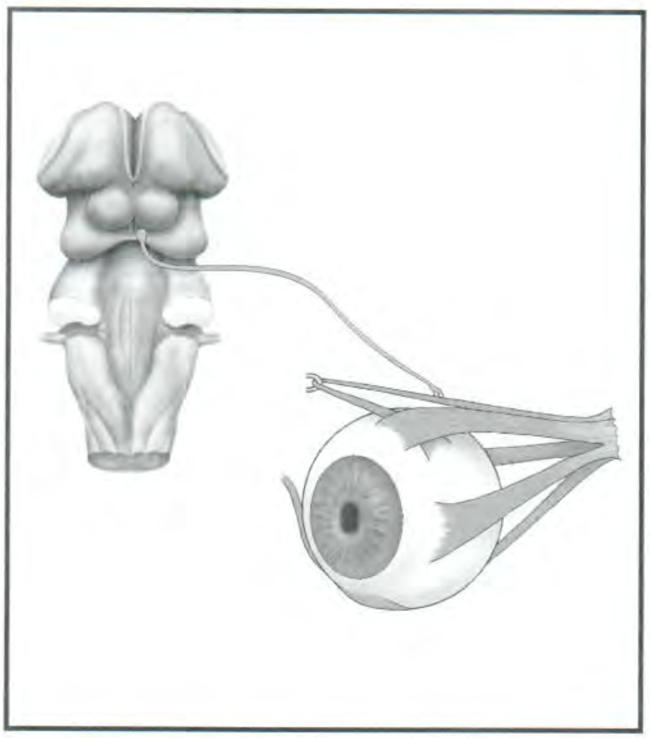


Oculomotor Nerve: Cranial Nerve III:

FUNCTION: The oculomotor nerve (CN III) carries both autonomic and motor fibers. Autonomic Component: The oculomotor nerve contains ANS motor fibers that control the smooth (involuntary) muscles of the eye. These are the ciliary muscles that adjust the shape of the lens for focusing (accommodation) and the pupillary sphincter muscles. These ANS fibers are the efferent part of a reflex arc for which the optic nerve serves as the afferent part.

Motor: The oculomotor nerve is motor to the following: skeletal (voluntary) muscles of the eye: dorsal, medial and ventral rectus muscles and ventral oblique muscle. It is also motor innervation to the levator palpebrae supenons, the muscle that raises the upper eyelid.

CRANIAL EXIT: Orbital fissure

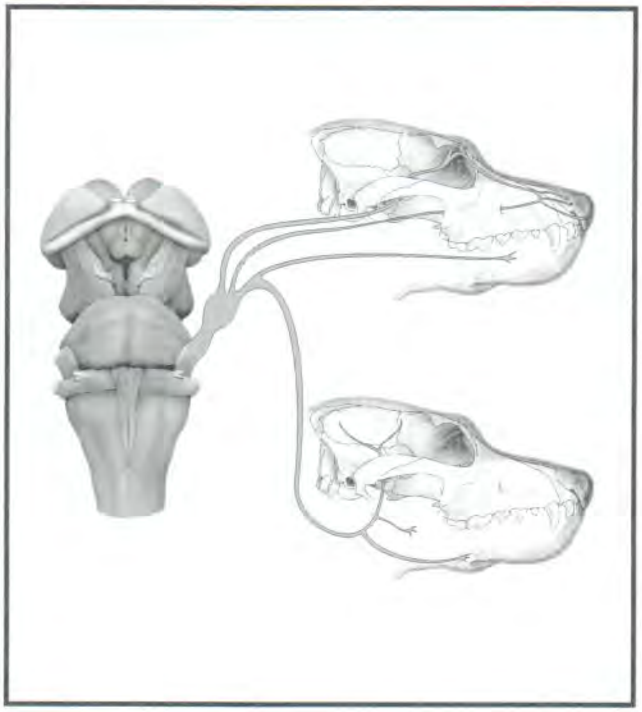


Trochlear Nerve: Cranial Nerve IV:

FUNCTION: The trochlear nerve is motor to the dorsal oblique muscle The trochlear nerve is unique in three aspects:

I. It is the smallest of the cranial nerves.
2. It is the only cranial nerve to emerge from the dorsal side of the brainstem.
3. It is the only cranial nerve to cross the midline and innervate the contralateral side.

CRANIAL EXIT: Orbital fissure



Trigeminal Nerve: Cranial Nerve V:

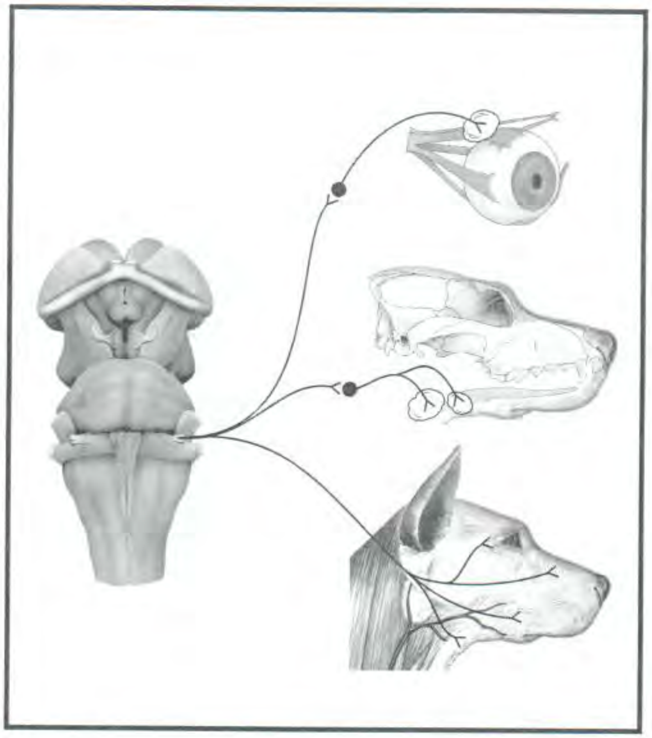
FUNCTION: The trigeminal nerve is sensory to the head. The trigeminal nerve is formed by the fusion of sensory and motor roots. The larger sensory root bears the massive trigeminal ganglion. The trigeminal nerve divides into a trio of branches giving the nerve its name. The ophthalmic branch (VI) and maxillary branch (V2) are purely sensory, and the mandibular branch (V3), while having a sensory component, is also motor to the muscles of mastication, (masseter, temporalis, medial and lateral pterygoid, mylohyoid, and rostral belly of the digastricus muscles).

CRANIAL EXIT: Distal to the trigeminal ganglion, the trigeminal nerve divides into the three branches, the ophthalmic branch (VI) that passes through the orbital fissure, the maxillary branch (V2) that passes into the round foramen and out the rostral alar foramen'and the mandibular branch (V3) that passes through the oval foramen.

Abducent Nerve: Cranial Nerve VI:

FUNCTION: The abducent nerve (CN VI) provides motor innervation to two skeletal (voluntary) muscles of the eye: the lateral rectus and the retractor buibi muscles. The name abducent is derived from the Latin word which means, "drawing away", a reference to the lateral pulling away of the eye by the lateral rectus muscle.

CRANIAL EXIT: Orbital fissure

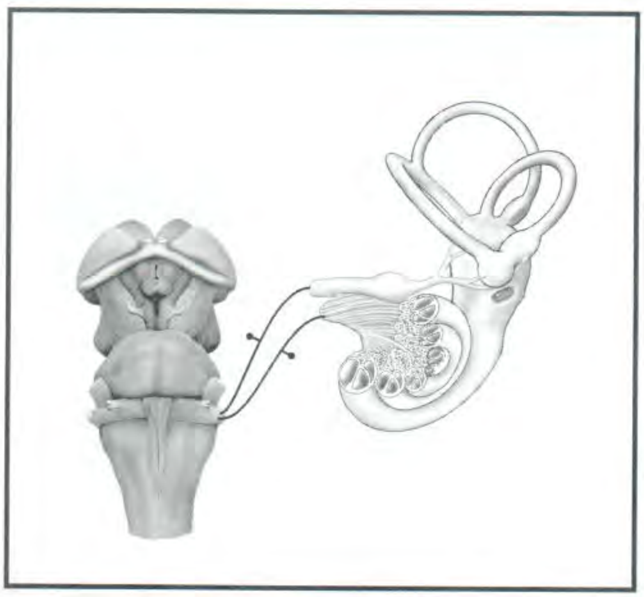


Facial Nerve: Cranial Nerve VII:

FUNCTION: The facial nerve has motor, sensory and autonomic components.

Motor - All the superficial muscles of the head and face as well as the caudal belly of the digastricus, platysma, stylohyoideus and stapedius muscles. Sensory - Taste to the rostral 2/3 of the tongue and palate through the chorda tympani nerve. The internal auricular branches are sensory to the concave surface of the ear and ear canal. Autonomic - Preganglionic parasympathetic innervation to the lacrimal, nasal and palatine glands. These preganglionic parasympathetic innervation to the mandibular and sublingual salivary glands. These fibers synapse in the mandibular and sublingual ganglions.

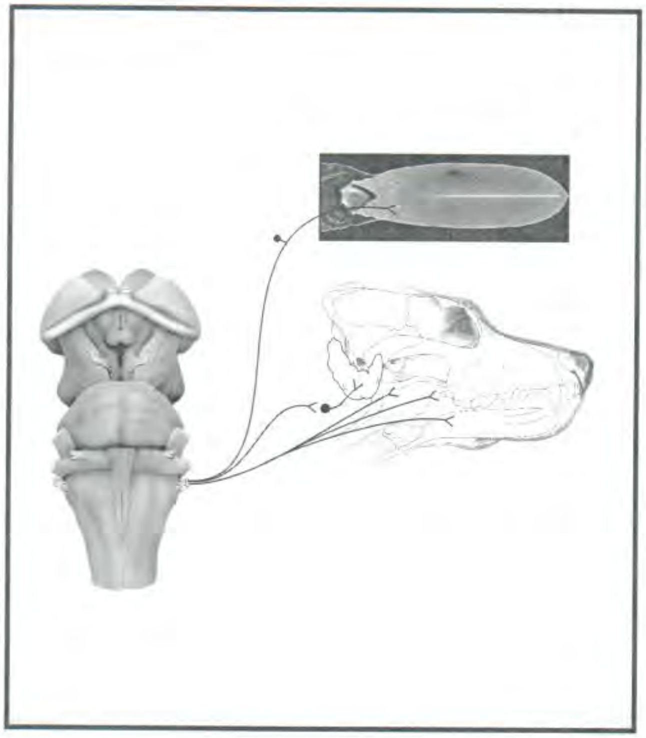
CRANIAL EXIT: Internal acoustic meatus, facial canal, stylomastoid foramen



Vestibulocochlear Nerve: Cranial Nerve VIII:

FUNCTION: The vestibulocochlear nerve (CN VIII) is a special sensory nerve that deals with hearing and equilibrium. It is divided into two branches, the cochlear and vestibular, which enter the petrous temporal bone through the internal acoustic meatus. In the petrous temporal bone they enter into the membranous labyrinth of the inner ear.

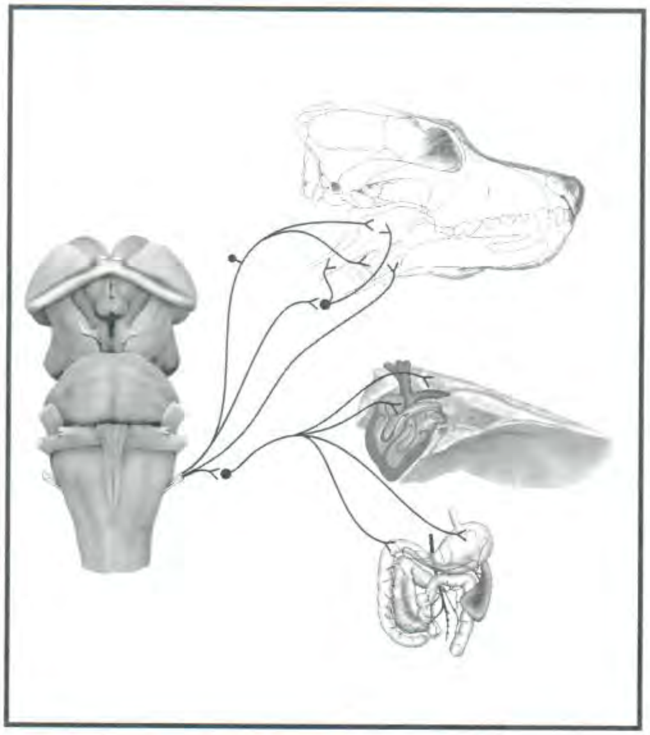
CRANIAL EXIT: Internal acoustic meatus



Glossopharyngeal Nerve: Cranial Nerve IX:

FUNCTION: The glossopharyngeal nerve is a mixed nerve supplying, as its name suggests, the tongue and pharynx. This nerve serves taste, swallowing and salivation. Functionally, this nerve can be divided as follows:
Taste: Taste sensation from the taste buds in the caudal 1/3 of the tongue.
Sensory: Sensation from the mucosa of the caudal 1/3 of the tongue, palate and pharynx. The glossopharyngeal nerve also innervates the baroreceptors and chemoreceptors of the carotid sinus.
Motor: Motor to the striated voluntary muscles of the pharynx.
Autonomic: Parasympathetic autonomic innervation to the parotid gland (through the otic ganglion) causing secretion of the parotid gland.

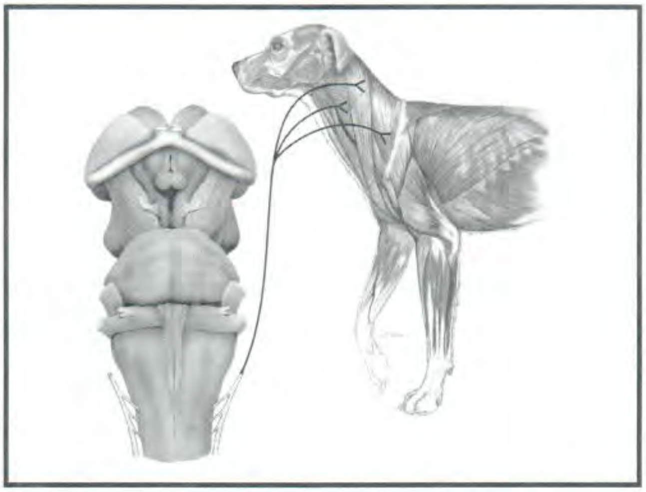
CRANIAL EXIT: Jugular foramen to tympano-occipital fissure



Vagus Nerve: Cranial Nerve X:

FUNCTION: The vagus nerve has the following functions:
Motor: The vagus nerve is motor to the pharyngeal muscles through the pharyngeal plexus. The vagus nerve is motor to the intrinsic muscles of the larynx (except the cricothyroideus muscle) through the recurrent laryngeal nerve and motor to the cricothyroideus muscle through the cranial laryngeal nerve.
Sensory: The vagus is sensory from the pharynx, larynx, and thoracic and abdominal viscera, including baroreceptors in the aortic bodies.
Autonomic nervous system: The vagus nerve carries parasympathetic fibers to the pharynx, larynx, trachea, esophagus and thoracic and abdominal organs.

CRANIAL EXIT: Jugular foramen to tympano-occipital fissure

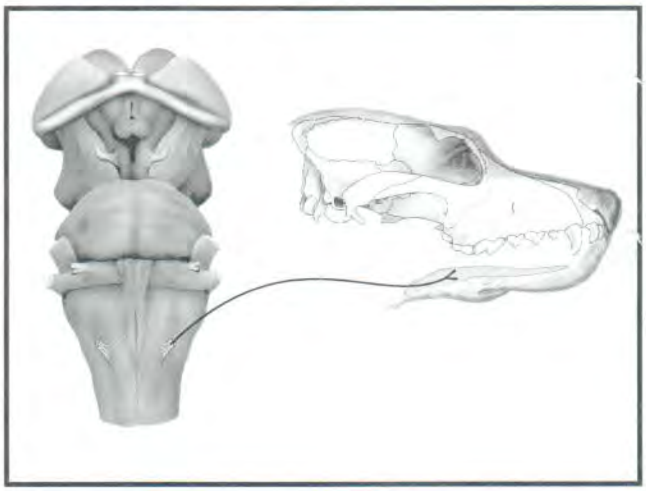


Accessory Nerve: Cranial Nerve XI:

FUNCTION: The accessory nerve innervates the muscles of the neck and forelimb. (sternocepahlicus, omotransversarius, portions of the brachio-

cephalicus & trapezius)

CRANIAL EXIT: Jugular foramen to tympano-occipital fissure

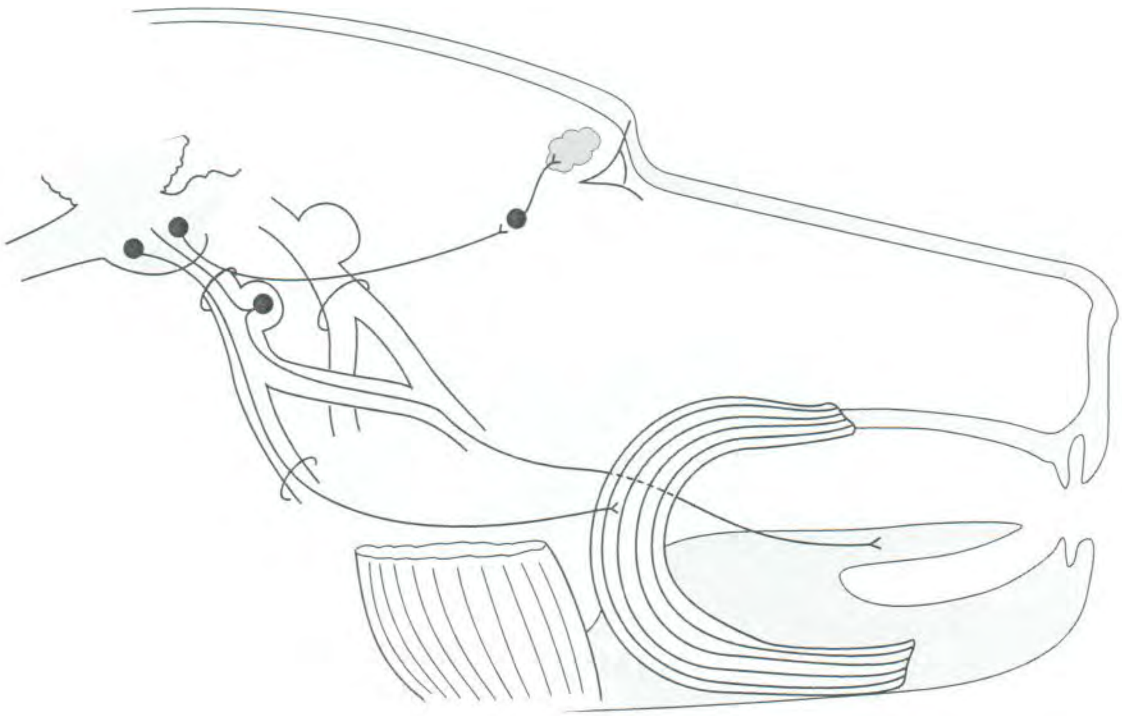


Hypoglossal Nerve: Cranial Nerve XII:

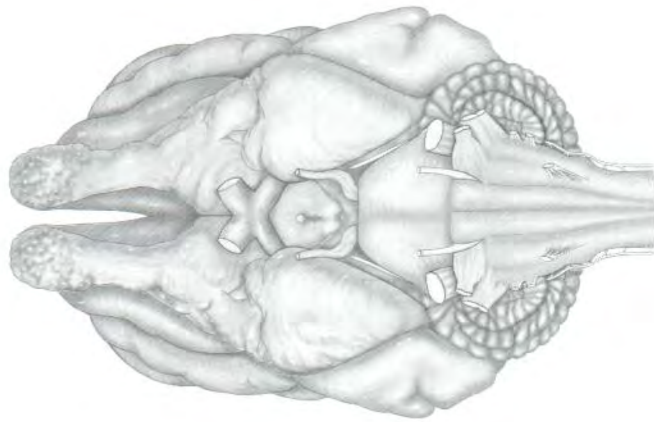
FUNCTION: The hypoglossal nerve is motor to the muscles of the tongue.

CRANIAL EXIT: Hypoglossal canal

TRIGEMINAL & FACIAL NERVES



Canine Brian

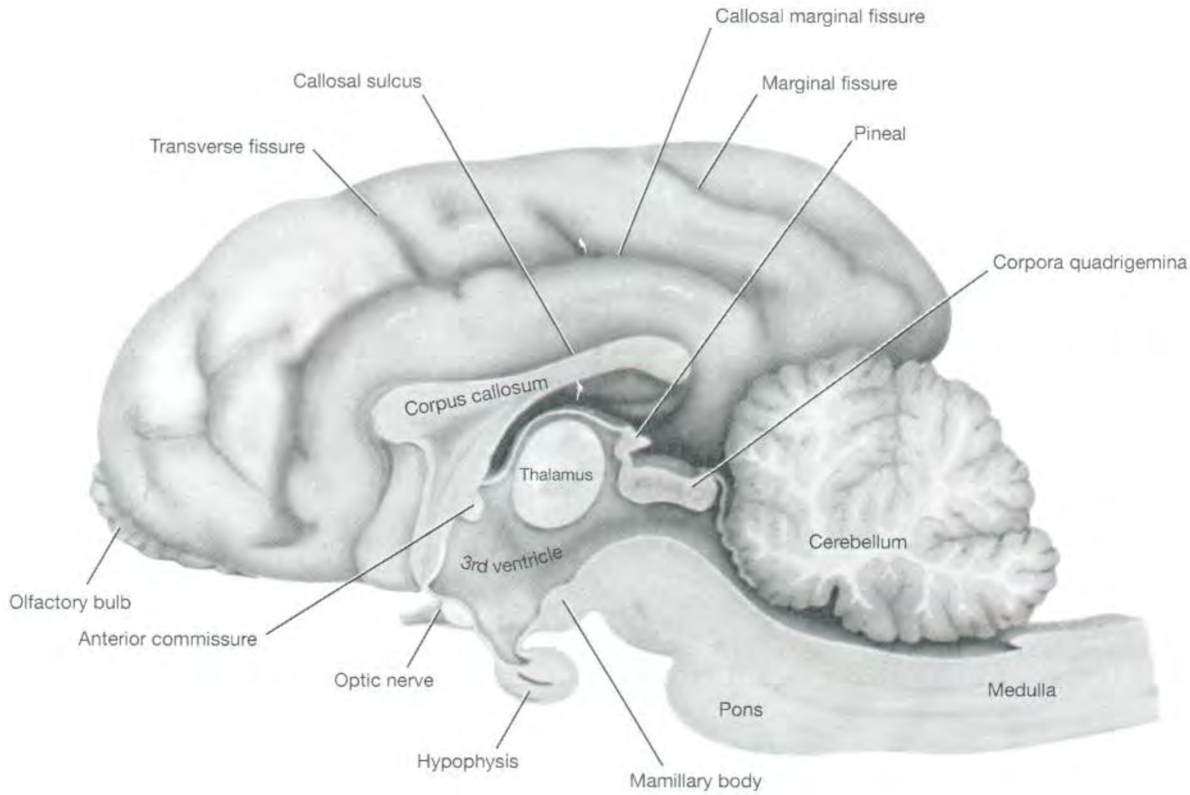


Ventral

Lateral

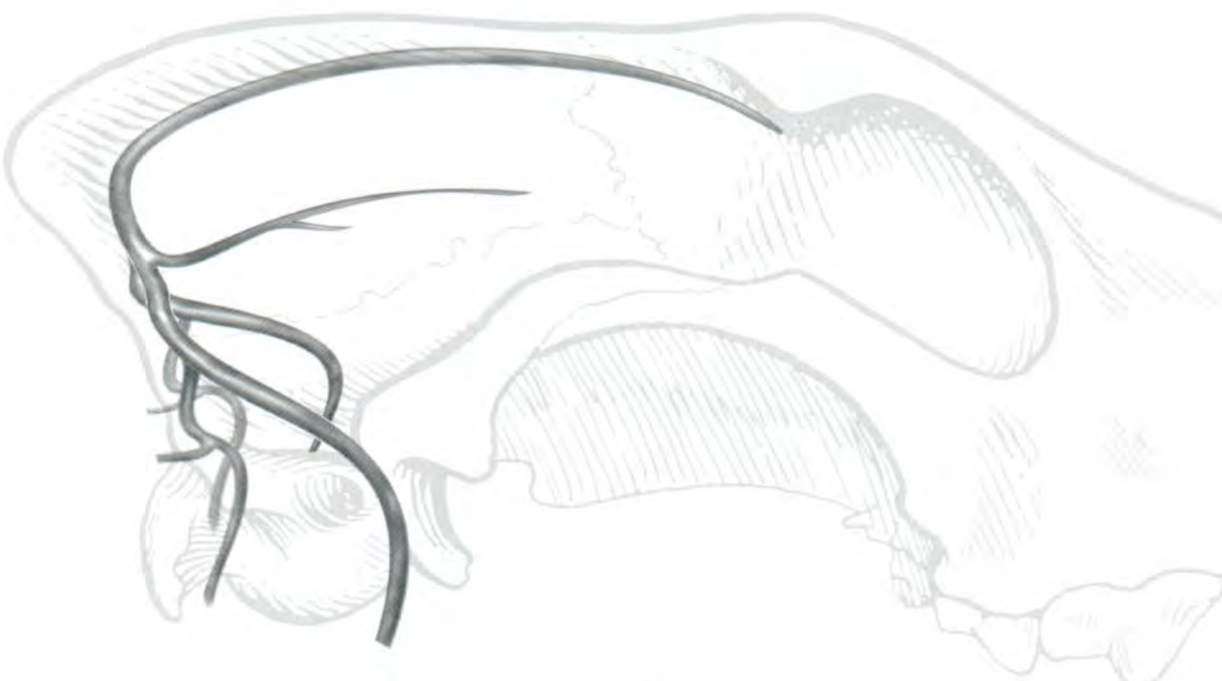
Dorsal

Midsagittal
Canine Brian



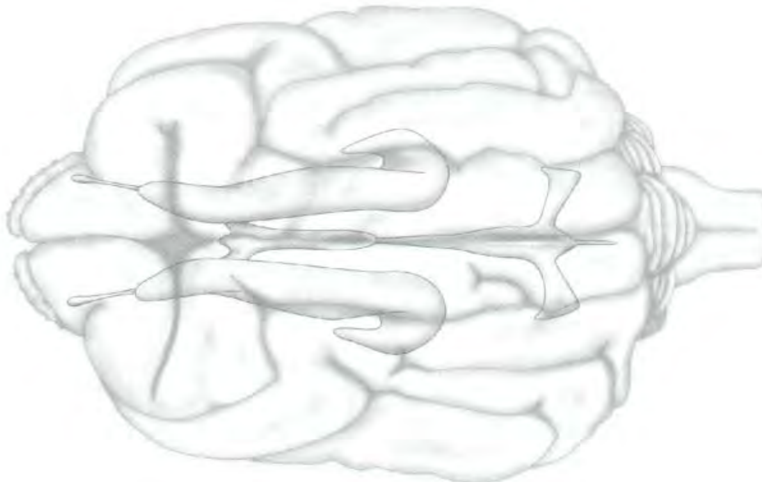
BLOOD SUPPLY TO HEAD

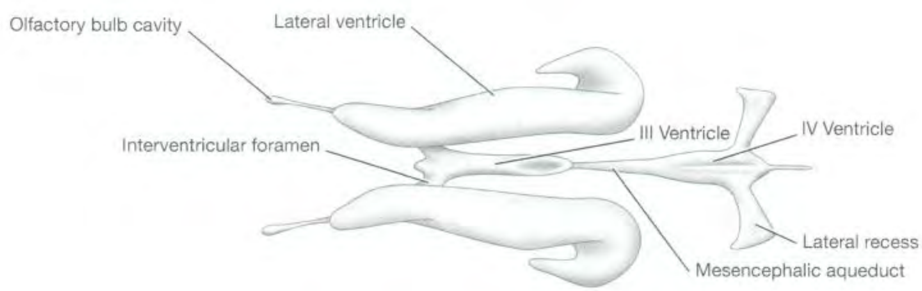
VENOUS SINUSES



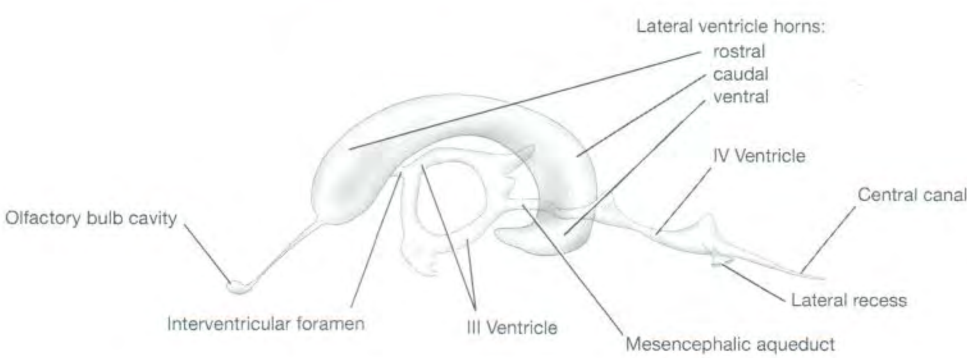
VENTRICULAR SYSTEM

DORSAL

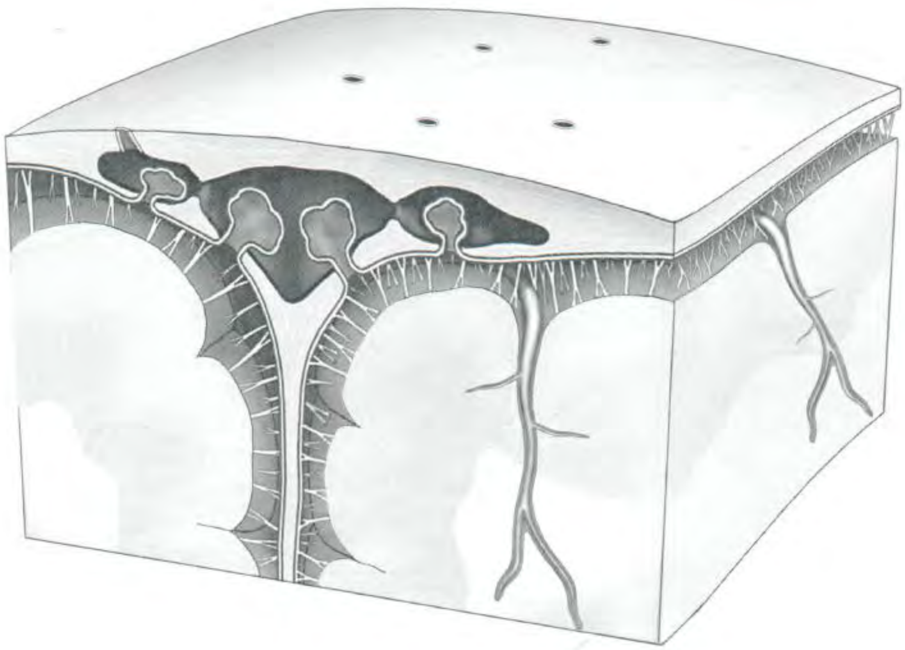




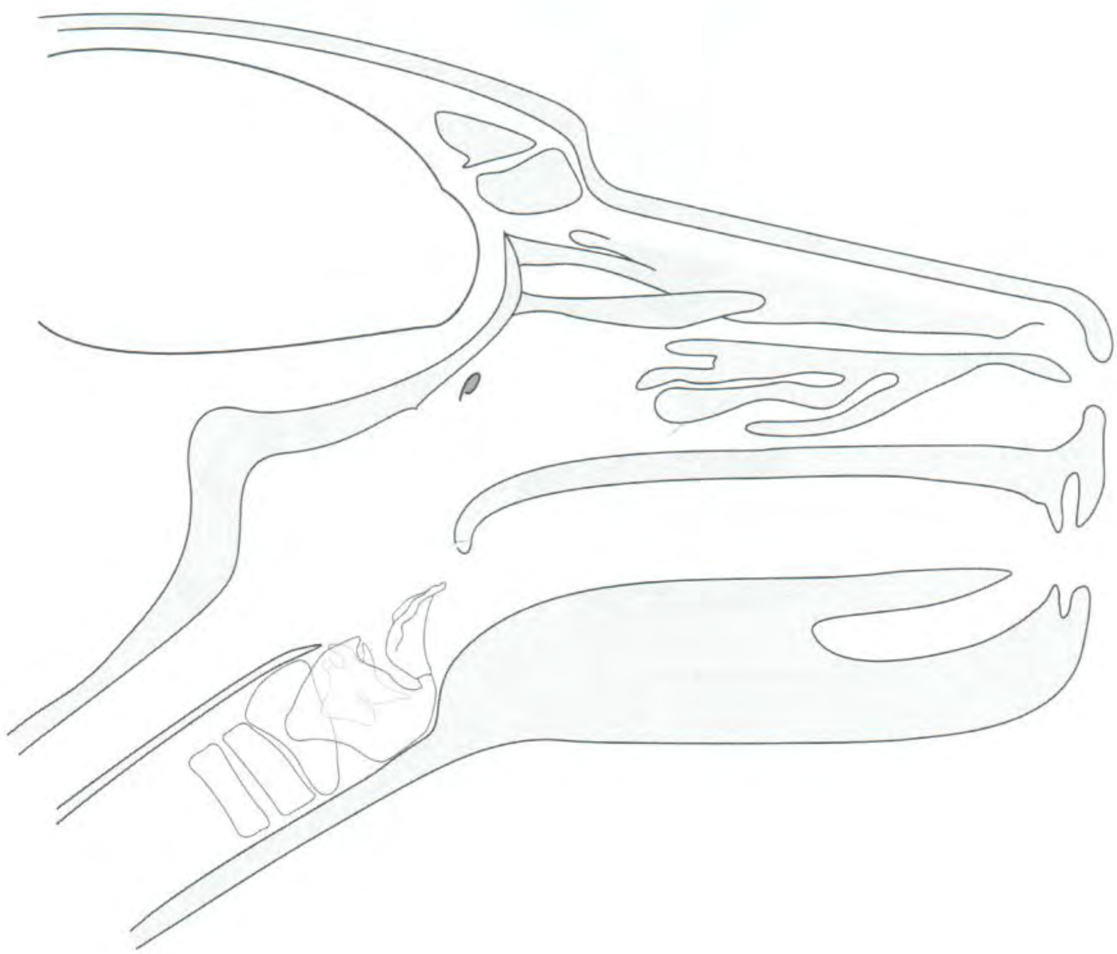
LATERAL



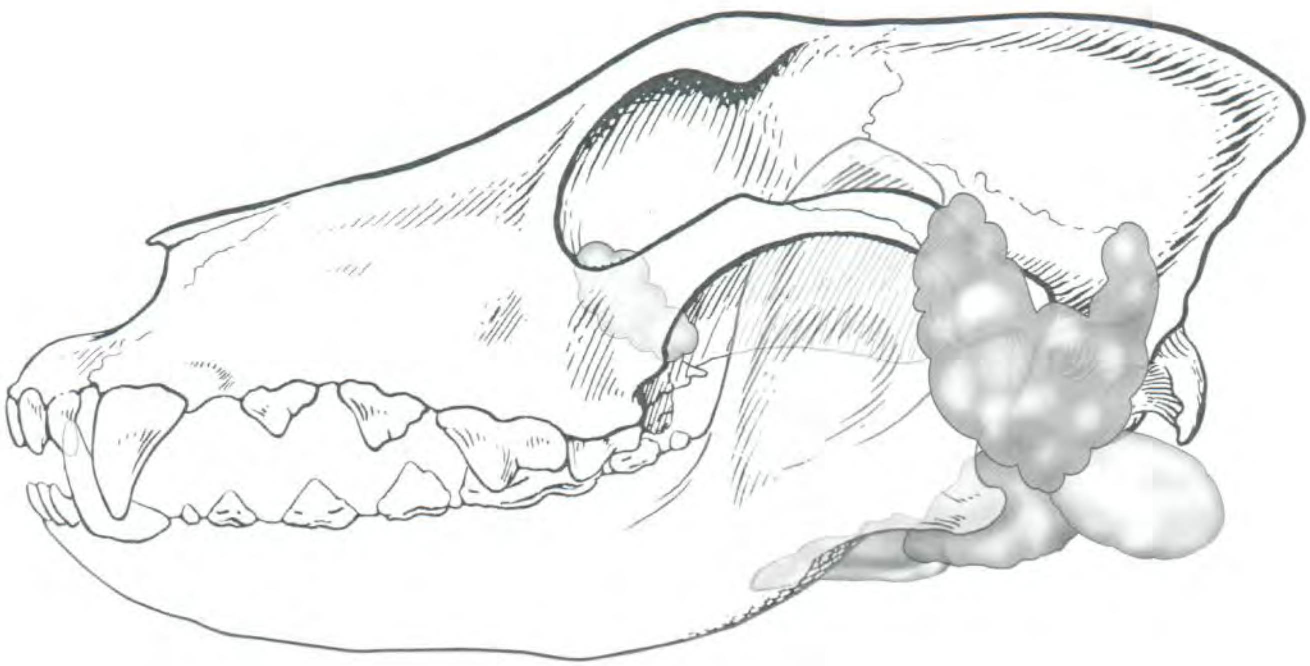
CSF RETURN



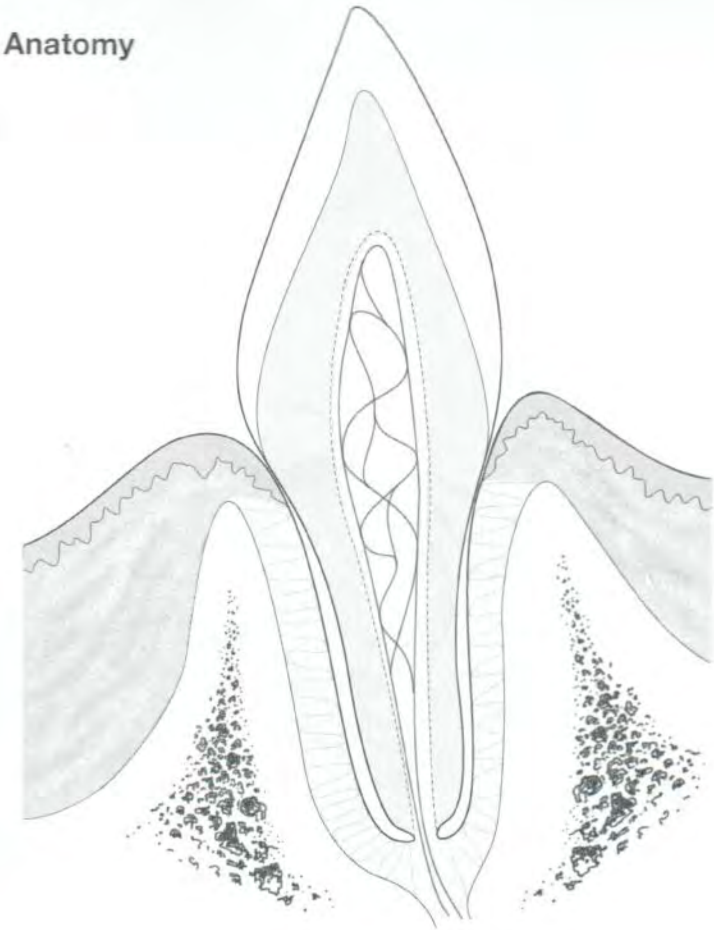
NASAL CAVITY



SALIVARY GLANDS



Tooth Anatomy

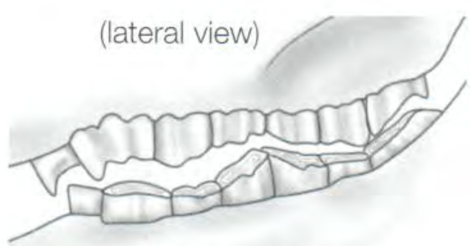


Tooth Anomalies

(anterior view)

Points

(lateral view)



Hooks & Waves

MAMMALIAN TEETH & DENTAL FØRMULAE

Heterodonty – different teeth specialized for different tasks
Diphyodonty – 1st set of teeth (deciduous teeth) replaced with a stronger set (permanent teeth)

Generic Formula: Upper jaw teeth / Lower jaw teeth

I-C-P-M	I = incisors	C = canines	P = premolars	M = molars
I-C-P-M	I = incisors	C = canines	P = premolars	M = molars

Individual teeth may be identified by upper/lower case letters (permanent teeth/deciduous teeth) and superscript and subscript numerals (upper teeth/lower teeth):

P^1 = 1st permanent upper premolar
i_2 = 2nd deciduous lower incisor

Mammalian family dental formulae:

Canine	3-1-4-2 3-1-4-3
Feline	3-1-3-1 3-1-2-1
Equine	3-1-3-3 3-1-3-3
Bovine	0-0-3-3 3-1-3-3

EQUINE TEETH AGING

Getting Started:

1. Distinguish the lower arcade from the upper arcade
   a. The palatal ridges are on the uppers.
2. Identify the set of teeth
   a. Only deciduous teeth (Go to A.)
   b. Mixed Set – both deciduous & permanent teeth (Go to B.)
   c. Only permanent teeth (Go to C.)

A. Only Deciduous Teeth

a. Upper: $di^1 = 1^{st}$ (central incisor), di^2=intermediate, di^3 = corner
b. Lower: $di_1 = 1^{st}$ (central incisor), di_2=intermediate, di_3 = corner
c. Eruption dates:

di_1 = birth to 1 week	di_2 = 1 to 2 months	di_3 = 6 to 9 months
~6 days	**~6 weeks**	**~6 months** **~12 months (1 y) – half way in** **~18 months (1 ½ y) – touching** **~24 months (2 y) – worn level** **~54 months (4 ½ y) – replaced**

B. Mixed Set – both deciduous & permanent teeth

a. Permanent Upper: $I^1 = 1^{st}$ (central incisor), I^2=intermediate, I^3 = corner, C^1= canine
b. Permanent Lower: $I_1 = 1^{st}$ (central incisor), I_2=intermediate, I_3 = corner, C_1= canine
c. Eruption dates in years (uppers & lowers erupt about the same time):

I1	I2	I3	C1
2 ½ years	3 ½ years	4 ½ years	4-5 years

d. In wear/touching (lowers wear before uppers):

3 years	4 years	5 years	4 ½ - 5 ½ years

C. Only Permanent Teeth

a. Eruption dates are based on fact.
b. Once teeth have erupted, aging is dependent on diet.
c. Determining age on all permanent teeth from wear patterns is an art form and will not be covered in this course.

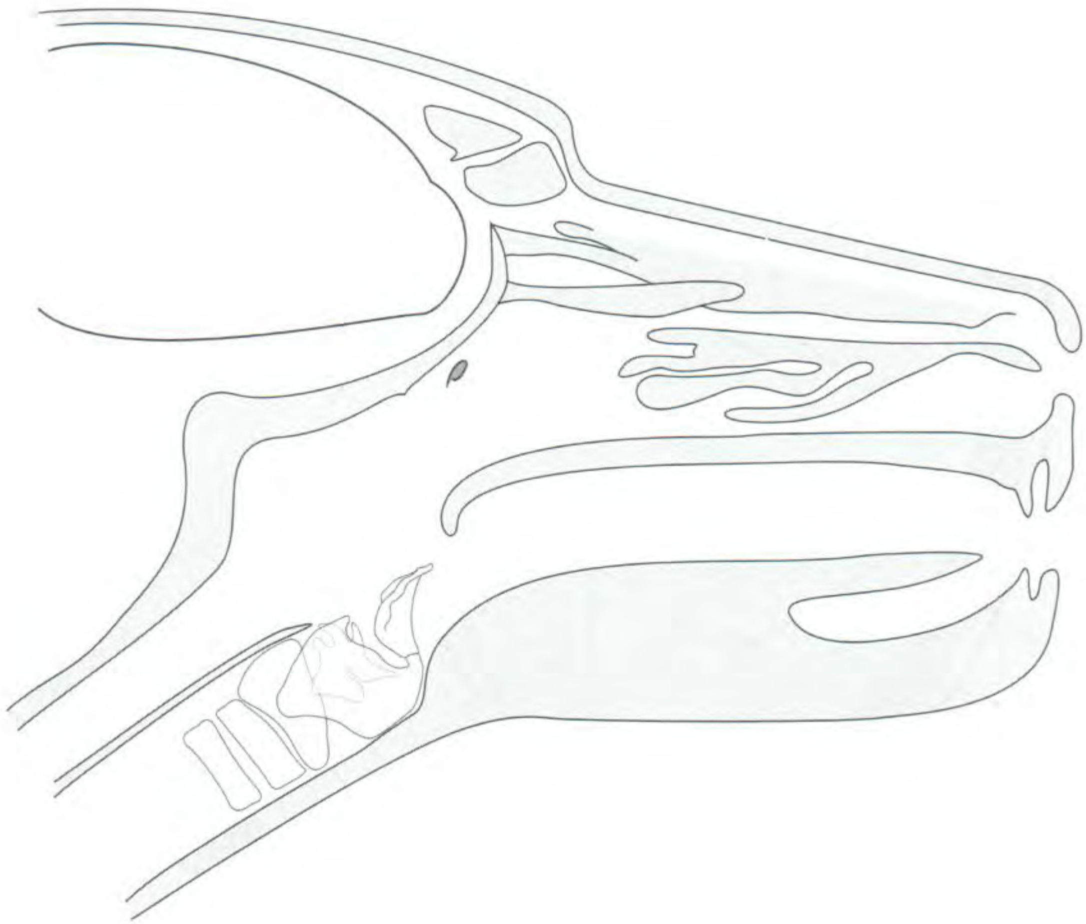
D. Helpful Hints

a. In the real world, you **ALWAYS** give a range when aging.
b. The younger the animal, the smaller the range.
c. The older the animal, the bigger the range.
d. In this exercise, it is **BETTER** for you to give a single number and **NOT** a range!
e. In the real world, you age using mainly the lowers because it is too difficult to see the uppers!
f. In this exercise, because you have access to the uppers, you will use both the uppers and the lowers.
g. In the real world using only the lowers, the animal will appear older than it is
h. Always indicate weeks, months or years!

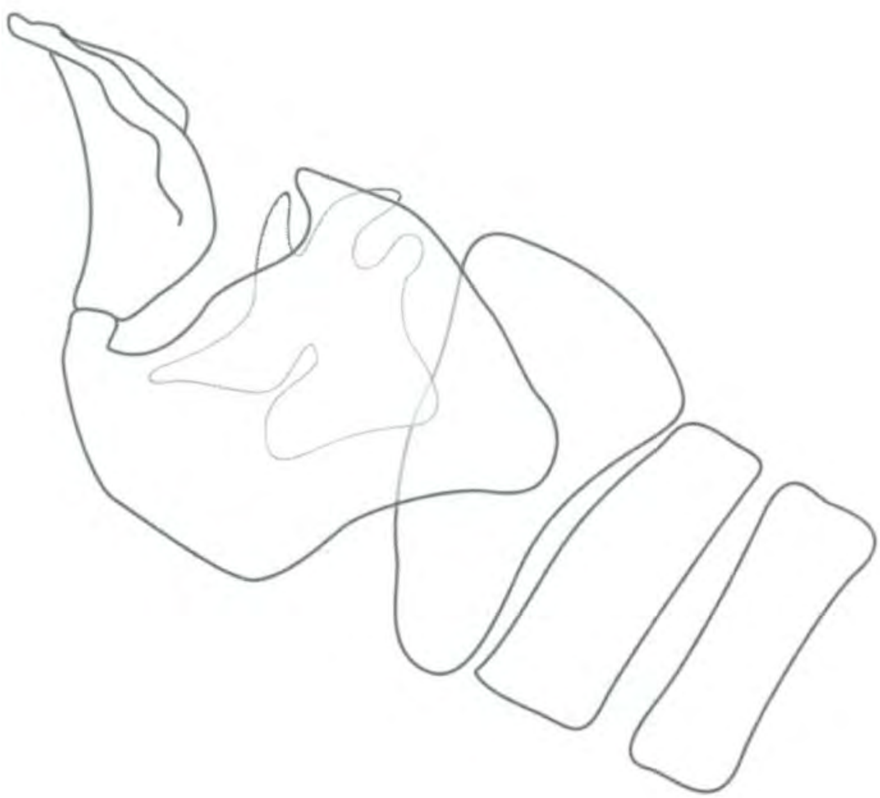
E. Importance of Aging Knowledge

a. 4-H judging of animals
b. Sale barns
c. Purchase exams
d. Judging contests

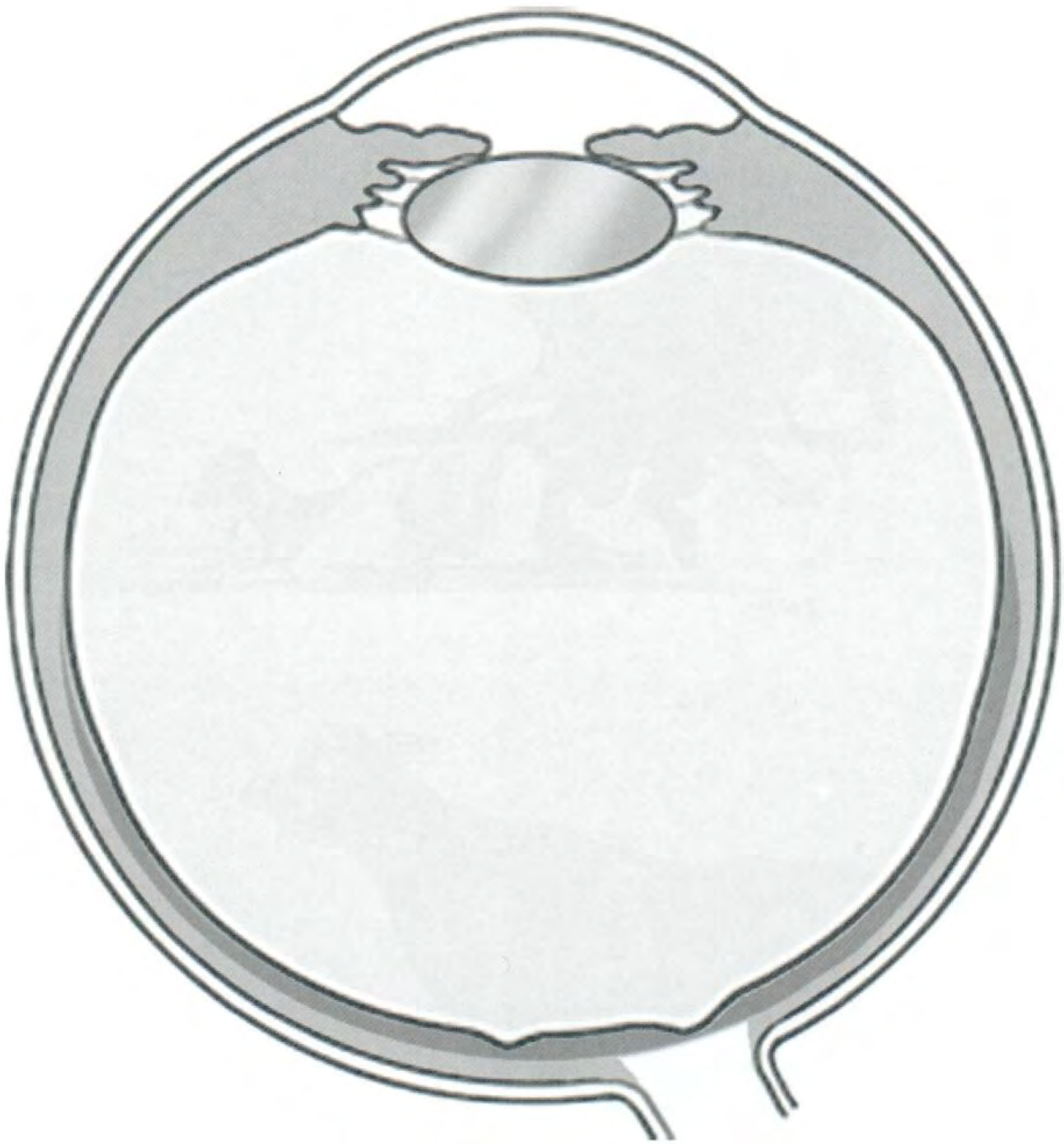
CANINE PHARYNX



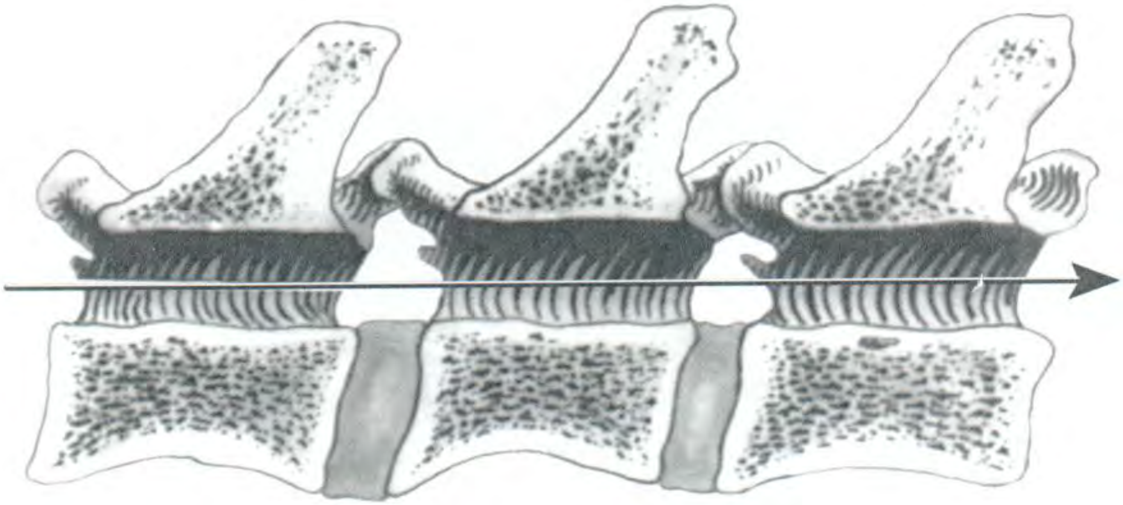
CANINE LARYNX

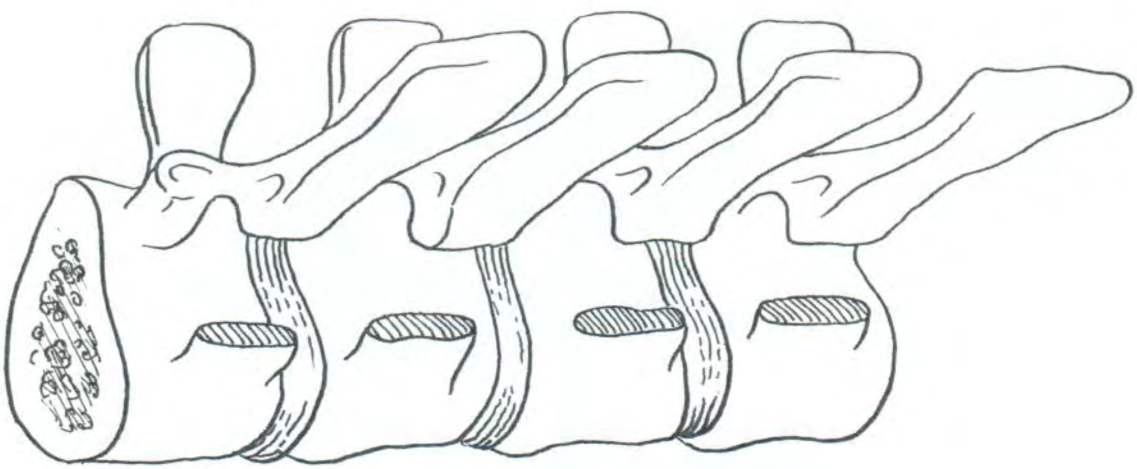


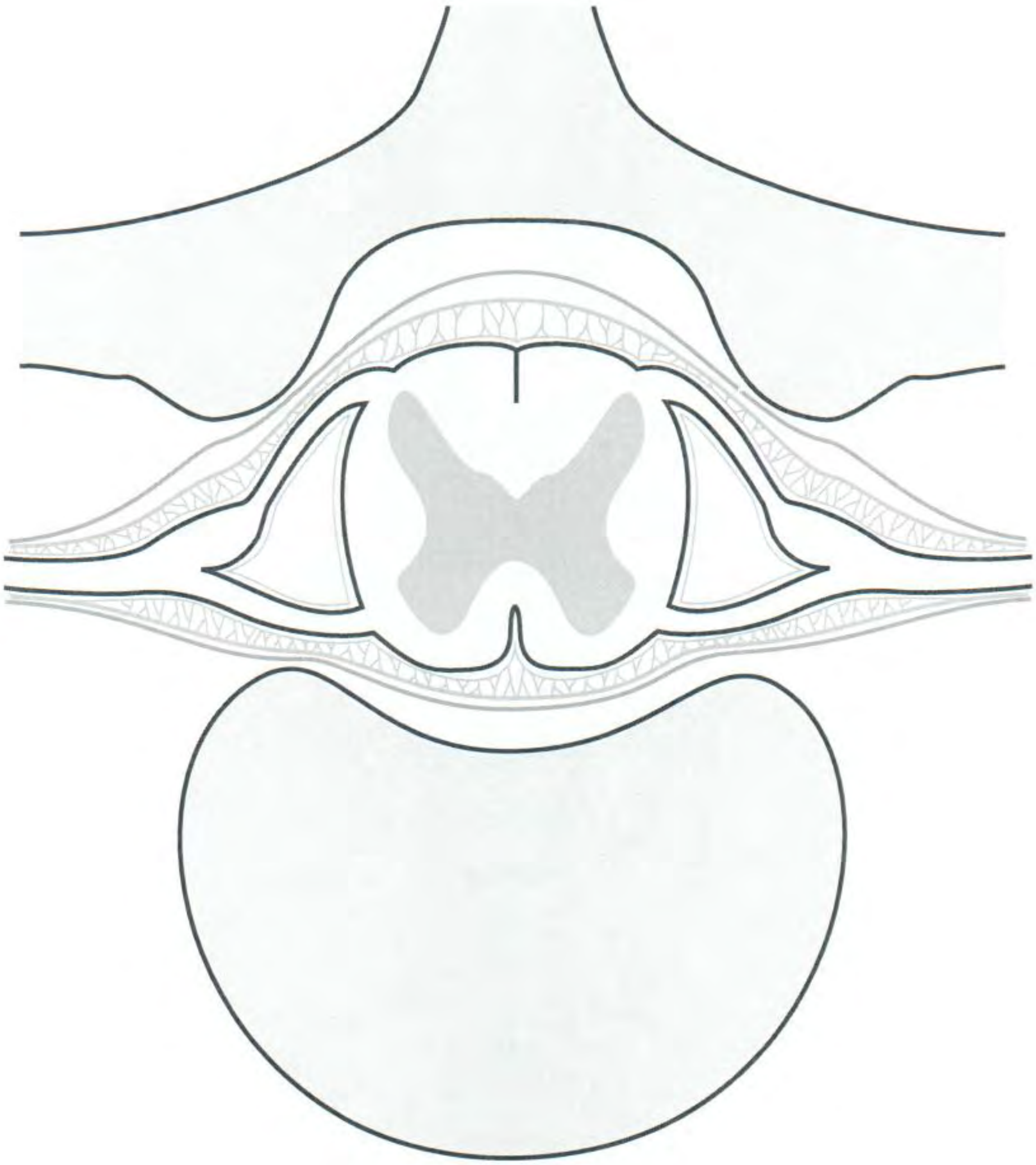
HORIZONTAL EYE



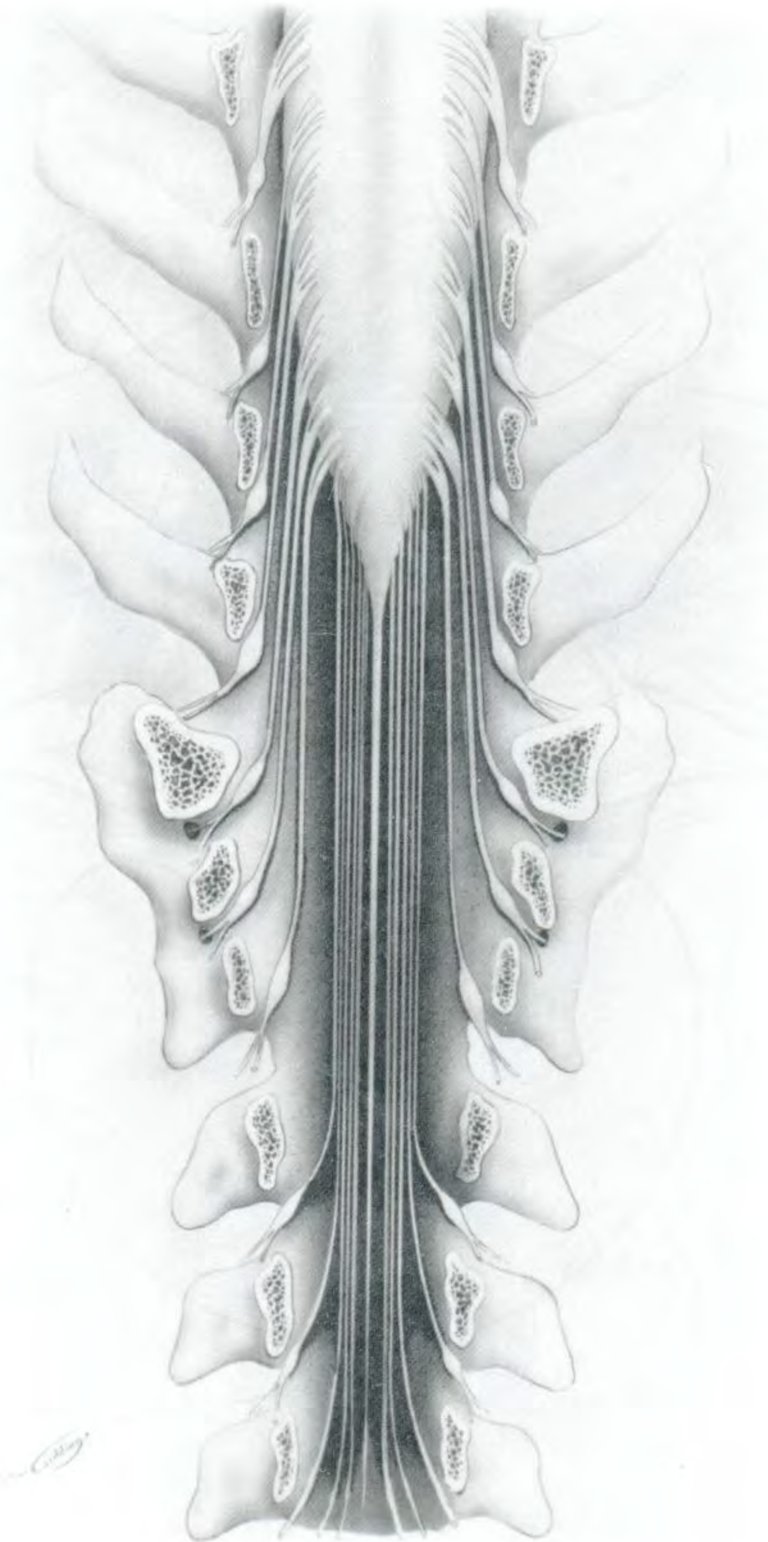
VERTEBRAL COLUMN



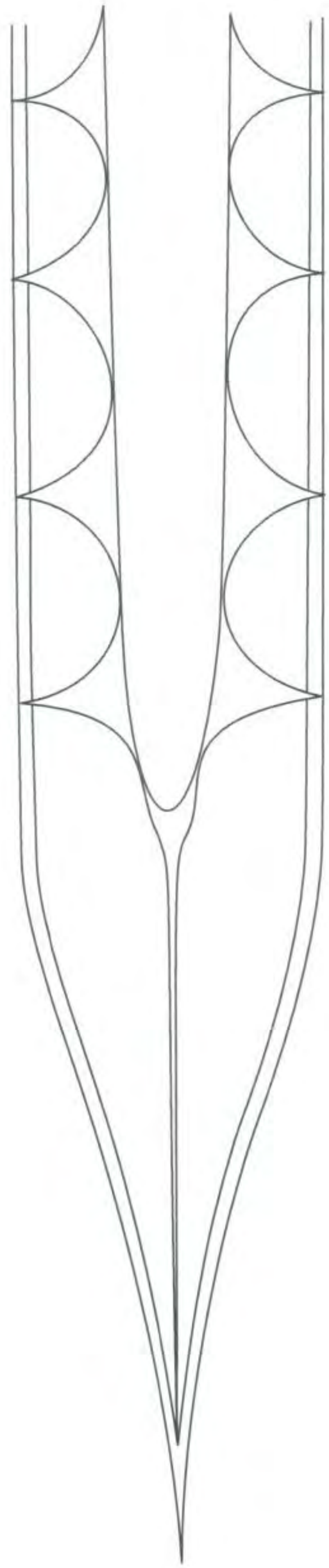




CAUDA EQUINA



DENTICULATE LIGAMENTS



AUTONOMIC NERVOUS SYSTEM

The *autonomic nervous system (ANS)* is a functional division of the nervous system that has parts in both the *central nervous system* and the *peripheral nervous system*. The ANS is made up of *neurons that innervate smooth muscle, cardiac muscle, or glandular epithelium or combinations of these tissues*. The ANS is also called the *visceral motor system.*. The *visceral motor system* ensures that tissues of the body receive appropriate nutrients, electrolytes, and oxygen, and that functions such as osmolarity and temperature arc properly regulated (homeostasis). In other words its primary function is to keep the internal environment of the body in balance.

The ANS has 2 major subdivisions, the *sympathetic and parasympathetic divisions*. These 2 divisions have overlapping and generally antagonistic influences on those viscera located in the body cavities and on some structures of the head, such as the iris. There are also visceral targets in the body wall and limbs. These are found in blood vessels, sweat glands and arrector pili muscles. Visceral structures of the body wall and the extremities are generally regulated by the sympathetic division alone. The sympathetic division thus has global distribution in that it innervates visceral structures in all parts of the body, whereas the parasympathetic division serves only targets in the head and body cavities.

<u>Anatomical Distinctions;</u>

There are structural similarities and differences between the *somatic motor outflow* (innervation to skeletal muscle) and *visceral motor outflow* (innervation to smooth and cardiac muscle and glandular tissue). Within somatic motor outflow a single neuron forms the final common pathway linking the CNS to skeletal muscle. The final common pathway for visceral motor outflow consists of two neurons. In visceral motor outflow the first, or *preganglionic neuron*, has its cell body in either the brainstem or the spinal cord. Its axon projects to and synapses with the cell body of the second neuron, **a** *postganglionic neuron*. The cell bodies of the postganglionic neurons form an autonomic ganglia. The axons of the postganglionic neuron project to visceral target organs such as smooth muscle. Generally, parasympathetic ganglia are found close to the target organ, and sympathetic ganglia arc close to the CNS. Consequently, parasympathetic pathways typically have long preganglionic fibers and short postganglionic fibers, whereas sympathetic pathways more often have short preganglionic fibers and long postganglionic fibers.

SUMMARY:

Somatic motor system

single neuron forms the final common pathway

Visceral motor system

2 neurons form the final common pathway

- Sympathetic Division -
  - short preganglionic fibers and long postganglionic fibers.
- Parasympathetic Division -
  - long preganglionic fibers and short postganglionic fibers

AUTONOMIC NERVOUS SYSTEM

The function of the sympathetic division of the ANS is to enable the organism to generate energy and thereby respond to both physical and emotional stress. In contrast the parasympathetic division of the ANS functions to build up and conserve energy and to eliminate waste.

COMPARISON OF EFFECTS OF SYMPATHETIC & PARASYMPATHETIC ACTIVITY ON SOME VISCERAL FUNCTIONS

PHYSIOLOGIC PROCESS	SYMPATHETIC STIMULATION	PARASYMPATHETIC STIMULATION
EYE		
pupil diameter	+	-
tear flow	-	+
SALIVARY GLAND FLOW	-	+
SKIN		
Piloerection	+	0
Sweating	+	0
blood flow	-	0
CARDIOVASCULAR		
cardiac output	+	-
BRONCHI		
bronchial	+	-
GUT		
secretion	-	+
peristalsis	-	+

+ = positive effect, - = negative effect, 0 = no effect

Sympathetic Preganglionic Neurons:

Cell bodies of the preganglionic sympathetic neurons are found in the *intermediolateral cell column of the spinal cord segments T1 to L2*. The sympathetic division of the visceral motor system is accordingly called **the** *thoracolumbar division*. The axons of these preganglionic neurons exit the spinal cord in the ventral root of a spinal nerve and enter the sympathetic trunk. Once in the sympathetic trunk the preganglionic fiber may do one of the following:

1. Terminate in the chain ganglion at its level of origin and synapse with the postganglionic fiber which joins that spinal nerve.

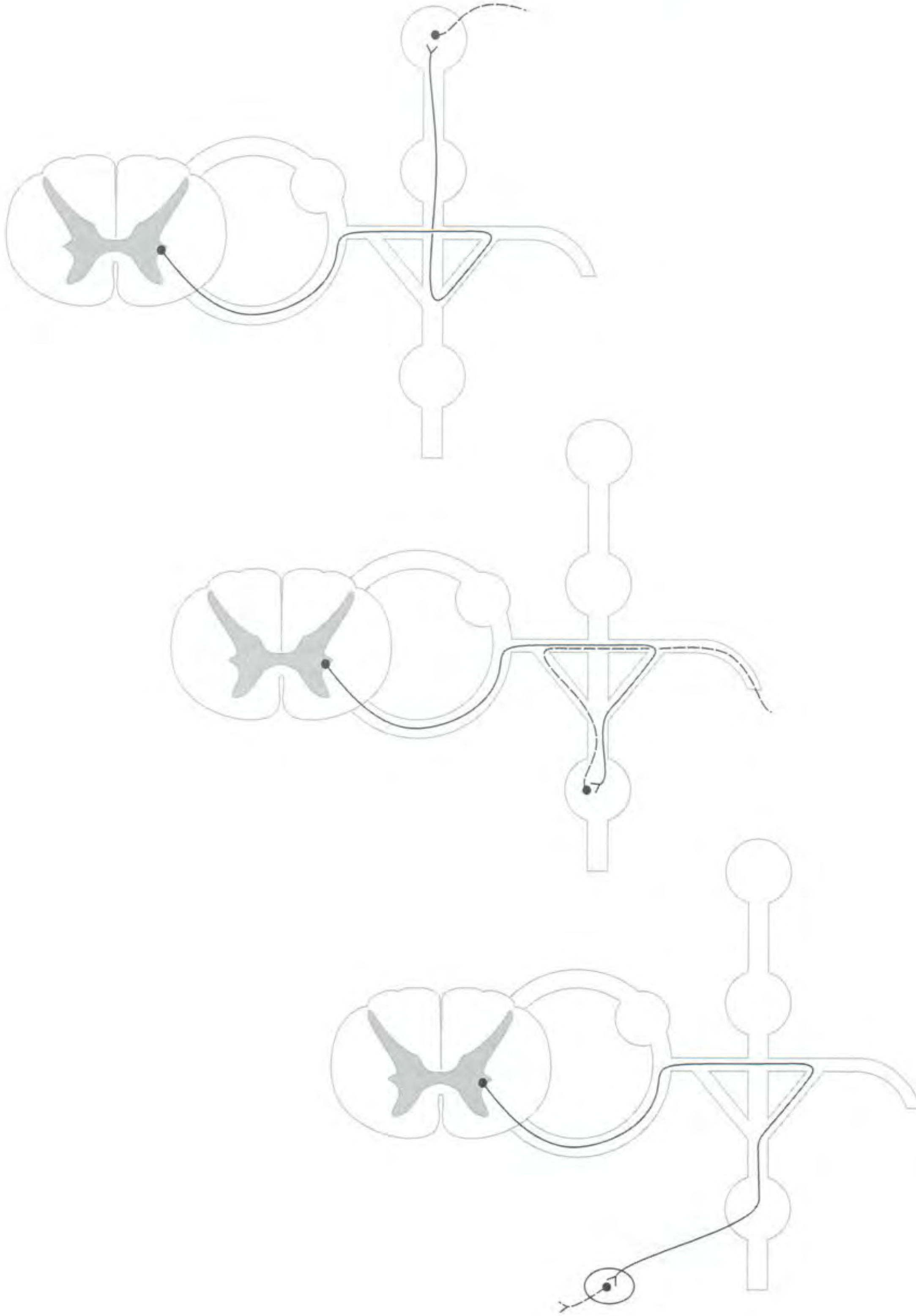
2. Ascend or descend in the sympathetic chain to synapse on postganglionic neurons which will then exit with that level spinal nerve.

3. Traverse the chain ganglion to enter a splanchnic nerve and terminate in a prevertebral ganglion (preaortic) (these ganglia are not found within the chain).

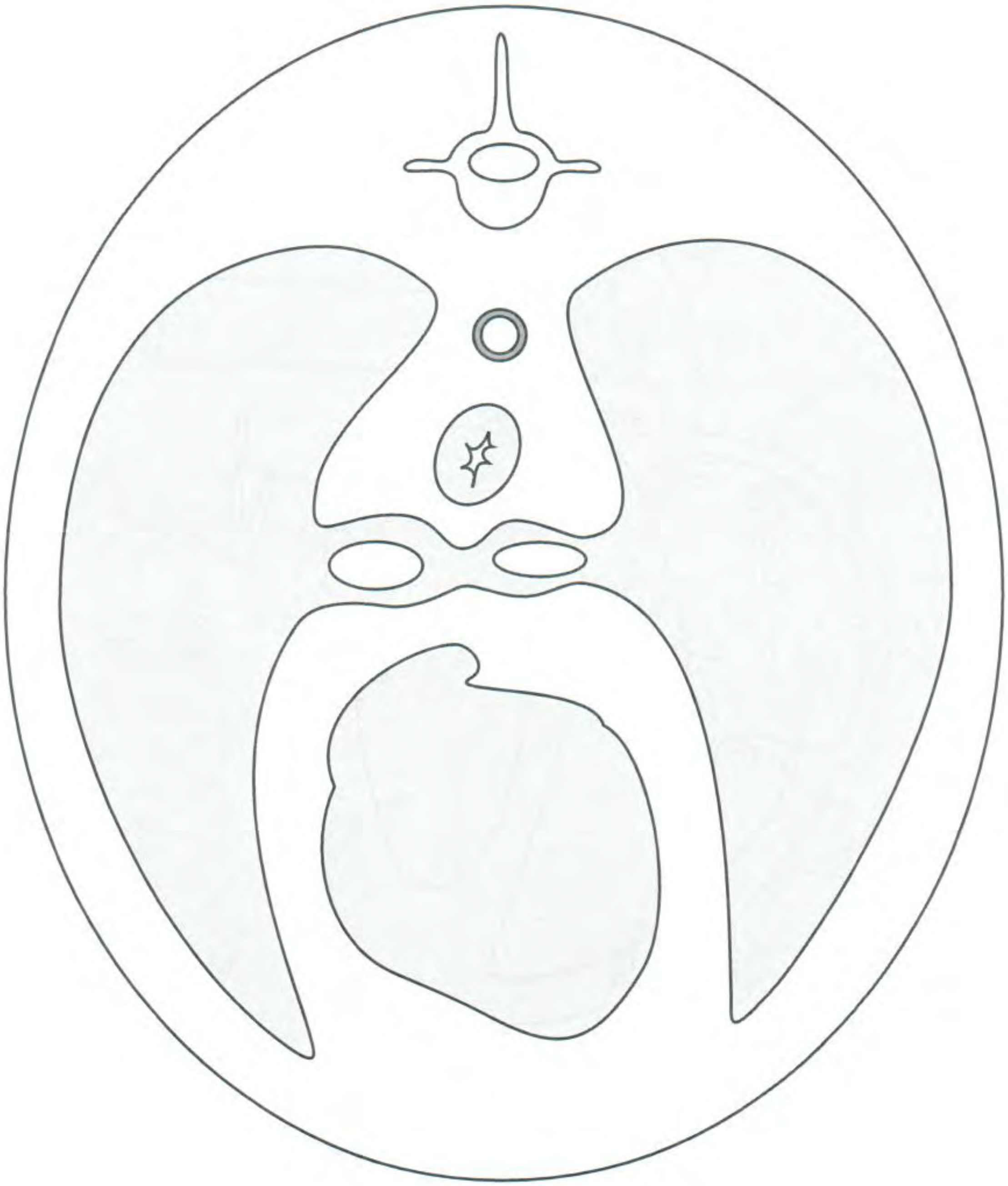
Parasympathetic Preganglionic Neurons :

Compared to the sympathetic division, the parasympathetic division is more restricted in its distribution. The cell bodies of the parasympathetic preganglionic neurons are located either in the brainstem motor nuclei of *cranial nerves III, (Oculomotor Nerve), VII, (Facial Nerve), IX, (Glossopharyngeal Nerve) and X, Vagus Nerve* **or** in sacral segments S2 -S4 of the spinal cord. The parasympathetic division of the visceral motor system is accordingly called the *craniosacral division*.

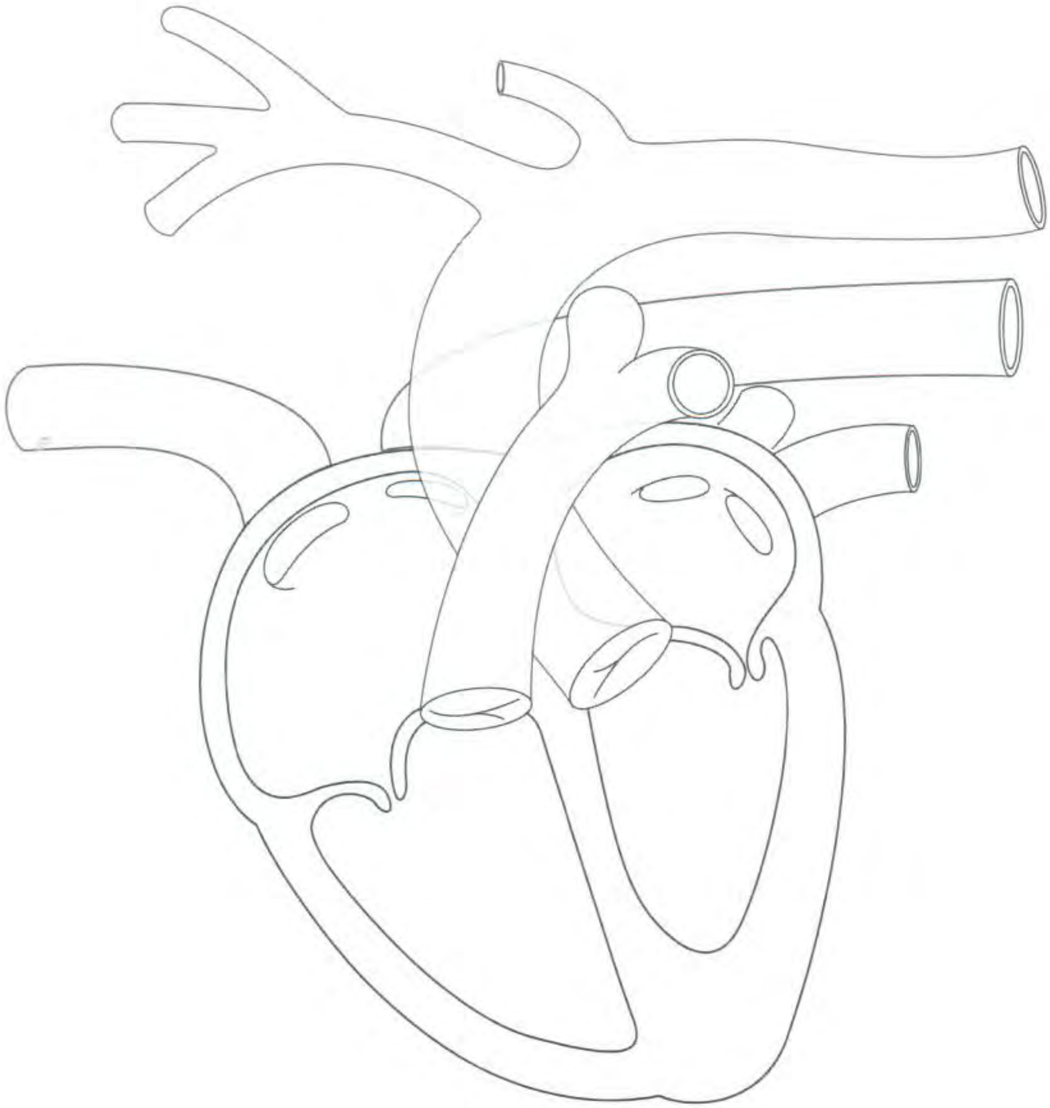
DIAGRAMS FOR ROUTES OF THE SYMPATHETIC DIVISION OF THE ANS



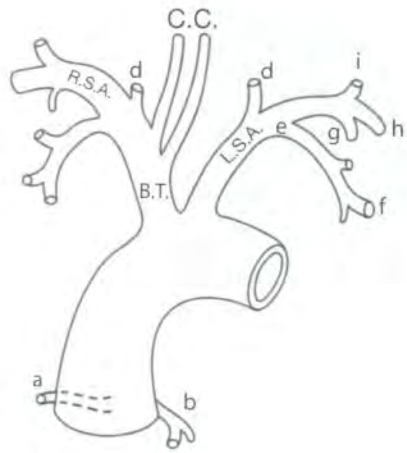
PLEURA AND PERICARDIUM



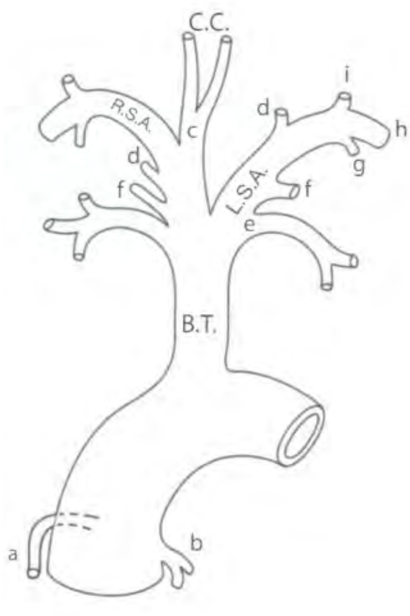
CANINE HEART, LEFT LATERAL VIEW



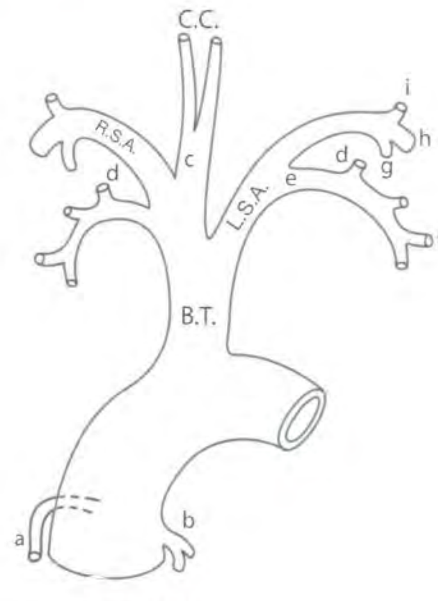
COMPARATIVE AORTIC ARCHES



CARNIVORA



EQUIDAE



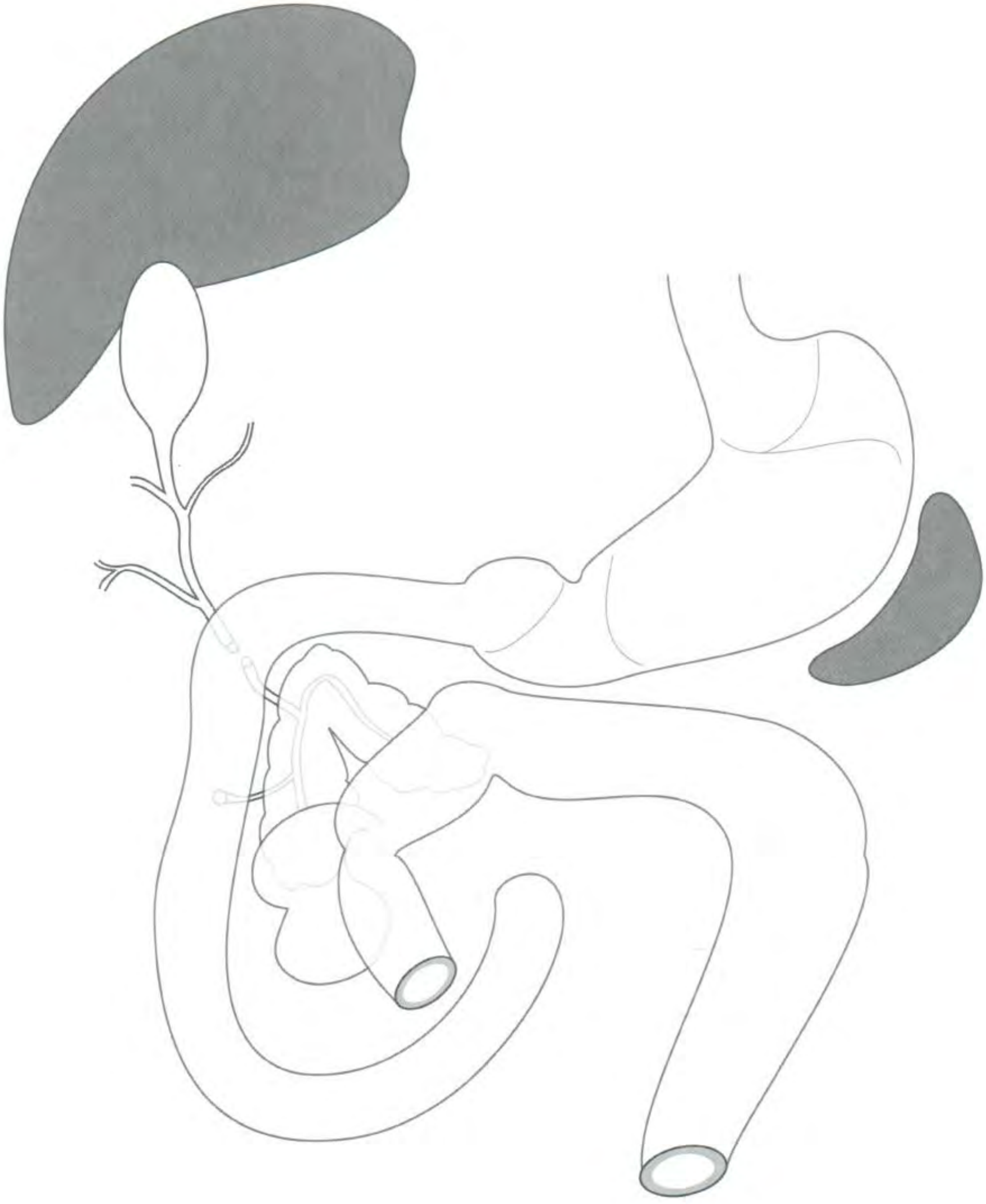
BOVIDAE

C.C. - Common carotid arteries
R.S.A. - Right subclavian artery
L.S.A. - Leftsubclavian artery
B.T. - Brachiocephalic trunk

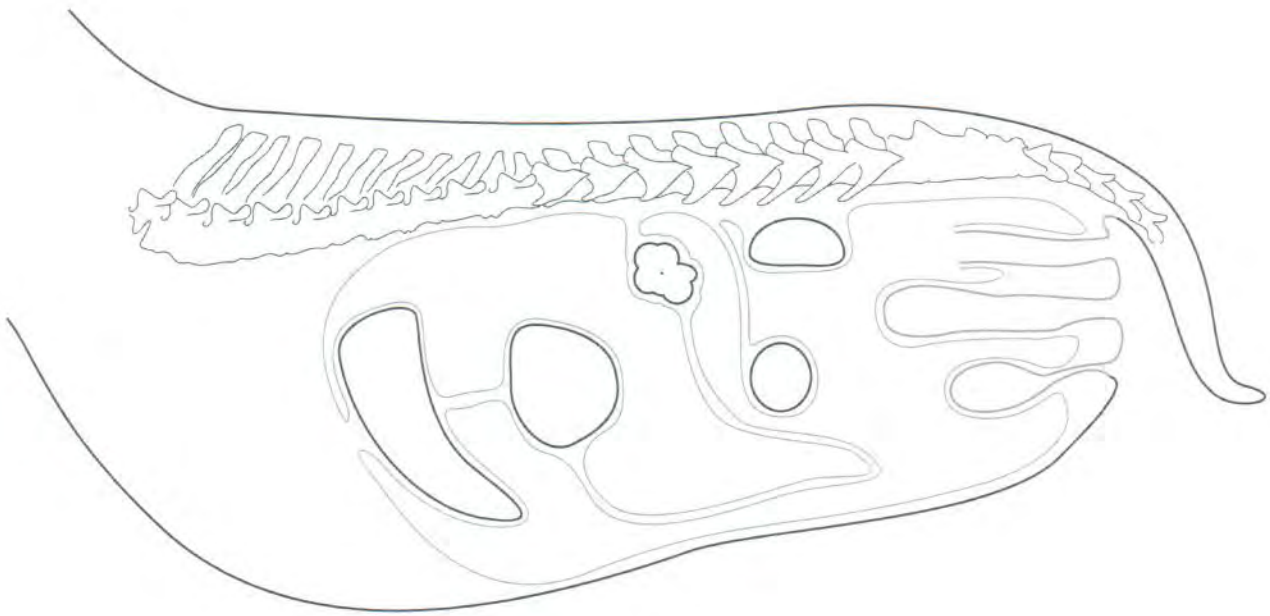
a - Right coronary artery
b - Left coronary artery
c - Bicarotid trunk (ungulates)
d - Vertebral artery

e - Costocervical trunk
f - Deep cervical trunk
g - Internal thoracic artery
h - Axillary artery
i - Superficial cervical artery

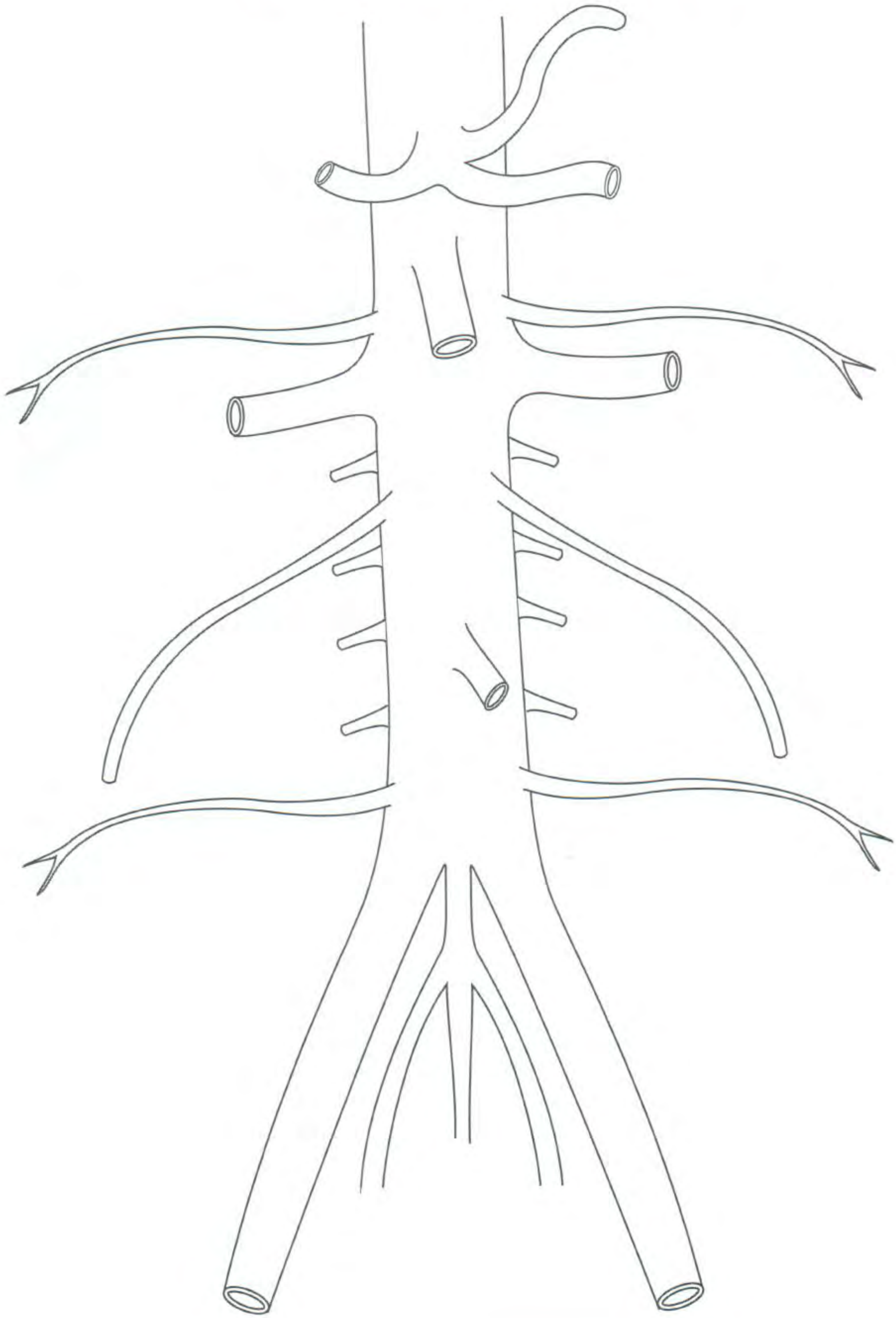
CANINE GASTROINTESTINAL TRACT



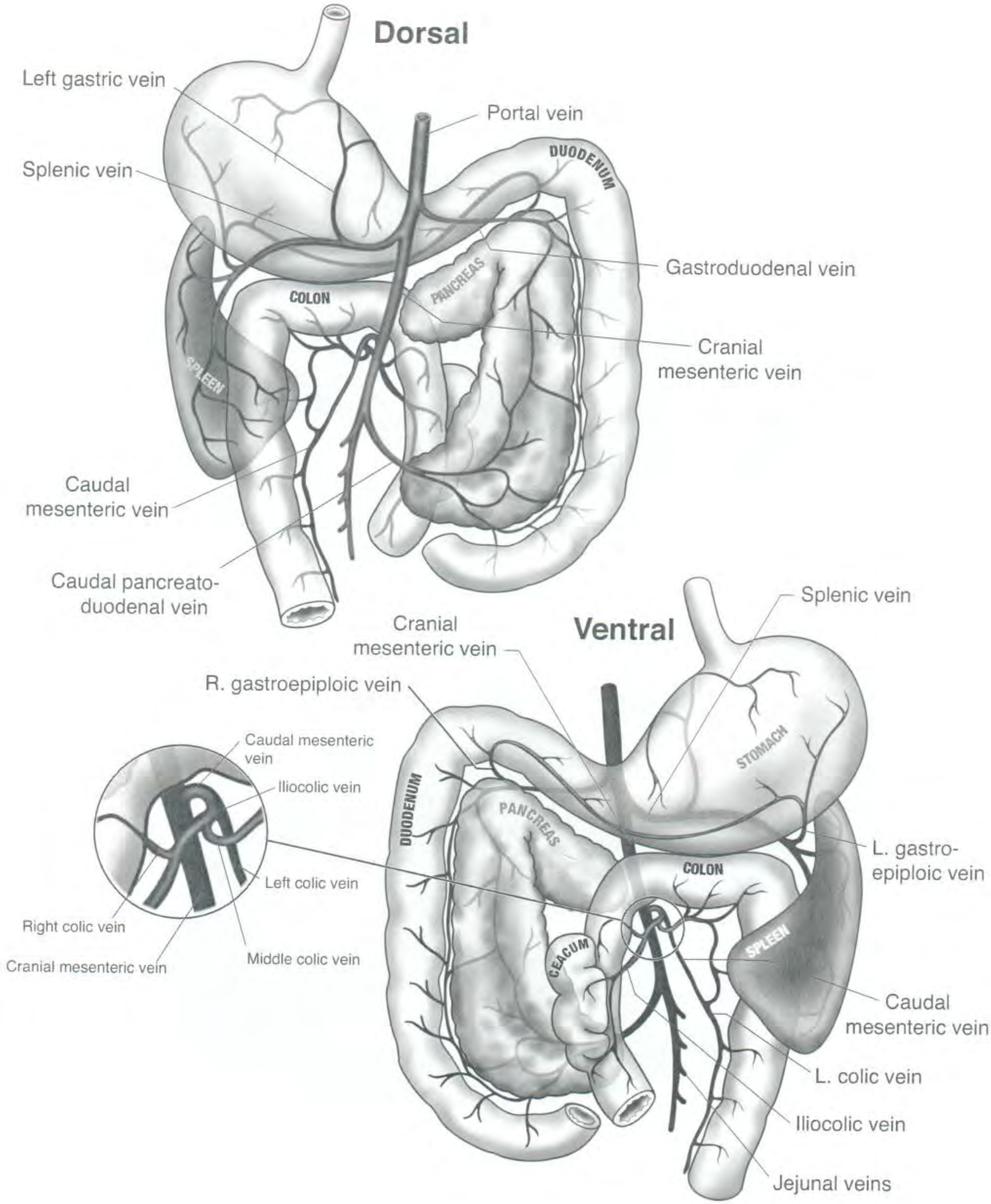
CANINE PERITONEUM



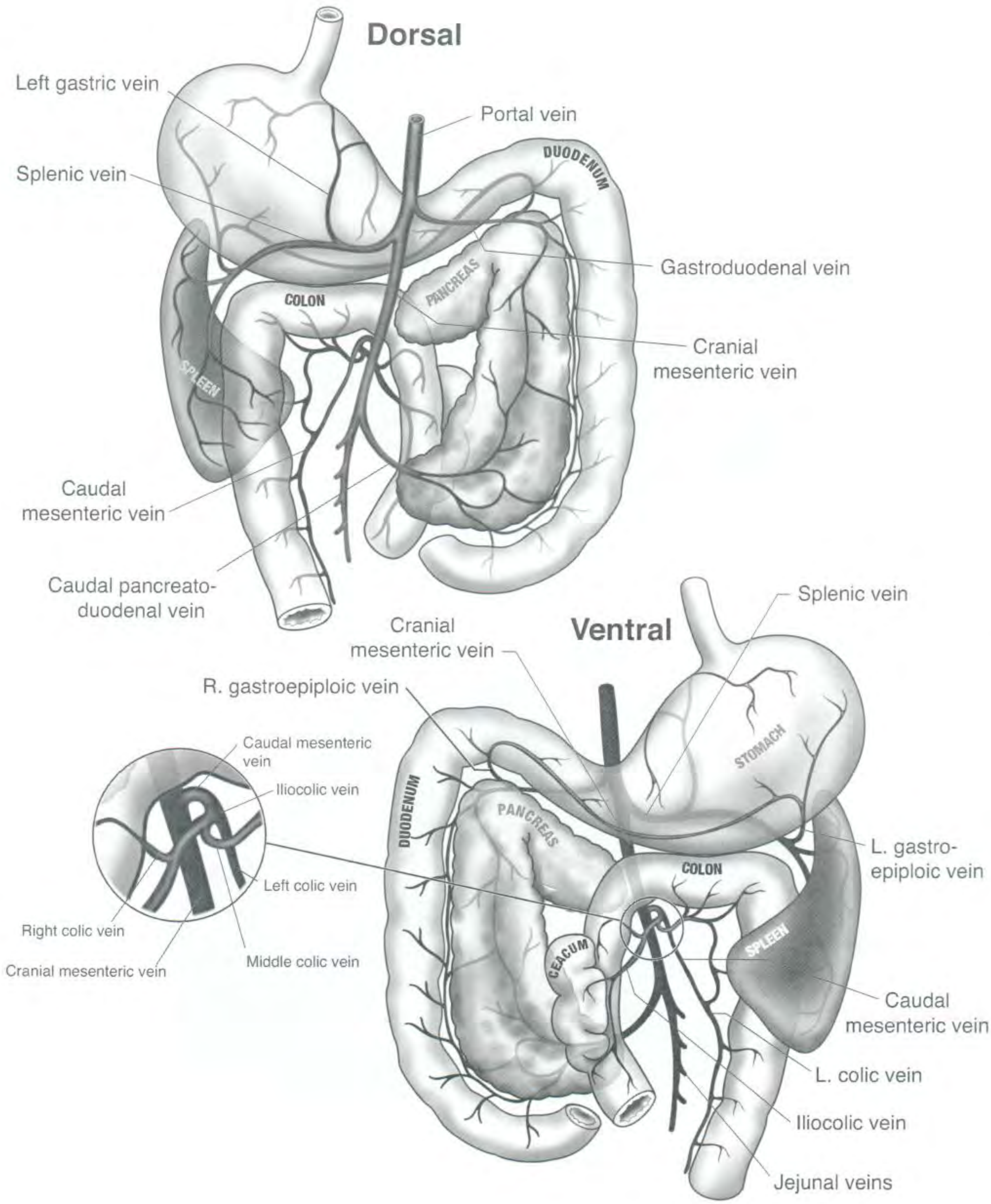
CANINE ABDOMINAL ARTERIAL SUPPLY



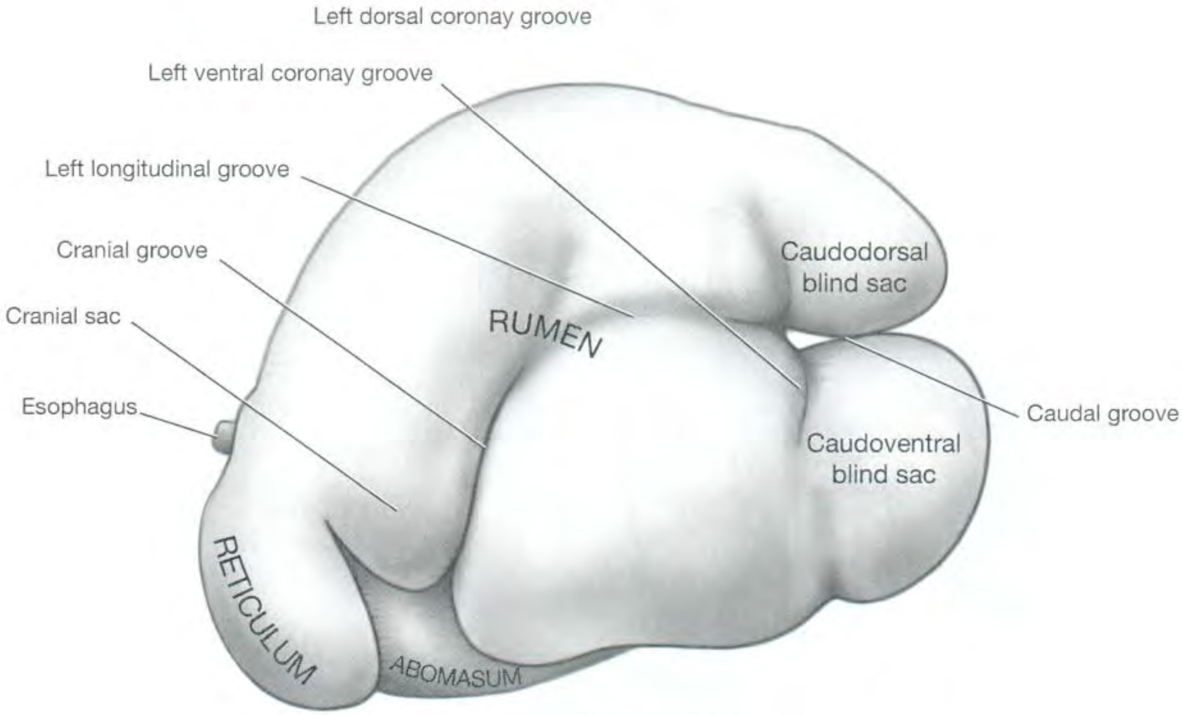
CANINE PORTAL SYSTEM



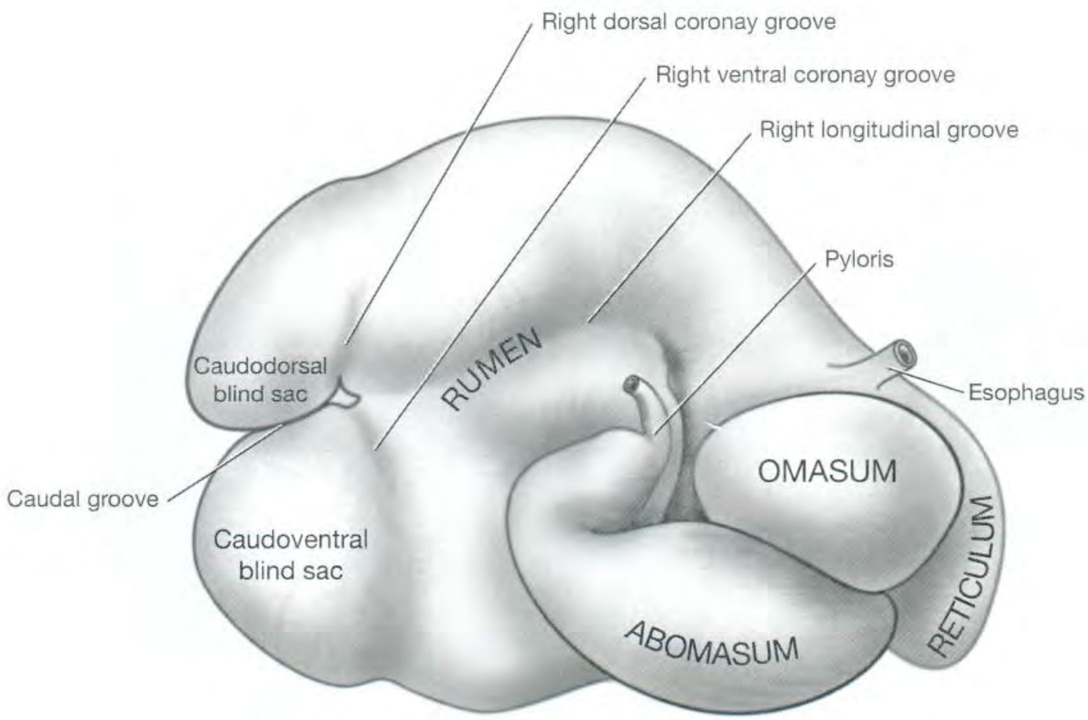
CANINE PORTAL SYSTEM



BOVINE STOMACH

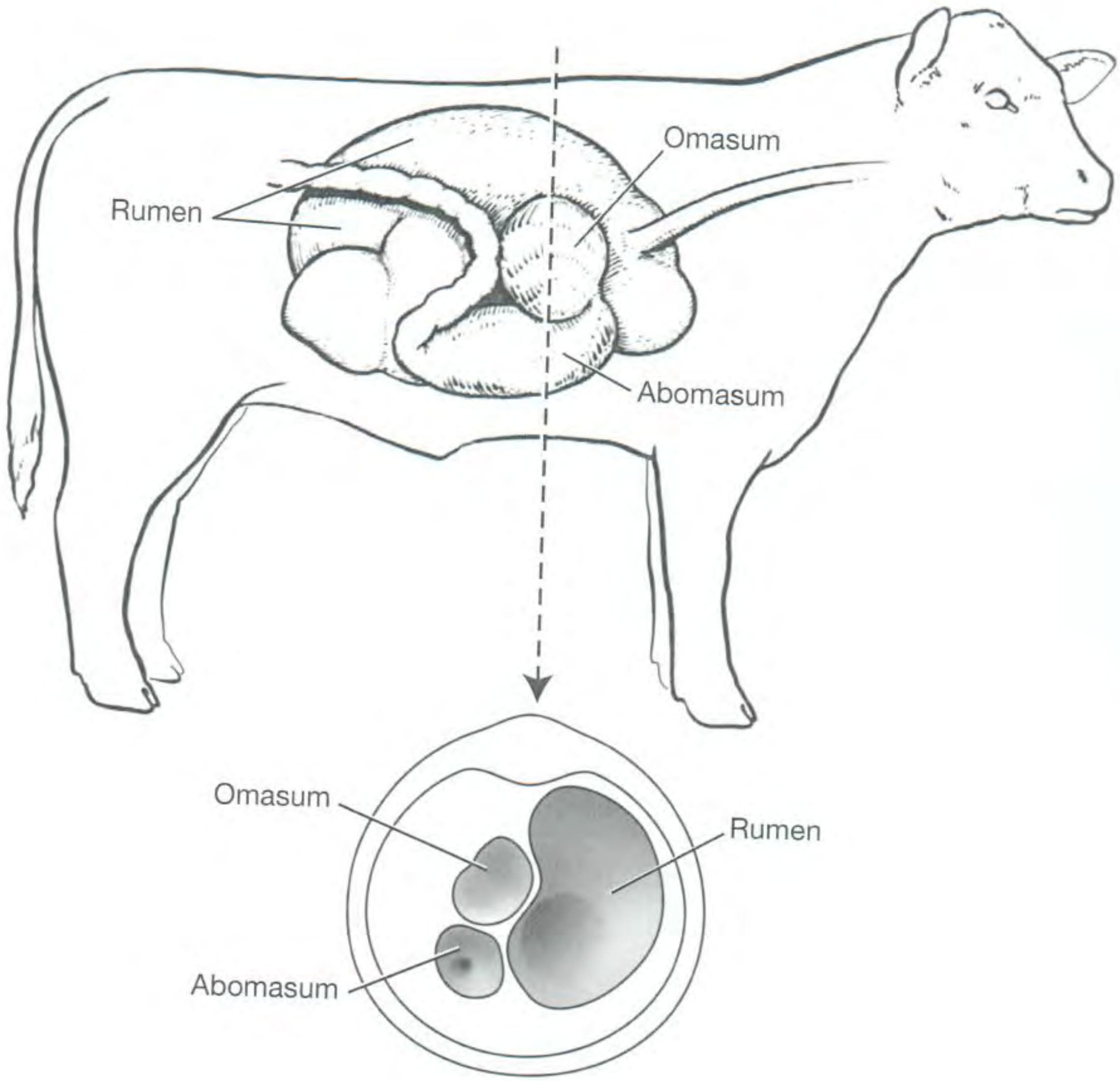


Left lateral aspect

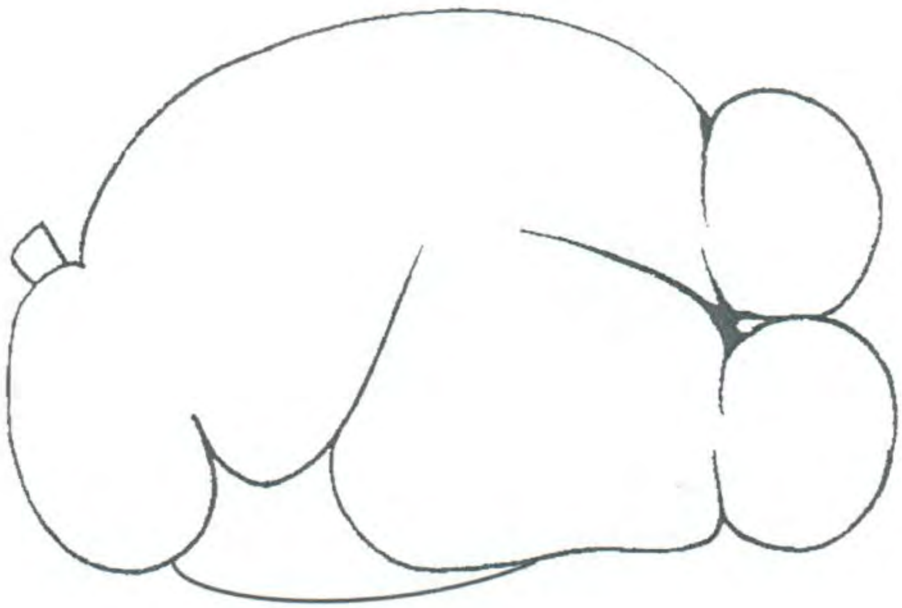


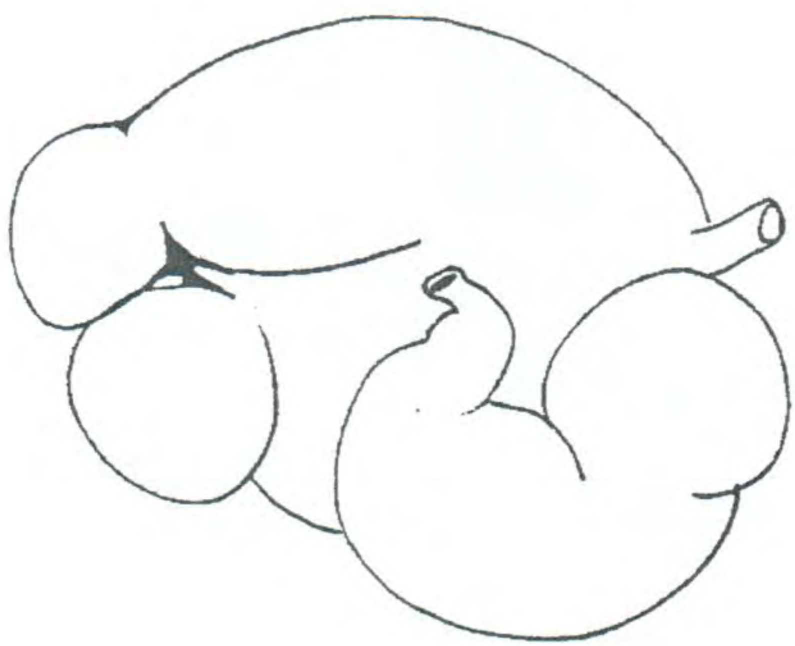
Right lateral aspect

RUMEN

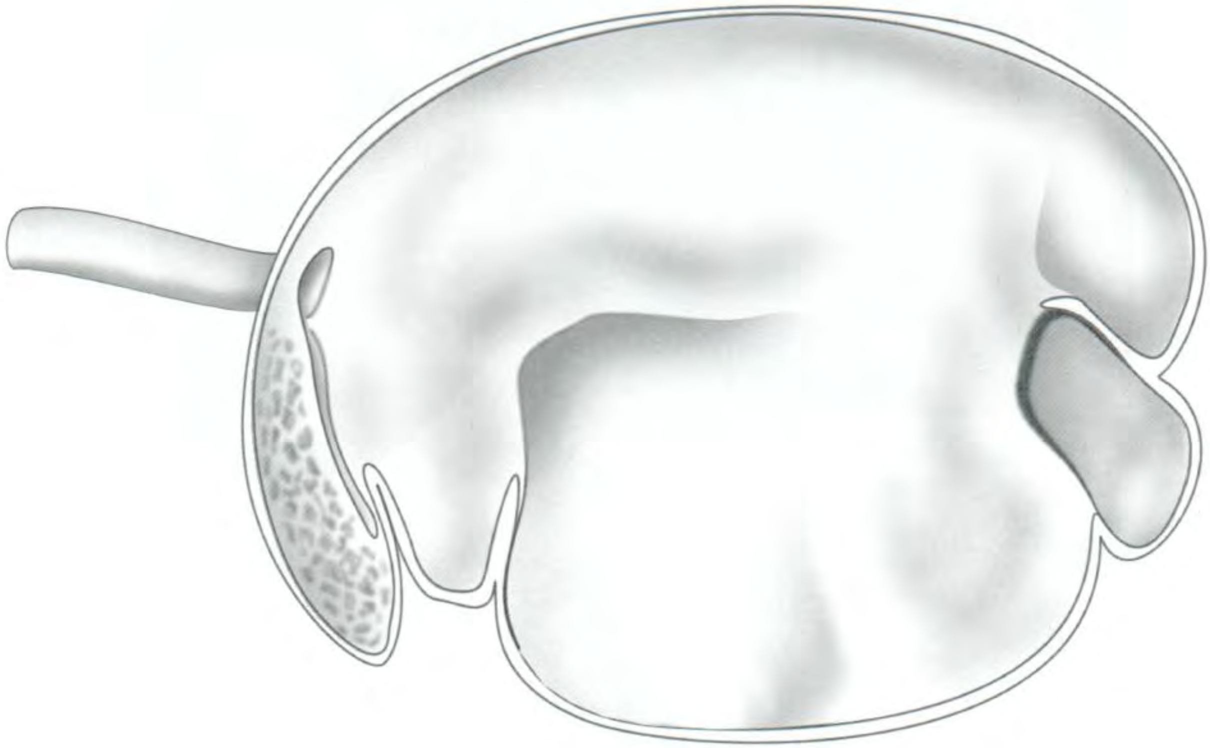


RUMEN

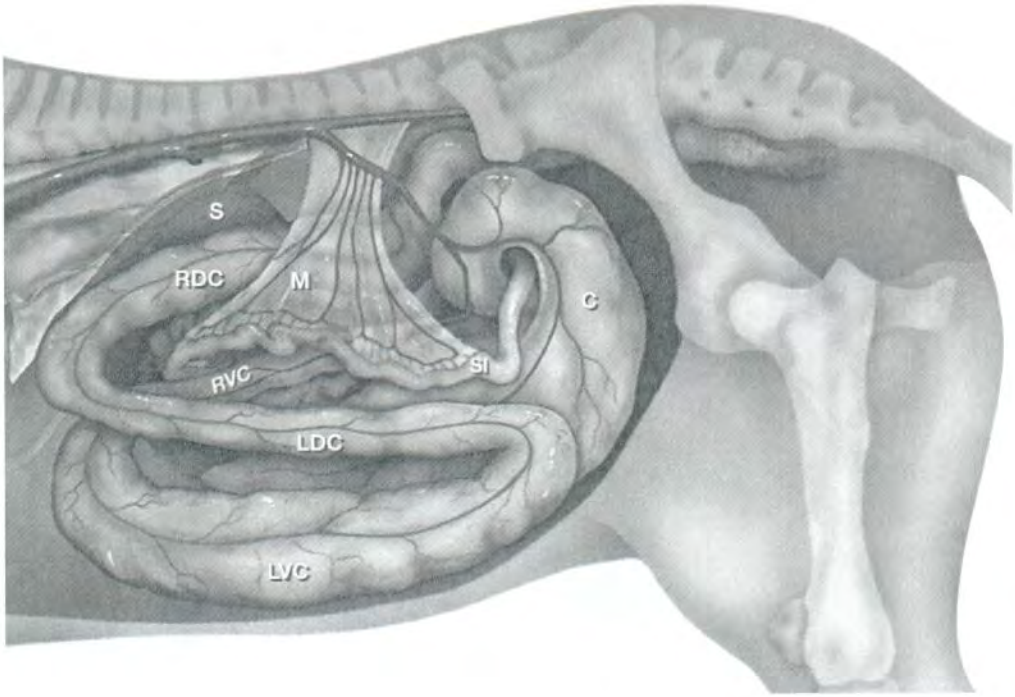


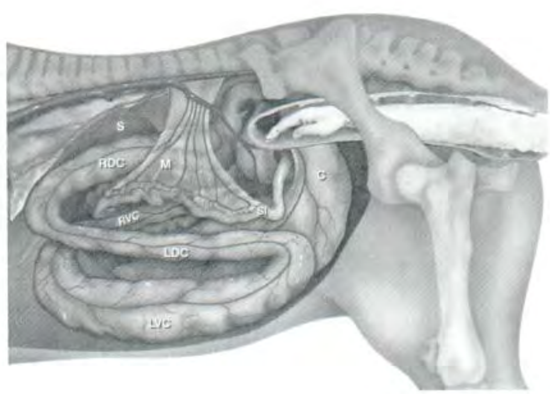


RUMEN

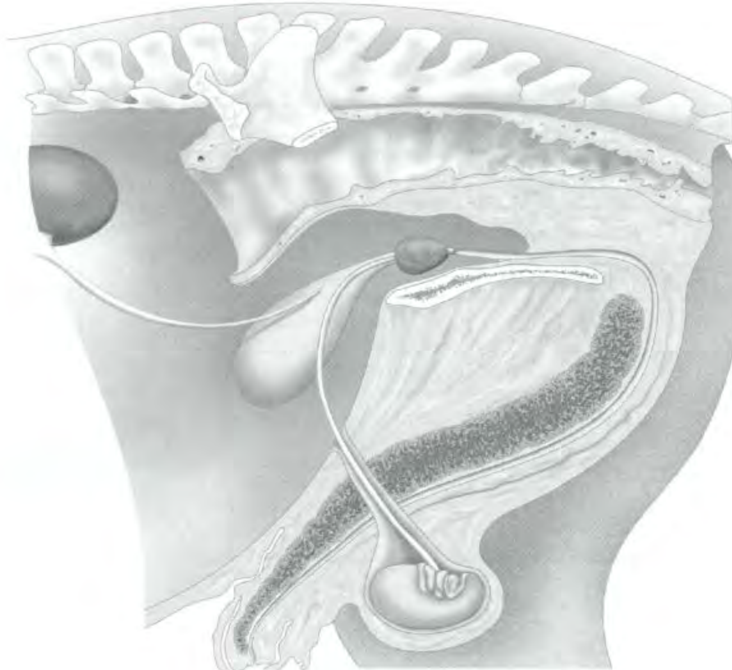


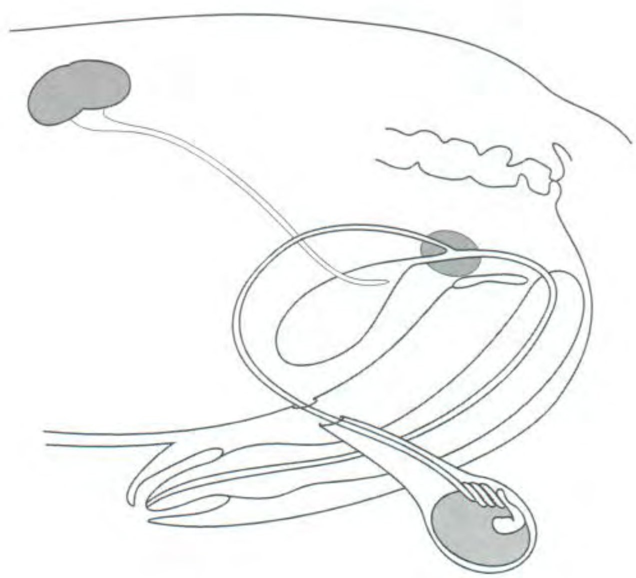
EQUINE COLON





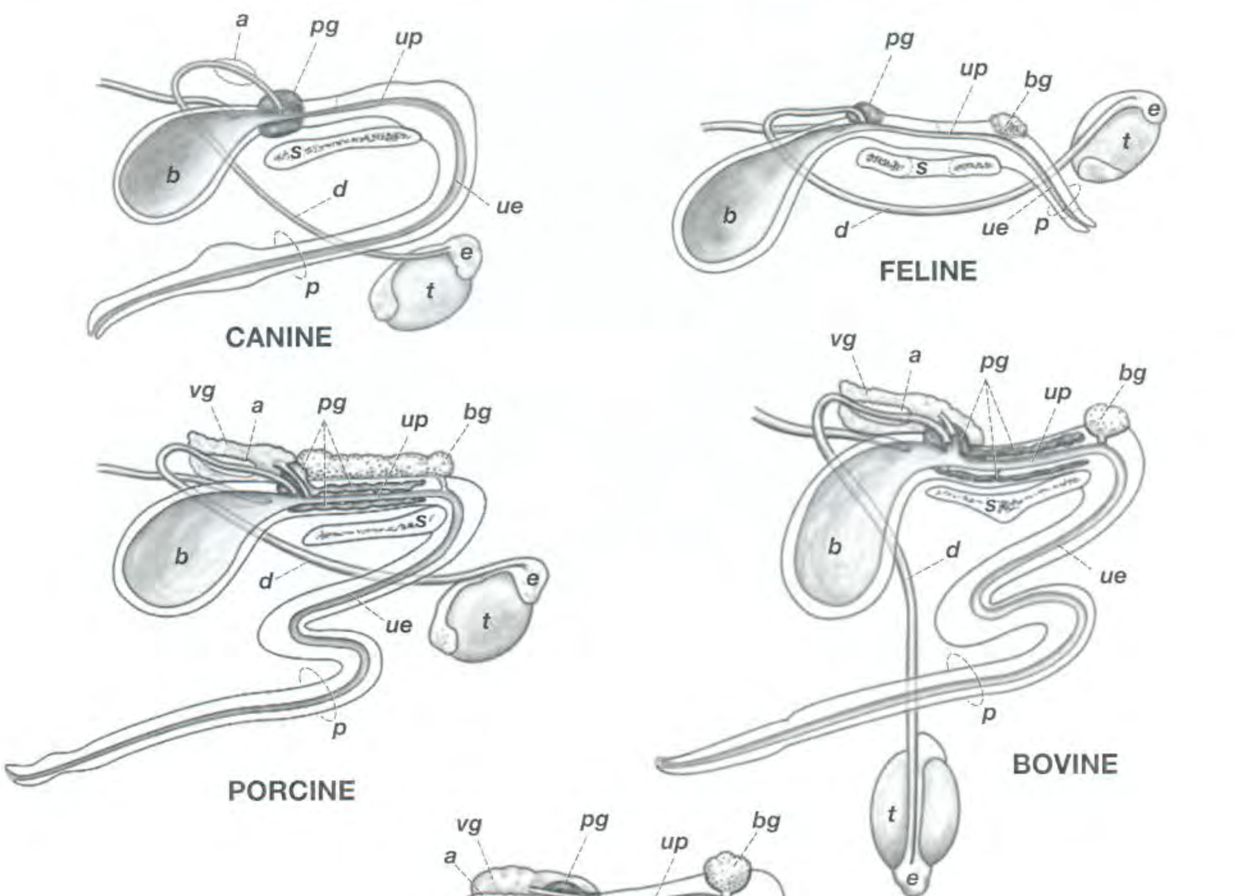
MALE REPRODUCTIVE SYSTEM

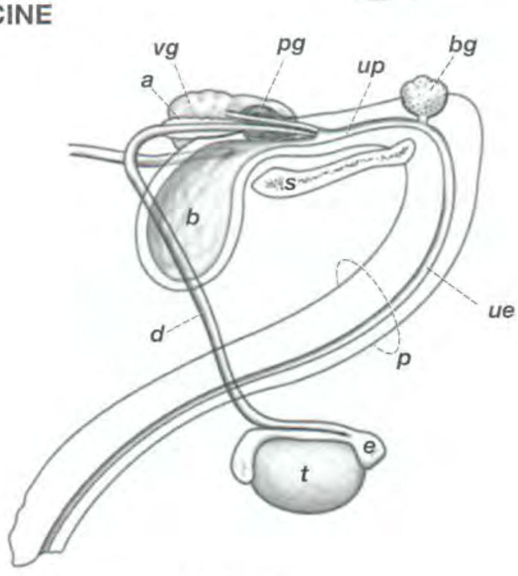




MALE REPRODUCTIVE SYSTEM

Schematic diagrams of male genital organs of domestic mammals showing characteristic structural differences between five domestic species. *Redrawn and modified after Schummer, Nickel & Sack: The Viscera of Domestic Mammals*





EQUINE

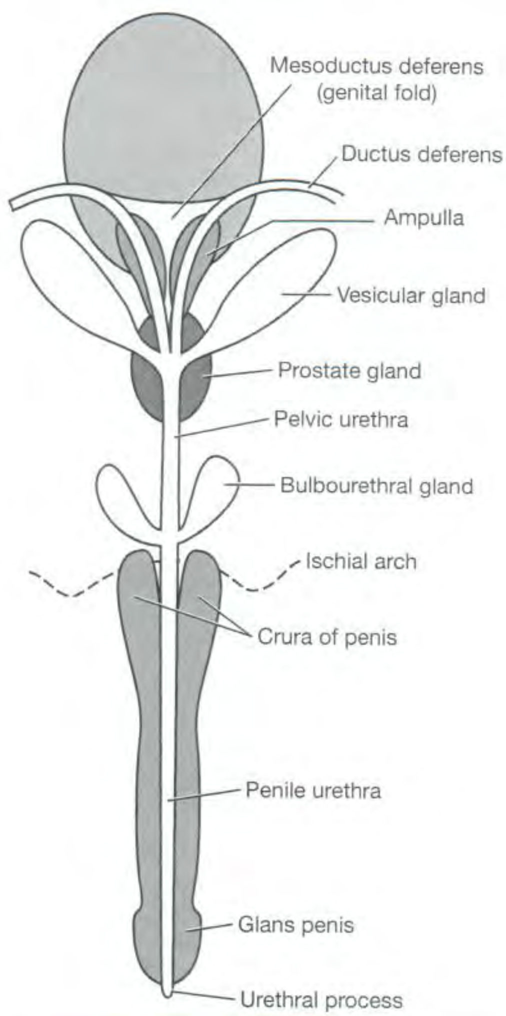
a) Ampulla of ductus deferens
b) Urinary bladder
bg) Bulbourethral gland
d) Ductus deferens
e) Epididymis
p) Penis
pg) Prostate gland;
t) Testis
ue) Extrapelvic urethra
up) Pelvic urethra, note different openings for ductus deferens and vesicular gland
vg) Vesicular gland.

MALE REPRODUCTIVE SYSTEM

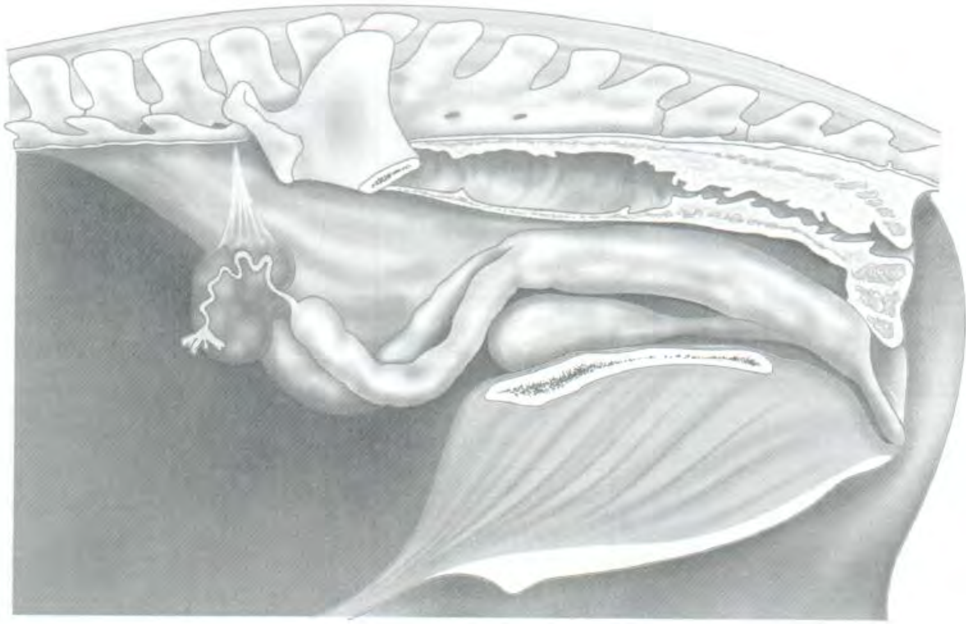
Accessory Sex Glands (male)

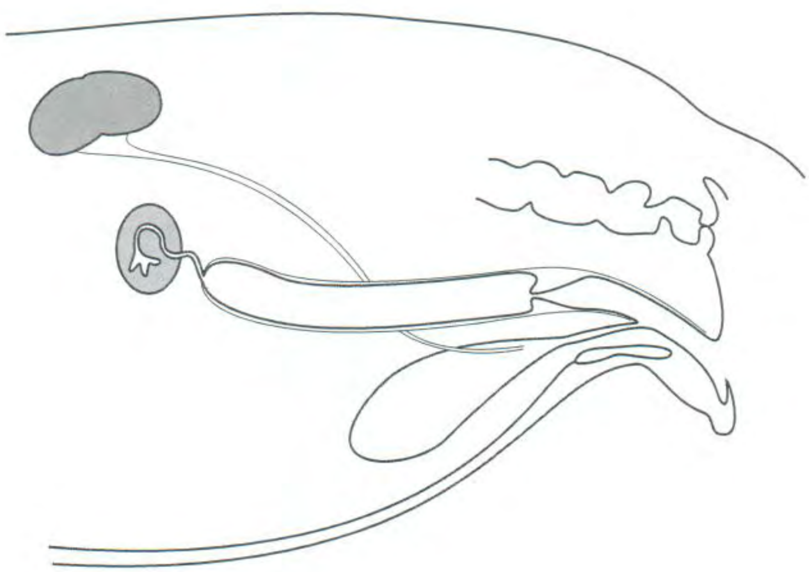
Species	Ampulla	Prostate	Vesicular glands	Bulbourethral glands
Dog	small	large body fully surrounds urethra: scant, disseminated	absent	absent
Tomcat	absent	large body partly surrounds urethra: scant, disseminated	absent	very small
Stallion	large	body has two undisseminated lobes	large and sac-like; aka "seminal vesicle"	present
Bull	small	small body, disseminated covered by urethralis muscle	moderate size, lobulated	present
Ram/Buck	small	disseminated part only	moderate size, lobulated	present
Boar	absent	small body, disseminated covered by urethralis muscle	very large size, lobulated	very large

"Generic" Male reproductive tract



FEMALE REPRODUCTIVE SYSTEM





-**<u>Frasier/Giddings, Domestic Animal Laboratory Guide, 2012</u>**

(green cover removed)

ANATOMICAL NOMENCLATURE

DIRECTIONAL TERM

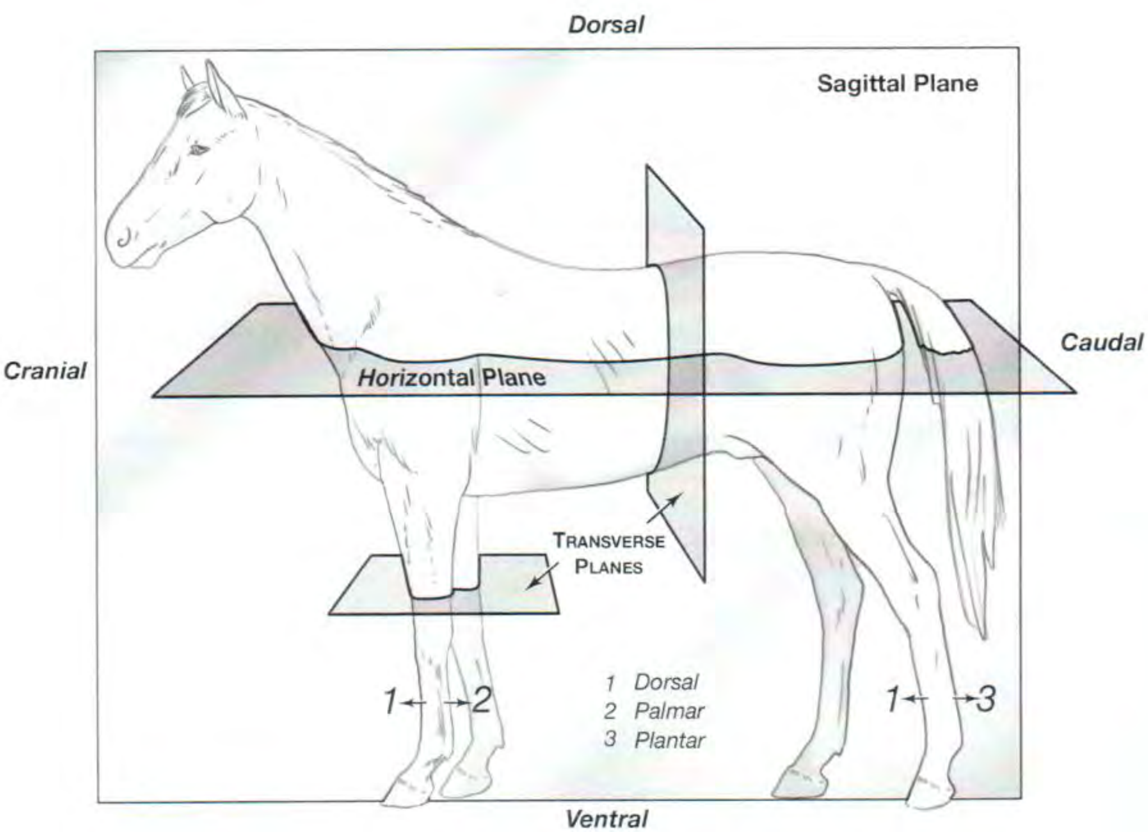
caudal
contralateral
cranial
deep
distal
dorsal
ipsilateral
lateral
medial
median palmar
~~palmer~~ plantar
proximal
rostral
superficial
ventral

PLANES OF SECTION

frontal plane
median plane/
midsagittal plane
sagittal plane
transverse plane

BONY FEATURES

canal
condyle
crest
epicondyles
fissure
foramen
fossa
fovea
head
line
neck
notch
process
sinus
spine
sulcus
trochlea
tubercle
tuberosity



Exercise 1, Bones of the Pelvic Limb

Identify the following bones & bony features of the canine/feline pelvic limb

Sacrum
- auricular surface
- median sacral crest
- dorsal sacral foramina
- pelvic sacral foramina
- promontory

Pelvis = ossa coxarum + sacrum
- pelvic canal
  - pelvic inlet
  - pelvic outlet
- symphysis pelvis

Os Coxae (hip bone) = hemipelvis
hemipelvis=
1ilium + 1 ischium + pubis +*1acetabular bone
ossa coxarum= 2 hemipelvis
- obturator foramen
- acetabulum
- acetabular notch
- transverse acetabular ligament

Ilium
- Iliac crest
- tuber coxae
- tuber sacrale
- auricular surface
- body

Pubis
- pubic tubercle

Ischium
- Ischiatic tuberosity

Femur
- head
- greater trochanter
- lesser trochanter
- third trochanter
- body
- medial and lateral condyles
- extensor fossa
- epicondyles, medial/lateral
- ligament of the head of the femur
- ~~transverse acetabular ligament~~
- trochlea

Sesamoids
- "patella" *(sesamoid bone of the quadriceps femoris m.)*
- "fabellae" *(sesamoid bone of the gastrocnemius m.)*

Tibia
- tibial tuberosity
- body
- extensor groove
- intercondylar ~~condylar~~ eminence
- medial malleolus
- cranial border ("crest")

Fibula
- fibular head
- lateral malleolus

Tarsus
- calcaneus
  - sustentaculum tali
  - calcaneal tuber
- talus
- central tarsal bone
- tarsal bone I -IV

Metatarsals II - V (I usually absent)

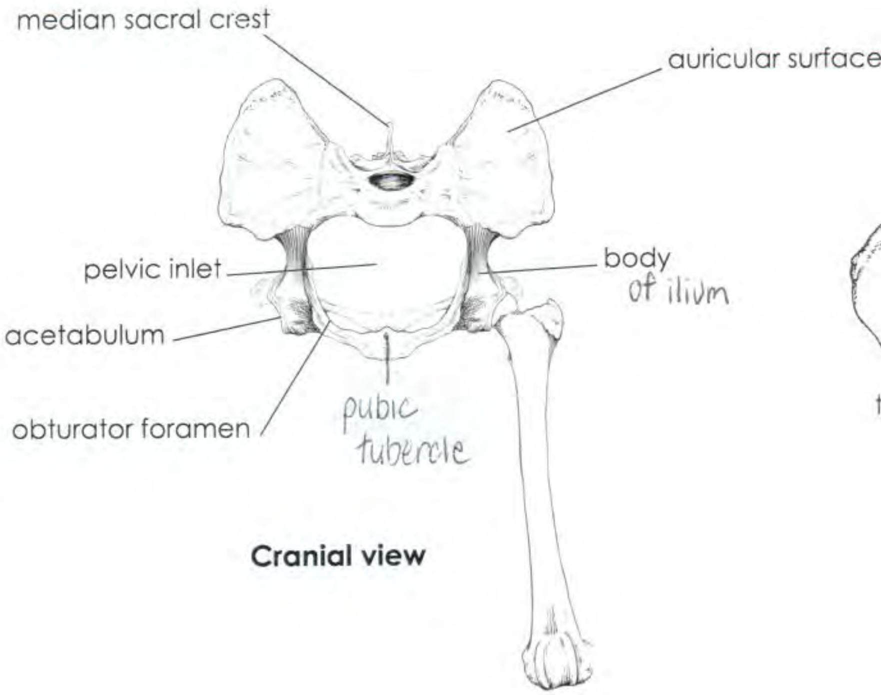
Digits II - V

Dewclaw (I) may or may not be present in dogs; if present phalanges are represented by small nodules of bone. Cats never have a dewclaw.

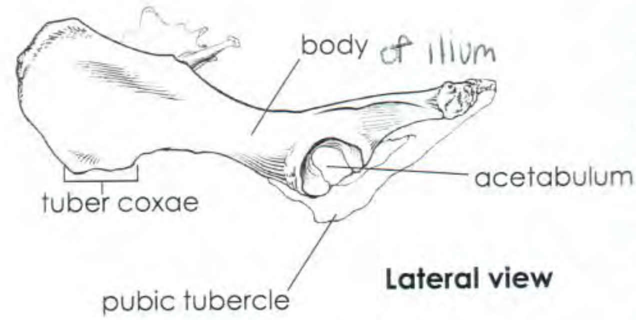
- proximal phalanx
- middle phalanx
- distal phalanx
  - ungual process

*Only discernible in fetus

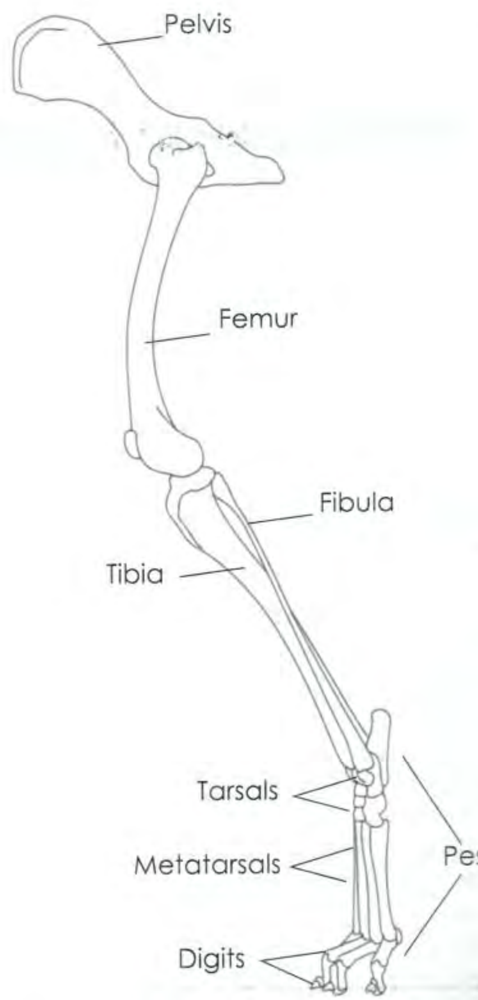
Canine Pelvic Limb



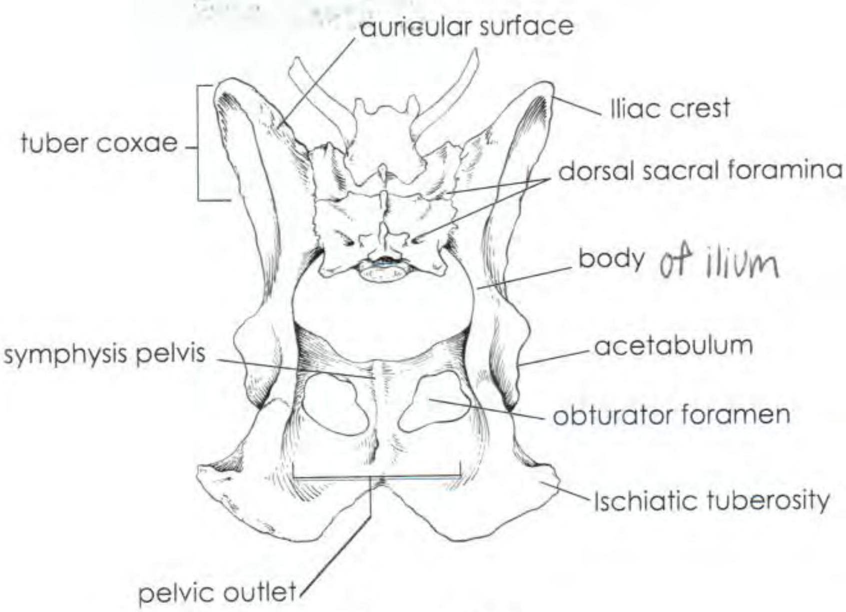
Cranial view



Lateral view

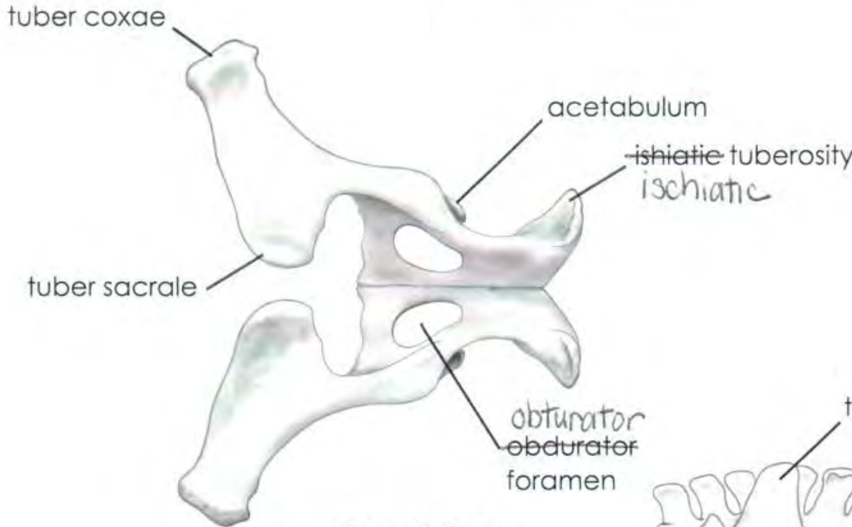


Canine pelvic limb (Lateral, articulated)



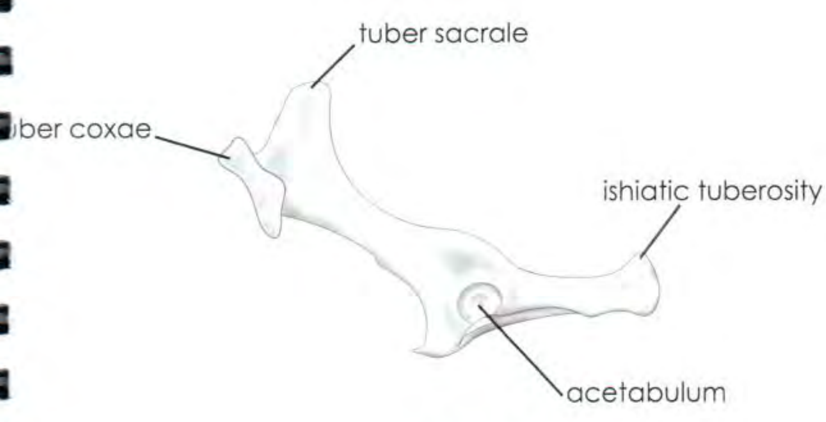
Dorsal view

Equine Pelvic Limb

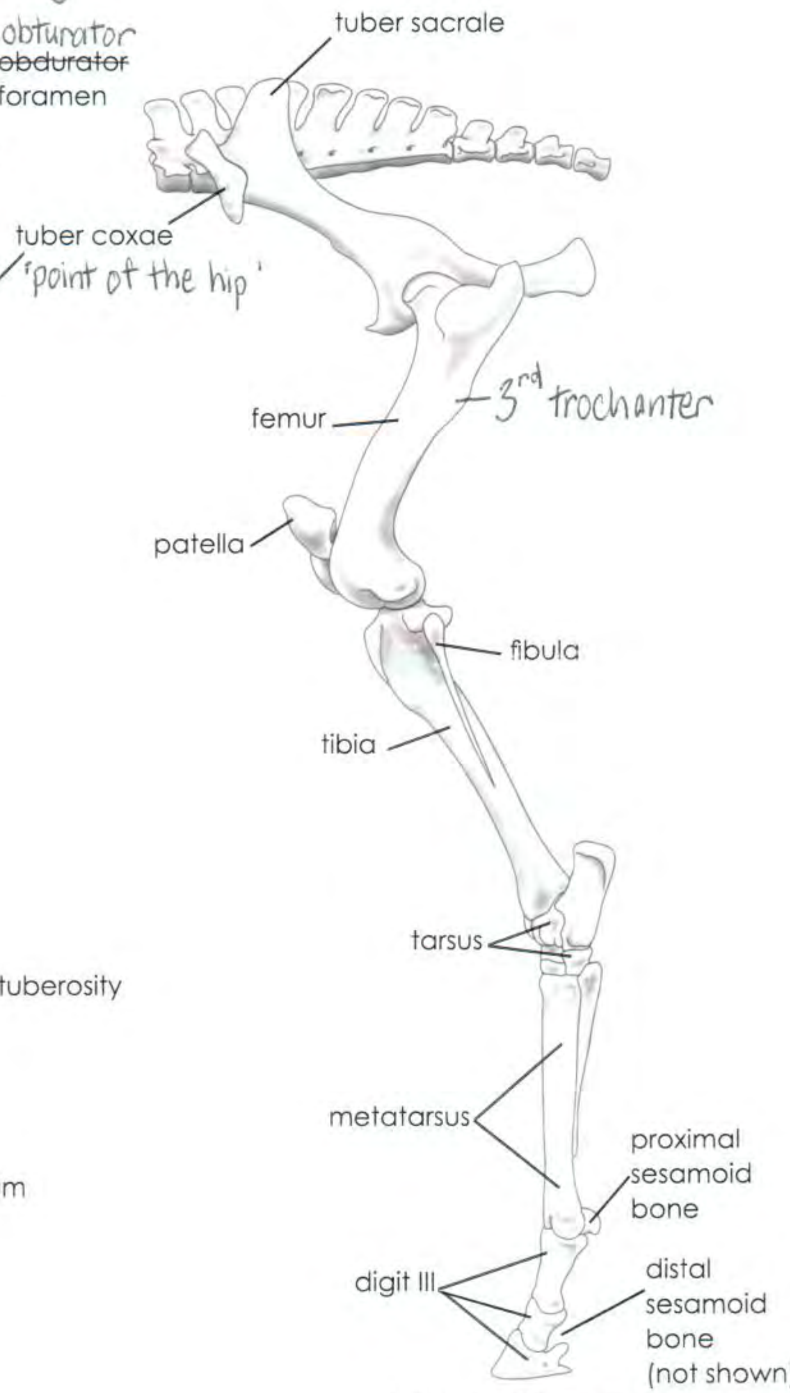


Dorsal view

Cranial view



Lateral view



Lateral, articulated

Identify the following bones and bony features of the equine pelvic limb

Pelvis = ossa coxarum + sacrum
- pelvic canal
  - pelvic inlet
  - pelvic outlet
- symphysis pelvis

Os Coxae
- acetabulum
- obturator foramen
- transverse acetabular ligament

Ilium
- tuber coxae
- tuber sacrale

Ischium
- ishiatic tuberosity

Pubis

Femur
- head
- fovea capitis
- neck
- greater trochanter
- lesser trochanter
- trochanteric fossa
- third trochanter
- body
- femoral trochlea
- medial ridge of trochlea
- medial & lateral condyle
- medial & lateral epicondyle
- extensor fossa
- ~~transverse acetabular ligament~~
- ligament of the head of the femur
- accessory ligament of the head of the femur

Patella
- note muscular contributions to ligaments

femoropatellar ligaments
patellar ligaments:
- medial
- intermediate
- lateral

Tibia
- tibial tuberosity
- body
- medial condyle
- lateral condyle
- intercondylar eminence
- extensor groove
- medial malleolus

Fibula (reduced to a small, proximal head & a distal lateral malleolus fused to the tibia)

Tarsus
- talus
- calcaneus
  - sustentaculum tali
- central tarsal bone
- I & II fused
- III
- IV

Metatarsus
- II (medial "splint" bone)
- III ("cannon" bone)
- IV (lateral "splint" bone)
- "buttons" (distal ends of "splint" bones)

Digit III
- proximal phalanx
  - ("long pastern" bone)
- middle phalanx
  - ("short pastern" bone)
- distal phalanx (coffin bone)
  - extensor process
- proximal sesamoids
- distal sesamoid ("navicular" bone)

Articulations of the hindlimb

- Sacroiliac joint - between ilia and sacrum
- Hip joint / coxofemoral - between acetabulum and femoral head
- Stifle joint / sometimes referred to as the knee - between femoral condyles and tibial condyles ~~and between and femur~~
- Tarsal joint / hock joint - between distal tibia / fibula and talus / calcaneus : compound joint
- Metacarpophalangeal joint / Fetlock in horses between metacarpal bones & proximal phalanges
- Proximal interphalangeal joint / pastern joint in horses between proximal & middle phalanges
- Distal interphalangeal joint / coffin joint in horses between middle & distal phalanges

Identify the following specific bony variations found in Bovidae

- Prominent **ischiatic tuber ("pin"), & tuber coxae ("hook")**
- Femur lacks a **third trochanter**
- **Fibula** has:
  1) head fused with the lateral tibial condyle,
  2) short, free **shaft**,
  3) separate, quadrilateral **distal extremity** forming the **lateral malleolus** of the fibula
- Separate **tarsal I**
- **Tarsals II and III** are fused
- **Central tarsal bone** and **tarsal IV** are fused
- Fused third and forth metatarsal bones comprise the **large metatarsal bone**
- Presence of a discoid **second metatarsal bone**

Exercise 2, Muscles of the Pelvic Limb

Identify the following muscles of the canine pelvic limb

Extrinsic mm.: connecting the limb to the body
Intrinsic mm.: muscles within the limb

fascia lata: deep fascia

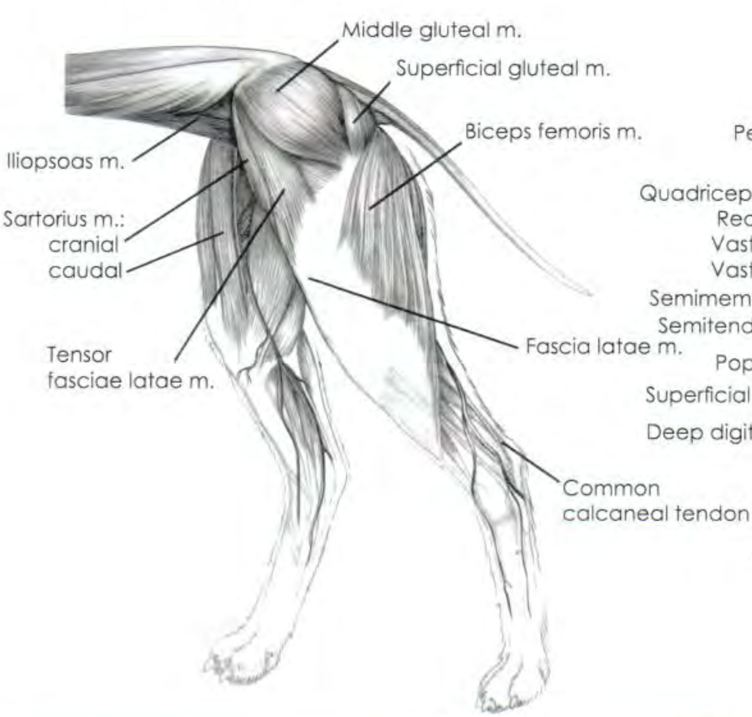
Hip muscles
- superficial, middle, & deep gluteal mm.
- internal obturator m.
- external obturator m.
- iliopsoas m.
- sacrotuberous ligament
- ~~piriformis m.~~
- ~~gemilli~~ m. gemelli m
- quadratus femoris m.

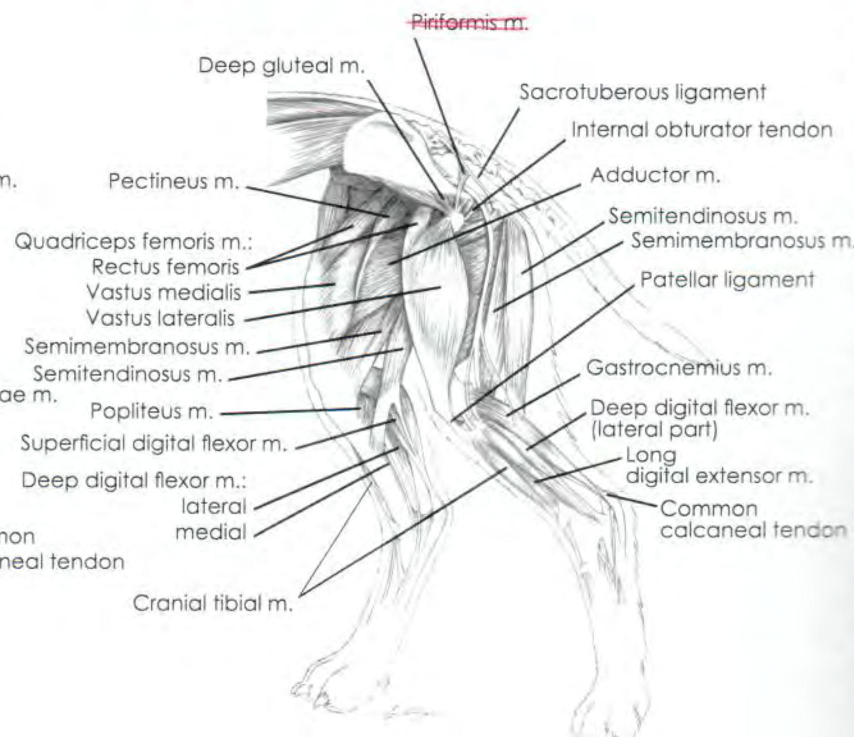
Thigh muscles
- ~~fascia lata m.~~
- tensor fasciae latae m.
- quadriceps femoris m.
  - rectus femoris m.
  - vastus lateralis m.
  - vastus intermedius m.
  - vastus medialis m.
- patellar ligament
- sartorius m. (cranial & caudal parts)
- pectineus m.
- gracilis m.
- adductor m.
- semimembranosus m.
- semitendinosus m.
- biceps femoris m.

Stifle
- Medial meniscus
- Lateral meniscus
- Cranial cruciate ligament
- Caudal cruciate ligament
- Medial collateral ligament
- Lateral collateral ligament

Crural muscles
- cranial tibial m.
- long digital extensor m
- peroneus longus m.
- lateral digital extensor m.
- gastrocnemius m. (medial & lateral heads)
- popliteal lymph nodes
- superficial digital flexor m.
- popliteus m.
- common calcaneal tendon = mm.
  - gastocnemius m.
  - superficial digital flexor m.
  - biceps ~~femorism.~~ femoris m.
  - semitendinosus m.
  - gracilis m.

deep digital flexor m.





Innervation & General Functions of Muscles of the Pelvic Limb

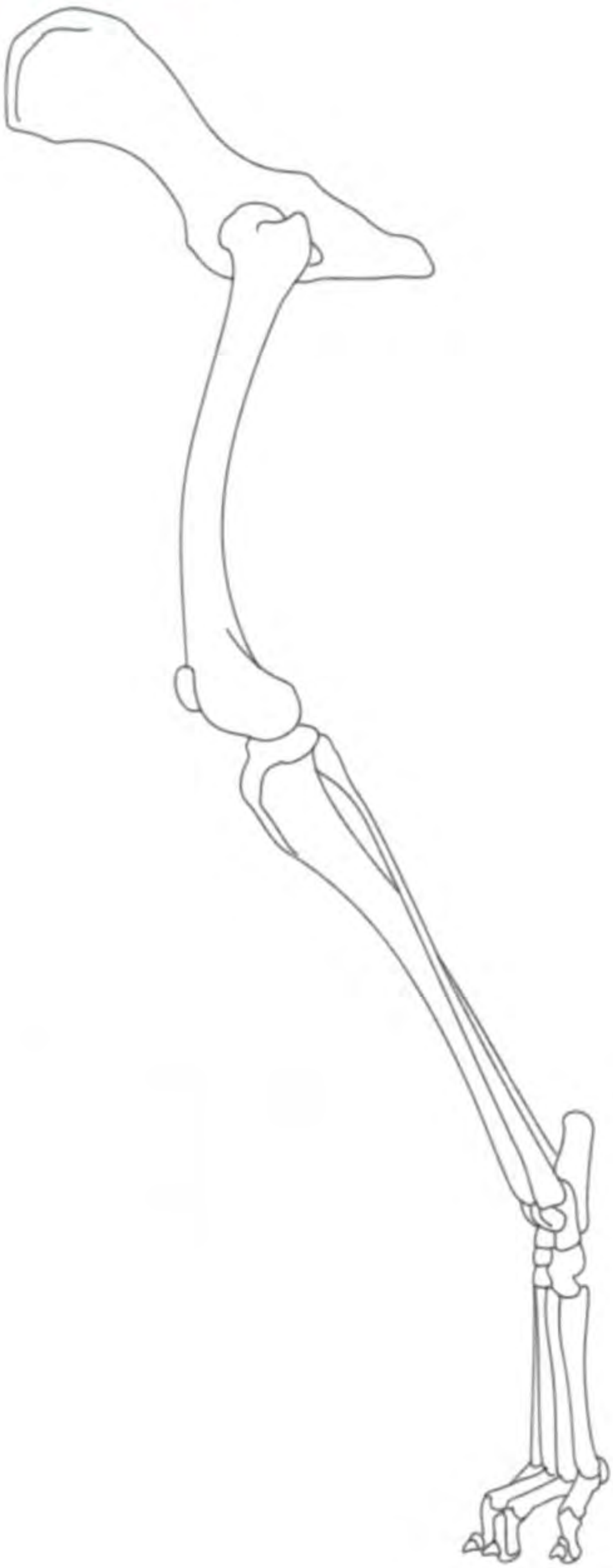
Function	*Innervation*
Flexors of the hip	
iliopsoas	lumbar spinal nn.
tensor fasciae latae	cranial gluteal n.
sartorius, both parts	femoral n.
rectus femoris	femoral n.
Extensors of the hip	
superficial gluteal	caudal gluteal n.
middle gluteal	cranial gluteal n.
deep gluteal	cranial gluteal n.
biceps femoris, cranial part	sciatic n.
semitendinosus	sciatic n.
semimembranosus	sciatic n.
gracilis	obturator n.
Outward rotators of the hip joint	
internal obturator	sciatic n.
external obturator	obturator n.
Flexors of the stifle joint	
sartorius, caudal part	femoral n.
biceps femoris, caudal part	sciatic n.
semitendinosus	sciatic n.
semimembranosus	sciatic n.
gracilis	obturator n.
gastrocnemius	tibial n.
Extensors of the stifle joint	
quadriceps femoris	femoral n.
tensor fasciae latae	cranial gluteal n.
biceps femoris	sciatic n.
sartorius, cranial belly	saphenous n.
popliteus	tibial n.
Adductors of pelvic limb	
adductor	obturator n.
gracilis	obturator n.
pectineus	obturator n.
Flexors of the hock	
cranial tibial	peroneal n.
long digital extensor	peroneal n.
lateral digital extensor	peroneal n.
peroneus longus	peroneal n.
Extensors of the hock	
gastrocnemius	tibial n.
superficial digital flexor	tibial n.
deep digital flexor	tibial n.
biceps femoris*	sciatic n.
semitendinosus*	sciatic n.
gracilis*	obturator n.

* via their contributions to the common calcaneal tendon; role in hock extension is much less than others

Draw the muscular attachments on these limbs

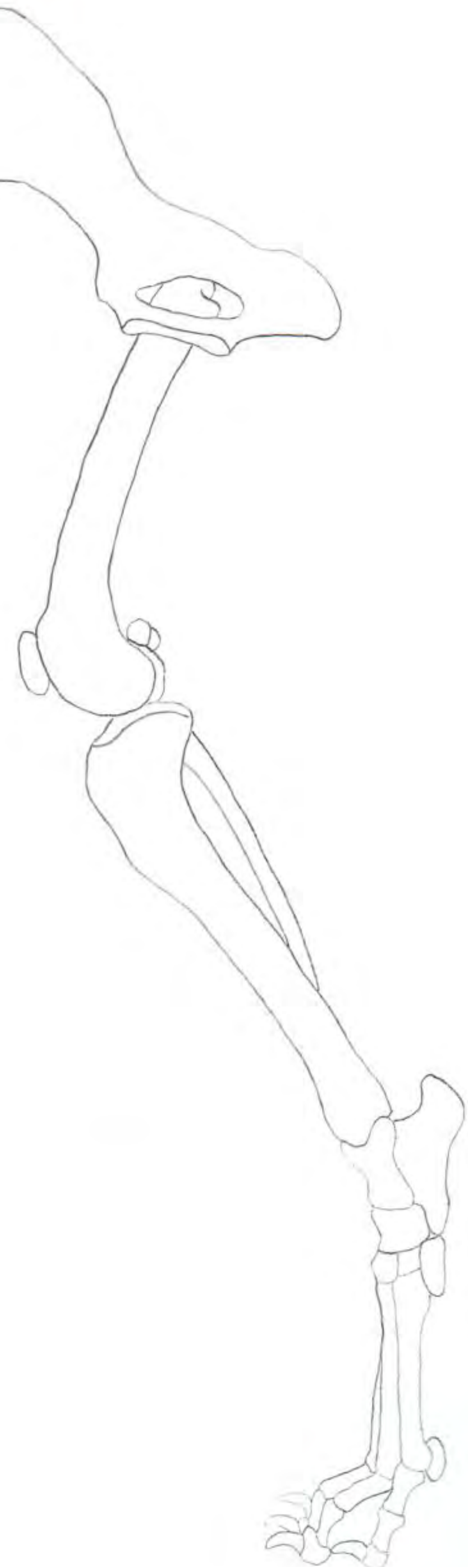
Lateral

~~Medial~~ view



Medial

~~Lateral~~ view



Identify the following muscles on the equine pelvic limb

Hip and Thigh muscles

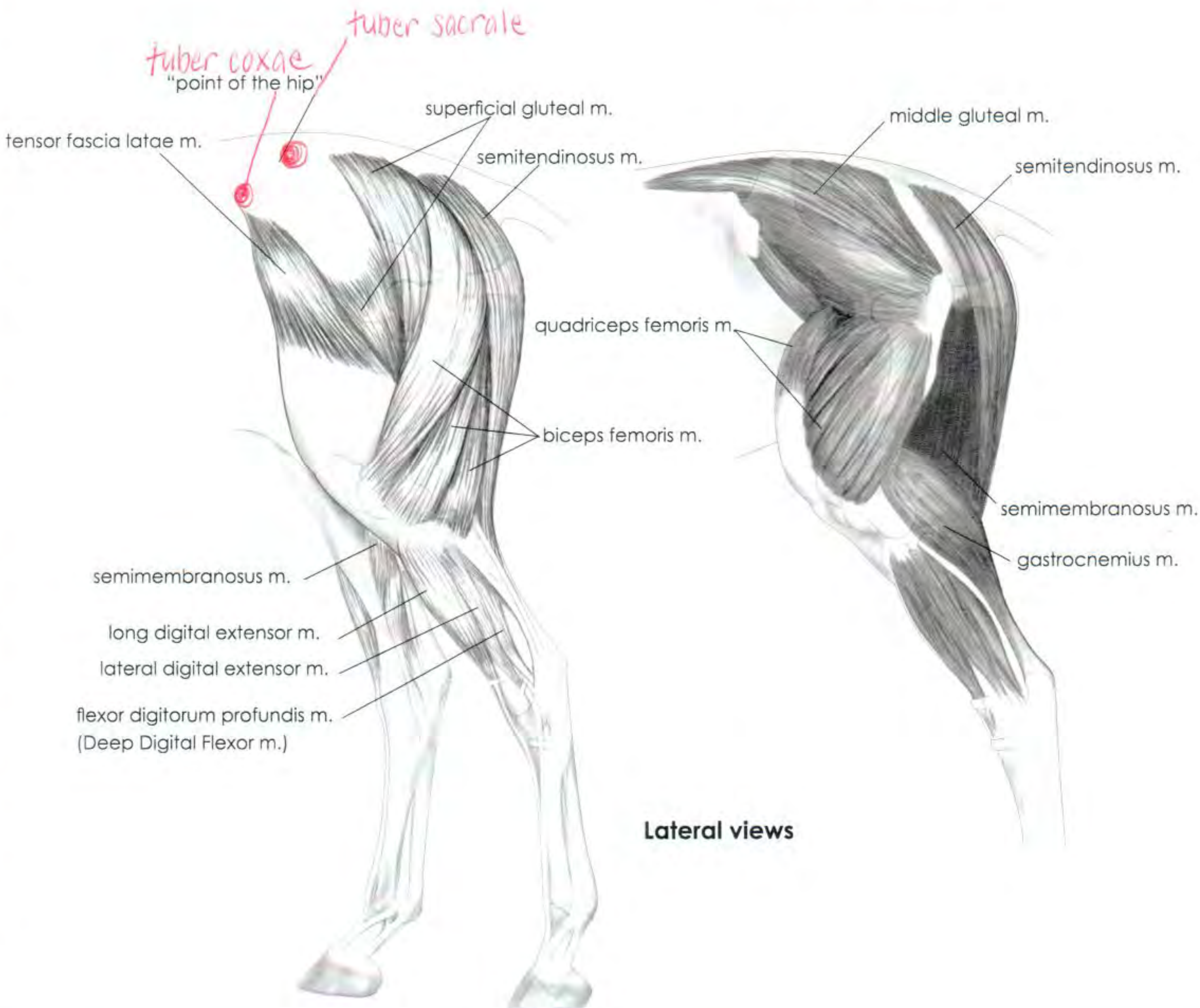
- superficial, & middle gluteal m.
- tensor fascia latae m.
- quadriceps femoris m.
- medial, intermediate, & lateral patellar ligaments
- biceps femoris m.
- semitendinosus m.
- semimembranosus m.
- gracilis m.
- ligament of the head of the femur
- transverse acetabular ligament
- accessory ligament of the head of the femur

Stifle

- Medial & lateral collateral ligaments
  - Cranial & caudal cruciate ligaments

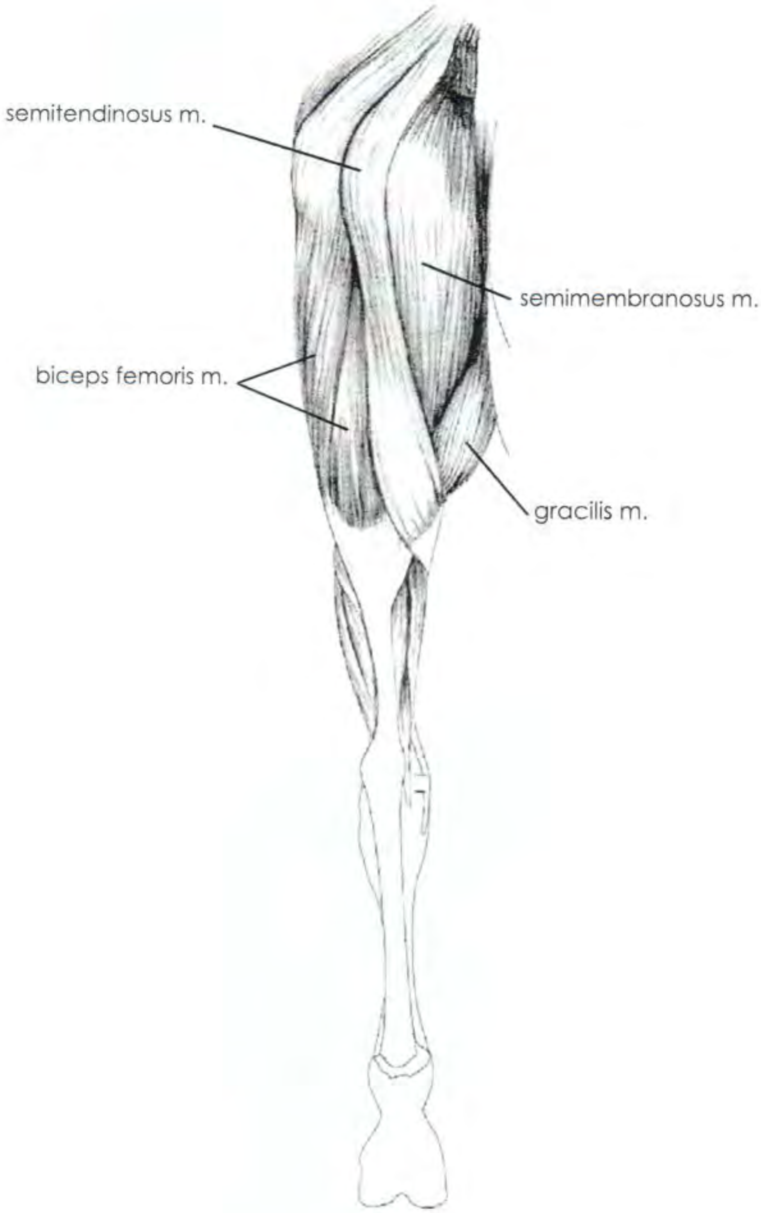
Crural muscles

- cranial tibial m.
  - cunean tendon
- peroneus tertius m.
- long digital extensor m.
- gastrocnemius m. (medial & lateral heads)
- superficial digital flexor m.
- deep digital flexor m.
- popliteus m.
- m. interosseous (suspensory ligament)
- lateral digital extensor m.



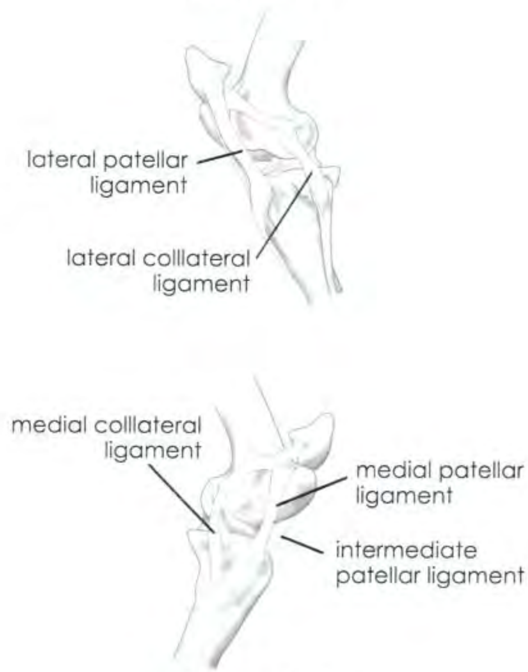
Lateral views

Caudal view



Stifle

left lateral



left medial

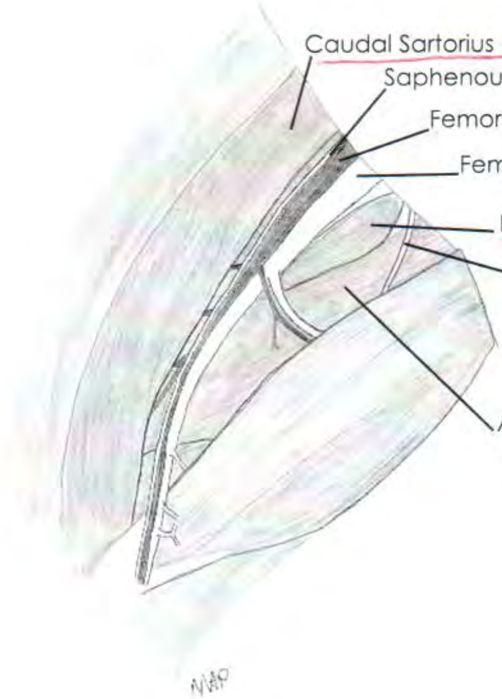
Identify the following muscle variations found in Bovidae

- Superficial gluteal m. combined with biceps femoris m. = **gluteobiceps m.**
- **Peroneus tertius m.** is muscular and forms most cranial muscle belly of crus.
- **Long digital extensor m.** possesses 2 muscle bellies & 2 tendons.
- Tendon of **peroneus longus m.** crosses laterad over lateral digital extensor tendon, inserts on plantar aspect of hock.
- Tendons and ligaments of hind fetlock and digit are similar to those of the forelimb.

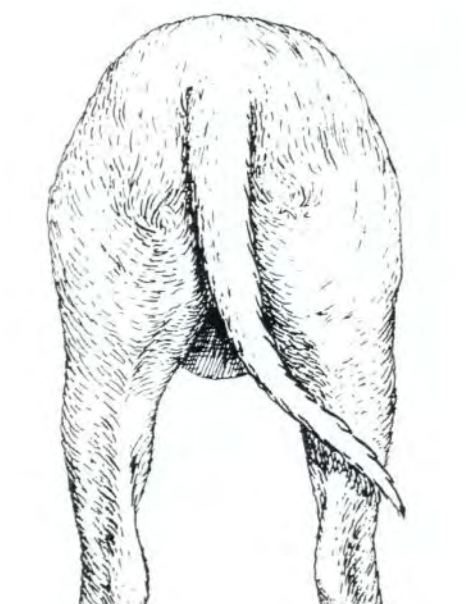
Palpation - live dog or undissected canine cadaver

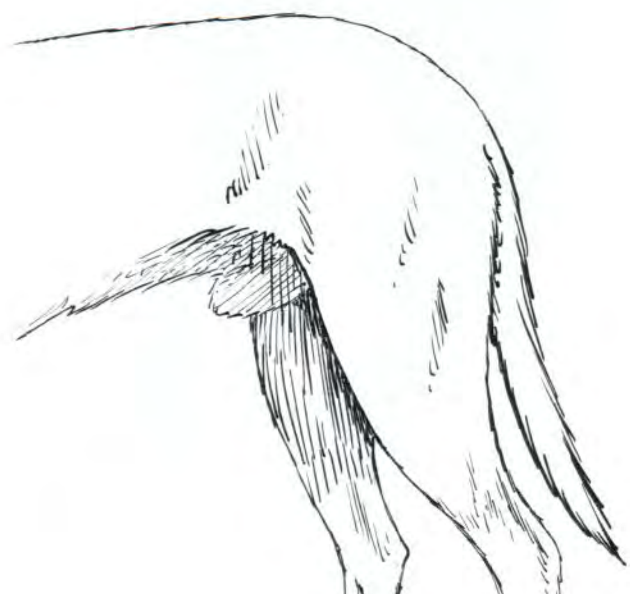
- Iliac crest
- Ischiatic tuberosity
- Greater trochanter
- Patella
- Patellar ligament
- Femoral condyles
- Tibial condyles
- Tibial tuberosity
- Trochlea of talus
- Femoral triangle
- Cranial tibial border ("crest")

Boundaries of the Femoral Triangle:
-cranial: caudal part of sartorius m.
-caudal: pectineus m.
-floor: iliopsoas m.



Femoral Triangle





Arteries:

Exercise 3. Vessels, & Nerves of the Pelvic Limb

cranial gluteal a.
caudal gluteal a.

Identify the following vessels and nerves of the canine pelvic limb

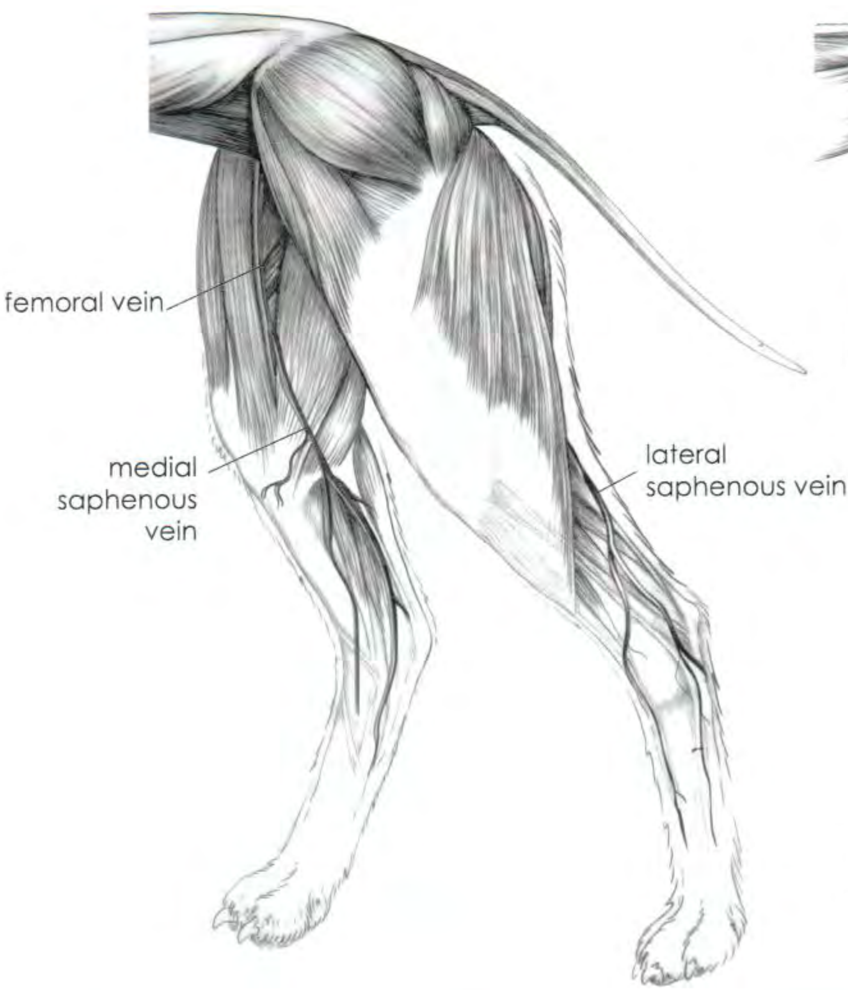
femoral a.
- medial circumflex femoral a.
- lateral circumflex femoral a.
- proximal caudal femoral a.
- saphenous a.
- middle caudal femoral a.
- distal caudal femoral a.

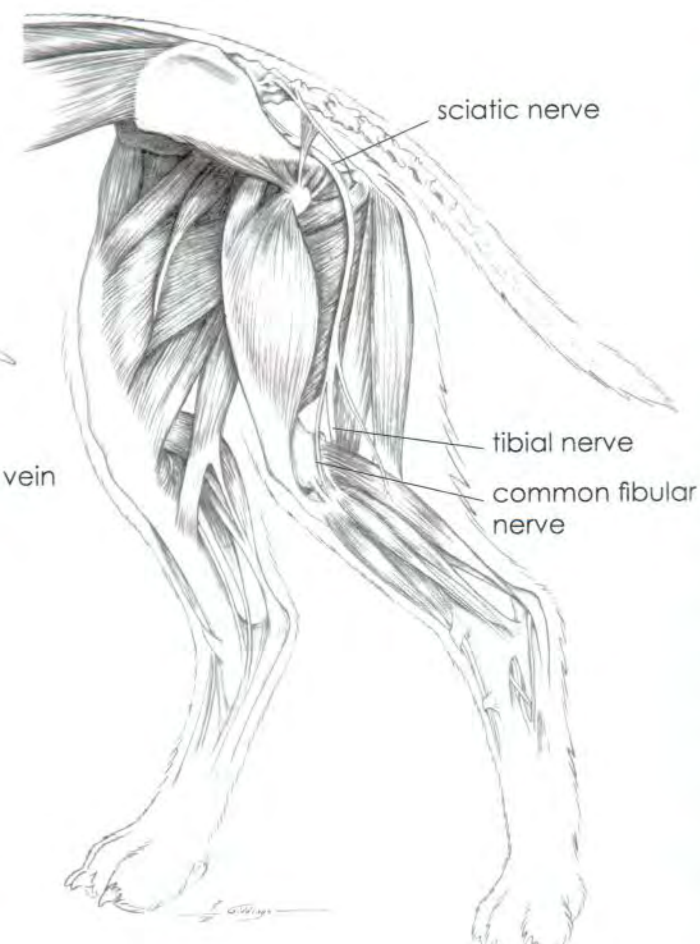
popliteal a.
cranial tibial a.
caudal tibial a.

Veins
- femoral v.
- lateral saphenous v.
- medial saphenous v.

Nerves
- cranial gluteal n.
- caudal gluteal n.
- obturator n.
- femoral n.
  - saphenous n.
- sciatic n.
  - common fibular n.
    - superficial fibular n.
    - deep fibular n.
  - tibial n.

Lymph nodes
- popliteal lymph nodes

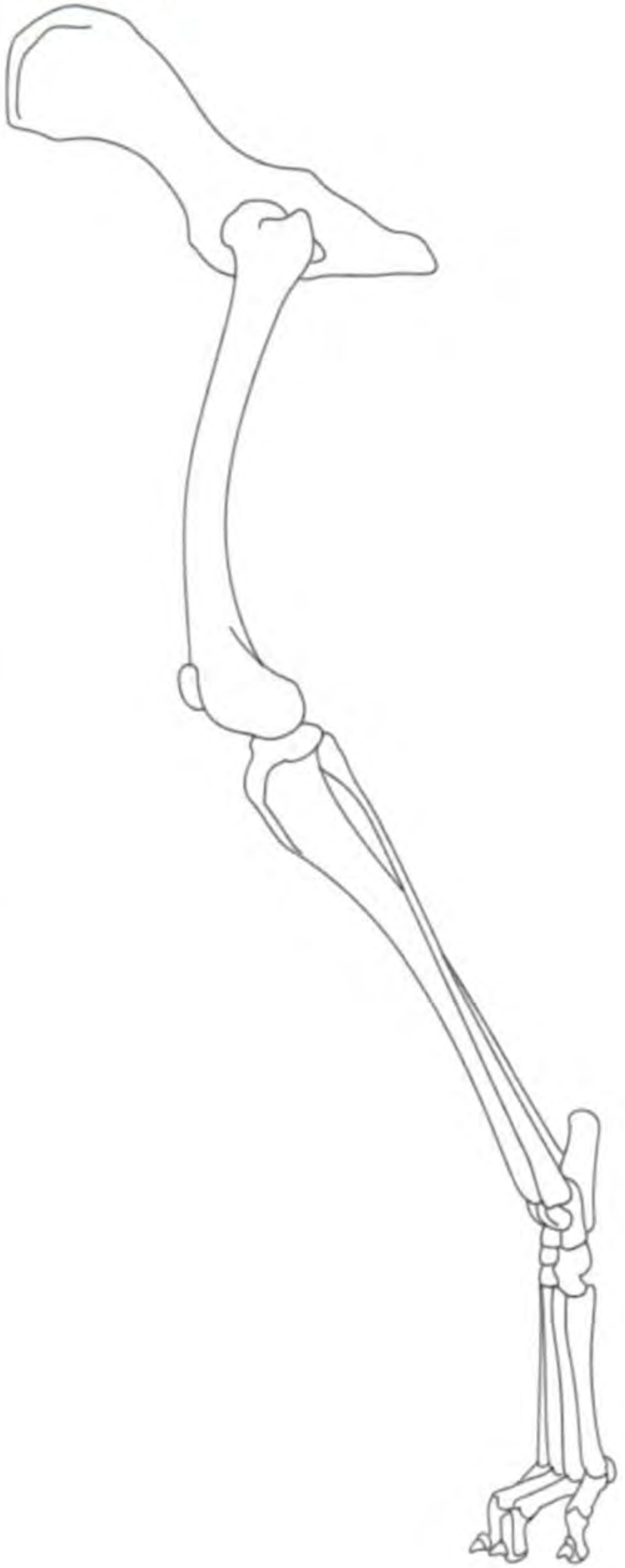




Draw the arteries on these limbs

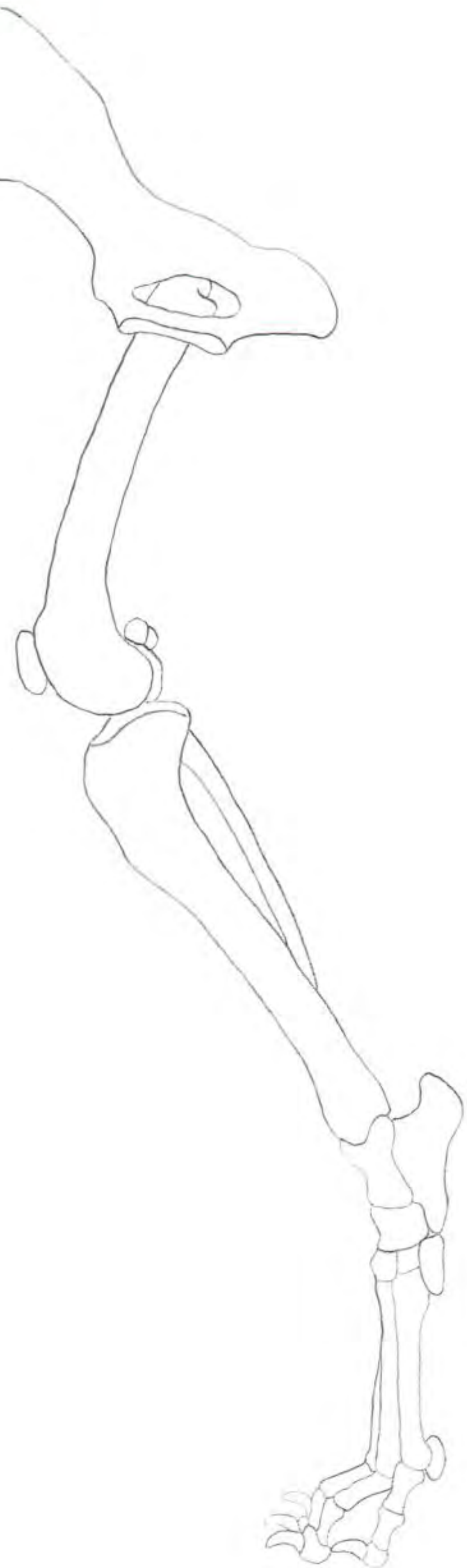
Lateral

~~Medial~~ view



Medial

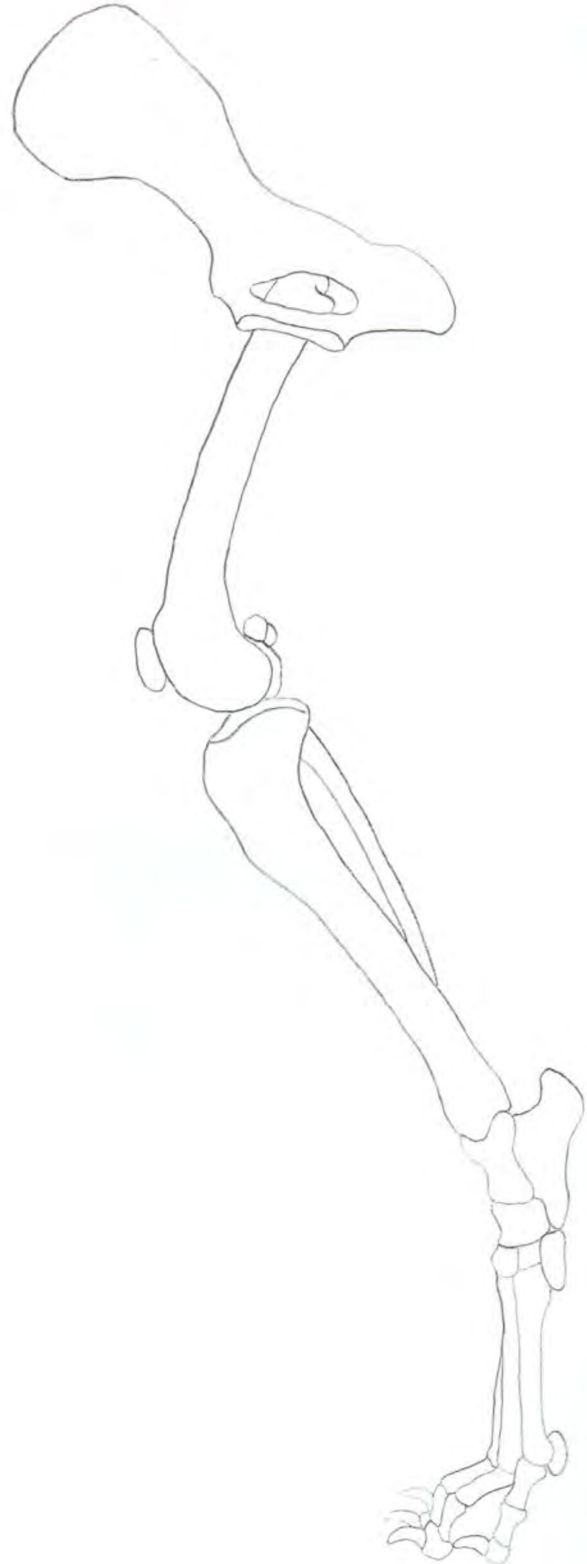
~~Lateral~~ view



Draw the nerves on these limbs

Lateral
~~Medial~~ view

Medial
~~Lateral~~ view



Arteries: **Identify the following vessels and nerves of the equine pelvic limb**

The femoral a. provides the primary arterial blood supply to the equine pelvic limb. After producing several muscular branches, as well as the saphenous a., it continues as the popliteal a. Locate the terminal branches of the popliteal a.: the cranial and caudal tibial aa.

caudal saphenous a.
- *medial and lateral plantar aa.

popliteal a.
- caudal tibial a.
  - *medial and lateral plantar aa.
- cranial tibial a.
  - dorsal pedal a.
    - dorsal metatarsal a. III
      - medial and lateral digital aa.

*The caudal branch of the saphenous a. forms an anastomosis with the caudal tibial a. just cranial to the calcaneal tuber. At the level of the sustentaculum tali, this anastomotic branch of the caudal saphenous a. divides into the medial and lateral plantar aa.

Veins

Cranial branch of medial saphenous v.

Nerves

Be aware that because of the manner in which these limbs have been removed from the trunk, it may be difficult to find the proximal stumps of the nerves. This is a good opportunity to remember that identification of the nerves should be based on where they are and where they are going. Note also that any nerves distal to the tarsus will be primarily sensory in function, as there are no muscles to innervate in the distal limb.

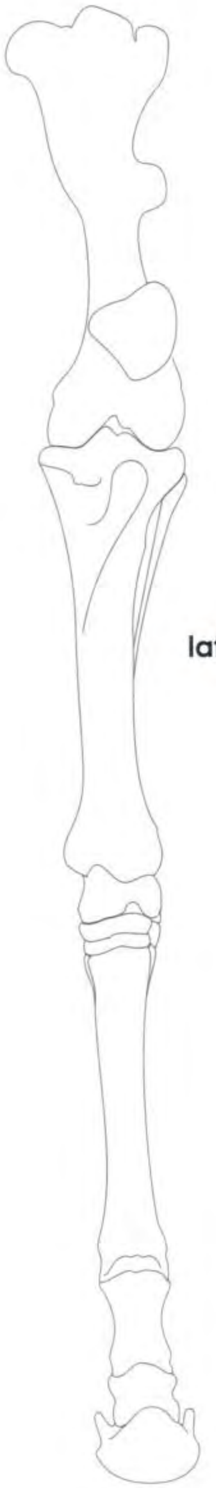
- sciatic n.
  - common fibular n.
    - deep fibular n.
    - superficial fibular n.
  - tibial n.
    - medial plantar n.
      - medial plantar digital n.
      - dorsal branches
    - lateral plantar n.
      - lateral plantar digital n.
      - dorsal branches

Draw the arteries on these limbs

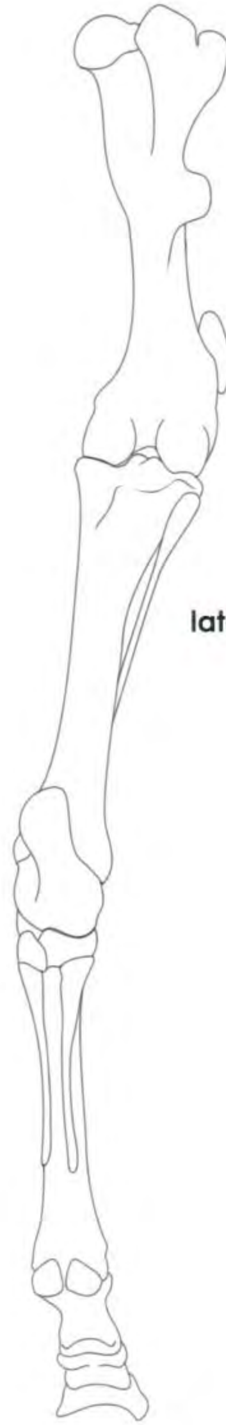
Left Hind Limb

Right Hind Limb

Cranial



Caudal



Exercise 4, Vertebral Column, Ribs, Back Muscles, & Spinal Cord

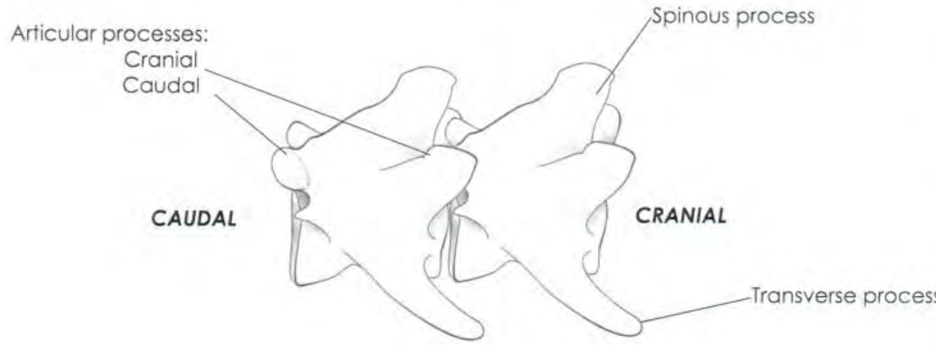
Identify the following bones and bony landmarks on the canine vertebral column

Vertebral formula
- Dog/Cat: C7, T13, L7, S3, Cd20
- Horse: C7, T18, L6(5), S5, Cd15-21
- Ox: C7, T13, L6, S5, Cd18-20

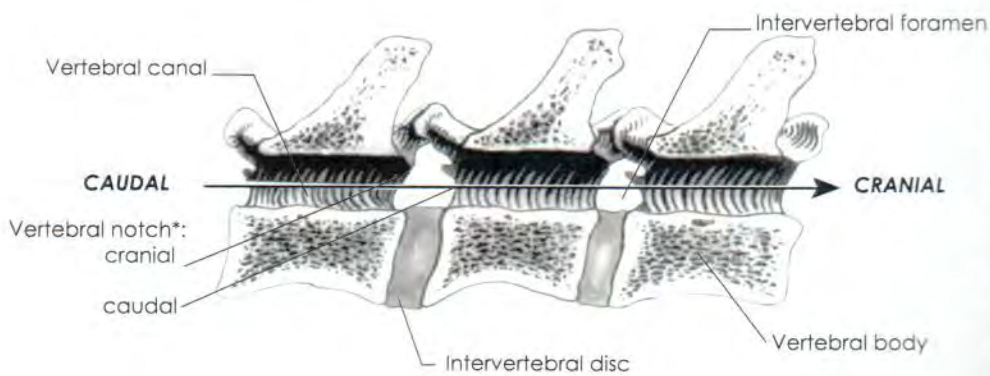
Vertebral column
- vertebral canal
- intervertebral foramina
  (formed from 2 vertebral notches)

Vertebrae (general)
- body
- arch
  - pedicles
  - laminae
- vertebral foramen
- vertebral notches
  - cranial
  - caudal
- spinous process
- transverse process
- articular process
  - cranial
  - caudal

Lumbar vertebrae



Lumbar vertebrae, hemisection



*Cranial/caudal are in reference to the vertebral body

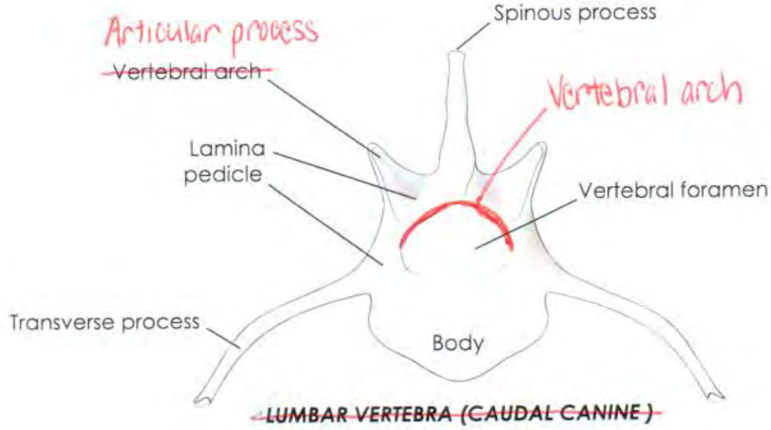
Identify the following structures of the vertebral column, back & spinal cord on the canine cadaver

Anticlinal vertebrae
- Dog/Cat: T11
- Horse: T16
- Ox: T13

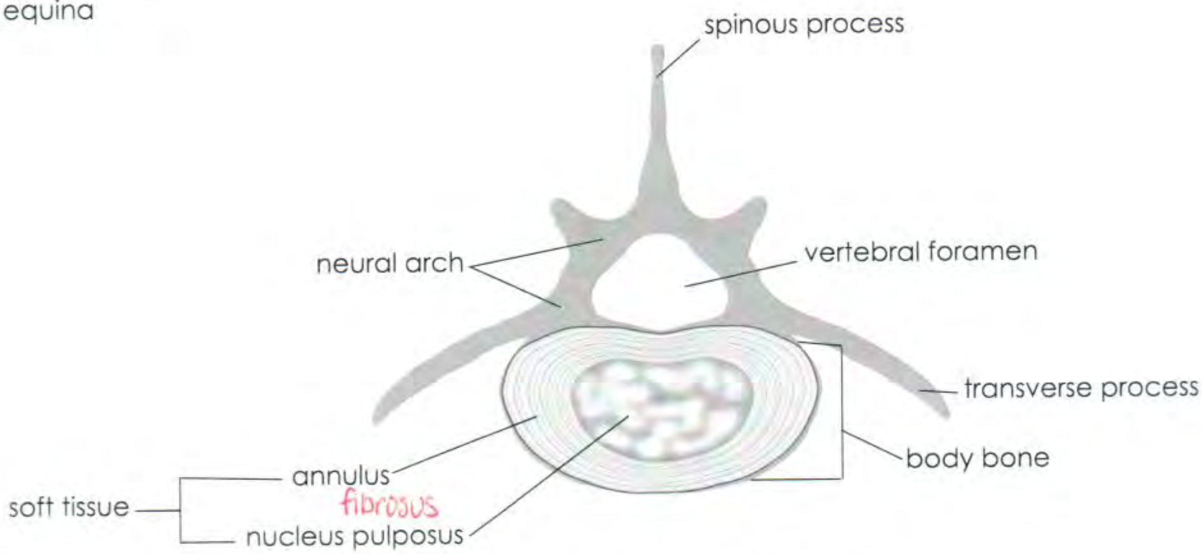
Ligaments
- nuchal ligament
- laminar and funicular parts (ungulates)
- supraspinous ligament*
- interspinous ligament*
- dorsal longitudinal
- ventral longitudinal (see in thorax)
- ligamenta flava

Articulations
- synovial & fibrocartilaginus joints
    - caudal/cranial articular processes
- intervertebral disc
    - annulus fibrosus
    - nucleus pulposus
- sacroiliac joint

Spinal cord
- epidural space
- spinal nerve
- dorsal root ganglion
- dura mater
- arachnoid
- pia mater
    - denticulate ligaments
    - filum terminale
- conus medullaris
- cauda equina



~~LUMBAR VERTEBRA (CAUDAL CANINE)~~
Canine lumbar vertebra
caudal view



Canine 5th lumbar vertebrae with intervertebral disk

*See on special preps

Exercise 5, Bones of the Thoracic Limb, & Cervical & Thoracic Spine

Identify the following bones and bony features of the canine/feline thoracic limb

Scapula
- glenoid cavity
- spine
- acromion
- supraglenoid tubercle
- scapular notch
- suprahamate process (feline)
- supraspinous fossa
- infraspinous fossa
- Subscapular fossa

Clavicle (feline)

Humerus
- head
- greater tubercle
- lesser tubercle
- intertubercular groove
- deltoid tuberosity
- humeral condyle
- lateral & medial epicondyles
- supracondylar foramen (feline)
- olecranon fossa

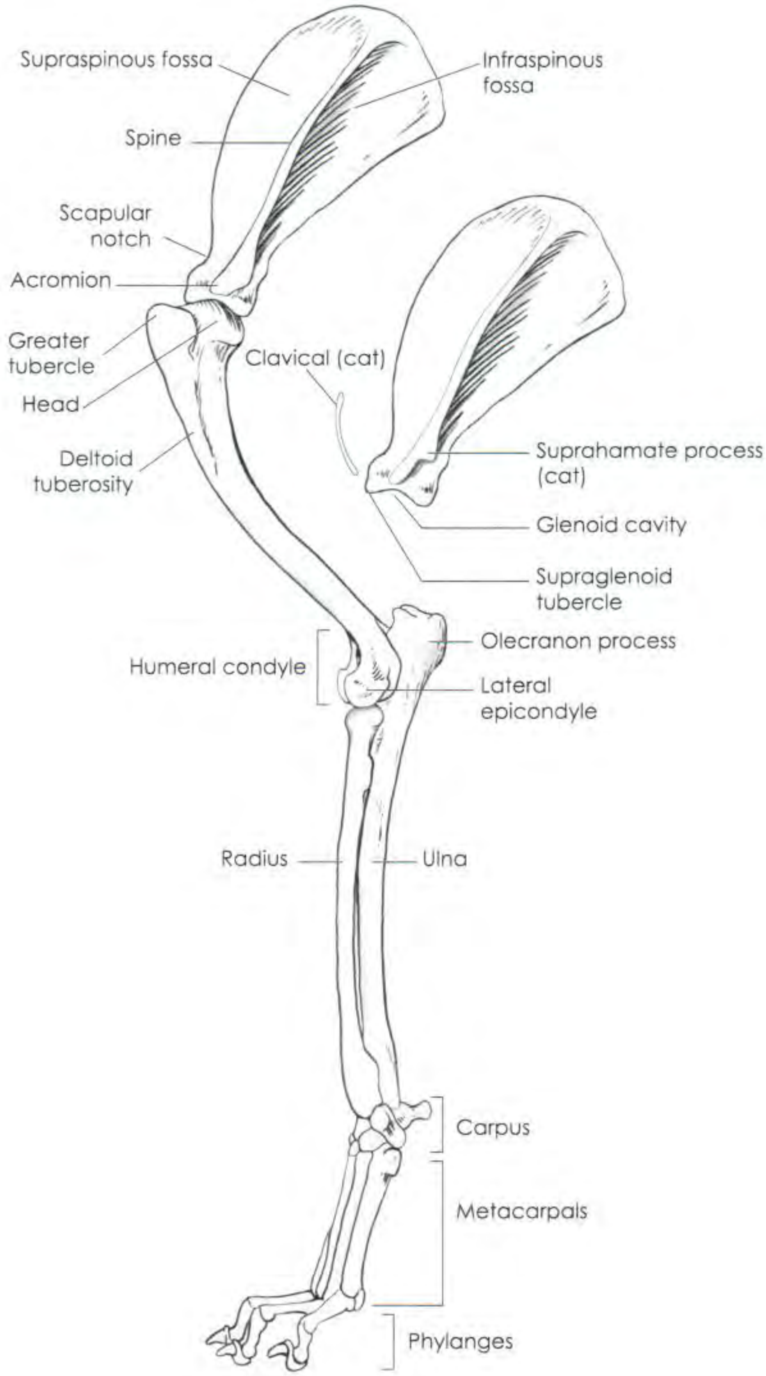
Radius
- head
- styloid process

Ulna
- olecranon
- trochlear notch
- radial notch
- anconeal process
- medial & lateral coronoid processes
- styloid process

Carpus
- accessory carpal bone
- ulnar carpal bone
- radial carpal bone
- carpals I - IV

Metacarpals I - V

Digits I - V
- proximal phalanx
- middle phalanx
- distal phalanx
  - ungual process



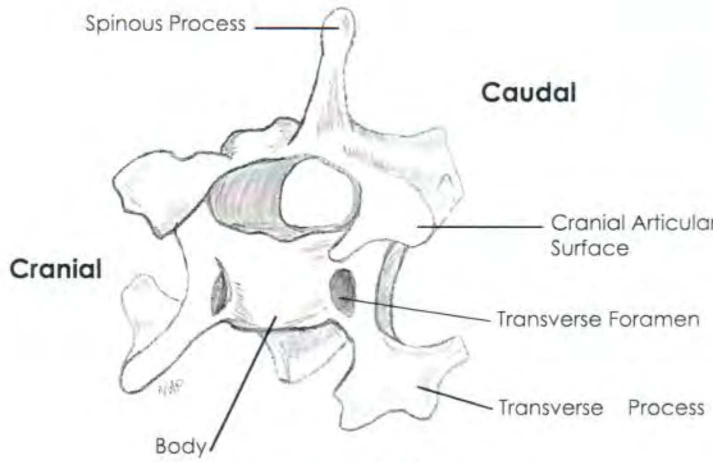
Identify the following muscles, bones, and bony landmarks on the canine vertebral column

Cervical vertebrae
- transverse foramina
- atlas
  - wing
  - transverse vertebral foramina
  - lateral vertebral foramina
- axis
  - dens
- spinous process

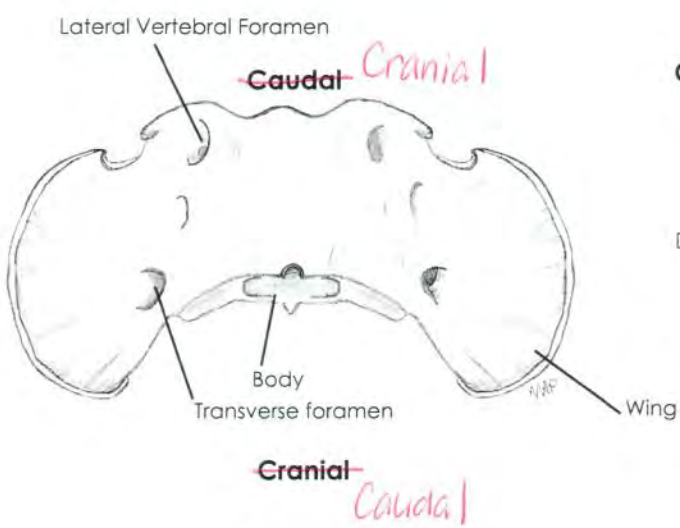
Thoracic vertebrae
- costal articular fovea
- anticlinal vertebra

Lumbar vertebrae
- accessory process

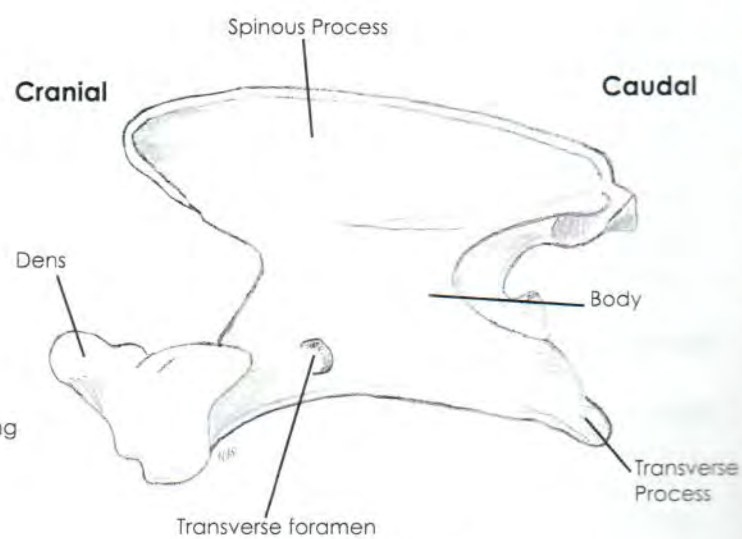
Muscles
- splenius m.
- iliocostal system of mm.
- longissimus system of mm.
- transversospinalis system of mm.
- serratus ventralis m.
- ~~serratus dorsalis cranialis m.~~
- scalenus m.



Fifth cervical vertebra craniolateral aspect



Atlas, dorsal

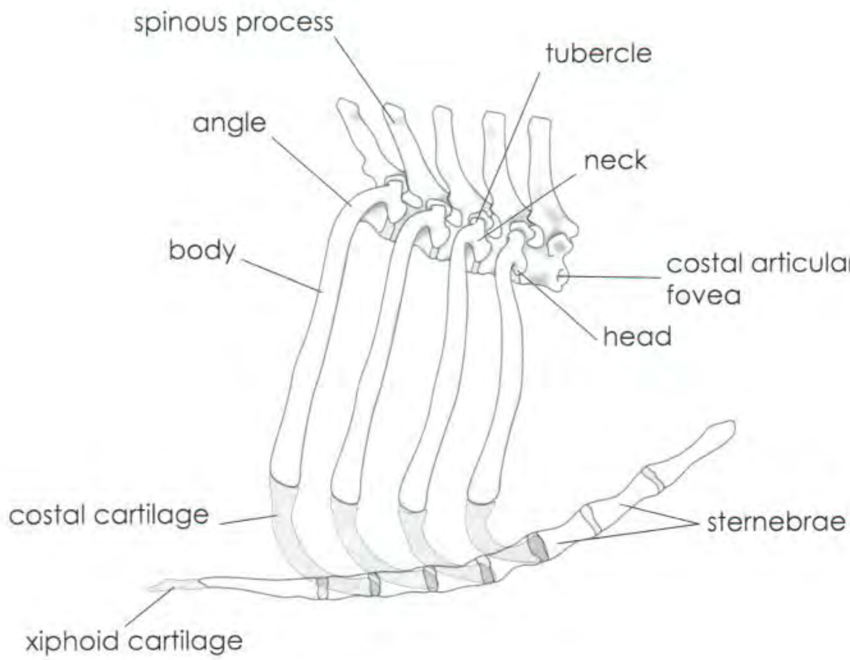


Axis, left lateral

Identify the following bones and bony landmarks on the canine vertebral column

Ribs
- head
- costal cartilage
- costal arch
- floating rib

Sternum
- sternebrae
- manubrium
- xiphoid process



Canine ribs & sternebrae
(~~left~~ lateral view)
right

Identify the following specific bony variations found in Bovidae

- Acromion of scapula
- Very larger greater tubercle on humerus
- Ulna fused to radius, but with complete body and styloid process
- Carpal I is absent, II & III are fused
- Large metacarpal bone formed by fusion of III and IV metacarpal bones
- Elongated oval small V metacarpal bone
- Fully developed III and IV digits
- II and V digits (dewclaws) are short, horny capsules with vestigial bones

Identify the following bones and bony features of the equine thoracic limb

Scapula
- spine & its tuberosity
- neck
- dorsal scapular cartilage
- glenoid cavity
- supraglenoid tubercle
- supraspinous fossa
- infraspinous fossa
- subscapular fossa

Humerus
- head
- greater tubercle
- lesser tubercle
- intermediate tubercle
- intertubercular groove (s)
- deltoid tuberosity
- olecranon fossa
- condyle
- medial & lateral epicondyles

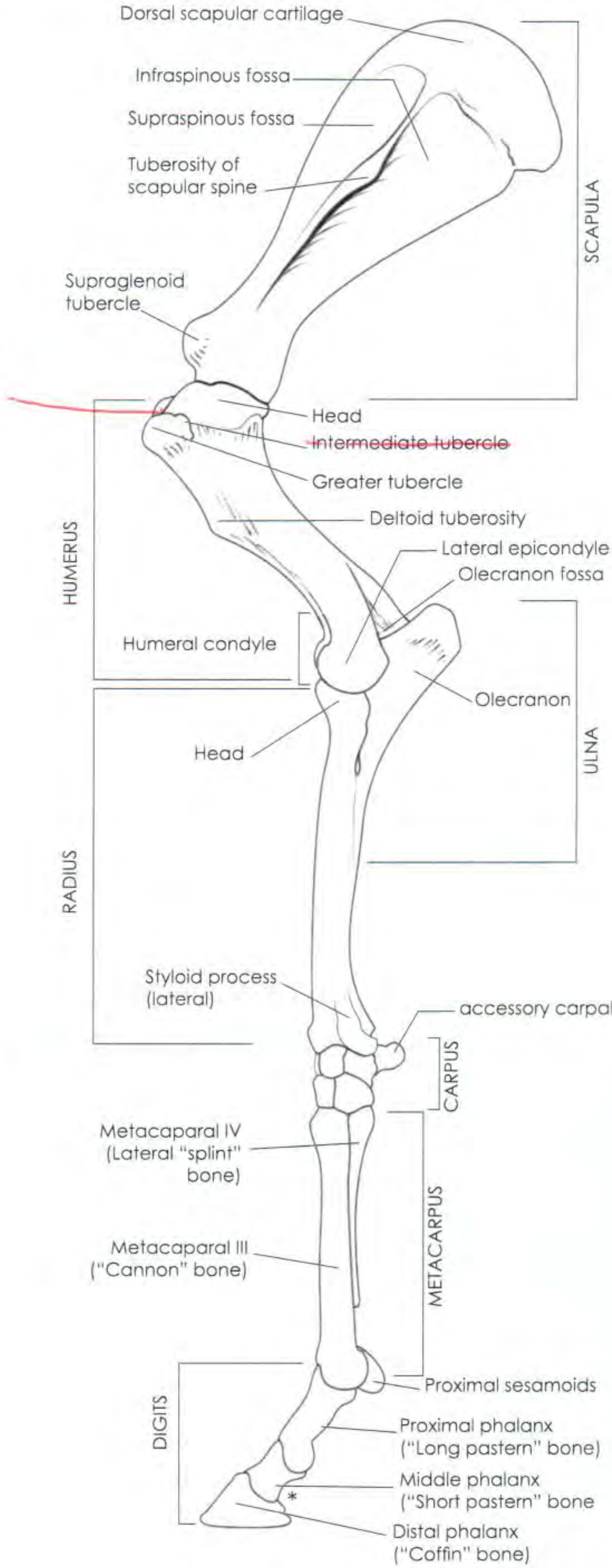
Radius
- head
- medial & lateral styloid processes

Ulna
- olecranon
- trochlear notch

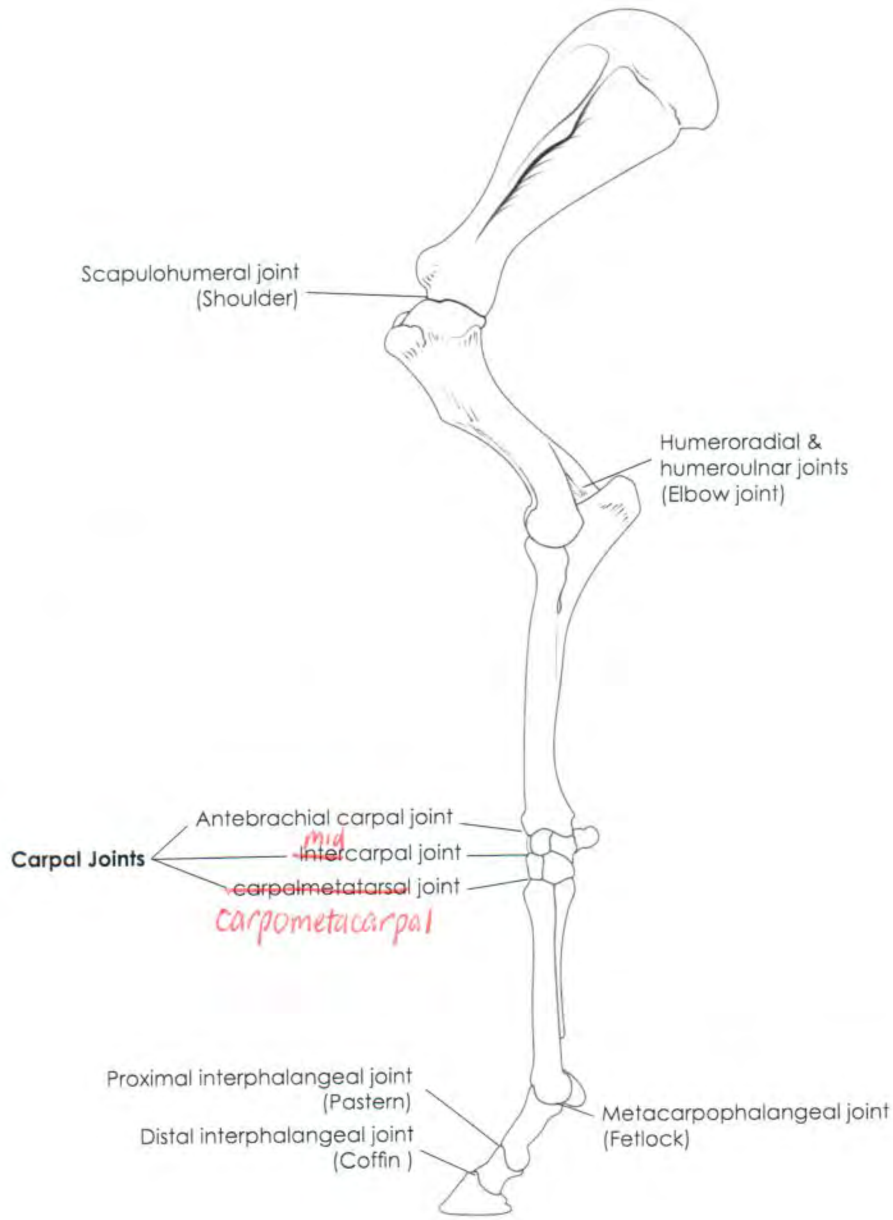
Carpus
- accessory carpal bone
- ulnar carpal bone
- intermediate carpal bone
- radial carpal bone
- carpal bones II - IV
  - (carpal I usually rudimentary or absent)

Metacarpus
- II (medial "splint" bone)
- III ("cannon" bone)
- IV (lateral "splint" bone)
- "buttons" (distal ends of "splint" bones)

Digits
- proximal phalanx
  - ("long pastern" bone)
- middle phalanx
  - ("short pastern" bone)
- distal phalanx ("coffin" bone)
- extensor process
- proximal sesamoids
- distal sesamoid ("navicular" bone)



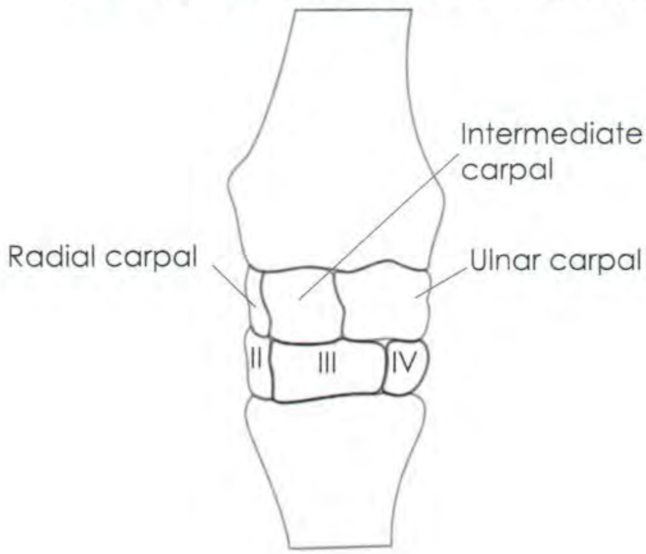
*Distal sesamoid ("navicular") bone not shown



Equine Forelimb (lateral)

Articulations of the Forelimb

- Shoulder joint between scapula & humerus
- Elbow joint between humerus and radius/ ulna
- Carpal joint - between antebrachium and carpals & carpals and metacarpals (sometimes called the knee by lay horse people)
- Metacarpophalangeal joint / Fetlock in horses between metacarpal bones & proximal phalanges
- Proximal interphalangeal joint / pastern joint in horses between proximal & middle phalanges
- Distal interphalangeal joint / coffin joint in horses between middle & distal phalanges



Equine Carpus (left cranial)

Palpation - live dog or canine cadaver that has not been dissected

- Spine of scapula
- Greater tubercle
- Acromion of scapula
- Epicondyles of humerus
- Olecranon process of ulna
- Accessory carpal bone

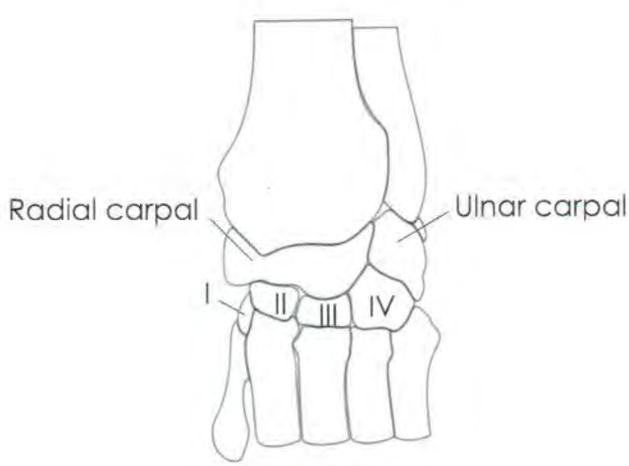
Thoracic Limb Terms

Thoracic Girdle
scapula
clavicle

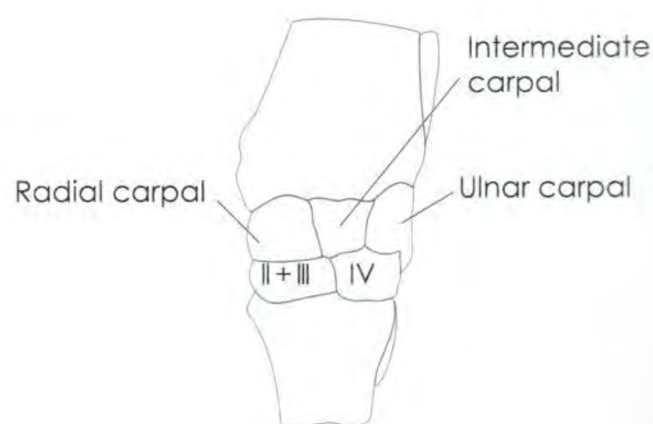
Arm or Brachium
Humerus

Forearm or antebrachium
Radius
ulna

Forepaw or manus
Carpal bones
Metacarpal bones
phalanges



Canine Carpus (left cranial)



Bovine Carpus (left cranial)

Exercise 6, Muscles of the Thoracic Limb

Identify the following muscles of the canine thoracic limb

Extrinsic Muscles: limb to body

superficial fascia
deep fascia
cutaneous trunci
superficial pectoral
deep pectoral
brachiocephalicus
    clavicular intersection
    cleidobrachialis
    cleidocephalicus

omotransversarius
    superficial cervical lymph nodes
        (deep to omotransversarius)
trapezius
rhomboideus
latissimus dorsi
serratus ventralis

Intrinsic Muscles: within limb only

Shoulder mm
    deltoideus
        acromial and scapular heads
    infraspinatus
    supraspinatus
    subscapularis
    teres major

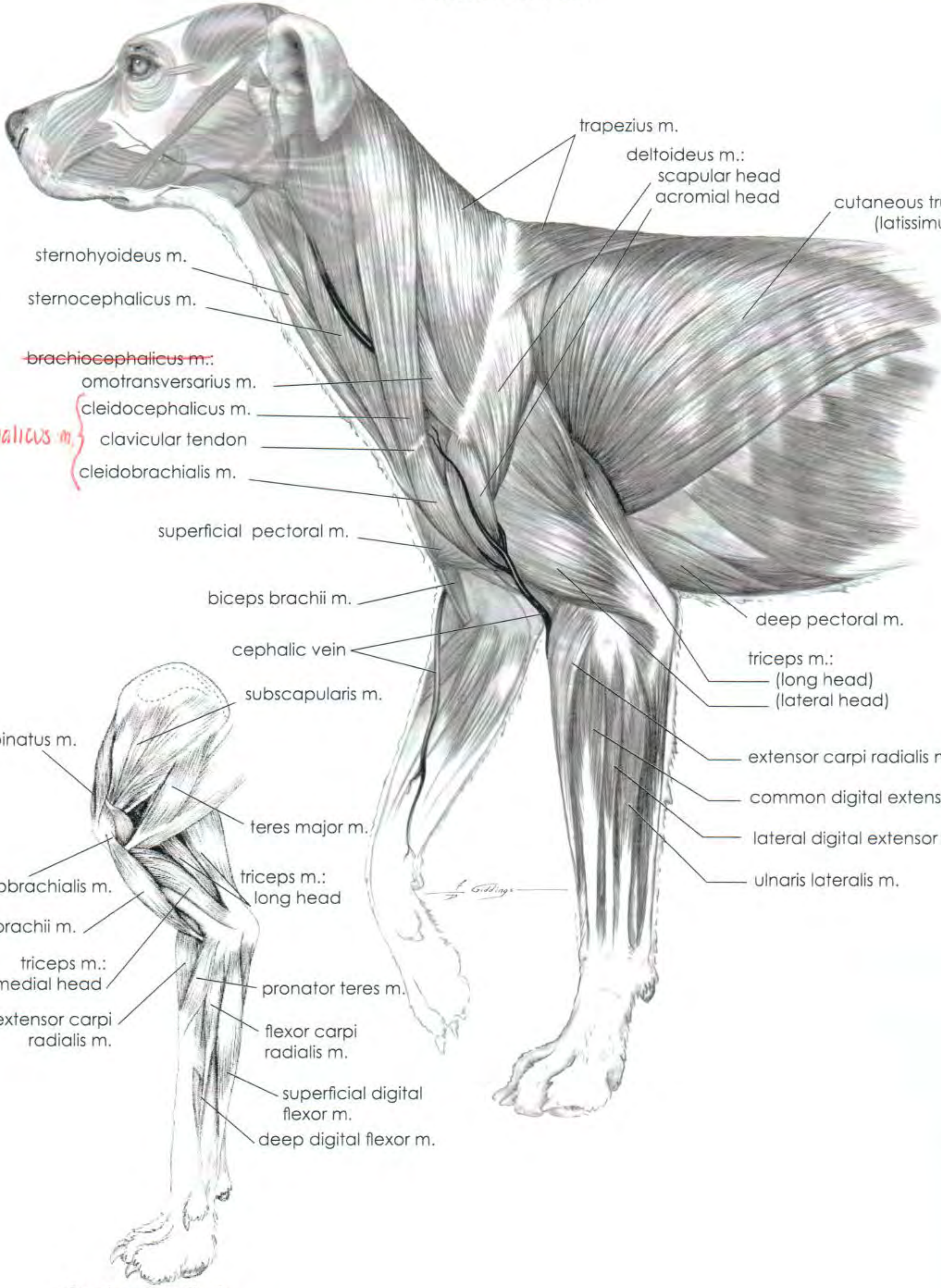
Brachial muscles
    tensor fascia antebrachii
    triceps brachii
        long head
        lateral head
        accessory head
        medial head
    biceps brachii
        transverse humeral retinaculum
    brachialis

Antebrachial muscles

Craniolateral group
    extensor carpi radialis
    extensor retinaculum
    common digital extensor
    lateral digital extensor
    extensor carpi ulnaris (ulnaris lateralis)
    supinator

Caudomedial group
    pronator teres
    flexor carpi radialis
    superficial digital flexor
    flexor carpi ulnaris (ulnar & humeral head)
    deep digital flexor

Canine Muscles



Canine Forelimb (medial)

Identify the following muscles on the equine thoracic limb

Extrinsic muscles: limb to body

cutaneous trunci
superficial pectoral
deep pectoral
subclavius
trapezius
omotransversarius
rhomboideus
serratus ventralis
latissimus dorsi
brachiocephalicus

Intrinsic muscles: within limb only

Shoulder mm
supraspinatus
infraspinatus
deltoideus (no separate heads)

Brachial mm
biceps brachii
lacertus fibrosis
brachialis
triceps brachii
long head
medial head
lateral head

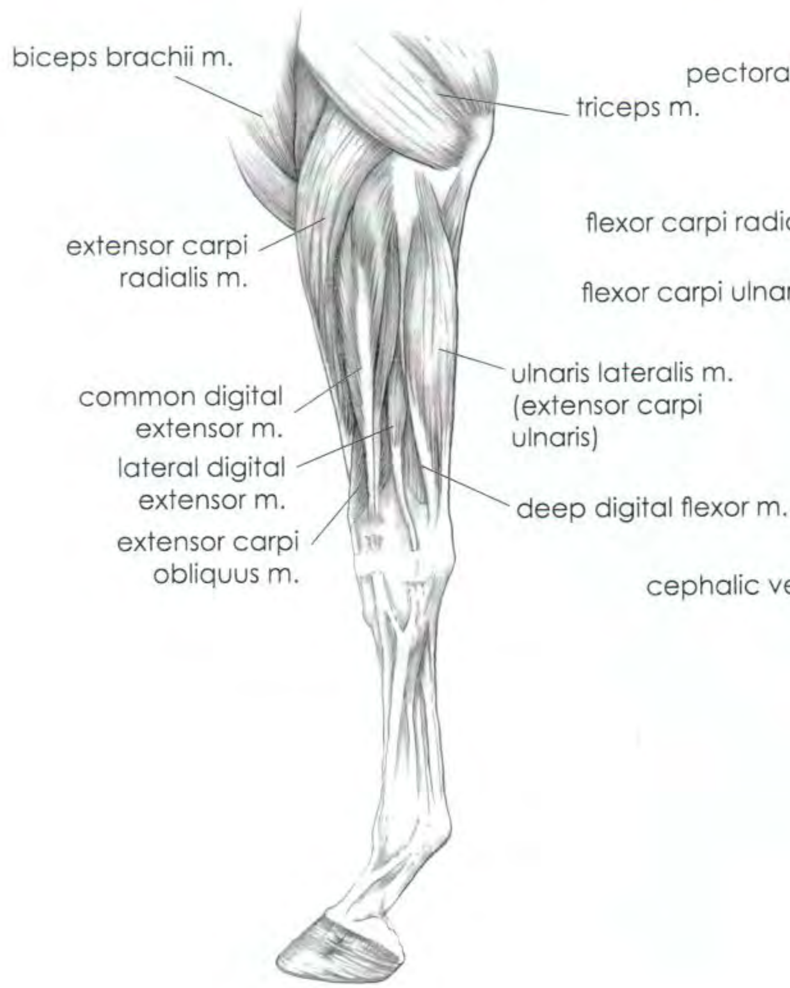
Antebrachial mm

Craniolateral group
extensor carpi radialis
common digital extensor
lateral digital extensor
extensor carpi ulnaris (ulnaris lateralis)

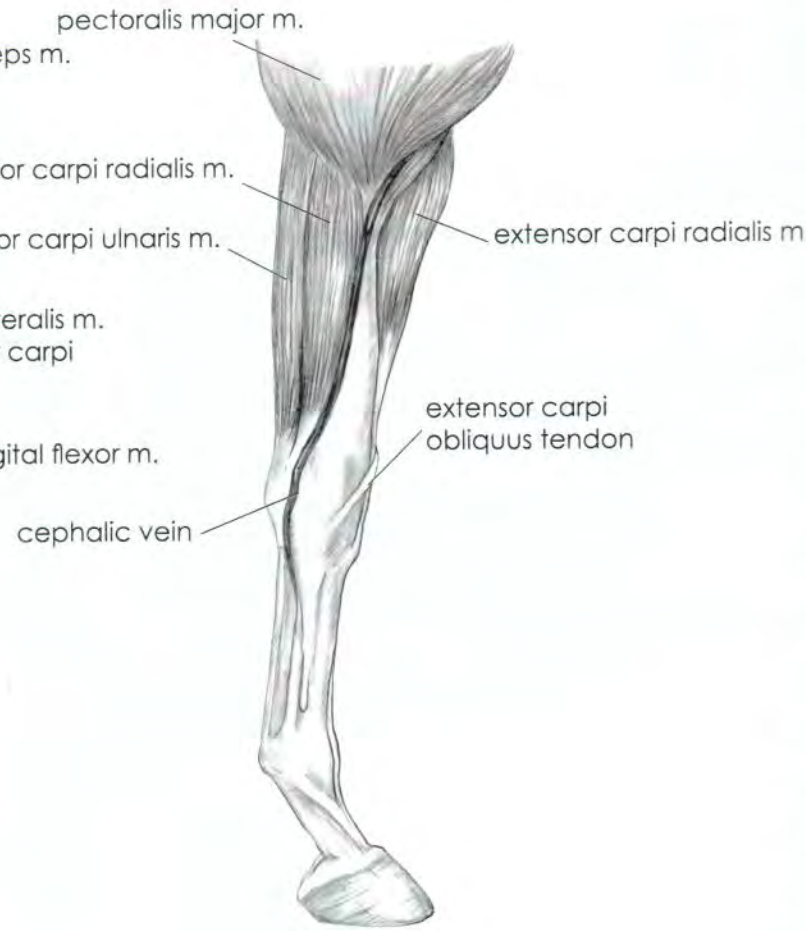
Craniomedial group
extensor carpi obliquus
flexor carpi radialis
flexor carpi ulnaris
superficial digital flexor
accessory (radial) check ligament
suspensory ligament
deep digital flexor
accessory (carpal) check ligament

Additional Structures
ergot
chestnut
interosseus muscle (suspensory ligament)

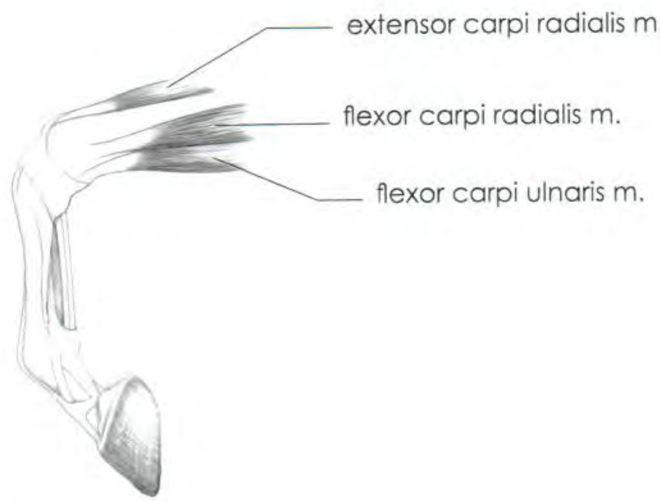
Muscles of the Equine Forelimb



Lateral



Medial



Flexed medial

Identify the following muscle variations found in Bovidae

- The **common digital extensor m.** possesses a large medial belly whose tendon ends on the middle phalanx of the medial digit (III) and a smaller lateral belly whose tendon parallels the medial one then splits a the fetlock to insert onto the distal phalanx of both digits (III and IV).

- The **lateral digital extensor muscle** tendon inserts on the middle phalanx of the lateral digit (IV). Note that with the tendons of the common digital extensor m., there are three digital extensor tendons on the dorsum of the bovine manus.

- The **superficial digital flexor m.** possesses two bellies deep and superficial each giving rise to a tendon. These fuse at mid-metacarpus, then the conjoined tendon splits again at the fetlock as it makes a contribution to each digit. There are no ìcheck ligaments associated with the bovine digital flexors.

- The **deep digital flexor m.** is similar to that of the horse. With the superficial digital flexor tendon, the deep splits into branches servicing each digit. The arrangement of the two digital flexor tendons in each toe is similar to that in the equine digit. There are no check ligaments associated with the bovine digital flexors.

- The **suspensory ligament** is related to the bones of the bovine manus as in the horse, but has considerable muscle tissue in young animals (hence, it may correctly be referred to as the **interosseus m.**). It generally is fully ligamentous in mature animals. There are actually two separate interosseus muscles, one for each metacarpal, and, like the bones, these are fused into one.

Innervation & General Functions of Muscles of the Thoracic Limb

Function	*Innervation*
Shoulder Flexors	
infraspinatus	suprascapular n.
deltoideus	axillary n.
teres minor	axillary n.
teres major	axillary n.
long head of triceps	radial n.
latissimus dorsi	thoracodorsal n.
Shoulder Extensors	
brachiocephalicus	accessory & cervical nn.
supraspinatus	suprascapular n.
biceps brachii	musculocutaneous n.
Elbow Flexors	
brachialis	musculocutaneous n.
biceps brachii	musculocutaneous n.
Elbow Extensors	
triceps brachii	radial n.
tensor fascii antebrachii	radial n.
Carpal Flexors	
flexor carpi radialis	median & ulnar nn.
flexor carpi ulnaris	median & ulnar nn.
deep & superficial digital flexors	median & ulnar nn.
Carpal Extensors	
extensor carpi radialis	radial n.
common & lateral digital extensors	radial n.
Digital Flexors	
deep & superficial digital flexors	median &* ulnar nn. ↳ deep digital flexor m.
Digital Extensors	
common & lateral digital extensors	radial n.

Exercise 7, Vessels, & Nerves of the Thoracic Limb, Paw, & Hoof

Identify the following vessels and nerves of the canine thoracic limb

Arteries

- axillary a.
  - subscapular a.
    - caudal circumflex humeral a
    - thoracodorsal a.
  - cranial cicumflex humeral a.
- brachial a.
  - deep brachial a.
  - collateral ulnar a.
  - common interosseous a.
- median a
  - radial a

Veins (*not in order)

- axillary v.
- cephalic v.
- accessory cephalic v.
- median cubital v.
- axillobrachial v.
- external jugular v.
- brachial v

Nerves

- suprascapular n.
- subscapular n.
- musculocutaneous n.
- axillary n.
- thoracodorsal n.
- lateral thoracic n.
- radial n.
  - deep branch
  - superficial branch
- median n.
- ulnar n.

Medial canine arteries & nerves

Identify the following vessels and nerves of the equine thoracic limb

Arteries

The proximal arteries that supply the thoracic limb of the horse are similar to those of the dog. Begin in the antebrachium by locating the continuation of the brachial artery, the median artery.

median a.
  medial palmar a.
    medial digital a.
    lateral digital a
    lateral palmar a.

Veins

external jugular v.

cephalic v.

Nerves

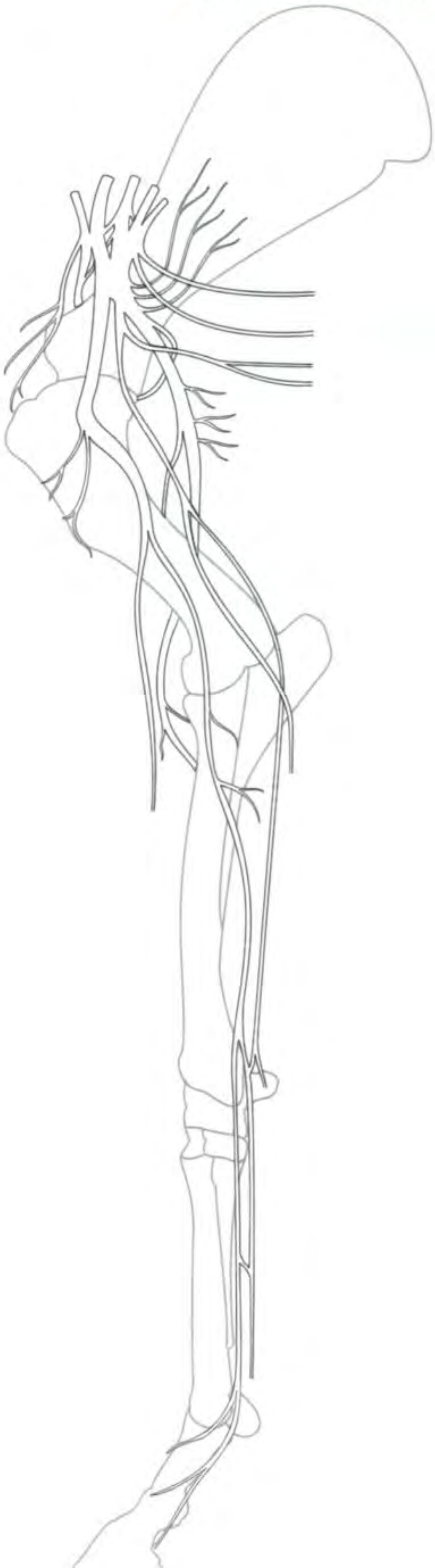
Be aware that because of the manner in which these limbs have been removed from the trunk, it may be difficult to find the proximal stumps of the nerves. This is a good opportunity to remember that identification of the nerves should be based on where they are and where they are going. Note also that any nerves distal to the carpus will be primarily sensory in function, as there are no muscles to innervate in the distal limb.

radial n.
median n.
    medial palmar n.
        medial palmar digital n.
            dorsal branches
    communicating branch
lateral palmar n.
    medial palmar metacarpal n.*
    lateral palmar metacarpal n.*
    lateral palmar digital n.
ulnar n.
    dorsal branch*

* Usually too small to visualize

We will not identify the vessels and nerves of the ox forelimb

Medial equine nerves



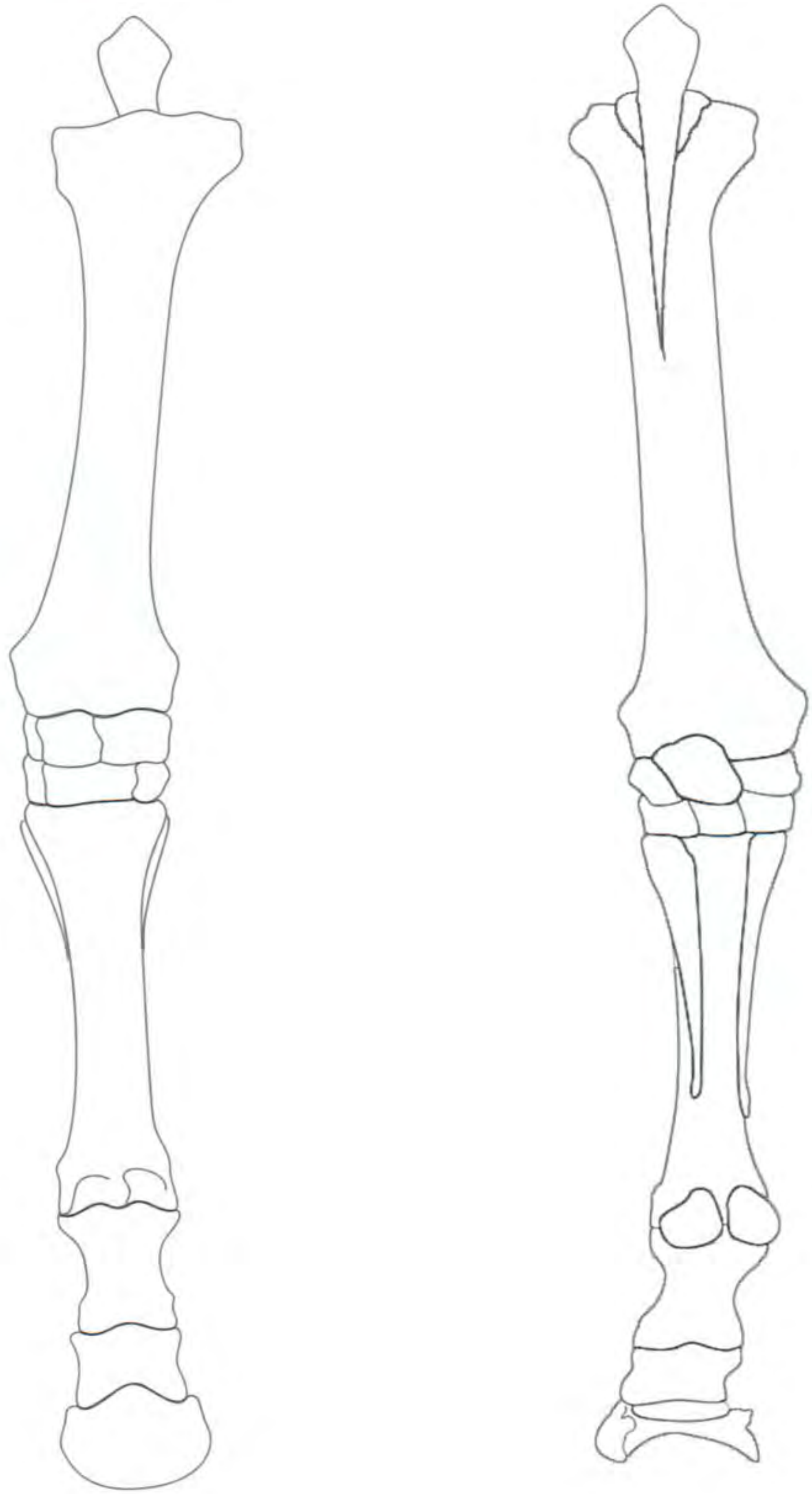
Medial equine arteries

Draw the nerves of the equine thoracic limb

Cranial

Caudal

Medial



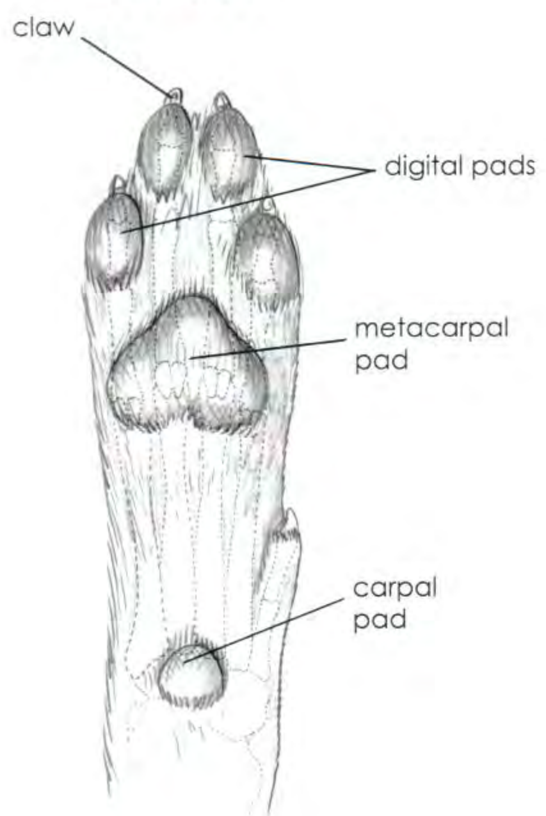
Medial

Identify the following structures on the canine foot

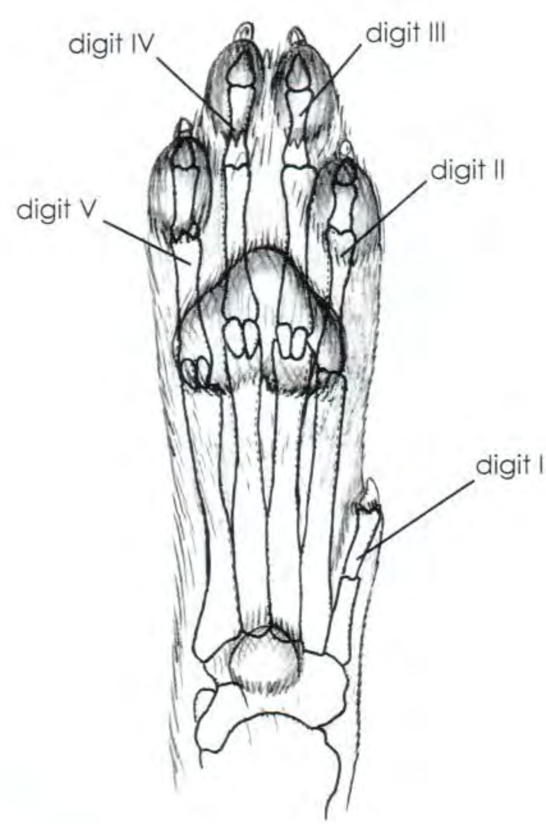
Claw
Distal phalanx
    Ungual process
Digital pads*

  Metacarpal (metatarsal) pad*
  Carpal pad* (no tarsal pads)

Soft tissue



Bones



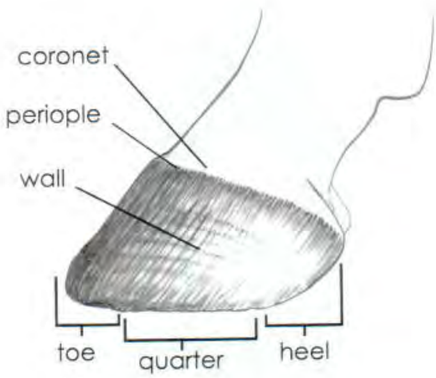
The importance of the foot/hoof to animals and those that work with them can be summarized by the old adage, "No Foot No Horse".

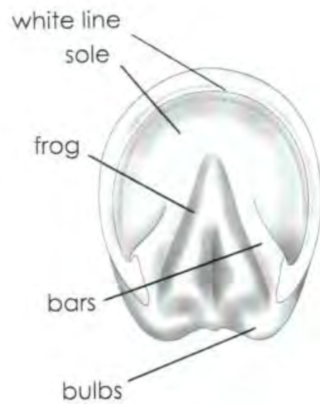
*use special preparations or special demonstrations for these structures

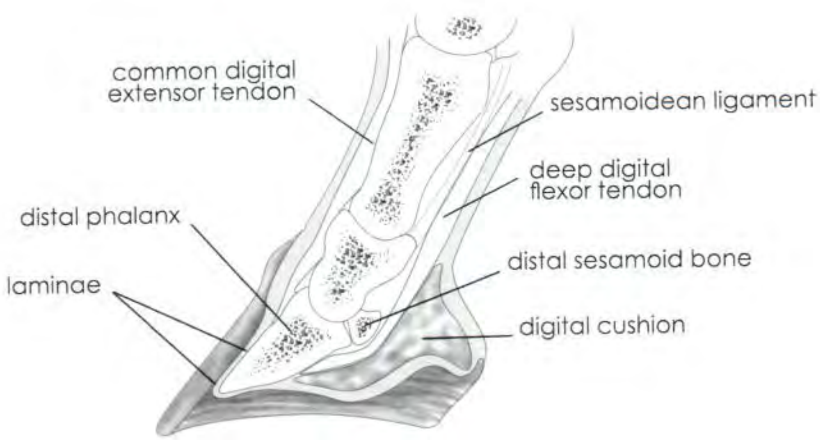
Identify the following regions of the equine hoof/foot

Coronet
Periople
Wall
Toe
Quarters
Heels
Ungual cartilages of distal phalanx*
Bulbs
Sole
Frog
  Collateral (paracuneal) sulci and
  central (cuneal) sulcus

Bars
White line*
Laminae (sensitive and insensitive)*
Distal phalanx
Distal Sesamoid bone (navicular bone)
Podotrochlear bursa (navicular bursa)*
Tendon of deep digital flexor
Tendon of superficial digital flexor
Common digital extensor tendon
Digital cushion*







Identify the following structures on the bovine foot (Digit III & IV)

Claw
Periople
Wall
Digits

Sole
Bulb
Digital cushion*

* use special preparations or special demonstrations for these structures

Exercise 8, Thoracic Wall, Cavity, & Thoracic Viscera

Identify the following structures of the thoracic wall & cavity on the canine cadaver

Thoracic wall
- scalenus mm.
- serratus ventralis m.
- latissimus dorsi m.
- external intercostals mm.
- internal intercostals mm.
- intercostal n.
- intercostal a.
- intercostal v.

Lymph nodes/centers
- trachiobronchial (hilar) lymph nodes
- thoracic duct (hard to find in K-9 - empties into subclavian vein in equine)

Thoracic cavity
- right and left lungs
- mediastinum (space)
- thymus
- aorta
  - ascending
  - arch
  - descending (thoracic)
- esophagus
- caudal vena cava
- trachea
  - carina
  - tracheal bronchus (ox)
- internal thoracic artery
- azygous v.

Serous membranes
- parietal pleura
  - costal pleura
  - diaphragmatic pleura
  - mediastinal pleura
- visceral (pulmonary) pleura
- plica venae cavae

Diaphragm
- rt. & lft. crura
- central tendon
- aortic hiatus
- esophageal hiatus
- caval foramen
- phrenic nerves

Lungs
- describe the lobation pattern of canine, equine and bovine lungs
- describe the names of the lobes of canine, equine and bovine lungs
- cardiac notch
- root of the lung

Autonomic nervous system

Sympathetic n.s.
- sympathetic trunk and ganglia
- cervicothoracic ganglion
- ansa subclavia
- middle cervical ganglion
- vagosympathetic trunk
- splanchnic nn.

Parasympathetic n.s.
- vagosympathetic trunk
  - ~~dorsal & ventral branches.~~
- vagus nerve
  - dorsal & ventral branches
  - dorsal + ventral vagal trunks

Identify the following structures of the thoracic wall & cavity on the canine cadaver

Heart

External
- apex
- base
- right coronary a
- left coronary a.
  - paraconal a.
  - circumflex a.
    - subsinosal a
- right & left atria
- auricle
- right & left ventricles
- cranial & caudal venae cavae
- coronary sinus
- pulmonary trunk
- ligamentum arteriosum

Internal
- right atrium
  - cranial & caudal vena cava
  - opening for coronary sinus
- pectinate mm.
- fossa ovalis
- right atrioventricular valve
  - valve cusps (leaflets)
  - chordae tendinae

- right ventricle
  - papillary muscles
  - moderator band in horse, ox
    - (trabecula septomarginalis)
  - pulmonary valve
  - interventricular septum

- left atrium
  - pulmonary veins
  - left atrioventricular valve
    - valve cusps (leaflets)
    - chordae tendinae

- left ventricle
  - papillary muscles
  - aortic valve
  - interventricular septum
- ascending aorta
  - aortic sinus
  - right & left coronary aa.

Heart - great vessels
- cranial vena cava
- caudal vena cava
- external jugular v.
- brachiocephalic vv. (lft. & rt.)
- subclavian v.
- ascending aorta
- aortic arch (K-9)
  - brachiocephalic trunk
    - lft. common carotid a.
    - rt. common carotid a.
    - right subclavian aa.
      - vertebral a.
      - costocervical trunk
      - internal thoracic a.
  - bicarotid trunk (horse and ox)
    - rt./lft. common carotid aa.
  - left subclavian a.
    - brr. same as rt.
    - subclavian

Midsagittal view of equine heart & right lung

Exercise 9, Absominal Wall, Cavity, & Abdominal Viscera

Identify the following structures on the canine cadaver

Abdominal wall
- external abdominal oblique m.
- internal abdominal oblique m.
- transverses abdominus m.
- rectus abdominus m.
  - prepubic tendon
- linea alba
- internal inguinal ring
- external inguinal ring
- inguinal canal
- vaginal process
- spermatic cord

Abdominal cavity

Peritoneal structures
- visceral peritoneum
- parietal peritoneum
- falciform ligament
- greater omentum
- lesser omentum
- great mesentery
- root of the great mesentery
- omental bursa

Stomach
- cardia
- fundus
- greater curvature
- lesser curvature
- body
- pylorus
  - torus pyloricus (ox, sus)
- gastric rugae

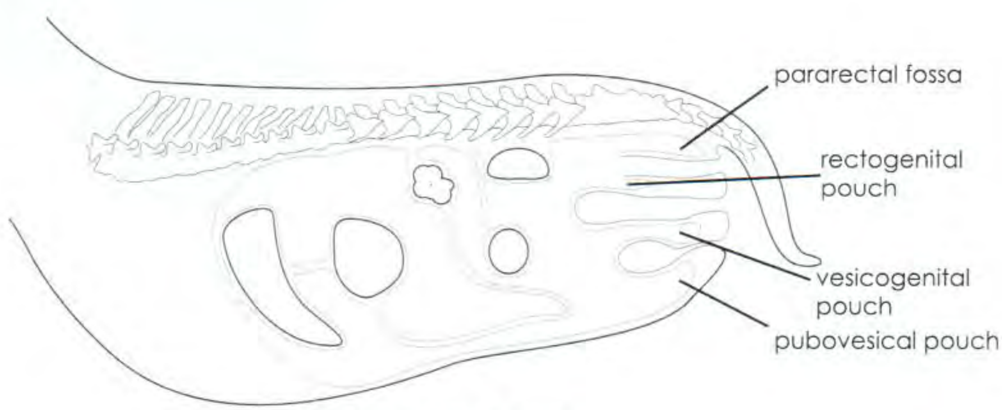
Small intestines, pancreas & liver
- duodenum
  - cranial duodenum
  - cranial duodenal flexure
  - descending portion
  - transverse portion (caudal flexure)
  - ascending portion
- jejunum
- ileum

Pancreas
- right & left lobes

Spleen
- gastrosplenic ligament

Liver
- gall bladder
- hilus
- hepatic ducts
- cystic duct
- bile duct
- portal v.
- caudal vena cava

Colon, rectum and anal region
- cecum
- ascending colon
- rt. colic flexure
- transverse colon
- lft. colic flexure
- descending colon
- rectum



Canine peritoneum (left lateral view)

Kidney & Urinary tract

Kidneys - Right + Left
- cortex
- medula
- renal pyramid

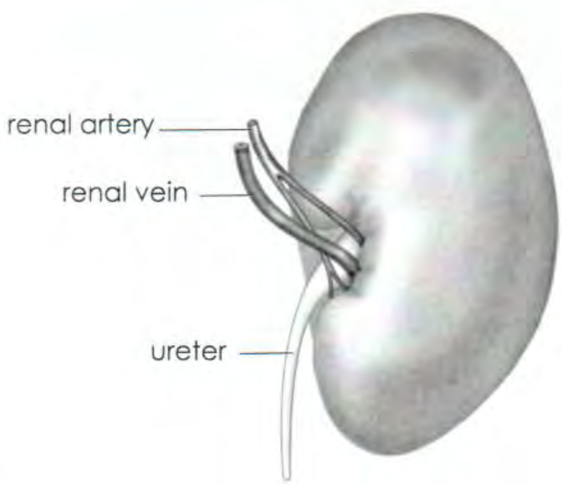
Adrenal glands

Urinary tract
- ureters
- urinary bladder
- urethra
- ~~adrenal glands~~

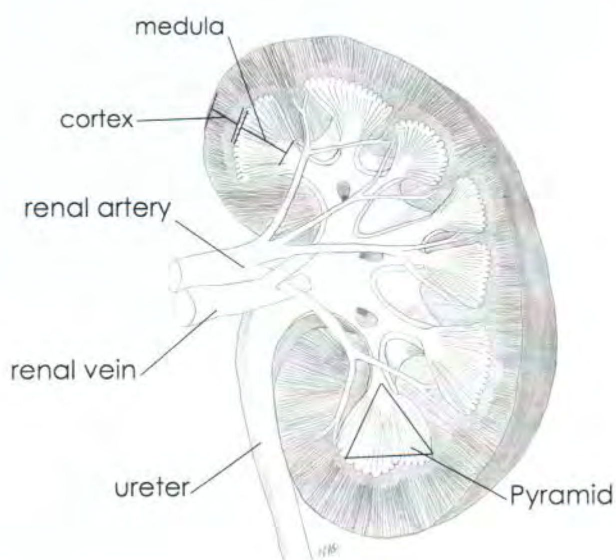
Abdominal and pelvic vasculature

Abdominal aorta
- phrenicoabdominal aa.
- celiac a.
  - left gastric a.
  - hepatic a.
  - splenic a.
- cranial mesenteric a.
  - middle colic a.
  - ileocolic a.
  - pancreaticoduodenal a.
  - jejunal a.
- renal aa.
- testicular/ovarian aa.
- caudal mesenteric a.
- lumbar aa.
- deep circumflex iliac aa.
- external iliac aa.
- internal iliac aa.
- median sacral a.

Portal v.
- splenic v.
- cranial mesenteric v.



Canine kidney



Canine kidney cross section

Identify the following structures on the hanging horse and/or fresh equine digestive tracts

Stomach
- fundus (saccus cecus)
- non-glandular region
- margo plicatus
- glandular region

Small intestine

Cecum

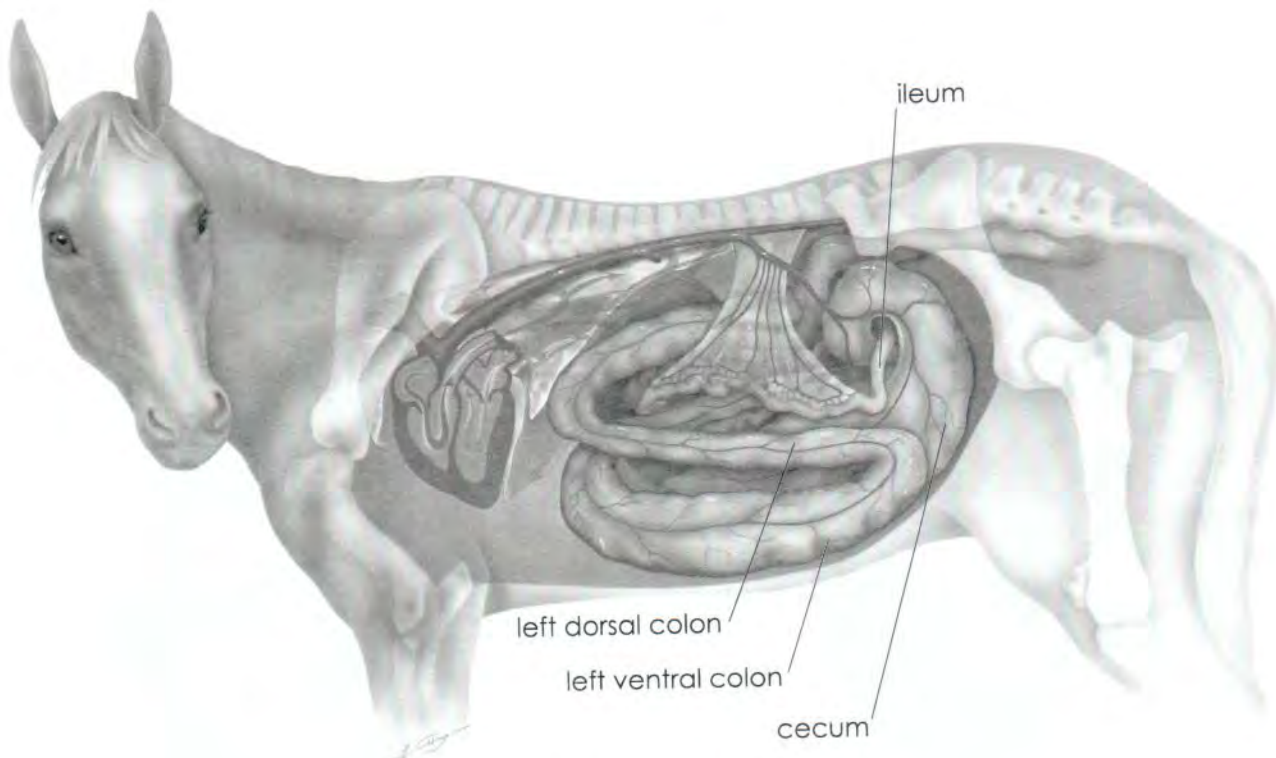
Nephrosplenic ligament

Ascending colon (great colon)
- bands (teniae coli)
- sacculations
- right ventral colon
- sternal flexure
- left ventral colon
- pelvic flexure
- left dorsal colon
- diaphragmatic flexure
- right dorsal colon

Transverse colon

Descending colon (small colon)

Rectum



Equine intestinal tract

Bands (Teniae) of the equine intestinal tract

Cecum	4
Right venteral colon	4
Sternal flexure	4
Left ventral colon	4
Pelvic flexure	1
Left dorsal colon	1
Diaphramatic flexure	3
Right dorsal colon	3
Transverse colon	2
Descending colon	2
Rectum	2

Identify the following structures on the hanging ox or fresh bovine digestive tracts, or special preps.

Rumen
- dorsal sac
  - caudodorsal blind sac
- ventral sac
  - caudoventral blind sac
- left longitudinal groove (pillar internally)
- right longitudinal groove (pillar internally)
- cranial groove (pillar internally)
- cranial sac (atrium)
- rt. & lft. dorsal coronary grooves (pillars internally)
- rt.& lft. ventral coronary grooves (pillars internally)

Reticulum (honeycomb)
- reticular groove

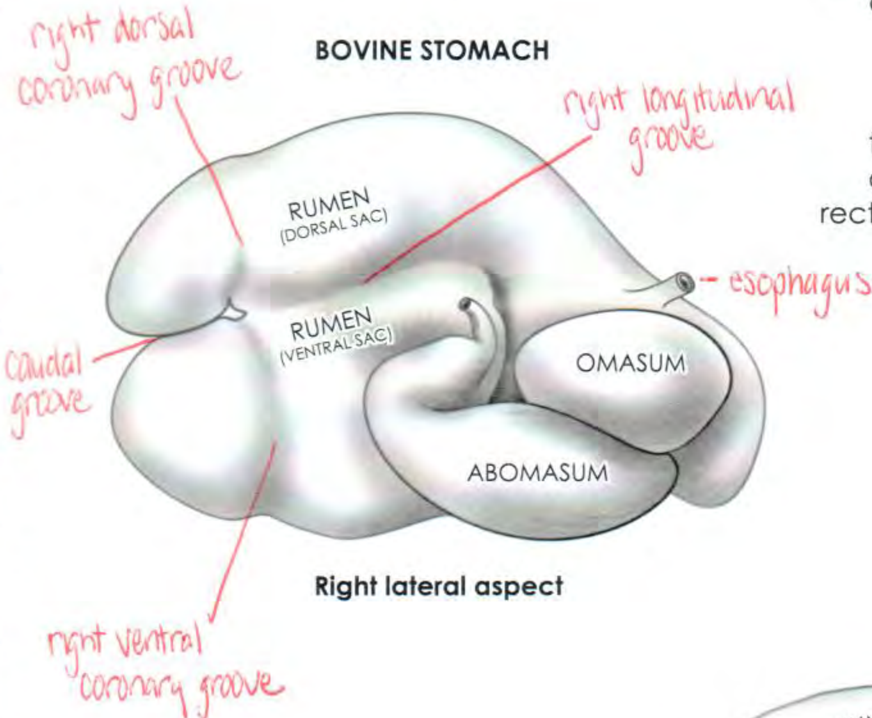
Omasum
- laminae

Abomasum
- torus pyloricus

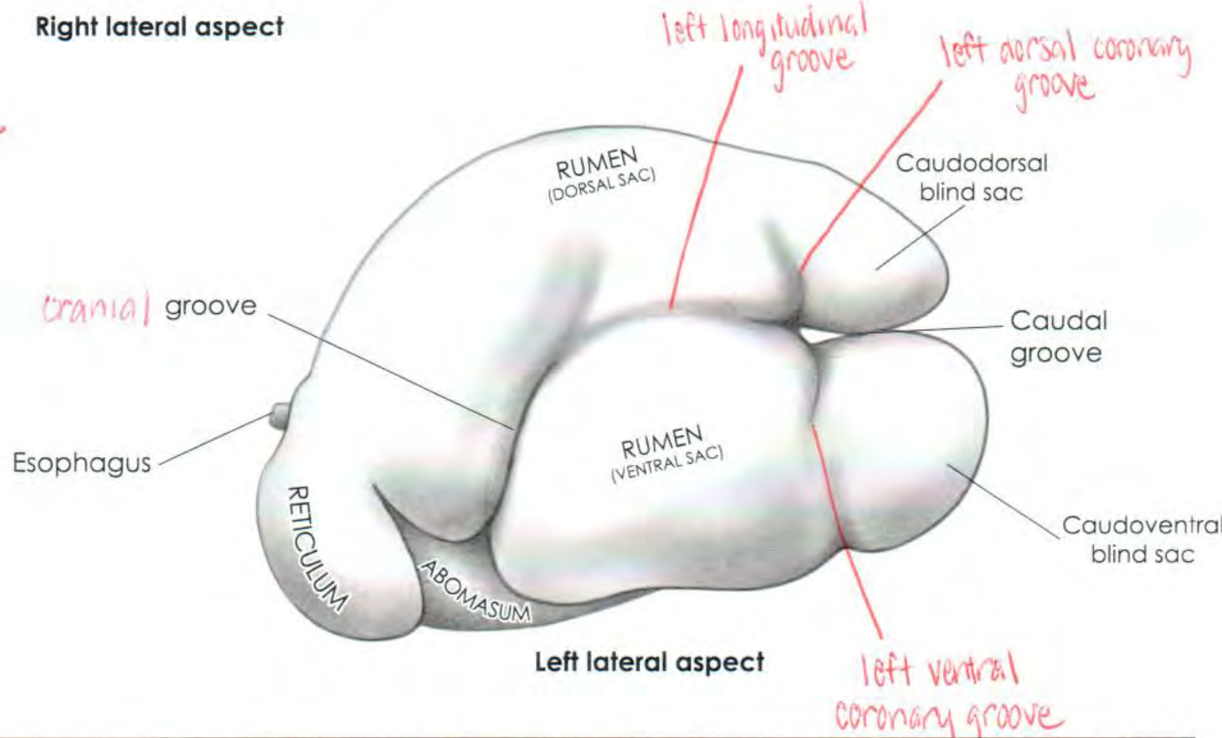
Small intestine

Large Intestine
- cecum
- colon
  - ascending colon
    - proximal loop
    - spiral loop
    - distal loop
  - transverse colon
  - descending colon
- rectum

BOVINE STOMACH



Right lateral aspect



Left lateral aspect

Exercise 10, Pelvic Cavity, & Viscera

Identify the following structures on the canine cadaver

Male
- penis
- prepuce
  - fornix
- scrotum
- testis
- pampiniform plexus
- epididymis
  - head
  - body
  - tail
- ductus deferens
- spermatic cord
- prostate gland
- testicular aa.
- urethra

Female
- ovary
- suspensory ligament of the ovary
- uterus
  - horns
  - body
- cervix
- vagina
  - vestibule
- vulva
- ovarian aa.
- uterine aa.
- vaginal aa.
- broad ligament

Identify the following structures on fresh equine reproductive tracts.

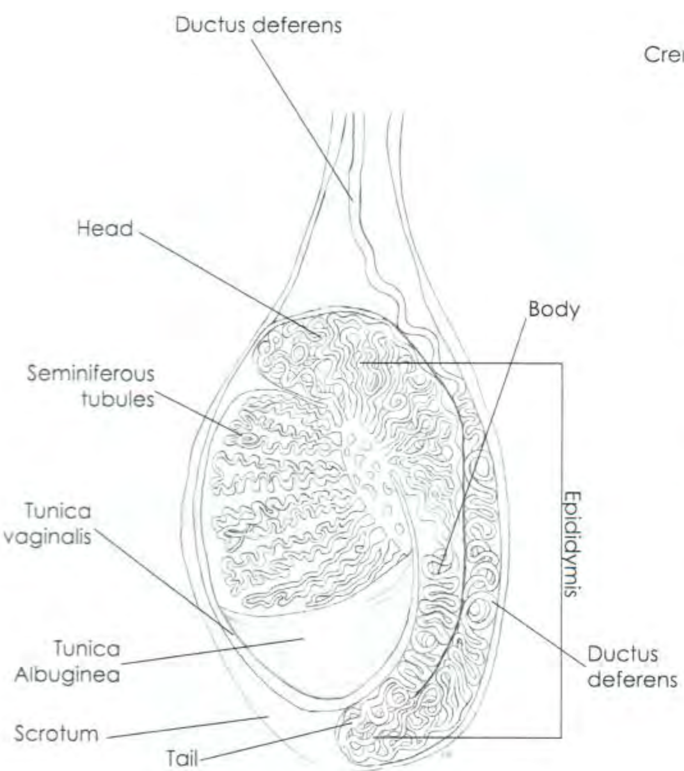
Stallion
- penis
  - urethral sinus
  - urethral process
- vesicular glands
- bulbourethral glands

Mare
- ovary
  - ovulation fossa
- uterus (note large body)

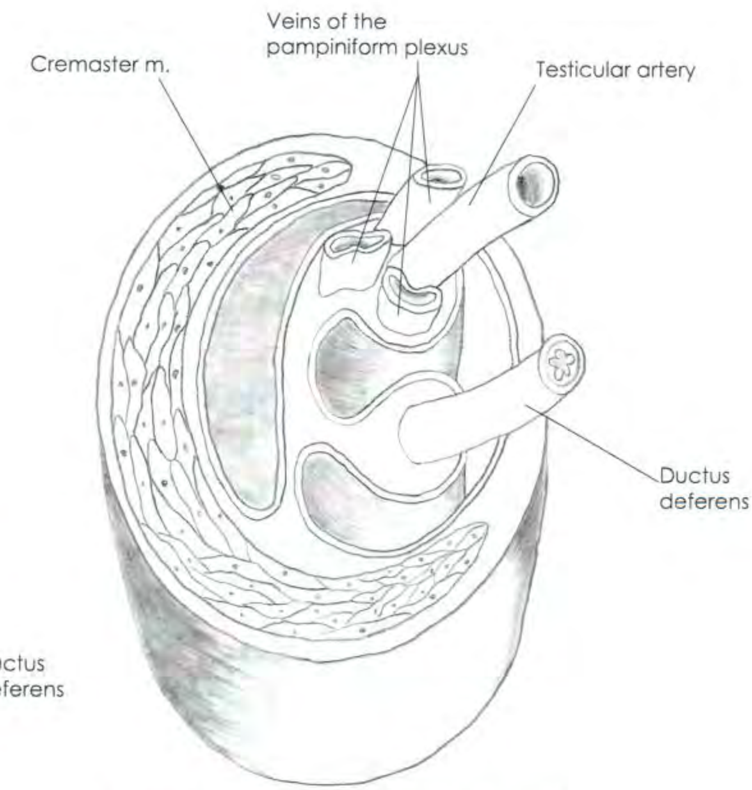
Identify the following structures on fresh bovine reproductive tracts

Bull
- fibroelastic penis
  - sigmoid flexure
  - urethral process
- vesicular glands
- bulbourethral glands

Cow
- ovary (note presence of follicles or corpora lutea if any)
- uterus (short body, long horns)
  - caruncles
  - Intercornual ligaments
- suburethral diverticulum



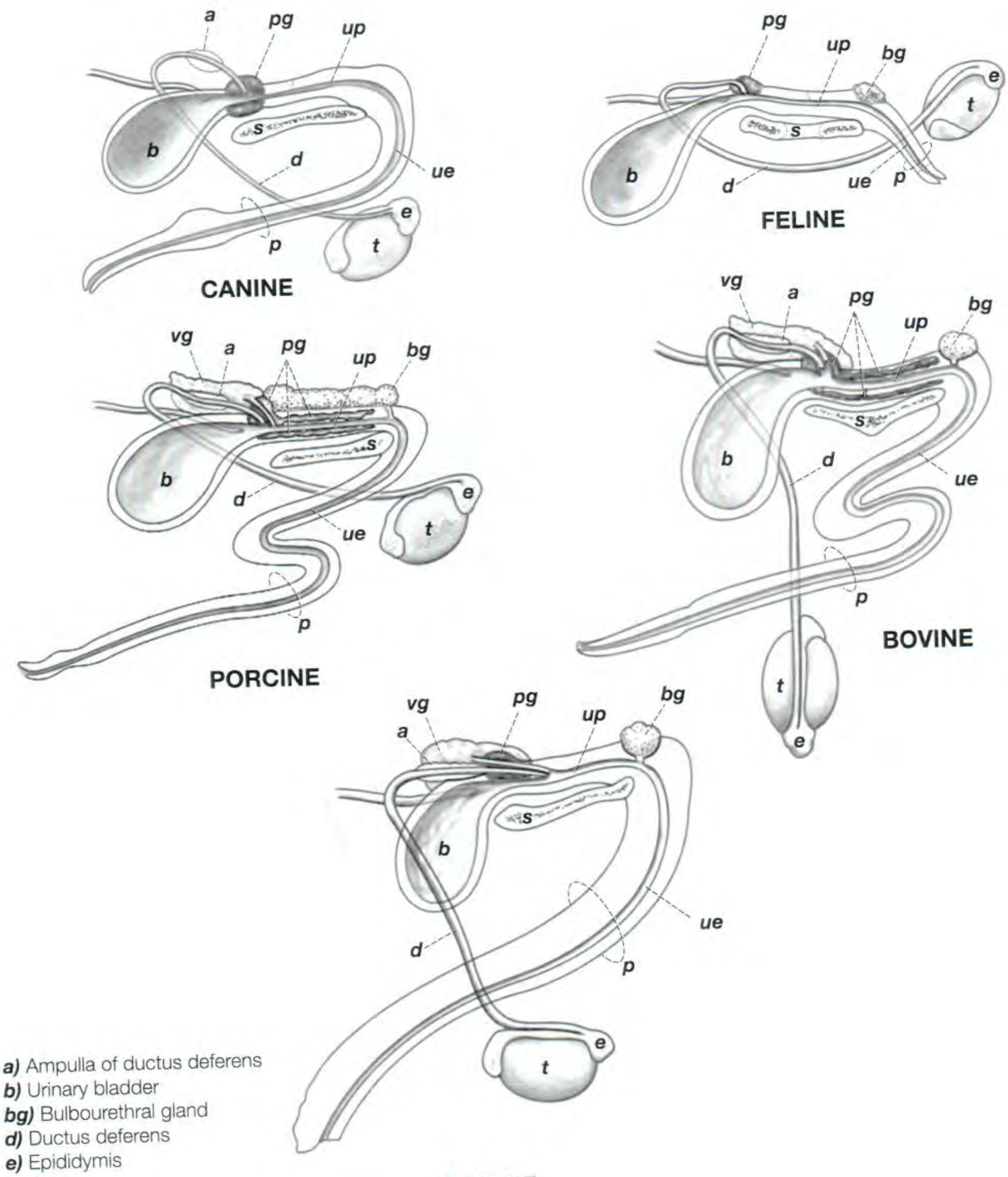
Sagittal section of testis



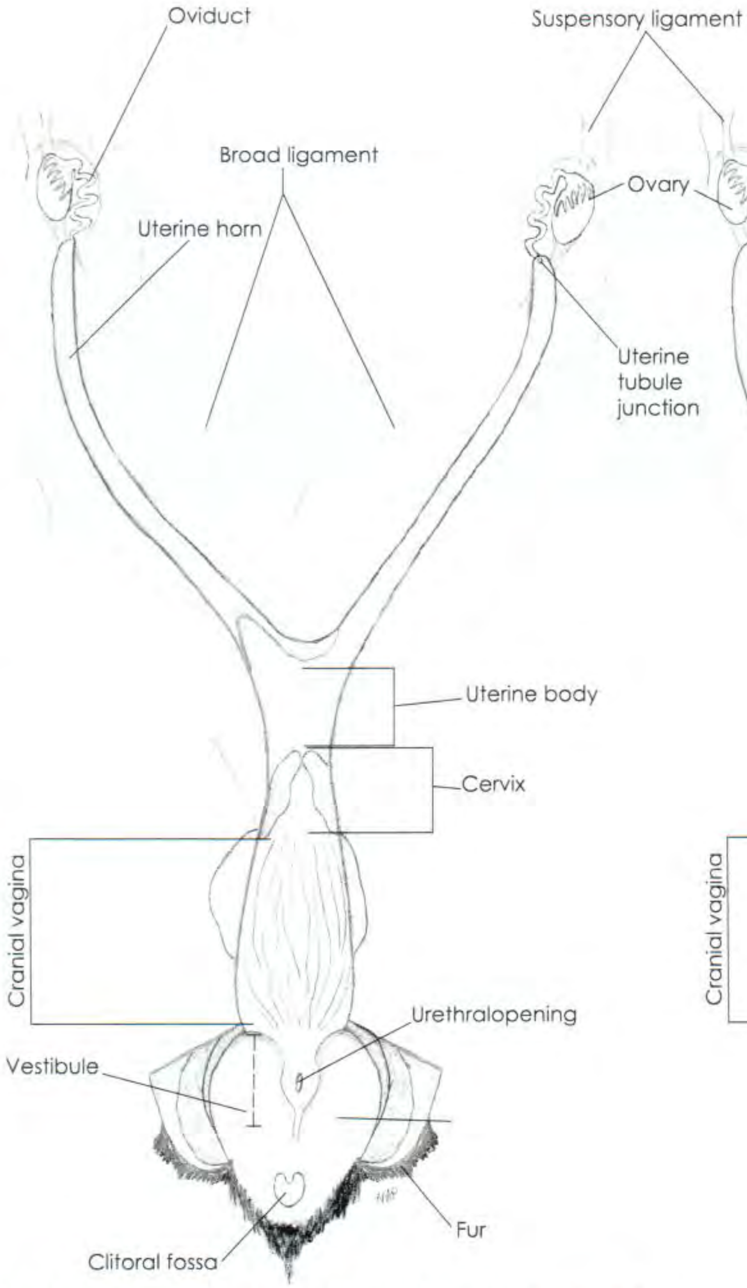
Cross Sectional Spermatic cord

For your own information only

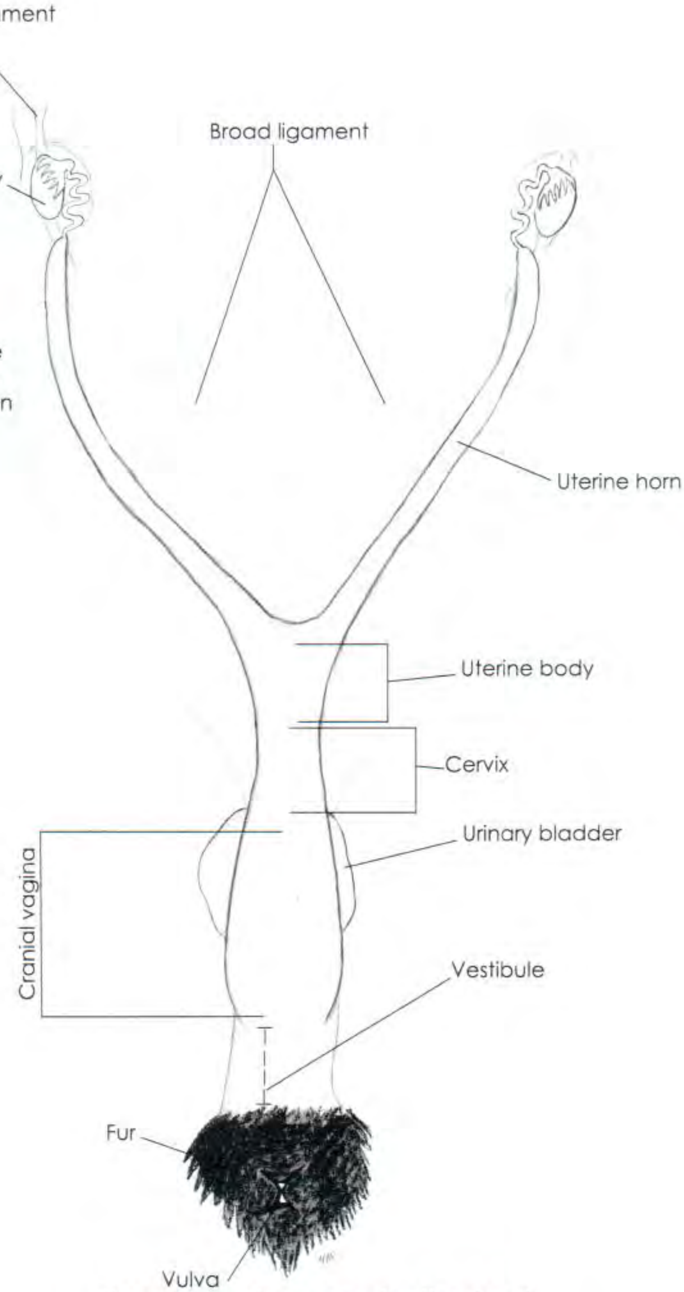
Schematic diagrams of male genital organs of domestic mammals showing characteristic structural differences between five domestic species. *Redrawn and modified after Schummer, Nickel & Sack: The Viscera of Domestic Mammals*



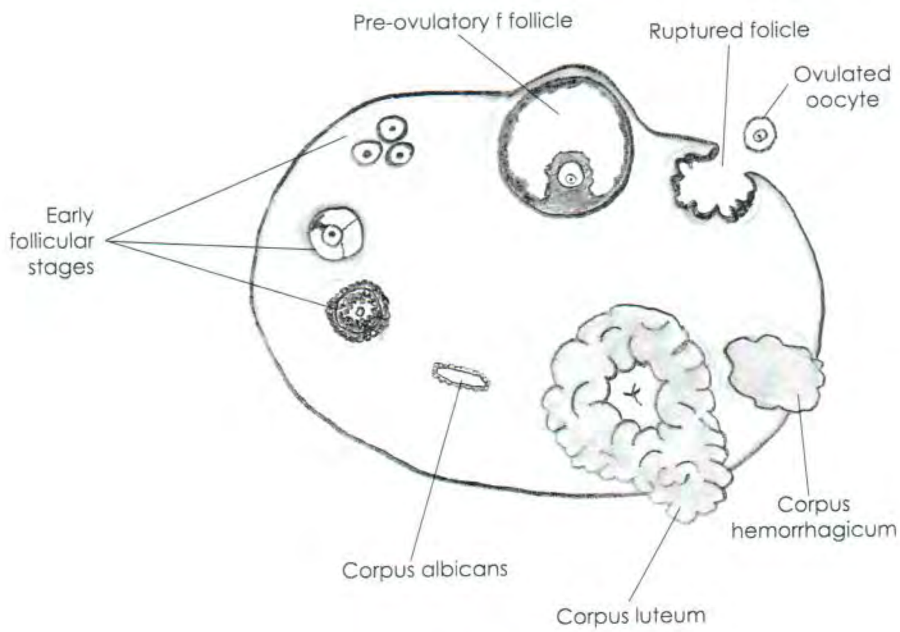
a) Ampulla of ductus deferens
b) Urinary bladder
bg) Bulbourethral gland
d) Ductus deferens
e) Epididymis
p) Penis
pg) Prostate gland;
t) Testis
ue) Extrapelvic urethra
up) Pelvic urethra, note different openings for ductus deferens and vesicular gland
vg) Vesicular gland.



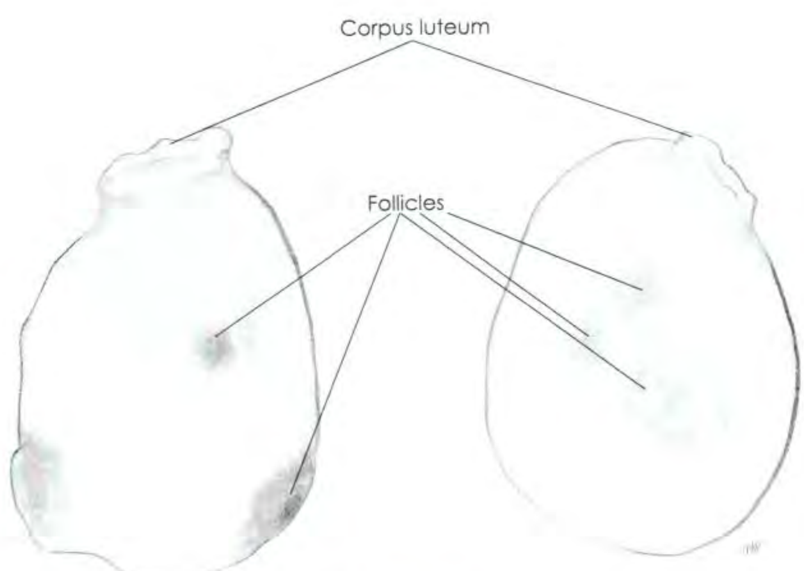
Female canine excised reproductive tract opened (dorsal view)



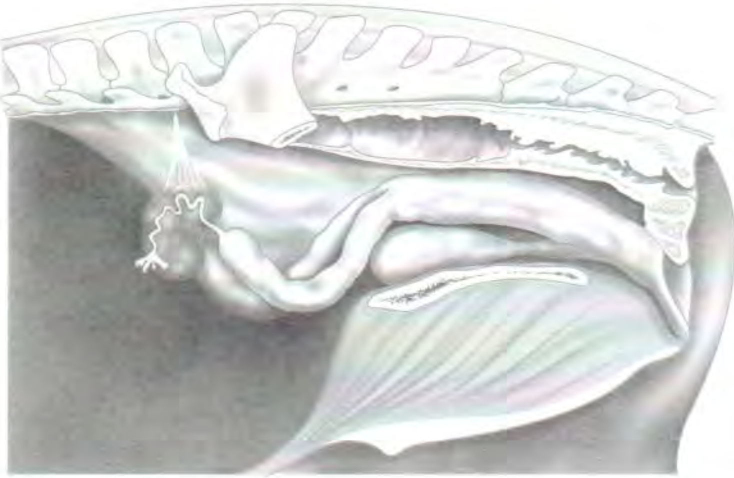
Female canine reproductive tract (dorsal view)



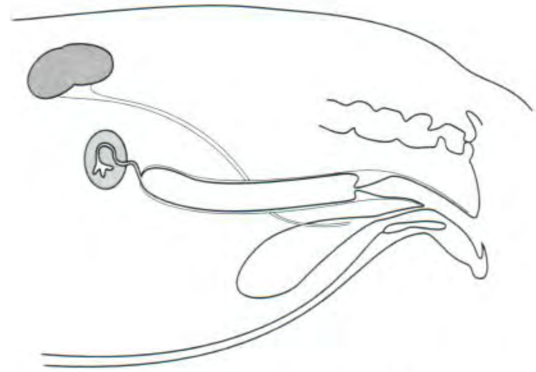
Follicular development



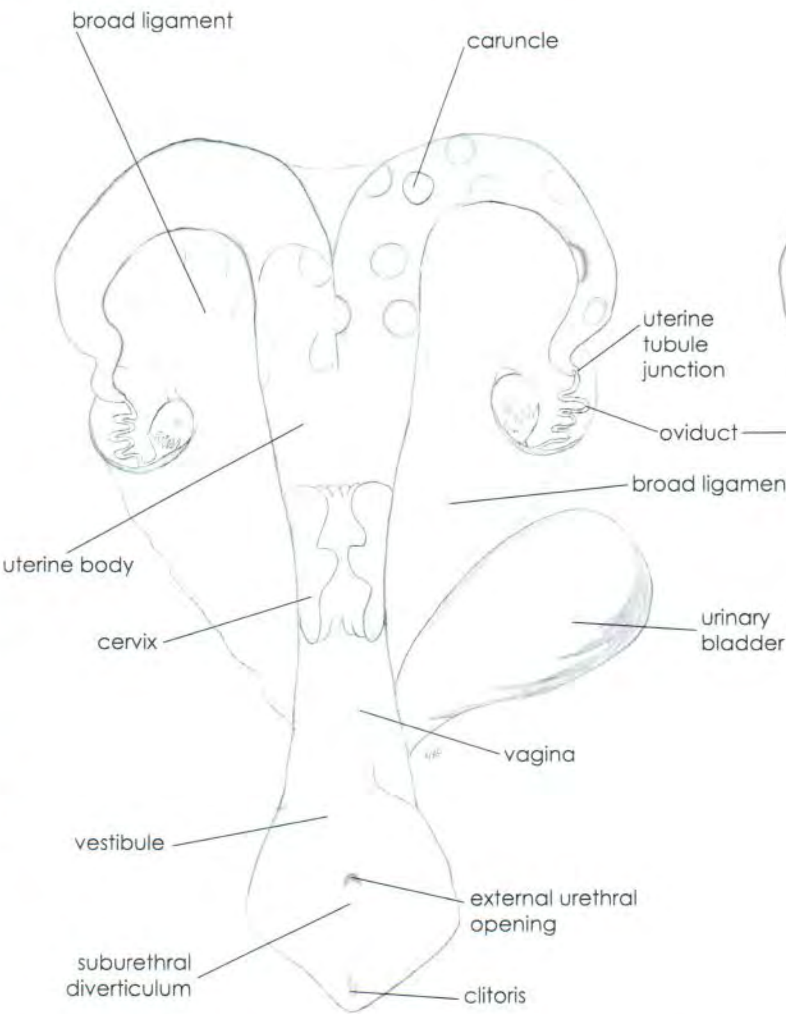
Ovaries



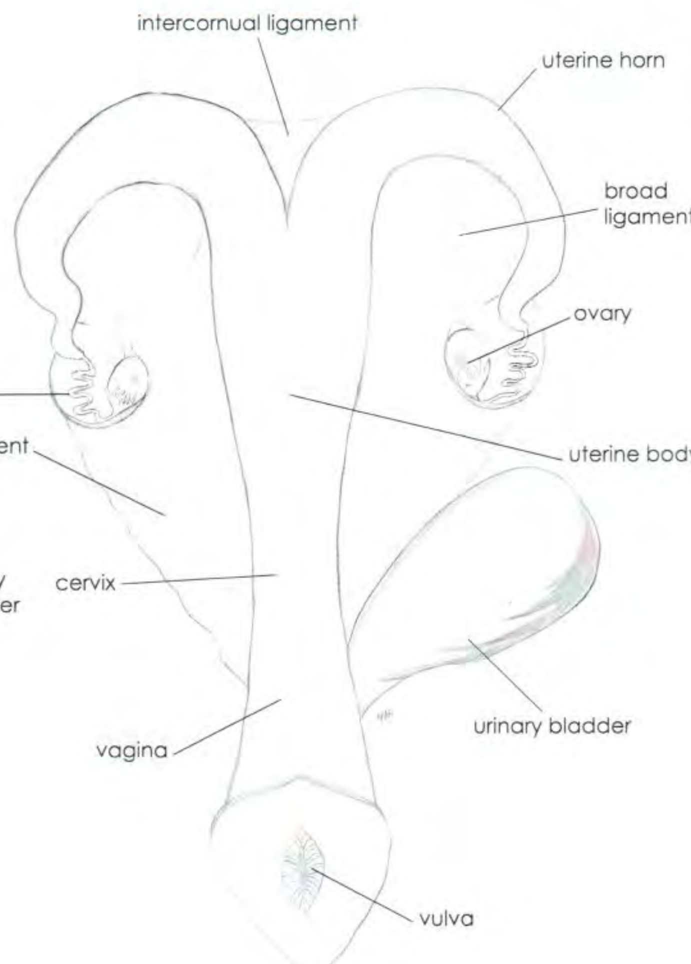
Female equine reproductive tract



Female reproductive tract



Female bovine excised reproductive tract opened (dorsal view)



Female bovine reproductive tract (dorsal view)

Exercise 11, Bones of the Skull

Identify the following bones and bony features of the canine skull

Nasal
- conchae

Vomer
- ~~alar canal~~
  - ~~rostral alar foramen~~
  - ~~caudal alar foramen~~
- ~~oval foramen~~

Incisive
- palatine fissure

Frontal
- zygomatic process
- frontal sinus

Maxilla
- infraorbital foramen & canal
- zygomatic process
- maxillary recess
- dental alveoli

Zygomatic bone

Palatine

Lacrimal

Ethmoid
- cribriform plate

Pterygoid

Sphenoid bone
- sella turcica
- optic canal
- orbital fissure
- round foramen
- alar canal
  - rostral alar foramen
  - caudal alar foramen
- oval foramen

Temporal
- tympanic bulla
- stylomastoid foramen
- external acoustic meatus
- zygomatic process
- mandibular fossa
- internal acoustic meatus

Parietal

Occipital
- foramen magnum
- occipital condyle
- ~~paracondylar process~~
- hypoglossal canal
- tympano-occipital fissure
- jugular process

Mandible
- ramus
  - coronoid process
  - condylar process
  - mandibular foramen & canal
  - masseteric fossa
  - angular process
- body
  - dental alveoli
  - mental foramina

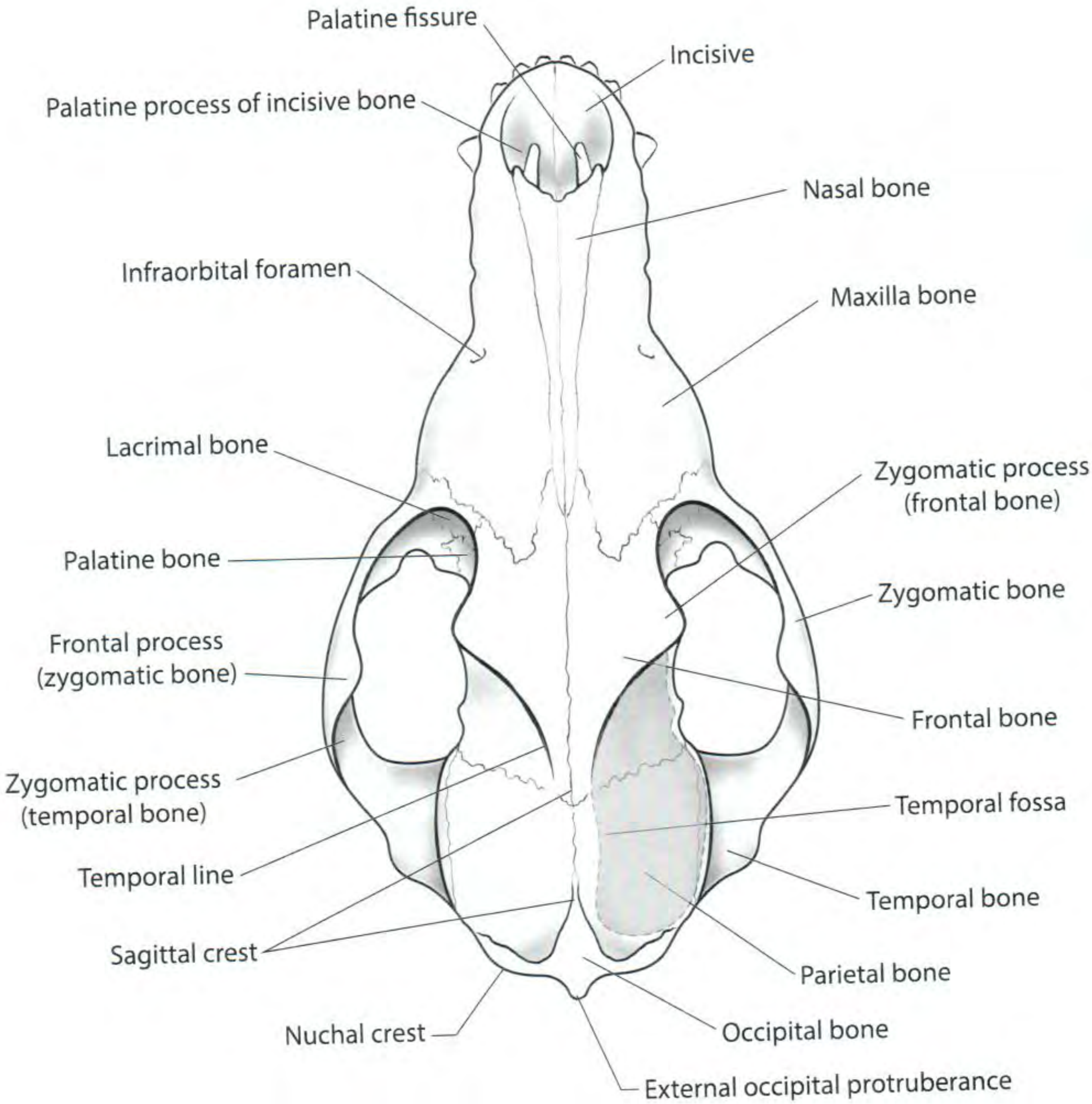
Hyoid apparatus

Articulations of the skull

- sutures of skull
- temporomandibular joint
- mandibular symphysis

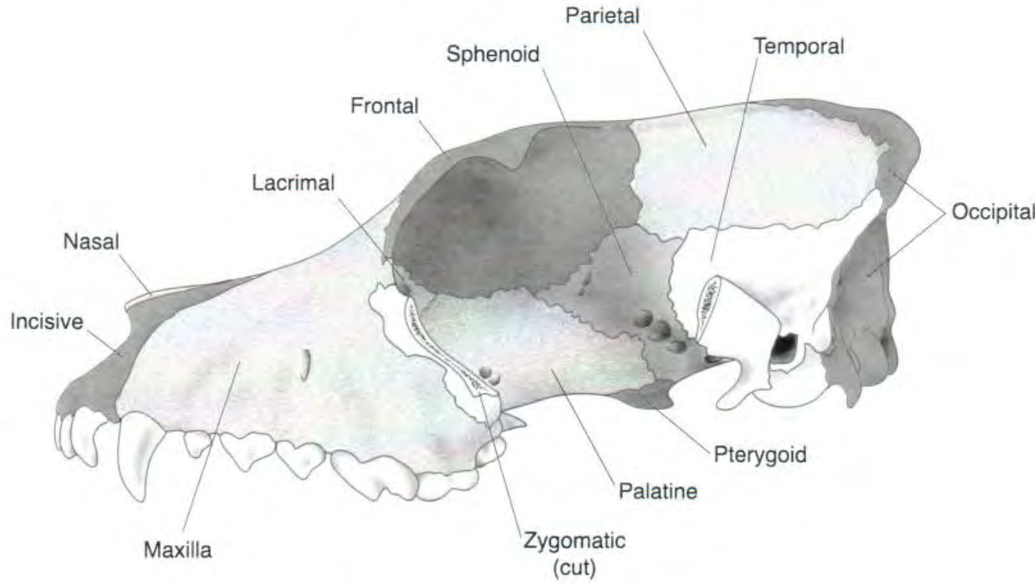
Canine Skull

Dorsal View

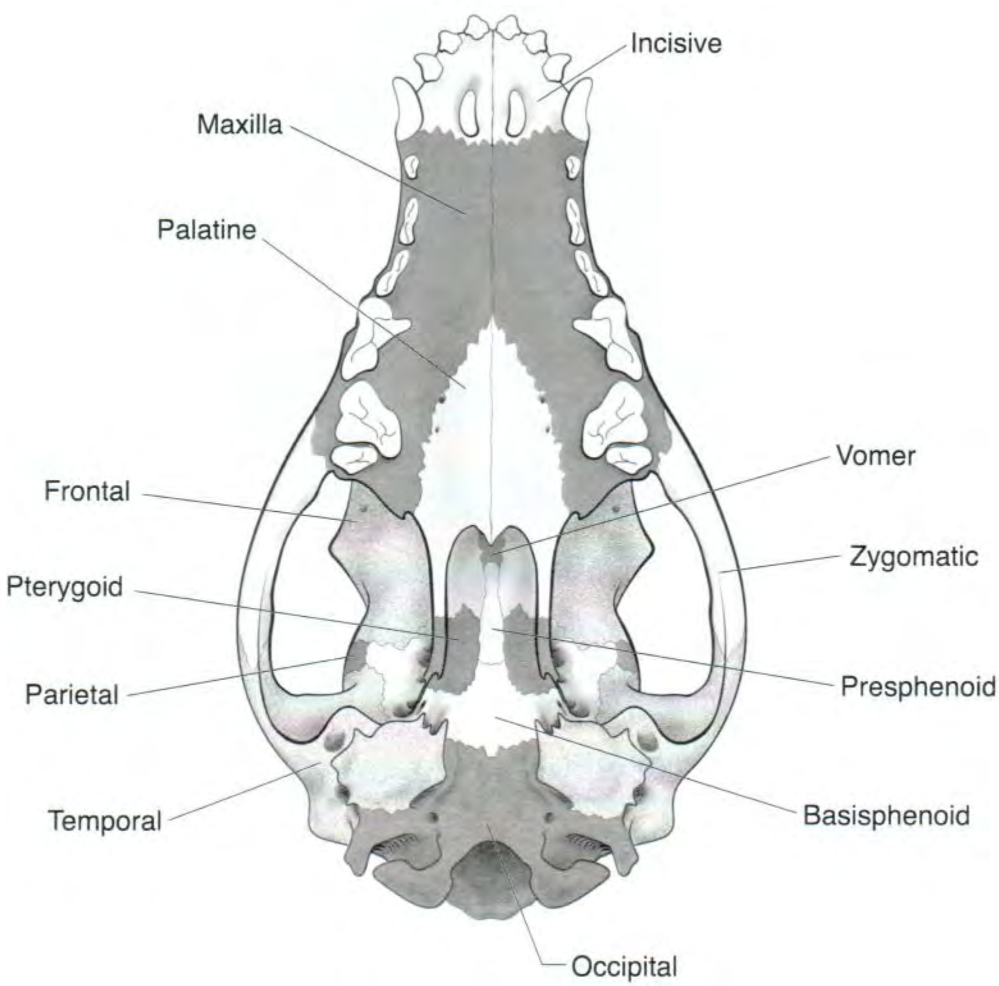


Canine Skull

Lateral View

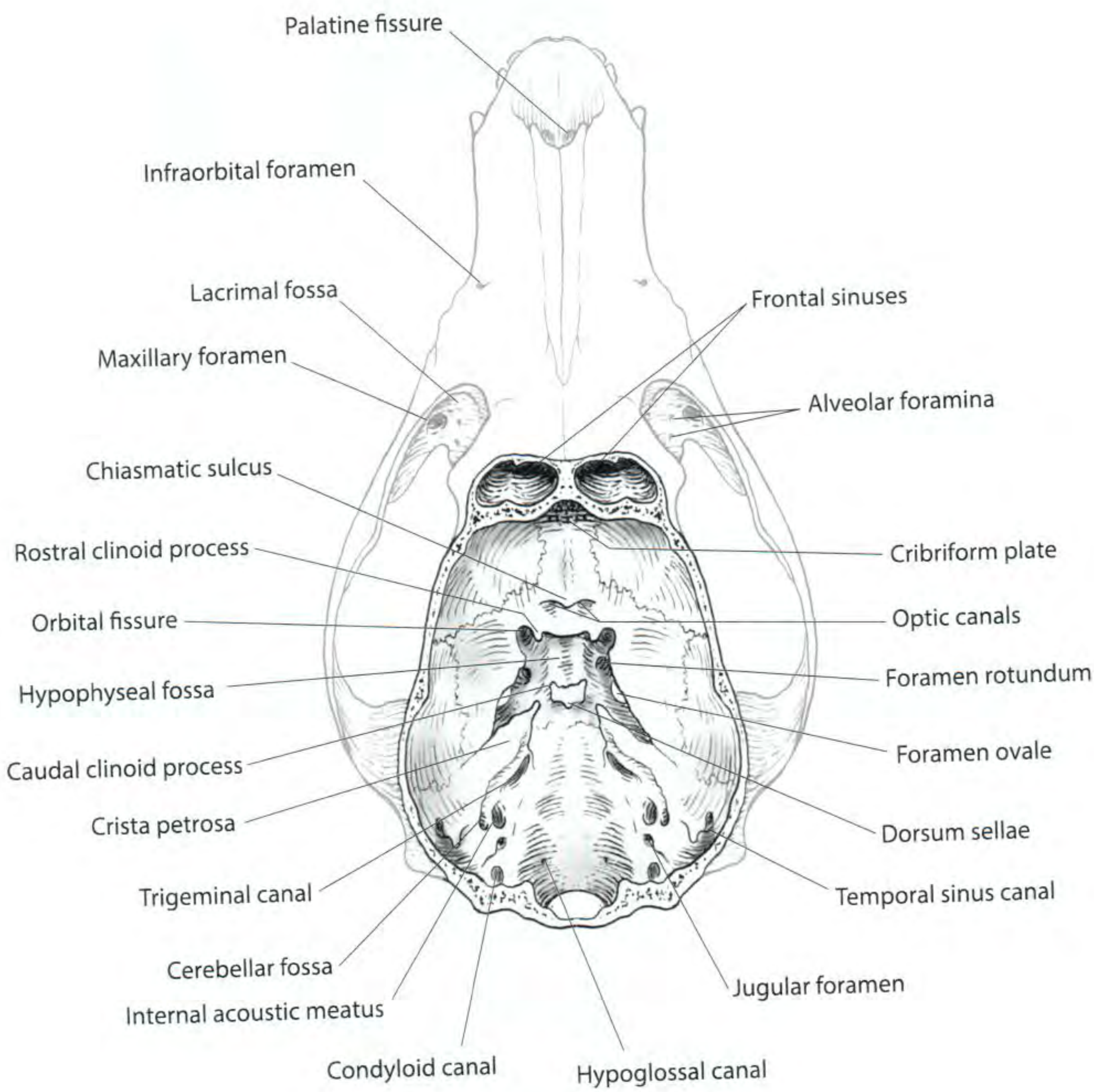


Canine Skull
Ventral View



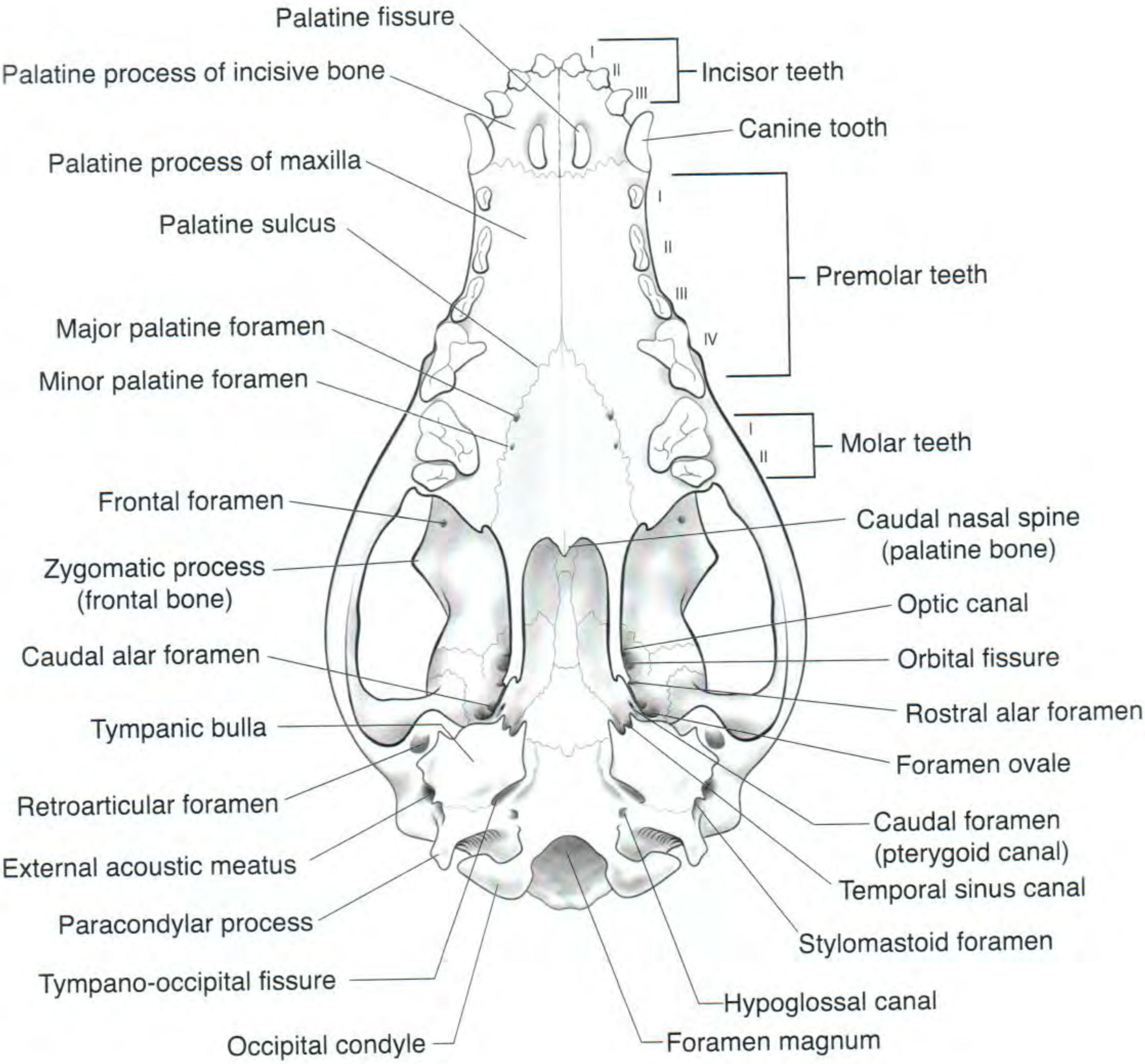
Canine Skull Foramina

Dorsal View
(calvaria removed)



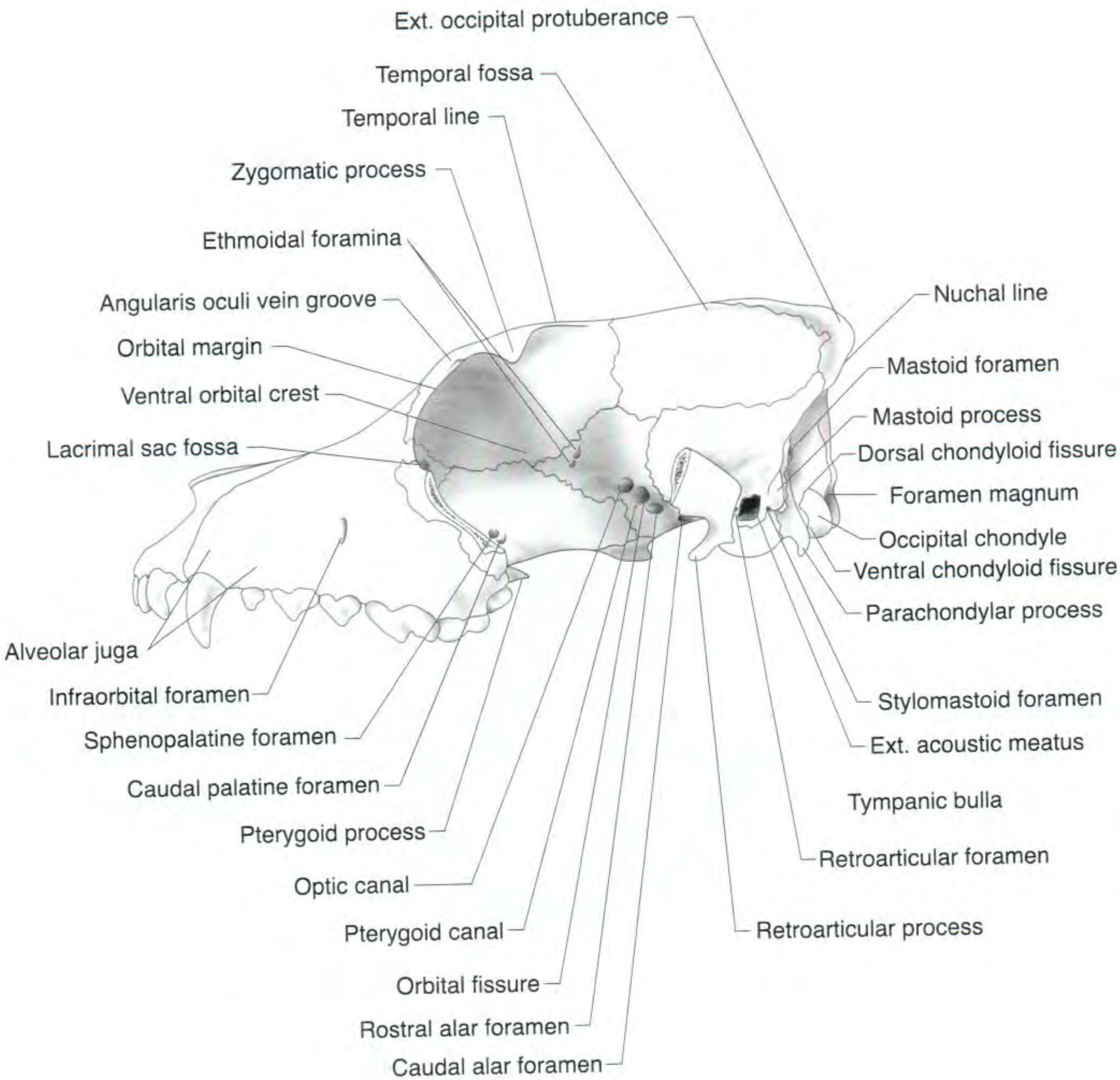
Canine Skull Foramina

Ventral View



Canine Skull Foramina

Lateral View



Features of the skull

- calvaria
- choanae
- conchae
- cranial cavity
- hard palate
    - palatine, maxillary & incisive bones
- nasal cavity
- nuchal crest
- orbit
- temporal fossa
- sagittal crest
- zygomatic arch
    - 2 processes
        - temporal bone
        - maxillary bone
    - zygomatic bone

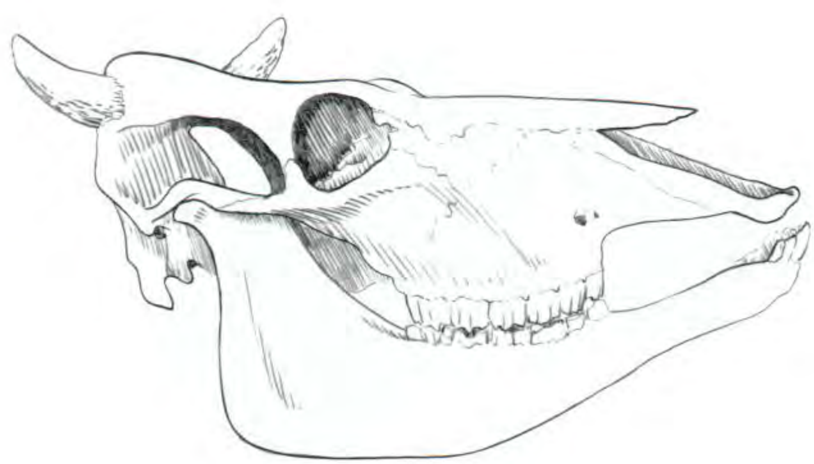
Conchae

Comparative aspects of Equine and Bovine skull anatomy:

Identify the same general bones and features of the large animal skulls to that of the dog (not foramina).

Note the following variations of skull anatomy when comparing large animals to the dog:

- Large **foramen lacerum** of each side of the ventral surface of the equine skull.
    Composed of the jugular foramen, carotid canal, oval foramen.
- The **foramen orbitorotundum** (Ox): composed of the orbital fissure and round foramen.
- The **facial crest** in the horse and **facial tuberosity** (Ox)
- The **cornual process** of the frontal bone in the horned ruminants
- **Cornual diverticulum** (Ox)
- Prominent **lacrimal bulla** of maxillary sinus (Ox)
- **Maxillary sinus** (Ox)
- **Frontal sinus** (Ox)
    - **Caudal frontal sinus** (Ox)
    - **Rostral frontal sinus** (Ox)
- **Sphenoid sinus** (Ox)
- **Palatine sinus** (Ox)
- **Maxillary sinus** horse
- **Sphenopalatine sinus** (horse)
- **Conchofrontal sinus** (horse)



Note:

Sphenoid & palatine sinuses in the ox and the sphenopalatine sinus in equine is difficult to visualize.

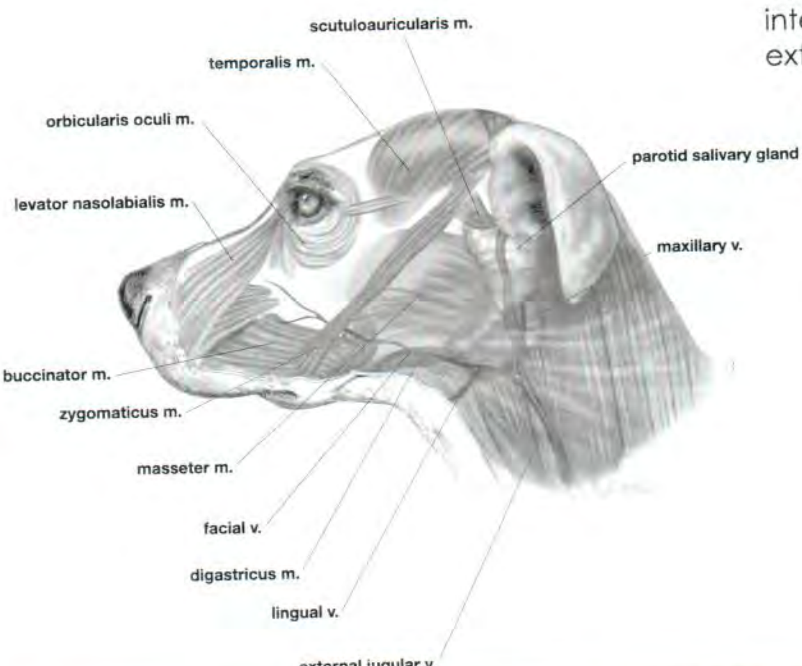
Exercise 12, Superficial, & Deep Structures of the Head

Identify the following structures of the canine head

Muscles of facial expression
- auricular muscles*
  - rostral
  - caudal
- orbicularis oris*
- buccinator*
- levator nasolabialis*
- zygomaticus*
- orbicularis oculi*
- frontalis*
- platysma*

Muscles of mastication
- masseter*
- temporalis*
- digastricus*
- pterygoids
  - medial
  - lateral

Salivary glands and lymph nodes
- parotid salivary gland*
  - parotid duct
- mandibular salivary gland*
- zygomatic salivary gland
- mandibular lymphocenter*
- retropharyngeal lymphocenter*



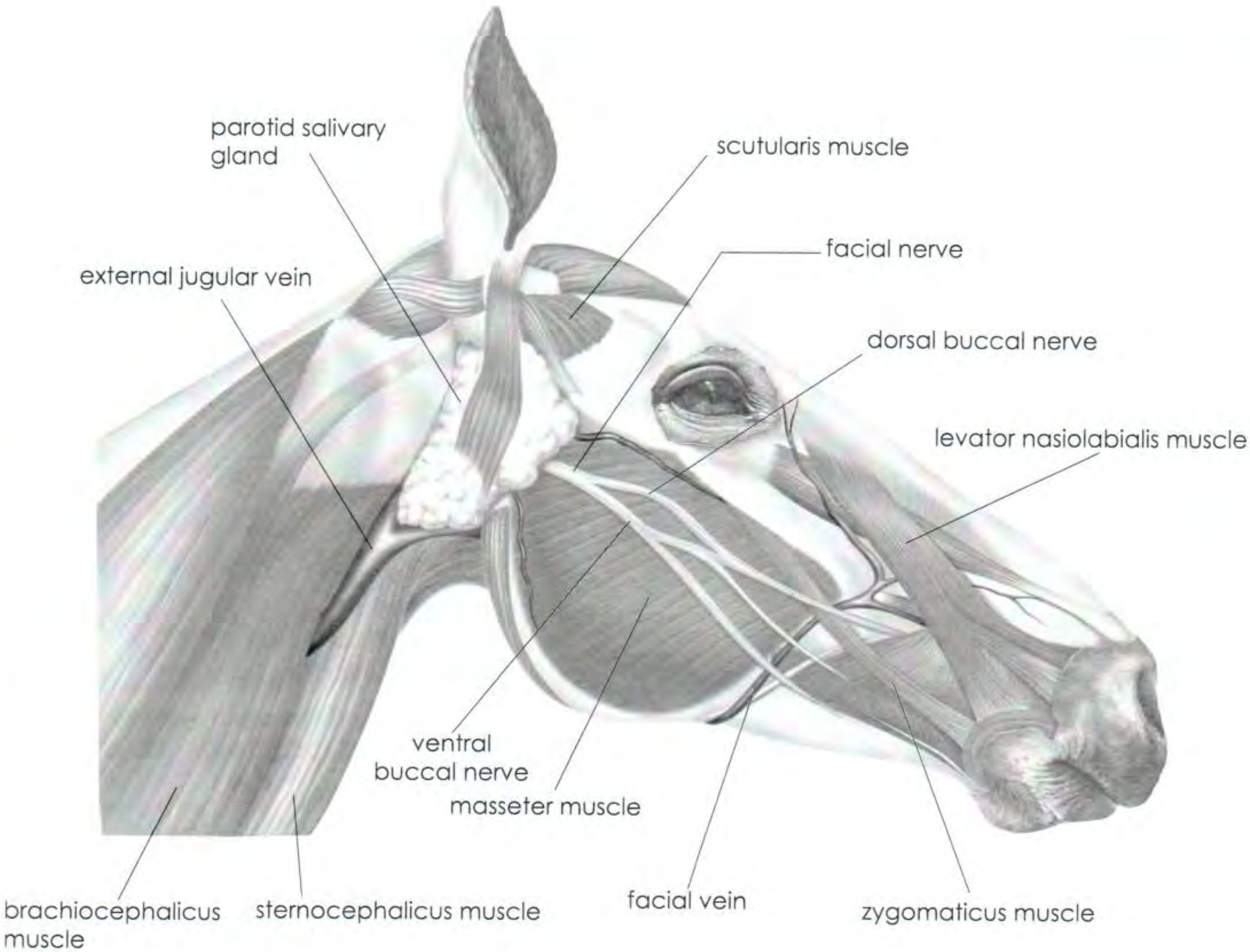
Veins
- external jugular v.*
  - maxillary v.
  - linguofacial v.*
    - facial v.
      - angularis oculi v.
    - lingual v.

Nerves
- facial nerve
  - chorda tympani nerve
  - ventral buccal nerve*
  - dorsal buccal nerve*
  - auriculopalpebral nerve*
    - palpebral
    - auricular
      - (rostral and caudal
- trigeminal nerve
  - buccal nerve
  - infraorbital n.*
  - mental n.*
  - lingual n.
  - inferior alveolar n.
  - mylohyoid n.
  - supraorbital n. *
- accessory n.
- hypoglossal n.

Arteries
- common carotid a.*
- internal carotid a.*
- external carotid a.
  - lingual a.
  - facial a.
  - maxillary a.

*If they have been tagged, identify these structures on the hanging horse and cow

Identify the following structures on the Equine head



Clinical Landmarks

Guttural pouch: a large, air-filled area that develops as a diverticulum of the auditory tube in the horse. Several important large vessels and nerves run over its surface and are vulnerable to pathology of the pouch. The pouch is divided into medial and lateral compartments by the stylohyoid bone.

Viborg's triangle: an area bounded rostrally by the vertical border of the mandibular ramus, dorsally by the tendinous insertion of the sternocephalicus muscle and ventrally by the linguofacial vein.

Jugular furrow: the groove on each side of the neck in which the jugular vein can be located. Lies dorsal to the brachiocephalicus m., deep to the omohyoideus m., and ventral to the sternocephalicus m. Be able to identify these muscles on the hanging horse.

Exercise 13, Brain

Identify the following structures of the canine brain

Brain overview
- cerebrum
  - hemispheres
  - longitudinal fissure
- cerebellum
- brainstem
  - pons
  - medulla
  - mesencephalon (midbrain)
  - diencephalon
- olfactory bulbs
- optic nerves
- optic chiasm
- pituitary gland

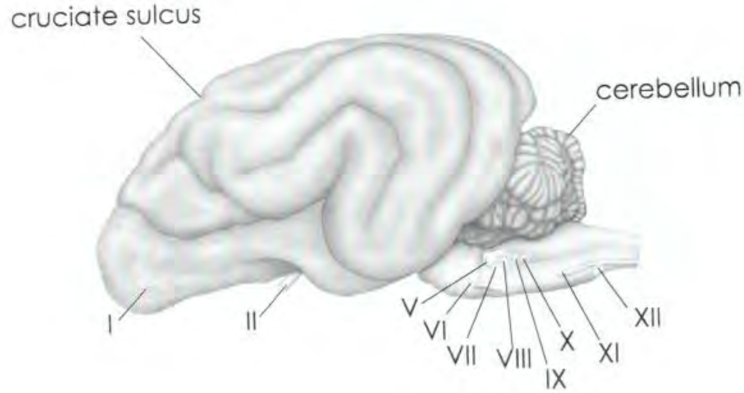
Ventricular system midsagittal
- corpus callosum
- lateral ventricles
- 3rd ventricle
- mesencephalic aqueduct
- 4th ventricle

Venous Sinuses
- dorsal sagittal sinus
- straight sinus
- cavernous sinus
- transverse sinus

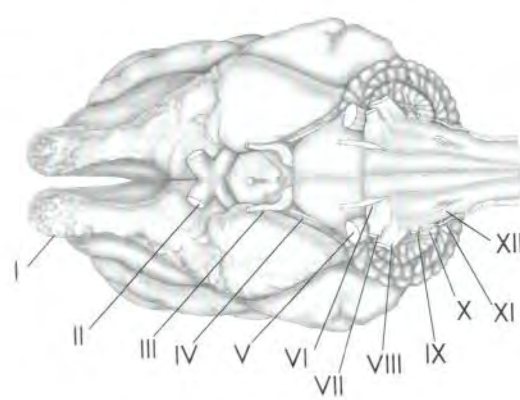
Meninges
- dura mater
  - falx cerebri
  - tentorium cerebelli
- arachnoid mater
- pia mater see with spinal cord

Arteries
- vertebral aa.
  - basilar a
- internal carotid aa.
  - middle cerebral aa.
  - rostral cerebral aa.
  - caudal communicating aa.
    - caudal cerebral aa.

Cranial vault
- trigeminal nn
- pituitary gland
- internal carotid aa.



(lateral)



(ventral)

CRANIAL NERVES

I. **Olfactory n.**	- sensory, smell (cribriform plate)
II. **Optic n.**	- sensory, sight (optic canal). Decussation at the optic chiasm
III. **Oculomotor n.**	- motor to mm. that move the eye - parasympathetic to pupil constriction (orbital fissure)
IV. **Trochlear n.**	- motor to m. that moves the eye (orbital fissure)
V. **Trigeminal n.**	- sensory to face, eye, and inside mouth and nose
Ophthalmic br.	- sensory to eye - cornea (orbital fissure)
Maxillary br.	- sensory to nose and upper maxilla (rostral alar foramen)
Mandibular br.	- sensory to nose and rostral 2/3 of tongue; - motor to mm. of mastication (oval foramen)
VI. **Abducent n.**	- motor to mm. that move the eye (orbital fissure)
VII. **Facial n**	- motor to mm. of facial expression (stylomastoid foramen) - sensory to pinna, taste to rostral 2/3 of tongue - parasympathetic to lacrimal and salivary glands
VIII. **Vestibulocochlear n.**	(internal acoustic meatus)
Vestibular	- sensory, equilibrium
Cochlear	- sensory, hearing
IX. **Glossopharyngeal n.**	- motor to swallowing mm. - sensory to pharynx - sensory, taste to caudal 1/3 of tongue - parasympathetic to salivary glands (tympano-occipital fissure)
X. **Vagus n.**	- motor to swallowing mm. and larynx - parasympathetic to thoracic and abdominal organs (tympano-occipital fissure) - taste to root of the tongue
XI. **Accessory n.**	- motor to neck mm. (tympano-occipital fissure)
XII. **Hypoglossal n.**	- motor to tongue mm. (hypoglossal canal)

Exercise 14, Neck, Oral, & Nasal Cavity, Pharynx, & Larynx

Identify the following structures on the canine/equine cadaver

Neck structures and muscles
- thyroid gland
- sternohyoideus m.
- sternothyroideus m.
- thyrohyoideus m.
- mylohyoideus m.
- digastricus m.
- geniohyoideus m.
- sternocephalicus m.
  - sternomastoideus m. (K-9)
  - sternooccipitalis m. (K-9)
- stylohyoideus m.

Equine neck
- jugular furrow
- sternocephalicus m.
- omohyodeus m.

Oral cavity
- oral cavity proper
- oral vestibule
- hard palate
  - palatine rugae
  - dental pad - ox
  - incisive papilla
- soft palate*

Tongue
- lingual torus - ox

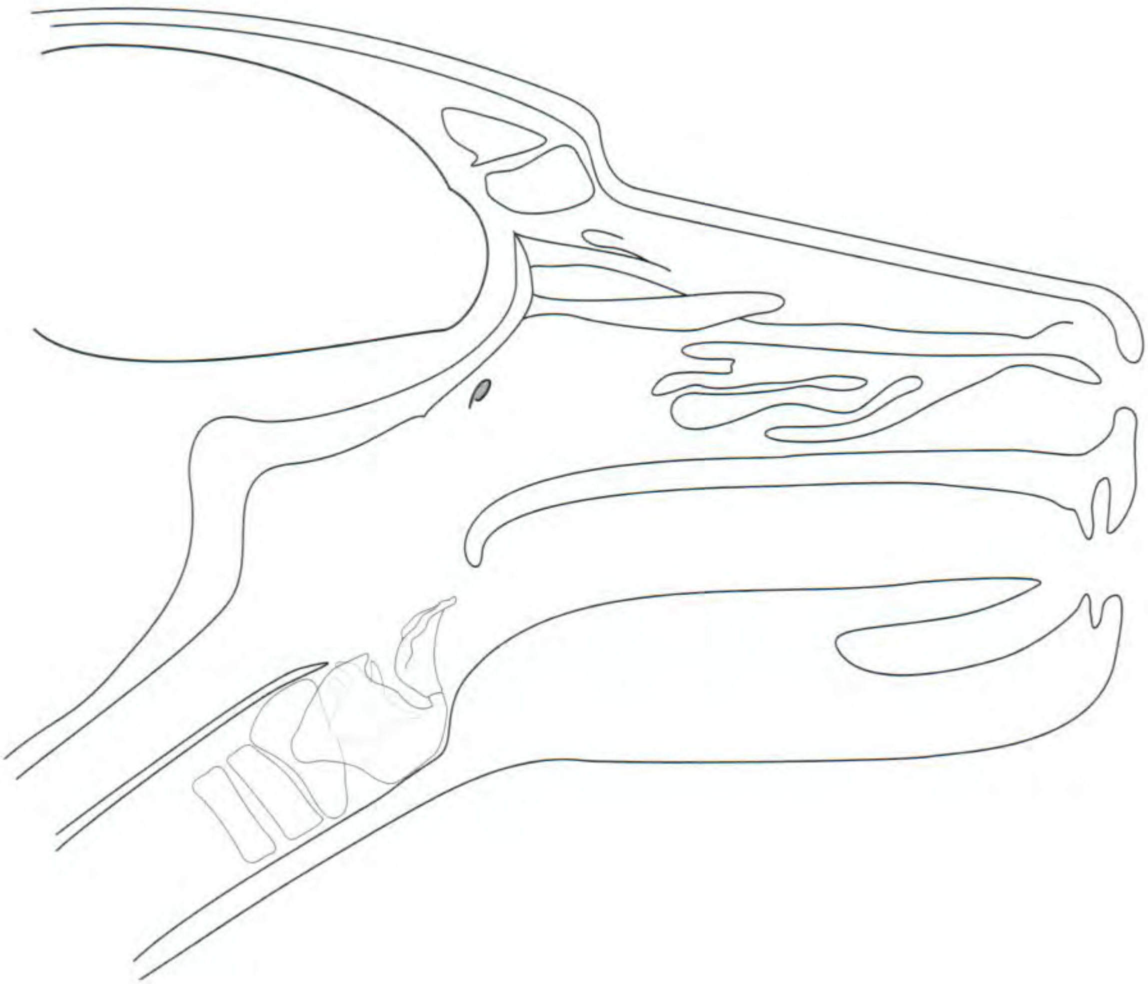
Nasal cavity
- Nasal conchae*
  - dorsal & ventral ethmoid conchae

Pharynx
- nasopharynx*
  - auditory tube opening*
- oropharynx*
  - palatine tonsil*
  - pharyngeal tonsil*
- laryngopharynx*
- gutteral pouch (EQ)**
  - medial compartment**
  - lateral compartment**
- palatine tonsils*
- pharyngeal mm (K-9)
  - constrictors
    - hyopharyngeus m.
    - thyropharyngeus m.
    - cricopharyngeus m.
  - dilators
    - stylopharyngeal m.

Larynx
- thyroid cartilage**
- cricoid cartilage**
  - dorsal lamina
- arytenoid cartilage**
  - vocal process
  - muscular process
- epiglottic cartilage**
- cricothyroid m.
- lateral cricoarytenoid m.
- dorsal cricoarytenoid m.
- laryngeal vestibule
- laryngeal ventricle
- infraglottic cavity
- cricothyroid ligament*
- vocal fold*
- cricotracheal membrane*
- vestibular fold*
- cranial laryngeal n.
  - external
  - internal
- recurrent laryngeal n.

* see on bisected specimens & VCA
** see on special preparations & VCA

Identify the features in the canine head



Mammalian Teeth & Dental Formulae

Dental anatomy
- carnassial teeth (K-9)
- wolf teeth (equine)
- teeth:
  - crown
  - neck
  - root**
  - enamel**
  - cementum (cement)**
  - dentin (dentine)**
  - pulp (dental) cavity**
- alveolus - skull*
- diastima BOV*

Heterodonty - different teeth specialized for different tasks
Diphyodonty - 1st set of teeth (deciduous teeth) replaced with a stronger set (permanent teeth)

Generic Formula: $\frac{\text{Upper jaw teeth (maxillary and incisive bones)}}{\text{Lower jaw teeth (mandibular bones)}}$

$$\frac{\textbf{I-C-P-M}}{\textbf{I-C-P-M}} \quad \frac{\textbf{I = incisors C = canines P = premolars M = molars}}{\textbf{I = incisors C = canines P = premolars M = molars}}$$

Individual teeth may be identified by upper/lower case letters (permanent teeth/deciduous teeth) and superscript and subscript numerals (upper teeth/lower teeth):

P^1 = 1st permanent upper premolar
i_2 = 2nd deciduous lower incisor

Mammalian family dental formulae:

Canine $\frac{3\text{-}1\text{-}4\text{-}2}{3\text{-}1\text{-}4\text{-}3}$

Feline $\frac{3\text{-}1\text{-}3\text{-}1}{3\text{-}1\text{-}2\text{-}1}$

Equine $\frac{3\text{-}1\text{-}3\text{-}3}{3\text{-}1\text{-}3\text{-}3}$

Bovine $\frac{0\text{-}0\text{-}3\text{-}3}{3\text{-}1\text{-}3\text{-}3}$

* see on bisected specimens & VCA
** see on special preparations & VCA

Equine Teeth Aging - For your own information

Getting Started:

1. Distinguish the lower arcade from the upper arcade (palatal ridges are on the upper).

2. Identify the set of teeth
   a. Only deciduous teeth (Go to A.)
   b. Mixed Set both deciduous & permanent teeth (Go to B.)
   c. Only permanent teeth (Go to C.)

A. Only Deciduous Teeth

a. Upper: di^1 = 1st (central incisor), di^2=intermediate, di^3 = corner
b. Lower: di_1 = 1st (central incisor), di_2=intermediate, di_3 = corner
c. Eruption dates:

di_1 = birth to 1 week	di_2 = 1 to 2 months	di_3 = 6 to 9 months
~6 days	**~6 weeks**	**~6 months** **~12 months (1 y) – half way in** **~18 months (1 ½ y) – touching** **~24 months (2 y) – worn level** **~54 months (4 ½ y) – replaced**

B. Mixed Set - both deciduous & permanent teeth

a. Permanent Upper: I^1= 1st (central incisor), I^2=intermediate, I^3 = corner, C^1= canine
b. Permanent Lower: I_1= 1st (central incisor), I_2=intermediate, I_3 = corner, C_1= canine
c. Eruption dates in years (uppers & lowers erupt about the same time):

I1	I2	I3	C1
2 ½ years	3 ½ years	4 ½ years	4-5 years

d. In wear/touching (lowers wear before uppers):

3 years	4 years	5 years	4 ½ - 5 ½ years

C. Only Permanent Teeth

a. Eruption dates are based on fact.
b. Once teeth have erupted, aging is dependent on diet.
c. Determining age on all permanent teeth from wear patterns is an art form and will not be covered in this course.

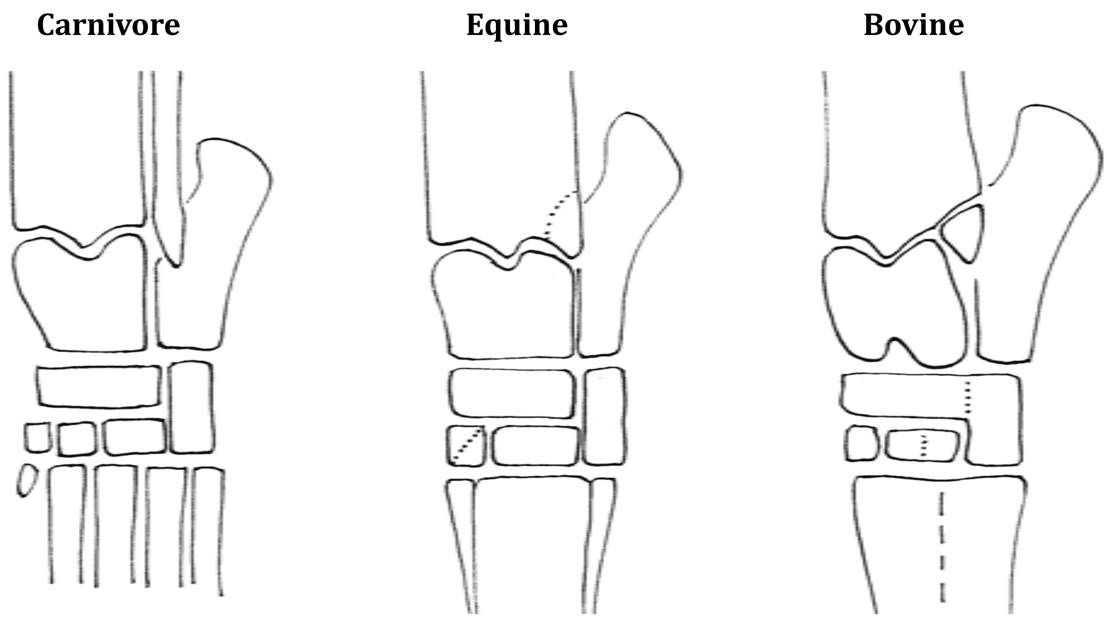
D. Helpful Hints

a. In the real world, you **ALWAYS** give a range when aging.
   i. The younger the animal, the smaller the range.
   ii. The older the animal, the bigger the range.
b. In this exercise, it is **BETTER** for you to give a single number and **NOT** a range!
c. In the real world, you age using mainly the lowers because it is too difficult to see the uppers!
d. Because you have access to the uppers, you will use both uppers and lowers In this exercise.
e. In the real world using only the lowers, the animal will appear older than it is.
f. **Always** indicate weeks, months or years!

E. Importance of Aging Knowledge

a. 4-H judging of animals
b. Sale barns
c. Purchase exams
d. Judging contests

BMS305/531 Domestic Animal Gross Anatomy Lecture and Laboratory Manual



5th Edition, 2020

The materials in this booklet are designed to help you succeed in learning the gross anatomy of the carnivore (canid, felid), equid, and ruminant (bovid). The objectives lists provided are the same for both BMS305 and BMS531. This manual is designed to be used in conjunction with the virtual tools that are utilized in BMS305/531.

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Anatomical Nomenclature

Directional Terms
abaxial
aboral
axial
caudal
contralateral
cranial
deep
distal
dorsal
ipsilateral
lateral
medial
median
oral
palmar
plantar
proximal
rostral
superficial
ventral

Planes of Section
frontal plane
median plane/midsagittal plane
sagittal plane
transverse plane

General Nomenclature
abduction
adduction
epaxial
extension
extrinsic
flexion
hypaxial
intrinsic
pronation
supination

Bony Features
canal
condyle
crest
epicondyles
fissure
foramen
fossa
fovea
head
line
neck
notch
process
sinus
spine
sulcus
trochanter
trochlea
tubercle
tuberosity

Species Nomenclature
bovine/bovid
canine/canid
caprine/caprid
equine/equid
feline/felid
ovine/ovid
porcine/porcid

NOTES

Pelvic Limb Laboratory Exercises

Lab 1 Exercises

Pelvis – All species

The pelvis, or pelvic girdle, attaches the pelvic limb to the vertebral column. The pelvis is made up of two hip bones and the **sacrum**. Two hip bones together are referred to as the **ossa coxarum**. Each hipbone is called an **os coxae**, and is formed by the fusion of 3 bones – the **ilium**, **ischium**, and **pubis**.

The pelvic limb provides much of the thrust for movement and the **coxofemoral joint** is the ball and socket (synovial) joint where the femur of the pelvic limb articulates with the **acetabulum**. All three bones of the os coxae, as well as the **acetabular bone** form the socket-shaped acetabulum. However, the acetabular bone fuses with the rest of the os coxae early in life.

The **ilium** is the largest bone of the os coxae and is recognized by its “**wing**” and “**body**”. Craniad, the wing has a crest, the **iliac crest**, which is bordered by two prominences, the **tuber coxae** and the **tuber sacrale**.

The body of the ischium forms the lateral edge of the **obturator foramen**. A caudolateral prominence, the **ischiatic tuberosity**, is a palpable landmark to which the caudal end of the sacrotuberous ligament is attached. The **sacrotuberous ligament** bridges from the transverse processes of the third sacral and first caudal vertebrae to the ischiatic tuberosity, and is the point of origin for a number of muscles in the rump of the animal.

The **pubis** is the smallest bone in the os coxae and forms the cranial border of the obturator foramen. Both os coxae are fused to each other at the pubis and the ischium by a cartilaginous joint called the **pelvic symphysis**.

The **pelvic canal** is the space through the pelvis and is bound by an inlet (inside) and outlet (outside). The shape of the pelvis and the pelvic canal can vary among species, according to the size of their offspring and how much “thrust” their hind legs are responsible for, but these bony features are similar for the pelvic bones in all species.

Canine - Pelvic Limb Bony Features

The pelvic limb articulates with the pelvis via the **coxofemoral joint** at the "hip". The **femur** is characterized by a round **head**, which articulates with the acetabulum of the pelvis, and a dent, the **fovea capitis**, where the **ligament of the head of the femur** attaches the femur to the pelvis. There is also a ligament along the "open" rim of the acetabulum – the **transverse ligament of the acetabulum** – that helps stabilize the joint.

The **greater trochanter of the femur** is the largest lateral eminence proximally, the attachment point for the gluteal mm., and is palpable in a live dog. The **lesser trochanter** lies on the medial side of the proximal femur. A small **third trochanter** can be viewed on the lateral aspect, just distal to the greater trochanter. Distally, the **femoral condyles** articulate with the **tibia** at the **femorotibial joint**. There is also a sesamoid bone here, the **patella**, which articulates with the **femoral trochlea**, and acts to reduce friction for the quadriceps femoris mm. and improve stability. The *patellar ligament is the continuation of the tendon of insertion for the quadriceps femoris mm*. and inserts on the tibial tuberosity.

The **femorotibial** and **femoropatellar joints** comprise the stifle. A term for "behind the stifle" is "**popliteal**" and you will hear vessels and other bony features called popliteal – look behind the stifle for them. The **tibial tuberosity** and the cranial border of the tibia are palpable landmarks for evaluating stability of the stifle. No muscles arise beyond the midpoint of the tibia.

The **fibula** in the dog articulates with the tibia proximally as the **head**, and distally as the **lateral malleolus**.

The tarsus is the beginning of the **pes**, or foot, which consists of the **tarsus**, **metatarsus**, and **phalanges**. The tarsus is a series of 7 small bones, the **calcaneus**, **talus**, **central tarsal**, and **tarsal bones I-IV** (Note – numbering is always medial to lateral). The tarsal bones are arranged in 3 rows that articulate with each other, however, only the articulation of the tibial cochlea with the trochlea of the talus (a tarsal bone) produces much movement. The palpable landmark of the tarsus is the **tuber calcanei** of the calcaneus bone.

The dog has 5 **metatarsal** bones (MT I-V, again numbered medial to lateral), but only MT II-V are weight bearing and MT I may be absent. The 5 **digits** articulate with the MT bones, and again, only digits II-V are weight bearing. Proximal sesamoid bones exist in the dog at the metatarsophalangeal joint, but have little clinical importance. The weight bearing digits are comprised of a **proximal**, **middle**, and **distal phalanx** (singular term; phalanges is the plural term). The first digit (Digit I) is called the “dew” claw, is missing a middle phalanx, and is non-weight bearing.

Equine - Pelvic Limb Bony Features

The **tuber coxae** is called the **“point of the hip**” in the horse. The pelvic limb articulates with the pelvis via the coxofemoral joint at the “hip” and is similar to the dog, except that there is also an **accessory ligament to the head of the femur**. This ligament provides some additional support and theoretically prevents a horse from kicking out (“cow-kicking”).

The greater trochanter of the femur bone is the largest lateral eminence proximally, and is the attachment point for the middle and deep gluteal mm. The lesser trochanter lies on the medial side of the proximal femur. The third trochanter in the horse is a large, palpable eminence at the base of the greater trochanter, and is the point of attachment for the superficial gluteal mm. Distally, the femoral condyles articulate with the tibia at the femorotibial joint. The patella acts to reduce friction for the quadriceps femoris mm. and improve stability. It also provides a locking mechanism in the equine pelvic limb by becoming secured over the **medial trochlear ridge** of the distal femur.

The femorotibial and femoropatellar joints comprise the stifle. The tibial tuberosity is a palpable landmark, but assessment of stifle stability is not as easy in the large animal.

The fibula in the horse consists only of a proximal portion: the head and shaft; the distal portion, the lateral malleolus, is fused to the tibia. No muscles arise beyond the midpoint of the tibia.

The tarsus is the beginning of the pes, or foot, which consists of the tarsus, metatarsus, and phalanges. The tarsus of the horse is similar to that of the dog, but is comprised of the calcaneus, talus, central tarsal bone, **fused tarsal bones I and II**, and tarsal bones III and IV. The palpable bony landmark of the tarsus is the tuber calcanei.

The horse has only three metatarsal bones, MT II-IV; only MT III is weight bearing. MT III is called the **“cannon”** bone, and MT II and IV are called “**splint**” bones. The distal ends of the splint bones are called “**buttons**”, and are palpable landmarks for nerve blocks. Only Digit III is present in the horse, which makes them a member of the Order Perissodactyla. The metatarsophalangeal joint is called the “**fetlock**”, and has two sesamoid bones, the **proximal sesamoid bones**, that articulate with the plantar aspect of the joint. The proximal, middle and distal phalanges of Digit III are often referred to as the **long pastern**, **short pastern**, and **coffin bones**, respectively. The **proximal interphalangeal joint** is called the “**pastern**” joint, and the **distal interphalangeal joint** is called the “**coffin**” joint. The coffin joint is the location of the **distal sesamoid bone**, the **navicular bone**, which articulates on the plantar surface of the joint. The sesamoid bones of the equine distal limb are clinically very important.

Bovine - Pelvic Limb Bony Features

The **tuber coxae** is called the “**hook**” and the **ischiatic tuberosity** the “**pin**” in the bovid. The pelvic limb articulates with the pelvis via the coxofemoral joint at the “hip” and is similar to that of the dog.

The round head of the femur articulates with the acetabulum of the pelvis, and is characterized by a dent, the fovea capitis, where the ligament of the head of the femur attaches the femur to the pelvis. The greater trochanter of the femur bone is the largest lateral eminence proximally and the attachment point for the middle and deep gluteal mm. The lesser trochanter lies on the medial side of the proximal femur. Bovids lack a third trochanter due to the presence of the gluteobiceps m. (fusion of superficial gluteal and biceps femoris mm.). Distally, the femoral condyles articulate with the tibia at the femorotibial joint.

The patella, which acts to reduce friction for the quadriceps femoris mm and improve stability, will also provide a moderate stabilizing mechanism in the bovine pelvic limb by becoming secured over the medial trochlear ridge of the distal femur. The femorotibial and femoropatellar joints comprise the stifle. The tibial tuberosity is a palpable landmark, but assessment of stifle stability is not as easily done in the large animal.

The bovine fibula consists of a vestigial proximal portion. The distal end – the **lateral malleolus** – is a separate bone that articulates with both the distal tibia and the tarsal bones. No muscles arise beyond the midpoint of the tibia.

The tarsus is the beginning of the pes, or foot, which consists of the tarsus, metatarsus, and phalanges. The bovine tarsus is similar to that of the dog, but is comprised of the calcaneus, talus, a **fused central and tarsal bone IV**, **fused tarsal bones II and III**, and tarsal bone I. The palpable bony landmark of the tarsus is the tuber calcanei.

In the bovid, **MT III and IV are fused** and are weight bearing. Again, only digits III and IV are weight bearing in the bovid, which makes them part of the Order Artiodactyla. Digits II and V are called “**dew claws**”. Each of digits III and IV include a proximal, middle, and distal phalanx, as well as two proximal sesamoid bones and one distal sesamoid bone.

The metatarsophalangeal joints each include two proximal sesamoid bones on the plantar aspect; there are four proximal sesamoid bones in total on each foot. The distal sesamoid bones are found on the plantar aspect of each distal interphalangeal joint; there are two distal sesamoid bones on each foot.

Lab 1 Short Objectives

Palpable bony landmarks of the pelvic limb: In addition to being able to name the bones on skeletal preparations, be able to find these landmarks on a skeletal preparation or an embalmed specimen for quiz next week & also for the exam.

Iliac crest (Ca)

Tuber coxae (Eq & Bo)

Tuber sacrale (Eq)

Ischiatic tuberosity

Greater trochanter

Third trochanter (Eq)

Patella (Ca, Eq) / medial ridge of trochlea (Eq)

Tibial tuberosity

Tuber calcanei (Ca)

Buttons of the splint bones (Eq)

Proximal sesamoid bones (Eq)

Lab 2 Exercises – Muscles of the Pelvic Limb

The focus of these Exercises is **regional anatomy** of the pelvic limb. The different regions have been divided according to their functions; within each functional region, you will be expected to learn the associated **muscles**, their **origin/insertion, action,** and **innervation.**

****Disclaimer: Some muscles have multiple actions. If a single muscle spans multiple joints (based on its origin and insertion), you will be expected to know the action it has on each of those joints. ****

For each region, we will identify the most prominent muscle(s) in terms of action, as well as their innervation and major arterial supply. Bear in mind that there will be differences across species, so refer to your notes for more detailed descriptions.

Hip Extensors: Gluteal (lateral hip) region

m: middle gluteal m.

n: cranial gluteal n.

a: cranial gluteal a.

Hip Extensors/Stifle Flexors: Caudal femoral region

m: biceps femoris m.

n: sciatic n.

a: caudal femoral a.

Lateral Hip Rotators: Deep hip region

mm: quadratus femoris, internal obturator, and gemelli mm.

n: sciatic n.

a: caudal gluteal a.

Stifle Extensors: Cranial/lateral femoral region

m: quadriceps femoris m.

n: femoral n.

a: lateral circumflex femoral a.

Limb adductors: Medial femoral region

m: adductor m.

n: obturator n.

a: deep femoral and medial circumflex femoral aa.

Hip Flexors: Deep cranial femoral region

m: iliopsoas m.

n: femoral n.

a: femoral a.

Hock Flexors/Digital Extensors: Cranial/lateral crus

mm: cranial tibial or long digital extensor m. (be aware of species-dependent variation in the largest/most cranial muscle of the crus)

n: common fibular n.

a: cranial tibial a.

Hock Extensors/Digital Flexors: Caudal crus

mm: gastrocnemius, superficial digital flexor, and deep digital flexor mm.

n: tibial n.

a: caudal tibial and distal caudal femoral aa.

Lab 2 Short Objectives

Be able to identify the landmark muscle in each region for the quiz & for the exam. The names of the associated artery and nerve are also part of the quiz (ex. What nerve innervates this muscle?), but the neurovascular structures will not be tagged for identification until the exam.

Gluteal region

Middle gluteal m
Note: The caudal gluteal a & gluteal nn are near this m

Caudal femoral region

Biceps femoris m
Note: The caudal femoral aa; and sciatic n are near this m

Cranial femoral region

Quadriceps femoris m
Note: The lateral circumflex femoral and femoral n supply this m

Medial femoral region

Adductor m
Note: The femoral a and obturator n are near this m

Deep cranial region

Iliopsoas m
Note: The femoral a and femoral n are near this m

Cranial/lateral leg

Cranial tibial m
Long digital extensor m
Note: The cranial tibial a and fibular n are near these mm

Caudal leg

Gastrocnemius m
Deep digital flexor m
Note: The caudal tibial a (not visible and tibial n are near these mm)

<u>**Lab 3 Exercises: Neurovascular Features of the Canine Pelvic Limb**</u>

Review appropriate bony landmarks and the major muscle(s) in each region tested in the first 2 quizzes. Be able to identify the other muscles listed in the lab guide that were not emphasized for the 2nd quiz. Be able to identify the arteries, veins, and nerves on the lab guide list for each region.

Gluteal (lateral hip) region

- mm: superficial, middle, and deep gluteal mm., ** *m. piriformis,* and m. tensor fascia latae
  students will not be asked to identify the piriformis muscle

- n: cranial gluteal n. innervates the middle and deep gluteal mm., as well as m. tensor fascia latae, and can be seen on the lateral surface of the deep gluteal m. The caudal gluteal n. innervates the superficial gluteal m. and m. piriformis, and is found entering the medial surface of the superficial gluteal m.

- aa: observe the cranial gluteal a. with the cranial gluteal n. on the surface of the deep gluteal m. The caudal gluteal a. can be found alongside the sciatic n., deep to the biceps femoris m.

Caudal femoral region

- mm: biceps femoris, semimembranosus and semitendinosus mm.

- n: The sciatic n. lies deep to the biceps femoris m.

- a: The femoral a. provides 3 caudal brr., the proximal, middle, and distal caudal femoral aa. The proximal caudal femoral a. leaves its parent vessel in the proximal thigh, passing into the deep side of m. gracilis. The middle caudal femoral a. branches from the femoral a. mid-thigh and passes into mm. adductor and semimembranosus. The distal caudal femoral a. is the last branch of the femoral a. before it passes between the heads of m. gastrocnemius as the popliteal a.

Deep hip region

- mm: gemelli, quadratus femoris, internal and external obturator mm.

- n: The sciatic n. runs directly over the gemelli mm., deep to the biceps femoris m.

- a: The caudal gluteal a. is found running caudodistally, with the sciatic n.

Cranial/lateral femoral region

- mm: quadriceps femoris and sartorius mm.

- nn: The femoral n. emerges from the body of the iliopsoas m. and immediately disappears into the quadriceps femoris m. The saphenous n., a branch of the femoral n., also emerges from the iliopsoas m. and continues superficially on the medial side of the limb with saphenous a.

- a: The lateral circumflex femoral a. branches from the femoral a. within the femoral triangle. It passes between the rectus femoris and vastus medialis medially, before crossing the cranial side of the femur and emerging laterally between vastus lateralis and m. tensor fascia latae.

Medial femoral region – includes femoral triangle

- mm: adductor, gracilis, and pectineus mm.

- n: The obturator n. leaves the cranial border of the obturator foramen and innervates the adductor group. It can be seen deep to the gracilis m., on the medial side of m. adductor.

- a/v: The femoral a. and vein are obvious within the femoral triangle. The medial saphenous v. can be seen terminating in the femoral v. in the distal thigh.

Cranial/lateral crus

- mm: The hock flexors and digital extensors of the cranial/lateral crus, including the cranial tibial, fibularis longus, long digital extensor, and lateral digital extensor mm.

- n: All the muscles in this group are innervated by the common fibular n., which branches from the sciatic n. within the thigh. The common fibular n. crosses over the lateral head of the gastrocnemius m. before passing between the lateral digital extensor and fibularis longus mm., at which point it divides into the deep and superficial fibular nn.

- a: The cranial tibial a. is the main continuation of the popliteal a. In the dog, the cranial tibial a. passes between the tibia and the fibula, and can be seen between the cranial tibial and long digital extensor mm.

Caudal crus

- mm: The hock extensors and digital flexors, including the gastrocnemius, superficial digital flexor, and deep digital flexor mm. The popliteus m. is also on the caudal crus, although its function is distinct from the other muscles in the region.

- n: All the muscles on the caudal crus are innervated by the tibial n., which branches from the sciatic n. in the thigh region and passes between the two heads of the gastrocnemius m. before continuing distally on the deep digital flexor m.

- a: The caudal tibial a. leaves the caudal aspect of the popliteal a. within the interosseus space.

- v: The lateral saphenous v. is visible on the caudolateral crus.

Lab 3 Exercises: The Equine Pelvic Limb

The overall structure of the equine pelvic limb is similar to that of the dog, although there are some notable differences in the crural muscles. We will use the equine pelvic limb to follow neurovascular structures beyond the stifle, to the distal limb, where they become difficult to find in the canine limb.

In the horse, the largest, most cranial muscle of the crus is the **long digital extensor m.** It covers the smaller **cranial tibial m.**, which is present, but less significant than in the dog, and has an additional tendinous insertion on the medial aspect of the hock: the **cunean tendon.** The **lateral digital extensor m.** is relatively large, and its tendon of insertion joins that of the long digital extensor m. mid-metatarsus. Horses have a thick, tendinous **fibularis (peroneus) tertius m.**, found deep to the long digital extensor m.

The caudal crural muscles, including the **popliteus, gastrocnemius, superficial digital flexor, and deep digital flexor mm.**, resemble those of the dog in terms of function. The equine **superficial digital flexor m.** is quite tendinous, but otherwise is not unlike that of the dog. The **deep digital flexor m.,** however, contains three heads – versus two in the dog – that are named for their relative position on the crus. Horses have an additional muscle on the caudolateral crus, the **soleus m.**, which originates on the head of the fibula and joins the tendon of the gastrocnemius m.

As in the dog, the two divisions of the **sciatic n.** – the **common fibular** and **tibial nn.** – innervate the crural muscles of the horse. The **common fibular n.** passes laterally over the gastrocnemius m. before dividing into the **superficial** and **deep fibular nn.** The superficial branch passes down the leg superficially, in the groove between the long and lateral digital extensor mm., while the deep branch dives deep between the same two muscles. The deep fibular n. divides into medial and lateral branches over the hock, which become the **medial** and **lateral dorsal metatarsal nn.;** they follow the groove between the cannon bone and splint bones.

The **tibial n.** passes between the two heads of the gastrocnemius m. on the caudal aspect of the crus. It innervates the muscles in the caudal group, and continues as a sensory nerve within the space between the common calcaneal tendon and the deep digital flexor m. Around the calcaneus, it divides into the **medial** and **lateral plantar nn.,** which continue beyond the fetlock as the **medial** and **lateral plantar digital nn.** These have **dorsal branches** that project toward the dorsal pastern.

In the equine pelvic limb, we can more easily trace the terminal branches of the **popliteal a.**, the **cranial** and **caudal tibial aa.** The cranial tibial a. is the larger of the two, and passes through the interosseus space between the tibia and fibula before passing distally along the cranial aspect of the tibia. It surfaces near the hock as the **dorsal pedal a.,** then enters the groove between the cannon bone and lateral splint bone, where it is known as the **dorsal metatarsal a. (of III),** or the **great metatarsal a.** Towards the fetlock, it passes beneath the free end of the splint bone to the plantar aspect of the cannon bone, where it anastomoses with the medial and lateral plantar aa. before dividing into the **medial** and **lateral digital aa.**

The **caudal tibial a.** is smaller than its cranial counterpart, and can be found coursing distally along the caudal aspect of the tibia. Towards the hock it enters the space before the calcaneal tendon and forms a short, S-shaped anastomosis with the caudal branch of the **saphenous a.** The caudal tibial a. itself reascends the leg to join the caudal femoral a., and the now-reinforced saphenous a. divides into the **medial** and **lateral plantar aa.** These arteries, along with the deeper medial and lateral plantar metatarsal aa., are of little individual importance, and may be difficult to find. They may fade away, or join the great metatarsal a. on its way to the hoof.

Lab 3 Canine Stifle Exercises

The stifle is an example of a **hinge joint** (Definition of a hinge joint – flexion/ extension in a single plane). The **femorotibial joint** is a **synovial joint** and is created by the articulation of the condyles of the distal femur with the corresponding condyles on the proximal tibia.

The joint is similar amongst the domestic species, characterized by meniscal cartilages that are important for mobility and shock absorption (wait until you get older, you'll understand…), and ligaments to stabilize this otherwise highly mobile joint against the forces of applied movements in the pelvic limb.

The **femoropatellar joint** is a **gliding joint** formed by the articulation of a **sesamoid bone, the patella,** and the **trochlea** of the femur. The patella is the lay term for the ***sesamoid bone embedded in the tendon of insertion of the quadriceps femoris muscle.*** Although the articulation of this joint does not vary, this joint is highly specialized in horses and somewhat specialized in cattle (next week's Exercises).

Femorotibial joint (all domestic species) – features/functions

- **Cartilages**

  Each femorotibial joint contains 2 **menisci**, one medial and one lateral. These crescent-shaped cartilaginous wedges are attached to the tibial condyles, and serve to absorb shock and deepen mobility of the joint.

- **Ligaments**

  Each femorotibial joint is stabilized by a series of ligaments, which limit movement of the joint.

  There are two **cruciate ligaments** within the joint capsule of each femorotibial joint; these attach the femoral condyles to the tibia, and are named according to their insertion on the proximal tibia. The **cranial cruciate ligament** attaches the medial side of the lateral femoral condyle to the cranial aspect of the tibial plateau, whereas the **caudal cruciate ligament** runs from the lateral side of the medial femoral condyle to the caudal tibial plateau. The

cruciate ligaments limit cranial/caudal tibial displacement, as well as hyperextension of the joint and rotation of the femur and tibia.
In addition to the cruciate ligaments, each joint has two **collateral ligaments,** one medial and one lateral, that run from the distal femur to the proximal tibia or fibula, and limit abduction or adduction of the tibia.

Canine Femoropatellar joint – features/functions

The canine femoropatellar joint contains a single **patellar ligament**, which is ***the continuation of the tendon of insertion of the quadriceps femoris muscle**.* Remember that the patella itself is actually a sesamoid bone embedded in this tendon. This functions to keep the quadriceps muscles on track, decrease friction, and increase leverage. The patella is held in place by **medial and lateral femoropatellar ligaments.** The canine and feline patella is further stabilized by **fabellae**, which are small sesamoid bones embedded in the tendons of origin of the gastrocnemius muscles.

Equine Stifle Exercises

The equine pelvic limb includes several specialized structures that add stability and allow the horse to remain in a standing position without active muscle involvement. This is a passive mechanism that prevents the limb from collapsing due to the weight of the animal, and enables the horse to remain on its feet – which is important for a prey animal – without fatiguing its muscles. Collectively, the structures that contribute to this mechanism are referred to as the **stay apparatus.** The stay apparatus includes the **stifle locking mechanism, the reciprocal apparatus, and the suspensory apparatus.**

Stifle locking mechanism:

The equine stifle contains modifications that allow the horse to "lock" the joint, preventing it from flexing. Unlike the canine stifle, which has a single **patellar ligament,** the equine stifle has three patellar ligaments: the **medial, intermediate,** and **lateral patellar ligaments.** The intermediate patellar ligament acts as the "true" patellar ligament, while the medial and lateral patellar ligaments are used to "lock" and "unlock" the stifle, respectively. All three ligaments attach to the **tibial tuberosity.**

The **patella** has a hook-shaped **parapatellar cartilage** attached to the **medial patellar ligament.** To "lock" the stifle, the horse contracts the **gracilis** and **sartorius** muscles to elevate the patella and draw it over the large **medial ridge of the femoral trochlea**. Once "locked," the stifle remains in position until contraction of the **tensor fascia latae** and **biceps femoris** muscles pulls the patella off of the medial ridge, using the **lateral patellar ligament.**

Reciprocal Apparatus:

The reciprocal apparatus involves ligamentous structures that connect the femur to the tarsus and metatarsus, ensuring that the **stifle and hock flex or extend in unison.** The **peroneus (fibularis) tertius muscle** is wholly ligamentous in the horse, creating essentially an unstretchable band of tissue between the lateral femoral condyle and the 4th tarsal/3rd metatarsal bones. Caudally, the tendon of the **superficial digital flexor muscle** connects the supracondylar fossa of the distal femur to the calcaneal tuber. The combined effect of this parallelogram of bands is to synchronize flexion and extension of the stifle and hock.

Suspensory Apparatus:

Remember that the neutral standing position of the horse requires the **metatarsophalangeal, proximal interphalangeal,** and **distal interphalangeal joints** to be in some degree of extension. The force of gravity – the weight of the horse – will naturally exert a downward force on those joints; the suspensory apparatus uses a series of ligaments to prevent the force of gravity from collapsing the joints of the distal equine limb into hyperextension.

The **interosseus muscle** is known as the **suspensory ligament** in the horse. Located on the plantar aspect of the cannon bone (MT III), deep to the tendon of the deep digital flexor muscle, the suspensory ligament originates at the distal row of tarsal bones/proximal cannon bone. At the fetlock, it divides into branches that attach to each of the proximal sesamoid bones before crossing to the dorsal aspect of the pastern. These extensor branches join the tendon of the long digital extensor muscle (which attaches to the extensor process of the distal phalanx).

There are a series of **sesamoidean ligaments** that continue the tension from the suspensory ligament, on the plantar aspect of the limb, beyond the proximal sesamoid bones. Named for their general appearance, these ligaments connect the proximal sesamoid bones to the proximal or middle phalanx. The most superficial of these, the **straight sesamoidean ligament**, inserts on the proximal end of the middle phalanx (P2). Paired **oblique seamoidean ligaments** attach to the distal end of the proximal phalanx (P1), and the deepest of the sesamoidean ligaments, the paired **cruciate sesamoidean ligaments**, insert on the proximal end of the proximal phalanx.

Pelvic Limb

Bones of the Pelvic Limb

Sacrum

auricular surface

median sacral crest

dorsal sacral foramina

pelvic sacral foramina

promontory

Pelvis = ossa coxarum + sacrum

pelvic canal

- pelvic inlet
- pelvic outlet

symphysis pelvis

Os Coxae (hip bone) = hemipelvis

hemipelvis = 1 ilium +1 ischium +1 pubis +1 acetabular bone*

ossa coxarum= 2 hemipelves

obturator foramen

acetabulum

acetabular notch

transverse acetabular ligament

*only discernible in fetus

Ilium

iliac crest

tuber coxae ("hook", Bo) ("point of the hip", Eq)

tuber sacrale

auricular surface

body
wing

Pubis

pubic tubercle

Ischium

ischiatic tuberosity ("pin", Bo)

Femur

head

    fovea capitis

ligament of the head of the femur
accessory ligament of the head of the femur (Eq)

neck

greater trochanter

lesser trochanter

trochanteric fossa

third trochanter (Car, Eq)

body

medial and lateral condyles

epicondyles, medial/lateral

extensor fossa

trochlea
    medial ridge of trochlea (Eq, Bo)

Sesamoid bones

"patella" (sesamoid bone of the quadriceps femoris m.)

    femoropatellar ligaments

    patellar ligaments: medial, lateral, intermediate (Eq, Ru)

"fabellae" (sesamoid bone of the gastrocnemius m.) (Car)
Popliteal sesamoid bone (Car)

Tibia

tibial tuberosity

body

medial condyle

lateral condyle

extensor groove

intercondylar eminence

medial malleolus

cranial border ("crest")

Fibula

fibular head

lateral malleolus (Eq: fused to tibia, Bo: separate distal extremity)

Tarsus

calcaneus

- sustentaculum tali
- calcaneal tuber

talus

central tarsal bone

tarsal bone I-IV

- Eq: I and II fused, separate III and IV
- Bo: separate I, II and III fused, central and IV fused

Metatarsals II-V (I usually absent-Car)

Eq: II=medial "splint bone", IV= lateral "splint bone", III= "cannon bone"

"buttons"= distal ends of "splint" bones

Bo: III and IV fused= large metatarsal bone

discoid metatarsal bone II

Digits

Car: II-V, Eq: III only, Bo: II-V (only III and IV fully developed)

proximal phalanx ("long pastern", Eq)

middle phalanx ("short pastern", Eq)

distal phalanx ("coffin bone", Eq)

ungual process (Car)

extensor process

proximal sesamoid bones (Eq, Bo)

distal sesamoid bone ("navicular bone", Eq, Bo)

Dewclaw (I) may be present in dogs

if present, phalanges represented by small nodules of bone

cats never have a dewclaw

Articulations of the Pelvic Limb

Sacroiliac joint

between ilia and sacrum

Coxofemoral (hip) joint

between acetabulum and femoral head

Stifle (knee) joint

includes femorotibial, femoropatellar, and tibiofibular articulations

Tarsal (hock) joint

includes tibiotarsal, proximal and distal intertarsal, and tarsometatarsal articulations: compound joint

Metatarsophalangeal joint (Fetlock joint, Eq)

between metatarsal bones and proximal phalanges

Proximal interphalangeal joint (Pastern joint, Eq)

between proximal and middle phalanges

Distal interphalangeal joint (Coffin joint, Eq)

between middle and distal phalanges

Pelvic Limb Terms

Hip

os coxae

Thigh

femur

Leg or crus

tibia
fibula

Hindpaw or pes

tarsal bones
metatarsal bones
phalanges

Muscles of the Pelvic Limb

Extrinsic mm.: connecting the limb to the body

Intrinsic mm.: muscles within the limb

Fascia lata: deep fascia of the thigh

Hip muscles

superficial, middle, and deep gluteal mm.

> Bo: gluteobiceps m. = combined superficial gluteal m. and biceps femoris m.

internal obturator m.

external obturator m.

iliopsoas m.

sacrotuberous ligament

gemelli m.

quadratus femoris m.

Thigh muscles

tensor fasciae latae m.

quadriceps femoris m.

- rectus femoris m.
- vastus lateralis m.
- vastus intermedius m.
- vastus medialis m.
- patellar ligament (Eq/Bo: medial, lateral, intermediate)

sartorius m. (cranial and caudal parts)

pectineus m.

gracilis m.

adductor m.

semimembranosus m.

semitendinosus m.

biceps femoris m.

Stifle

medial meniscus

lateral meniscus

cranial cruciate ligament

caudal cruciate ligament

medial collateral ligament

lateral collateral ligament
(origin) tendon of the long digital extensor m.

Crural muscles

cranial tibial m.

Eq: cunean tendon

long digital extensor m.

Bo: 2 muscle bellies and 2 tendons

fibularis (peroneus) longus m. (Car, Bo)

fibularis (peroneus) tertius m. (Eq, Bo)

lateral digital extensor m.

gastrocnemius m. (medial and lateral heads)

popliteal lymph nodes

superficial digital flexor m.

popliteus m.

deep digital flexor m.
interosseous m. (suspensory ligament – Eq, Bo)

Common calcaneal tendon

gastrocnemius m.

superficial digital flexor m.

biceps femoris m.

gracilis m.
semitendinosus m.

Innervation and general functions

Function	Innervation
Flexors of the hip	
ilopsoas m.	lumbar spinal nn., femoral n.
tensor fasciae latae m.	cranial gluteal n.
sartorius m.	femoral n.
rectus femoris m.	femoral n.
Extensors of the hip	
superficial gluteal m.	caudal gluteal n.
middle gluteal m.	cranial gluteal n.
deep gluteal m.	cranial gluteal n.
biceps femoris m. (cranial part)	sciatic n.
semitendinosus m.	sciatic n.
semimembranosus m.	sciatic n.
gracilis m.	obturator n.
Outward rotators of the hip	
internal obturator m.	sciatic n.
external obturator m.	obturator n.
Flexors of the stifle	
sartorius m. (caudal part)	femoral n.
biceps femoris m. (caudal part)	sciatic n.
semitendinosus m.	sciatic n.
semimembranosus m.	sciatic n.
gracilis m.	obturator n.
gastrocnemius m.	tibial n.

Extensors of the stifle	
quadriceps femoris m.	femoral n.
tensor fasciae latae m.	sciatic n.
biceps femoris m.	sciatic n.
sartorius m. (cranial part)	obturator n.
popliteus m. *(mainly rotates leg medially)*	tibial n.
Adductors of the pelvic limb	
adductor m.	obturator n.
gracilis m.	obturator n.
pectineus m.	obturator n.
Flexors of the hock	
cranial tibial m.	fibular n.
long digital extensor m.	fibular n.
lateral digital extensor m.	fibular n.
fibularis longus m.	fibular n.
Extensors of the hock	
gastrocnemius m.	tibial n.
superficial digital flexor m.	tibial n.
deep digital flexor m.	tibial n.
biceps femoris m.*	sciatic n.
semitendinosus m.*	sciatic n.
gracilis m.*	obturator n.

*via contributions to common calcaneal tendon; role in hock extension is much less than others

Vessels and Nerves of the Pelvic Limb (Canine)

Arteries

cranial gluteal a.

caudal gluteal a.

femoral a.

- medial circumflex femoral a.
- lateral circumflex femoral a.
- proximal caudal femoral a.
- saphenous a.
- middle caudal femoral a.
- distal caudal femoral a.

popliteal a.

cranial tibial a.

caudal tibial a. (Eq)

Veins

femoral v.

lateral saphenous v.

- cranial branch

medial saphenous v.

Nerves

cranial gluteal n.

caudal gluteal n.

obturator n.

femoral n.

- saphenous n.

sciatic n.

- common fibular n. (branch of sciatic n.)
    - superficial fibular n.
    - deep fibular n.
- tibial n. (branch of sciatic n.)

Lymph nodes

popliteal lymph nodes

Vessels and Nerves of the Pelvic Limb (Equine)

Arteries

femoral a.

caudal saphenous a.

medial & lateral plantar aa.*

popliteal a.

caudal tibial a.

medial & lateral plantar aa.*

cranial tibial a.

dorsal pedal a.

dorsal metatarsal a. III

medial & lateral digital aa.

*caudal branch of saphenous a. forms an S-shaped anastomosis with caudal tibial a., just cranial to calcaneal tuber at level of sustentaculum tali, anastomotic branch divides into medial & lateral plantar aa.

Veins

cranial branch of the medial saphenous v.

Nerves

sciatic n.

- common fibular n. (branch of sciatic)
  - deep fibular n.
  - superficial fibular n.
- tibial n. (branch of sciatic)
  - medial plantar n.
    - medial plantar digital n. & dorsal branches
  - lateral plantar n.
    - lateral plantar digital n. & dorsal branches

NOTES

Thoracic Limb Laboratory Exercises

Lab 4 Exercises

Bones of the Thoracic Limb

The appendicular skeleton of the thoracic limb is attached to the thorax and axial skeleton by a series of strong muscles, rather than a bony articulation. This **synsarcosis** is formed by the **extrinsic muscles** of the thoracic limb, which connect the axial to the appendicular skeleton.

The **scapula** is a flat, blade-like bone that forms the basis of the shoulder region. In ungulates – the horse and ox – there is a large, **dorsal scapular cartilage** that increases the surface for muscle attachment. The distinct **spine** of the scapula divides its lateral face into the more cranial **supraspinous fossa**, and the more caudal **infraspinous fossa**. In the dog and the ox (NOT the horse), the spine is enlarged at its distal end as the **acromion**. The feline scapula has an additional projection, the **suprahamate process**, dorsal to the acromion. The scapula narrows towards its distal end, forming the **scapular notch** along its cranial border, for passage of the suprascapular nerve. A shallow, concave **glenoid cavity** on the scapula's distal end articulates with the rounded head of the humerus. The protuberances located just cranial and caudal to the glenoid cavity are the **supraglenoid** and **infraglenoid tubercles**, respectively, which serve as points for muscle attachment. Only the felid has a bony **clavicle**; the canine brachiocephalicus muscle has a clavicular intersection, which is the tendinous remnant of the canine clavicle.

The **humerus** is a relatively large bone whose rounded **head** articulates with the glenoid cavity of the scapula to form the **scapulohumeral** (shoulder) **joint**. It is the only bone in the true 'arm,' or brachium. The humeral head is flanked by two irregular prominences that serve as points of attachment for muscles that stabilize the shoulder joint – particularly important because the joint lacks prominent collateral ligaments. The **lesser tubercle** is the smaller of the two, located medial to the head; the larger **greater tubercle** projects craniolaterally, and is a palpable bony landmark in the live animal, commonly referred to as the 'point of the shoulder.' The greater and lesser tubercles are separated by an **intertubercular groove** through which the tendon of m. biceps brachii passes. In the horse, there is a distinct **intermediate tubercle** in the middle of the intertubercular groove that participates in stabilization of the thoracic limb. The **body** of the humerus has a characteristic spiral, the **brachial groove**, that accommodates the radial nerve and brachialis muscle. The humerus has several prominences named for the muscles that insert upon them, including the laterally located **deltoid** and **teres minor tuberosities** as well as the medially located **teres major tuberosity.** The distal humerus is rounded into a large **condyle** that articulates with the radius and ulna to form the elbow joint, with a deep **olecranon fossa** on its caudal aspect. In carnivores, this fossa includes a **supratrochlear foramen**; in the cat there is an additional **supracondylar foramen**. **Medial** and **lateral epicondyles** provide the origins for the corresponding collateral ligaments of the elbow as well as for the muscles of the antebrachium.

The bones of the 'forearm,' or **antebrachium**, include the **radius** and **ulna.** Both bones articulate with the humerus to contribute to the elbow, a compound joint. Proximally, the radius has a flattened **head**, while the more caudal ulna has a large projection, the **olecranon**, which is a palpable bony landmark – the 'point of the elbow.' The olecranon serves as the point of insertion for m. triceps brachii, the large extensor of the elbow joint. Cranial to the olecranon, the ulna has a deep **trochlear notch** that articulates with the humerus. The proximal protrusion of the trochlear notch is the **anconeal process**, which 'perforates' the olecranon fossa during extension of the elbow. The canine radius and ulna are separate, fully-formed bones, which have an **interosseus space** that allows for rotational movement – pronation and supination – of the antebrachium. In the horse and ox, the ulna is fused to the radius, which prevents rotational movement of the limb. The distal radius is grooved cranially to accommodate the tendons of the extensor muscles, and includes a distinct point – the **radial styloid process** – on its medial side. The distal ulna also tapers to a point: the **ulnar styloid process.**

The bones of the antebrachium articulate with the proximal row of **carpal** bones to form the **antebrachiocarpal joint**, at which point the **manus** begins. The manus corresponds to the pes of the pelvic limb, and includes the **carpus, metacarpus,** and **phalanges.** The carpal bones vary among different species, but are similarly arranged into two transverse rows. The proximal row – from medial to lateral – consists of the **radial, intermediate, ulnar,** and **accessory carpal bones.** In carnivores, **radial and intermediate carpal bones are fused** into the radial carpal bone. The accessory carpal bone is a palpable palmar projection, and provides the lateral boundary of the **carpal canal**, which allows passage of neurovascular structures and flexor tendons. The distal row includes **carpal bones 1** through **4**, numbered medial to lateral. In the horse and ox, carpal bone 1 is often absent or very small, and can be confused with a bone 'chip' fracture on radiographs. In the bovid, **carpal bones 2 and 3 are fused.** There is significant movement at the antebrachiocarpal joint (~90°), some movement between the proximal and distal rows of carpal bones, at the **midcarpal joint** (~45°), but essentially no movement at the **carpometacarpal joint**.

The remainder of the manus resembles the pes, although the canid is likely to have a formed **digit I**, the ‘dewclaw.’ The canine digit **I** includes a **P1** and **P3**, but lacks a middle phalanx, while **digits II-V** have **proximal, middle,** and **distal phalanges.** The distal phalanges have a curved **ungual process**, to which the claw attaches. In the horse, only **digit III** is fully-formed and weight-bearing; with the large **metacarpal III (**a.k.a. **“cannon” bone**) bearing 100% of the body weight in both the pelvic and thoracic limbs. **Metacarpals II** and **IV** (a.k.a. **“splint” bones**) are much smaller and non-weight bearing. In the ox, **metacarpals III** and **IV** are fused as the **large metacarpal bone**, while the vestigial **metacarpal V**, which is non-weightbearing, is referred to as the **small metacarpal bone**. The equine/bovine **phalanges** and **sesamoid bones** of the manus are the same as those of the pes.

Lab 4 Exercises: Muscles of the Thoracic Limb

Extrinsic vs. Intrinsic Muscles

The thoracic limb lacks a ‘true’ articulation with the axial skeleton, as mentioned. The **synsarcosis** is accomplished by a series of muscular attachments; the **extrinsic muscles** of the thoracic limb are those that attach the axial and appendicular skeletons. These muscles are important in terms of supporting the weight of the body and pulling the entire thoracic limb cranially or caudally, for ‘big’ actions like running or jumping.

The dog and ox have **8 extrinsic muscles**, which include the **deep pectoral, superficial pectoral, brachiocephalicus, omotransversarius, trapezius, rhomboideus, latissimus dorsi,** and **serratus ventralis muscles.** The horse has an additional extrinsic muscle, the **subclavius muscle.**

There are additional muscles that affect movement of the joints within the thoracic limb. Muscles whose attachments are confined to the appendicular skeleton are the **intrinsic muscles**. These include muscles that flex, extend, or otherwise act upon the shoulder and elbow joints, as well as the antebrachial muscles, which affect the joints of the distal limb.

General Organization of Intrinsic Muscles

Remember that when muscles contract, they cause flexion or extension, according to their attachments and the joints they cross. The intrinsic muscles of the thoracic limb can be grouped into **shoulder muscles, brachial muscles,** or **antebrachial muscles**.

Shoulder muscles:

> The muscles of the shoulder take origin on the scapula and insert on the humerus, and serve to flex, extend, or stabilize the shoulder joint. The lateral shoulder muscles – those that originate on the lateral surface of the scapula – include the **supraspinatus, infraspinatus, deltoideus,** and **teres minor muscles.** The medial shoulder muscles include the **subscapularis, coracobrachialis,** and **teres major muscles.**

Brachial muscles:

Brachial muscles originate either on the scapula or the humerus and insert on the proximal part of the radius or ulna. These muscles are primarily responsible for flexion or extension of the elbow joint, although they also participate in stabilizing the limb, and can affect the shoulder joint (depending upon their attachments). The **triceps brachii muscle** is the primary extensor of the elbow joint, and actually contains **four heads** in carnivores. Other elbow extensors include the **anconeus** and **tensor fasciae antebrachii muscles.** The elbow flexors are the **biceps brachii** and **brachialis muscles.**

Antebrachial muscles:

The antebrachial muscles can be grouped into a **craniolateral** and a **caudomedial** group, according to their relative positions on the antebrachium.

The craniolateral group takes origin from the **lateral epicondyle of the humerus**, is innervated by the **radial nerve**, and serve as **extensors of the carpus and digits**. These include the **extensor carpi radialis, common digital extensor, lateral digital extensor,** and **extensor carpi ulnaris muscles.**

The majority of the caudomedial group originates from the **medial epicondyle of the humerus**, receives innervation from the **median** or **ulnar nerves**, and function as **flexors of the carpus and digits**. These include the **flexor carpi radialis, deep digital flexor, superficial digital flexor,** and **flexor carpi ulnaris muscles.**

Several of these muscles have multiple heads and/or bellies that can vary among different species, and bear in mind that the tendons of insertion of the digital flexors/extensors will correspond to the number of digits present.

In carnivores, there are additional antebrachial muscles that pronate or supinate the limb by acting on the **radioulnar joints.** In the horse and ox, these muscles are vestigial or missing, due to their diminished capacity for these movements. The **supinator muscle** originates on the lateral epicondyle of the humerus and inserts on the medial radius; the **pronator teres muscle** runs from the medial epicondyle of the humerus to the medial radius.

4 Short Objectives

Bony landmarks

Spine of the scapula

Olecranon process of the ulna

Styloid process of the ulna

Anconeal process of the ulna

Accessory carpal bone

Greater tubercle of the humerus

Intertubercular groove of the humerus (Eq)

Deltoid tuberosity of the humerus

Muscles – *including classification as intrinsic/extrinsic muscles, attachments (particularly if they are on the bony objectives list), action(s), and innervation using VCA images & canine specimens. If there is a * next to the structure, be prepared to identify it and give its function in the VEA and/or equine specimens.*

Supraspinatus m.*

Infraspinatus m.*

Subscapularis m.*

Rhomboideus m.

Triceps brachii m. (all heads)*

Biceps brachii m.*

Extensor carpi ulnaris m.*

Common digital extensor m.*

Flexor carpi ulnaris m.*

Superficial digital flexor m.*

Deep digital flexor m.*

Lab 5 Exercises: Neurovascular Features of the Canine Thoracic Limb

Brachial Plexus

This network of nerves is derived from the ventral branches of the last 3 cervical and first one or two thoracic spinal nerves (C6-T2), and emerges ventral to m. scalenus, cranial to the first rib, before branching into the named nerves that supply the thoracic limb. Some of the nerves associated with these spinal nerves – and therefore with the brachial plexus – branch out to innervate some of the extrinsic muscles of the thoracic limb:

> The **lateral thoracic nerve** is the sole innervation of the cutaneous trunci muscle. It leaves the caudal portion of the brachial plexus before passing between the latissimus dorsi and deep pectoral muscles.
>
> The **long thoracic nerve** innervates the serratus ventralis muscle, and can be seen emerging dorsal to the scalenus muscle on the lateral side of m. serratus ventralis.
>
> There are **cranial** and **caudal pectoral nerves** that innervate the superficial and deep pectoral muscles, respectively. The caudal pectoral nerves are often combined with the lateral thoracic nerves.

There are 8 nerves of the brachial plexus that continue farther distally, 4 to the shoulder region, and 4 to the distal limb:

> The **suprascapular nerve** is found passing between the supraspinatus and subscapularis muscles, before crossing laterally via the scapular notch to innervate the supraspinatous and infraspinatous mm.
>
> The **subscapular nerve**, which may have two branches, crosses the axillary space and dives directly into the medial side of m. subscapularis.
>
> The **axillary nerve** can be seen caudal to the shoulder joint, in the ‘soft spot’ between the teres major and subscapularis muscles. It innervates the flexors of the shoulder: deltoid, teres major, and teres minor mm.
>
> The **thoracodorsal nerve** emerges caudal to the shoulder joint and can be seen coursing caudally with the thoracodorsal vessels, on the medial aspect of m. latissimus dorsi.

The **musculocutaneous nerve** lies between the biceps brachii muscle and the brachial vessels, on the medial aspect of the brachium. It can be seen entering the proximal, medial portion of m. biceps brachii. It also innervates mm. brachialis and coracobrachialis.

The **median** and **ulnar nerves** arise from a common trunk, which diverges in the distal brachium. The two nerves are seen on the deep side of the medial head of m. triceps brachii. The median nerve is the more cranial division from their common trunk, and continues distally to the antebrachium alongside the brachial artery. The ulnar nerve is the more caudal nerve, and can be seen passing deep to the ulnar head of m. flexor carpi ulnaris caudodistal to the medial epicondyle of the humerus.

The **radial nerve** runs alongside the trunk of the median and ulnar nerves for a short period, before entering the triceps brachii muscle between its medial and long heads. The nerve continues through the triceps brachii muscle, wrapping distocaudally around the humerus to emerge on the lateral side of the limb between m. brachialis and the lateral head of m. triceps brachii. In the distal brachium, the radial nerve terminates as **deep** and **superficial branches**. The radial nerve innervates all extensor mm. of the elbow, carpus, and digits.

Blood Vessels of the Canine Thoracic Limb

The major blood supply for the thoracic limb is the **axillary artery**, which arises from the subclavian artery and passes to the medial brachium from the first rib. The **subscapular artery** branches from the axillary artery and passes between the subscapularis and teres major muscles after giving rise to a series of muscular branches, including the **thoracodorsal artery** and the **caudal circumflex humeral artery**. The thoracodorsal artery can be seen branching from the dorsal side of the subscapular artery, going into the deep surface of m. latissimus dorsi. The caudal circumflex humeral artery branches from the subscapular artery opposite the thoracodorsal artery; it passes between the head of the humerus and the teres major muscle. The **cranial circumflex humeral artery** is a branch from the axillary artery that wraps around the cranial aspect of the humerus towards m. biceps brachii. The axillary artery also produces the lateral thoracic artery, which joins the lateral thoracic nerve to course caudally along the latissimus dorsi muscle. It is important to identify these vessels by their location and path, rather than branching pattern, as there can be variability among individual animals. For example, the cranial circumflex humeral artery may branch from the axillary artery proximal OR distal to the subscapular artery.

Upon reaching the brachium, the axillary artery continues as the **brachial artery**.

The brachial artery produces the **deep brachial artery** within the proximal brachium; the deep brachial artery passes between the medial and long heads of the triceps brachii muscle, along with the radial nerve. In the distal portion of the brachium, the brachial artery gives off the **bicipital artery**, which goes directly to the medial aspect of m. biceps brachii. The brachial artery, at this point, has been joined by the median nerve. The **collateral ulnar artery** arises from the brachial artery near the distal end of the humerus. It courses caudally towards the elbow joint, alongside the ulnar nerve. The **superficial brachial artery** branches opposite the collateral ulnar artery in the distal brachium. It courses down the cranial antebrachium to supply the dorsum of the manus.

The brachial artery continues into the proximal antebrachium; it produces a short, stout artery, the **common interosseus artery**, that passes deep into the interosseus space between the radius and ulna before dividing. Once the brachial artery has given off the common interosseus artery, it continues distally in the antebrachium as the **median artery**.

The median artery produces a caudal branch, the **deep antebrachial artery**, before giving off the **radial artery**. The radial artery branches from the medial side of the median artery in the middle of the antebrachium, and follows the medial side of the radius. The median artery continues distally through the carpal canal to supply the manus, running deep to the flexor carpi radialis muscle.

The **accessory cephalic vein** receives venous blood from the dorsal aspect of the paw; it joins the **cephalic vein** on its course from the palmar side of the paw to ascend the cranial antebrachium. In the proximal antebrachium, the **median cubital vein** crosses the flexor surface of the elbow to connect the cephalic vein to the **brachial vein**, which is found on the medial brachium, alongside the brachial artery. The brachial vein continues proximally as the **axillary vein**, which drains into the subclavian vein within the thorax.

The cephalic vein continues up the lateral aspect of the brachium, beyond the median cubital vein. It can be found between the brachiocephalicus muscle and the lateral head of m. triceps brachii. The cephalic vein passes deep to m. brachiocephalicus before joining the **external jugular vein** near the thoracic inlet. Mid-brachium, the **axillobrachial vein** branches caudally from the cephalic vein; it crosses the lateral head of m. triceps brachii before passing deep to m. deltoideus to join the axillary vein.

Lab 5 Exercises: Equine Thoracic Limb

Muscular and neurovascular structures

The muscular and neurovascular structures of the equine thoracic limb are similar to those of the dog, although there are some significant differences. We will identify the equine muscles and how they differ from the dog and the ox, as well as use the disarticulated equine limbs to follow the neurovascular structures to the distal limb.

It is important to remember that the horse has an additional extrinsic muscle – **m. subclavius** – that is not found in the dog (and is rudimentary in the ox). The equine scapula is structurally different from the bovine or canine scapula, in that it **lacks an acromion**; this translates to a difference in the **deltoid muscle**, which has an **acromial head** (as well as a **scapular head**) in the dog and the ox, but only a single head in the horse. The **triceps brachii muscle** has only three heads – **medial, lateral** and **long** – versus the four heads seen in the dog and the ox (who have an **accessory head**).

There is a thick, tendinous band, **lacertus fibrosus**, which connects the **biceps brachii muscle** to **m. extensor carpi radialis**. This couples the normal load-bearing position of the shoulder and elbow joints to extension of the carpus (preventing the joint from collapsing into flexion), and is an important stabilizing feature of the equine thoracic limb. The ox also has a lacertus fibrosus, although it is less significant.

The remainder of the craniolateral muscles of the antebrachium include the **common digital extensor, lateral digital extensor**, and **extensor carpi ulnaris (ulnaris lateralis) muscles.** Except for the ulnaris lateralis m., which flexes the carpus, all of these muscles are carpal and/or digital extensors. All are innervated by the radial nerve. Mid-radius, we can visualize the origin of the **extensor carpi obliquus muscle**, which arcs mediodistally to insert on the medial splint bone. This muscle exists in the dog (m. abductor pollicis longus or m. abductor digiti longus I), but functions somewhat differently than it does in the horse and the ox. The supinator muscle is absent in the horse (and ox).

The caudomedial muscle group of the antebrachium includes the carpal and digital flexors. The **deep digital flexor muscle** of the horse contains three heads – radial, ulnar, and humeral – as it does in the dog; in the large animals, the ulnar head is quite superficial, and usually visible from the lateral side of the limb. The accessory (check) ligament of the deep digital flexor muscle is found distal to the carpus: the **carpal check ligament.** The **superficial digital flexor muscle** is large, and includes an accessory (check) ligament that connects to the distal radius: the **radial check ligament.** The **flexor carpi radialis** and **flexor carpi ulnaris muscles** resemble those of the dog.

The distribution of nerves that arise from the brachial plexus is comparable among different species, with some slight variations. After innervating the muscles of the extensor group, the **superficial branch** of the **radial nerve** produces a sensory branch (the lateral cutaneous antebrachial nerve, which we will not ask students to name) that fades at the level of the carpus – unlike in other species, in which it continues farther distally.

The **median nerve** is the largest branch of the brachial plexus, and is seen running alongside the **median artery** along the caudomedial aspect of the radius. Just before it passes through the carpal canal, the median nerve divides into the **medial** and **lateral palmar nerves**. There is a brief **communicating branch** that extends from the medial palmar nerve to the lateral palmar nerve over the superficial digital flexor tendon in the mid-metacarpal region. The medial and lateral palmar nerves continue beyond the fetlock as the **medial** and **lateral palmar digital nerves**, which produce **dorsal branches** that extend toward the dorsal surface of the pastern bones.

The equine **ulnar nerve** is large, and easily seen near the proximal portion of the carpal/digital flexor muscles. It provides muscular (motor) branches to several muscles before continuing distally as a sensory nerve, along the ulnar head of the deep digital flexor muscle. Just above the carpus, the ulnar nerve divides into **dorsal** and **palmar branches.** The palmar branch communicates with the lateral palmar nerve as it passes through the carpal canal; after this point, the lateral palmar nerve produces a branch that becomes the **medial** and **lateral palmar metacarpal nerves**, which are small and obscured by the splint bones.

The **median artery**, the large continuation of the axillary artery, can be followed on its path to the distal limb. Just proximal to the carpus, the median artery trifurcates, producing a small **palmar branch**, as well as the **radial artery**; the main trunk of the median artery continues through the carpal canal (with the digital flexor tendons), emerging as the **medial palmar artery**. Just above the fetlock (in the midcarpal region), the medial palmar artery inclines toward the midline of the limb before splitting into the **medial** and **lateral digital arteries.**

The small palmar branch of the median artery anastomoses with the collateral ulnar artery proximal to the carpus, before contributing to the **lateral palmar** and **lateral palmar metacarpal arteries**. The radial artery produces the **medial palmar metacarpal artery**. The palmar metacarpal arteries, as well as the lateral palmar artery, form anastomotic contributions to the medial palmar artery as it divides into the digital arteries.

Pads and Hoof

While the distal limb of our domesticated species may seem vastly different, the structures are highly related and have become modified to serve the purpose of the animal. In these animals, the epidermis is stratified in several layers and keratinized. In animals that walk on the soles of their feet (*plantigrade* or *digitgrade*), there are shock absorbing, hairless, keratinized epidermal organs known as “pads”. Additional modification, with some retention of these structures, occurs in the animals that we study. For our purposes, these animals can be separated in to two different groups: those with claws (which includes our carnivores), and those with hooves (*ungulates*).

<u>Carnivores</u>

The distal joints of the canid limbs are protected on their palmar and plantar surfaces by thickened layers of epidermis and and modified subcutis so that each digit has its own respective **digital pad**. Sweat glands located in the digital pads are used for marking. The characteristic “clawing” seen by cats on the furniture or dogs in areas where they have defecated are actually related to territorial marking behaviors. In the thoracic limb, a **metacarpal pad** (or corresponding metatarsal pad in the pelvic limb) lies palmar to the metacarpal region of the manus and the sesamoid bones of the metacarpophalangeal joints are embedded in this pad. Weight is primarily borne on the metacarpal/metatarsal pads and digital pads for digits II-V, as they are the weight-bearing digits. The thoracic limb retains a **carpal pad** located palmar to the carpal joint, but there is no tarsal pad in the canine pelvic limb.

The **claw** of a carnivore consists of keratin and is shaped by the ungual process of the distal phalanges, to which they are attached by a laminar dermis. The ventral margin of the claw contains the sole, which is a whitish, crumbly substance. Claws of domesticated carnivores, if not worn down, will require trimming to prevent growing around and penetrating the digital pads. Special trimmers should be used (read: *not your toenail trimmers*) so that *even* pressure is applied during a trim and care should be taken not to trim the claw to the level of exposing or damaging the vascular and sensitive dermis. The claws of canids and felids are kept retracted by elastic dorsal ligaments that extend from the proximal ends of the middle phalanges to the unguicular crests of the distal phalanges. In the felid, additional elastic ligaments also extend from the proximal phalanx and retract the feline digits so that they are both more elevated than the canid claws, but also drawn towards the middle digit. The **deep digital flexor tendon** opposes this ligament and when tension is applied via contraction of the deep digital flexor muscle, the claws protrude for scratching and/or digging.

Ungulates

The **claw** of the bovid is the common term for their hooves and dewclaws. There is one hoof for each weight-bearing digit and the organization of the bovid hoof is similar to that of the equid. Our ungulates bear weight on their digital cushion and hoof wall. The digital cushion is encased within the hoof wall and these structures are specialized for absorption of concussive forces.

The outer **wall** of the equid's hoof is divided into several regions: the dorsal **toe,** the **quarters**, and the palmar/plantar **heels**. Much like the claw, the hoof wall is composed of horny, keratinized epithelial cells. The outermost layer, the **periople,** is a waxy substance that essentially waterproofs the hoof. At the proximal edge of the hoof (the **coronet**), it overlies the **coronary band** – the visible portion of the coronary dermis.

When viewing the solar surface of the foot, the triangularly-shaped **frog**, a modified digital pad, can be seen projecting in to the dorsally arched **sole**. The middle groove of the frog is the **central sulcus**. **Collateral sulci** lie on either side of the frog and are separated from the sole by the **bars**, which are the solar projections of the wall adjacent to the **heels**. Palmarly, the frog becomes the **bulbs** that fill the space between the heels. The shock-absorbing digital cushion is found just deep to the frog. The function of the hoof includes reducing the concussive forces on the digit and its elastic nature aids in the return of blood to the heart.

Overlying the coffin bone is the laminar dermis (**sensitive laminae**) that physically interdigitates with the deepest layer of the epidermis of the wall (**insensitive laminae**). The junction between the two is represented more superficially by the **white line**, which is found on the solar surface of the hoof. In a saggital section of the hoof, the white line will form the actual separation between dermis and epidermis.

Proximally, the **tendon of the superficial digital flexor m**. inserts on the distopalmar/distoplantar aspect of the long pastern bone (P1), as well as the proximopalmar/proximoplantar region of the short pastern bone (P2). The **deep digital flexor tendon** continues distally to insert on the palmar/plantar aspect of the coffin bone (P3). DDF tendon is separated from the **navicular bone** (distal sesamoid bone**)** by the **navicular (podotrochlear) bursa**, which prevents excessive strain and wear on the tendon. As in the canid, the extensor tendon inserts on the extensor process of the distal phalanx. The coffin bone is extended proximopalmarly by the **ungual cartilages**. These lateral cartilages aid in the function of the digital cushion to return blood from the limb and in distributing the concussive forces. With repetitive concussion, ungual cartilages may become ossified (a condition known as “**sidebone**”).

In the equid, **ergots** are found on the palmar/plantar aspects of the equine fetlock, and are equivalent to metacarpal/tarsal pads in the canid. The ergot is also stabilized with medial and lateral ligaments of the ergot that can be confused during palpation of the digit for the digital neurovascular bundle. The **chestnut**, found proximal and medial to the carpus, is the equid’s vestigial carpal pad. Unlike canids that lack tarsal pads, chestnuts are also present on the equine pelvic limb of the domestic horse (however, they are lacking in some wild equids).

Lab 5 Short Objectives

Neurovascular structures - *Identification and primary function of these structures in VCA images & on canine specimens. If there is a * next to the structure, be prepared to identify it and give its function in the VEA and equine specimens.* *<u>If there is a # next to the structure, it is found in the equine or bovine limb only.</u>*

Median cubital v.
Cephalic v.
Accessory cephalic v.
Brachial v.

Subscapular a.
Brachial a.
Collateral ulnar a.
Median a.*
Medial palmar a. #
Medial and lateral digital aa. #

Axillary n.
Median n.*
Ulnar n. *
Radial n.*
Musculocutaneous n.
Medial and lateral palmar nn. #
Medial and lateral palmar digital nn. #

Equine Stabilization

Serratus ventralis m.
Lacertus fibrosis
Radial check ligament
Carpal check ligament
Suspensory apparatus
Biceps brachii m.

Thoracic Limb

Bones of the Thoracic Limb

Scapula

dorsal scapular cartilage (Eq)

scapular spine

- tuberosity of the scapular spine (Eq)
- acromion (Car, Ru)
  suprahamate process (Fe)

supraspinous fossa

infraspinous fossa

supscapular fossa

neck

- suprascapular notch

glenoid cavity

supraglenoid tubercle

infraglenoid tubercle

coracoid process

Clavicle (Fe)

Humerus

head

greater tubercle (Bo: very large)

intermediate tubercle (Eq)

lesser tubercle

intertubercular groove(s)

deltoid tuberosity

teres major and minor tuberosities

humeral condyle

lateral and medial epicondyles

olecranon fossa

supratrochlear foramen (Can, Eq, Bov)

supracondylar foramen (Fe)

Radius

head

styloid process

Eq: medial and lateral styloid processes

Ulna

olecranon

trochlear notch

radial notch

anconeal process

medial and lateral coronoid processes

styloid process (Car, Ru)

Carpus

accessory carpal bone

ulnar carpal bone

radial carpal bone

intermediate carpal bone (Ru, Eq)

carpal bones I-IV

Eq: carpal bones II-IV (I rudimentary or absent)

Bo: carpal bone I absent, II and III are fused

Metacarpal bones I-V

Eq: II=medial "splint bone", IV= lateral "splint bone", III= "cannon bone"

"buttons"= distal ends of "splint" bones

Bo: III and IV fused="large metacarpal bone"

elongated, oval, small metacarpal bone V*

*<u>not</u> an extra carpal bone.

proximal sesamoid bones

Digits I-V

Car: I-V (I lacks middle phalanx), Eq: III only, Bo: II-V (only III and IV fully developed)

proximal phalanx

middle phalanx

distal phalanx

ungual process (Car)

distal sesamoid bone(s)

Articulations of the Thoracic Limb

Scapulohumeral (shoulder) joint

between the glenoid cavity of the scapula and the head of the humerus

Elbow joint

includes humeroradial, humeroulnar, and proximal radioulnar articulations

Carpal joint

includes antebrachiocarpal, midcarpal, and carpometacarpal articulations

Metacarpophalangeal joint (Fetlock joint, Eq)

between metacarpal bones and proximal phalanges

Proximal interphalangeal joint (Pastern joint, Eq)

between proximal and middle phalanges

Distal interphalangeal joint (Coffin joint, Eq)

between middle and distal phalanges

Palpation

spine of scapula

greater tubercle of humerus

acromion of scapula

epicondyles of humerus

olecranon process of ulna

accessory carpal bone

Thoracic Limb Terms

Thoracic girdle

scapula

clavicle (Fe)

Arm or brachium

humerus

Forearm or antebrachium

radius

ulna

Forepaw or manus

carpal bones

metacarpal bones

phalanges

Muscles of the Thoracic Limb

Extrinsic muscles: limb to body

superficial fascia

deep fascia

cutaneus trunci m.

superficial pectoral m.

deep pectoral m.

subclavius m. (Eq, Bo)

brachiocephalicus m.

- clavicular intersection
- cleidobrachialis
- cleidocephalicus

omotransversarius m.

- superficial cervical lymph nodes (deep to omotransversarius)

trapezius m.

rhomboideus m.

latissimus dorsi m.

serratus ventralis m.

Intrinsic muscles: within limb only

Shoulder mm.

deltoideus m.

acromial and scapular heads (no separate heads in Eq)

infraspinatus m.

supraspinatus m.

subscapularis m.

teres major m.
teres minor m.
coracobrachialis m.

Brachial mm.

tensor fascia antebrachii m.

triceps brachii m.

long head

lateral head

accessory head (Car, Bo)

medial head

biceps brachii m.

transverse humeral retinaculum
internal tendon

lacertus fibrosis (Eq)

brachialis m.
anconeus m.

Antebrachial mm.

Craniolateral group

extensor retinaculum

extensor carpi radialis m.

common digital extensor m.

lateral digital extensor m.

extensor carpi ulnaris m. (ulnaris lateralis m.)

supinator m. (Car)

extensor carpi obliquus m. (Eq, Bo)
abductor digiti I longus m. (Car)

Caudomedial group

pronator teres m. (Car)

flexor carpi radialis m.

superficial digital flexor m.

  accessory (radial) check ligament (Eq)

flexor carpi ulnaris m. (ulnar and humeral heads)

deep digital flexor m.

  accessory (carpal) check ligament (Eq)

suspensory ligament/interosseus m. (Eq, Bo)

Additional structures (Eq)

ergot (metacarpal pad)

chestnut (carpal pad)

Bovine muscle variations

common digital extensor m.

large medial belly (inserts on middle phalanx of digit III)

smaller lateral belly (inserts on distal phalanx of both digits)

lateral digital extensor m.

tendon inserts on middle phalanx of digit IV

superficial digital flexor m.

two bellies (deep & superficial)
  deep belly is termed interflexorius m.

two tendons (fuse at mid-metacarpus)

combined tendon splits at fetlock and inserts on both digits

no check ligaments

deep digital flexor m.

tendon splits and inserts on both digits

no check ligaments

suspensory ligament

two separate interosseus mm. (one for each metacarpal) fused into one

Innervation and General Functions

Function	Innervation
Shoulder flexors	
infraspinatus m.	suprascapular n.
deltoideus m.	axillary n.
teres minor m.	axillary n.
teres major m.	axillary n.
long head of triceps brachii m.	radial n.
latissimus dorsi m.	thoracodorsal n.
Shoulder extensors	
brachiocephalicus m.	accessory and cervical nn.
supraspinatus m.	suprascapular n.
biceps brachii m.	musculocutaneous n.
coracobrachialis m.	musculocutaneous n.
Elbow flexors	
brachialis m.	musculocutaneous n.
biceps brachii m.	musculocutaneous n.
Elbow extensors	
triceps brachii m.	radial n.
tensor fasciae antebrachii m.	radial n.
Carpal flexors	
flexor carpi radialis m.	median n.
flexor carpi ulnaris m.	ulnar n.
superficial digital flexor m.	median n.
deep digital flexor m.	median & ulnar nn.

Carpal extensors	
extensor carpi radialis m.	radial n.
common digital extensor m.	radial n.
lateral digital extensor m.	radial n.
Digital flexors	
superficial digital flexor m.	median n.
deep digital flexor m.	median & ulnar nn.
Digital extensors	
common digital extensor m.	radial n.
lateral digital extensor m.	radial n.

Vessels and Nerves of the Thoracic Limb, Paw, & Hoof

Arteries

axillary a.
- subscapular a.
  - caudal circumflex humeral a. (branch of subscapular)
  - thoracodorsal a. (branch of subscapular)
- cranial circumflex humeral a. (branch of axillary)

brachial a.
- deep brachial a.
- bicipital a.
- collateral ulnar a.
- superficial brachial a.
- common interosseus a.

median a.
- deep antebrachial a.
- radial a.

Veins

axillary v.

cephalic v.

accessory cephalic v.

median cubital v.

axillobrachial v.

external jugular v.

brachial v.

Nerves

suprascapular n.

subscapular n.

axillary n.

thoracodorsal n.

lateral thoracic n.
musculocutaneous n.

radial n.

- deep branch
- superficial branch

median n.

ulnar n.

Equine vessels and nerves

Arteries

collateral ulnar a.

median a.

- radial a.
- lateral palmar a.
- medial palmar a.
  - lateral digital a.
  - medial digital a.

Veins

external jugular v.

cephalic v.

Nerves

radial n.

median n.

medial palmar n.

medial palmar digital n. & dorsal branches

communicating branch

lateral palmar n.

medial & lateral palmar metacarpal nn.*

lateral palmar digital n. & dorsal branches

ulnar n.

dorsal branch*

*usually too small to visualize

Structures of the Canine Foot

claw

distal phalanx

ungual process

digital pads

metacarpal (metatarsal) pad

carpal pad (no tarsal pads)

Structures of the Equine/Bovine Hoof/Foot

digit III (Eq), III/IV (Bo)
claw (Bo)
coronet
periople
wall
toe
quarters (Eq)
heels (Eq)
ungual cartilages of distal phalanx (Eq)
bulbs
sole
frog
    collateral (paracuneal) sulci (Eq)
    central (cuneal) sulcus (Eq)
bars
white line
laminae (sensitive and insensitive)
distal phalanx
distal sesamoid bone (navicular bone)
podotrochlear (navicular) bursa
tendon of the deep digital flexor m.
tendon of the superficial digital flexor m.
common digital extensor tendon
digital cushion

NOTES

Vertebral Column/Spinal Cord Laboratory "Exercises"

Lab 6 Exercises

Vertebral Column and Formula

The different sections of the vertebral column are named in association with the spinal cord anatomy in that region. The most cranial vertebrae are the 7 **cervical vertebrae**. The 7th cervical vertebra articulates with the 1st **thoracic vertebra**. The number of **thoracic vertebrae** vary among species; horses have 18, while the dog and ox have 13. Moving caudally, we reach the **lumbar vertebrae**, which also vary in number – not just among different species, but among different breeds of the same species (horses, in particular). The **sacrum** is formed by the fusion of the **sacral vertebrae,** and articulates with the ossa coxarum. The **caudal vertebrae** form the tail, and can vary among widely among species and breeds.

A **vertebra** is a single bone; collectively, the **vertebrae** form the **vertebral column,** which supports and protects the spinal cord, and is the foundation of the **axial skeleton.** A typical vertebra has a round, ventrally-located **body** that is convex on its cranial aspect and concave on its caudal aspect. The vertebral bodies articulate with one another, via **cartilaginous joints** supported by intervertebral disks.

Dorsal to the body, the **vertebral arch** is formed by the right and left **pedicles** (walls) and **laminae** (roof). The body and arch create a space in the vertebra, the **vertebral foramen**, through which the spinal cord passes. All of the vertebral foramina join to form the **vertebral canal**. Most vertebrae have a dorsal projection, the **spinous process**, on top of the arch, and **transverse processes** projecting laterally. There is also an **accessory process** present on the thoracic and lumbar vertebrae, most prominently on L1-L3. The spinous processes in the cranial vertebral column project more caudally, while those in the caudal vertebral column project more cranially. Each species has a specific vertebra where this change in 'inclination' occurs – the **anticlinal vertebra**. (**T11 dog, T16 horse, T13 ox).**

Articulation of adjacent vertebrae includes not only the cartilaginous joint between bodies, but also **synovial joints** between the **cranial** and **caudal articular processes** of neighboring vertebrae; these processes are named for their relative location on the vertebra – not the joint. This articulation creates pairs of openings between neighboring vertebrae, the **intervertebral foramina**, through which spinal nerves and blood vessels pass. Each intervertebral foramen is formed by a **cranial** and **caudal vertebral notch**, which are again named for their relative locations on the vertebrae.

Spinal Articulation and Ligaments

Vertebral joints include synovial joints between the articular processes, and cartilaginous joints between adjacent vertebral bodies. These cartilaginous joints include **intervertebral discs**, which have outer circumferential fibers, the **annulus fibrosus**, and an inner gelatinous core, the **nucleus pulposus.**

Narrow longitudinal ligaments are located along the length of the **vertebral canal**. The **ventral longitudinal ligament** is found on the ventral aspect of the vertebral bodies, from C2 to the sacrum. The thicker **dorsal longitudinal ligament** is dorsal to the vertebral body, on the floor of the vertebral canal, ventral to the spinal cord. The **ligamentum flavum (yellow ligament)** is found dorsal to the spinal cord itself, running between adjacent vertebral arches. This is the ligament that is penetrated when entering the epidural space.

Above the vertebral arches, there are **interspinous ligaments** that connect adjacent spinous processes. The **supraspinous ligament** is a longitudinal band of fibrous connective tissue that connects the apices of the spinous processes from T1-Cd3, and also contains contributions from the tendons of the epaxial muscles. Cranially, this ligament continues as the **nuchal ligament**, from C2-T1 in dogs. The nuchal ligament is much more elastic than the other spinal ligaments, and is very prominent in the horse and ox; they have a dorsal 'rope-like' **funicular** portion that extends between the spines of the 'withers' – spinous processes of T2-T4 – and the skull, as well as a ventral **laminar** ('page-' or 'sheet-like') portion which forms a fenestrated sheet of attachment from the spines of T2/3 to those of C2-C7.

Cervical and Thoracic Vertebrae

Notice that the first and second cervical vertebrae – the **atlas** and **axis** – are shaped differently from the other vertebrae to allow for increased movement of the head, although they retain the characteristics (body, arch, etc.) of a 'normal' vertebra.

The **atlas, C1,** has a small body that bears a shallow depression, the **fovea dentis,** on its dorsal surface, within the vertebral foramen. The transverse processes of the atlas are modified into broad, flat **wings**, which bear the **transverse foramina**, through which vertebral arteries pass. The arch of the atlas contains additional foramina, the **lateral vertebral foramina**, which allow passage of the first spinal nerve (n. C1).

The **axis, C2,** has a body that is more-or-less typical, but is modified at its cranial end into the prominent **dens**, which articulates with the fovea dentis of the atlas. The spinous process of the axis is flattened and elongated into a distinctive fin-like shape. The lateral sides of the axis bear **transverse foramina**, through which vertebral arteries pass.

The remaining cervical vertebrae share many characteristics – a cylindrical **body**, identifiable **cranial** and **caudal articular processes**, a relatively short **spinous process**, and short, broad **transverse processes.** There are only **transverse foramina** through the 6^{th} cervical vertebrae, however; **C7** does *not have transverse foramina*. The transverse foramina – from C1-C6 – contain the vertebral arteries and nerves; note that the vertebral nerves are *not* the same as spinal nerves. Spinal nerves exit the spinal column via the **intervertebral foramina** between adjacent vertebrae (with the exception of the first spinal nerve).

C7 articulates with the first **thoracic vertebra**. The thoracic vertebrae form the dorsal aspect of the thoracic cavity, which is protected by the ribcage. Thoracic vertebrae, which vary in number among different species, have short, cylindrical **bodies** and prominent **spinous processes**. The short **transverse processes** of the thoracic vertebrae have rounded depressions on their ventral surfaces to accommodate the rounded tubercles of the ribs. Each thoracic vertebra has a **cranial** and **caudal costal fovea**, named for their location on the vertebra; the costovertebral joints are formed by the articulation of the head of a rib with the costal fovea of two neighboring vertebrae, whose cranial and caudal costal fovea line up to form a single depression large enough to accommodate the head of the rib.

The ribs themselves consist of a bony **head** and **body**, and a cartilaginous section, the **costal cartilage**, which articulates with the **sternebrae** in the sternal, or ‘true’ ribs, or forms the **costal arch** in the asternal, or ‘false’ ribs. The **sternum** is composed of 8 individual **sternebrae**, the most cranial of which is called the **manubrium**. The last sternebra is a flattened bone called the **xiphoid process**. The manubrium always articulates with the first pair of ribs, although the number of sternal versus asternal ribs varies among different species.

Spinal Cord

The **brain** and the **spinal cord** are the fundamental elements of the **central nervous system**. The spinal cord is divided into segments according to its associated vertebra. **Dorsal** and **ventral roots** leave each spinal cord segment on either side and combine to form a **spinal nerve** before exiting the spinal column through the **intervertebral foramina**. The **dorsal root ganglia**, located in the dorsal roots, are the collected cell bodies of the afferent sensory neurons bringing sensory information from the periphery. The spinal nerves provide motor and sensory innervation to the adjacent tissues, and combine - in the **brachial** and **lumbosacral plexi** – to form peripheral nerves that innervate the limbs.

Within the bony protection of the skull and vertebral column, the brain and spinal cord are covered by 3 layers of connective tissue called the **meninges**. The **pia mater** is the layer that adheres directly to the nervous tissue. The **arachnoid** is the next layer, which is separated from the pia by a **subarachnoid space**. This anatomical space is filled with **cerebrospinal fluid**. The arachnoid connects directly to the thickest, outermost meninx, the **dura mater**. Within the skull, the dura mater is fused with the cranial periosteum, eliminating the **epidural space**. In the spinal cord, the epidural space – between the dura and the vertebral column – is filled with fat, fluid, and a vertebral venous plexus that cushions the spinal cord and allows it to adjust to the movements of the vertebral canal.

On the lateral surface of the spinal cord, the pia mater is thickened into **denticulate ligaments**, which attach to the interior of the arachnoid and dura between each of the spinal nerve roots and adjacent spinal cord segments. The spinal cord comes to an end near L6/L7 as the **conus medullaris**, which resembles a narrow, pointed cone. It is connected to the caudal vertebrae by the **filum terminale**, a narrow cord of pia mater. Caudal to the conus medullaris, there are lumbar, sacral, and caudal nerve roots that extend beyond the termination of the spinal cord. These long nerve roots form a fibrous bundle called the **cauda equina.**

Muscles of the Back

The muscles of the back are divided into two different groups, according to their location relative to the vertebral column and their innervation.

The **hypaxial muscles** are ventral to the transverse processes, and are supplied by ventral rami (branches) of the spinal nerves. These include muscles of the abdominal and thoracic walls.

The **epaxial muscles** lie dorsal to the line of the transverse processes of the vertebrae, and are supplied by the dorsal rami (branches) of the spinal nerves. These groups of muscles are extensors of the vertebral column, and are arranged in three parallel columns on either side of midline. The most lateral group is the **m. iliocostalis**, which extends from C7 to the wing of the ilium bone. The middle column is the **m. longissimus**, which runs from the head to the wing of the ilium. The most medial column is the **m. transversospinalis**, which extend between two or more vertebrae. The epaxial muscles are best appreciated in the thoracic region.

The **splenius muscle** is an epaxial muscle. It has been described as a modification of the transversospinalis muscle system that is associated with the cranial portion of m. longissimus. This thick, triangular muscle extends from the skull to the dorsal spines of T3, and is covered by the **rhomboideus** and **trapezius muscles.** There are named muscles deep to m. splenius that are 'true' members of the transversospinalis system in the cervical region, but students will not need to identify these for this course. Simply recognize that the splenius muscle is an *epaxial muscle*.

There are muscles that originate dorsal to the transverse processes and insert below it, including **m. serratus dorsalis cranialis** and **m. serratus dorsalis caudalis)**, which are important in respiration. The **m. serratus ventralis** originates along the transverse processes of C3-C7 and the ventral halves of ribs 1-7 or 8 and inserts on the serrated face of the medial aspect of the scapula bone. This large, fan-like muscle is critical for supporting the trunk and limb during different phases of the gait. The **scalenus muscle** is a wedge-shaped hypaxial muscle found ventral to m. serratus ventralis. It also joins the ribs (1, 3, 4, 7-8) to the transverse processes of C4-C7, and assists with flexion of the neck and respiration.

Vertebral Column

Vertebral formula

Dog/Cat: C7, T13, L7, S3, Cd (variable)

Horse: C7, T18, L6(5), S5, Cd15-21

Ox: C7, T13, L6, S5, Cd18-20

Vertebral column

vertebral canal

intervertebral foramina (formed from 2 vertebral notches)

Vertebrae (general)

body

arch

- pedicles
- laminae

vertebral foramen

vertebral notches (cranial and caudal)

spinous process

transverse processes

articular processes (cranial and caudal)

Anticlinal vertebrae

Dog/cat: T11

Horse: T16

Ox: T13

Ligaments

nuchal ligament (Ungulates: laminar and funicular parts)

supraspinous ligament

interspinous ligament

dorsal longitudinal ligament

ventral longitudinal ligament

ligamenta flava (yellow ligament)

Articulations

caudal/cranial articular processes (synovial joint)

intervertebral disc (fibrocartilaginous joint)

- annulus fibrosus and nucleus pulposus

sacroiliac joint (synovial joint)

Spinal cord

epidural space

spinal nerve

dorsal root ganglion

dura mater

arachnoid

pia mater

- denticulate ligaments
- filum terminale

conus medullaris

cauda equina

Cervical vertebrae

transverse foramina

atlas

- wings (transverse processes)
- lateral vertebral foramina

axis

- dens

spinous process

Thoracic vertebrae

costal articular fovea (cranial and caudal)

anticlinal vertebrae

Lumbar vertebrae

accessory processes

Muscles

iliocostal system of mm.

longissimus system of mm.

transversospinalis system of mm.
- splenius m.

serratus ventralis m.

scalenus m.
sternothyroideus m.
sternohyoideus m.

Ribs

head

costal cartilage

costal arch

floating rib

Sternum

sternebrae

manubrium

xiphoid process

NOTES

Thorax/Abdomen/Pelvis Laboratory Exercises

Lab 7 Exercises

It is ***highly*** recommended that you take the time to review your lecture notes **AND** the VCA for the *functional significance* of the structures listed in the objectives. The Exercises will give you a *brief* overview and orientation of the thorax, lungs, and heart, but **are not** designed to be all-inclusive summaries of the material. Exam questions will not only ask for identification, but also knowledge of the structure (eg., does it contain pre vs. post ganglionic fibers? Are they sympathetic vs. parasympathetic? Is the blood in this vessel "oxygenated" or "deoxygenated"?).

Thoracic Wall and Thorax

The **thoracic wall** is formed by the thoracic cage, which is the cranial portion of the body wall. The cavity within the thoracic wall is the **thorax**, which functions to protect the heart and lungs, withstand the negative pressure of respiration, and support the forelimb. The thorax is cone shaped with an **inlet** formed by the first thoracic vertebrae (T1), the first rib, and the manubrium. The **thoracic outlet** is the last thoracic vertebra, the costal arch, and the xiphoid. The internal margin of the thoracic outlet is the **diaphragm**, a musculotendinous "dome" that separates the thorax from the abdominal cavity and has a role in several physiologic functions. The diaphragm inserts along the thoracic wall, and contains three natural openings – the **esophageal hiatus**, the **aortic hiatus**, and the **caval foramen** – that allow structures to pass into the abdominal cavity.

Several muscles maintain the integrity of the thoracic wall, including extrinsic, epaxial, hypaxial, and intercostal muscles. *Be sure to review the muscles along the thoracic wall.*

The **internal** and **external intercostal muscles** are an "extension" of the internal and external abdominal oblique muscles, respectively. These muscles are innervated by the **intercostal nerves**, which are found just caudal to each rib and are accompanied by the **intercostal artery** and **intercostal vein.** The intercostal arteries are branches from the aorta that anastamose with the **internal thoracic arteries** ventrally. The **internal intercostal veins** drain in to the **azygous vein**, which is an unpaired vein found dorsally in the thorax.

The thorax or thoracic cavity contains two main sections: the **pulmonary cavities** and the **mediastinum**. These "spaces," or cavities, are defined by the **pleura**, serous membranes that line the interior of the thoracic cavity (and mediastinum) and envelope the lungs. These serous membranes can be divided into **visceral pleura,** which is closely attached to the surface of the lungs, and **parietal pleura.** The parietal pleura is attached to structures 'away' from the lungs within the thorax, and can be divided into regions: the **mediastinal**, **diaphragmatic,** and **costal parietal pleura.**

The mediastinum is a potential space, lined with mediastinal pleura, which contains a number of structures: the thymus gland, heart, aorta, cranial vena cava, azygous vein, internal thoracic artery, esophagus, trachea, thoracic duct, sympathetic trunk, vagus nerve, and phrenic nerves. The **caudal vena cava** is contained within its own reflection of pleura – the **plica vena cava** – and is therefore NOT in the mediastinum.

Heart – External Anatomy

The heart is located within the mediastinum and cradled within the **cardiac notch** of the lungs. The great vessels join the **base** of the heart within the central thorax; the heart tapers to a point, the **apex**, that faces ventrally and caudally.

The heart resides in the **pericardium**, or heart sac, which is comprised of serous membrane and connective tissue. The visceral layer of the serous pericardium, the **epicardium**, is adhered tightly to the heart. A small amount of pericardial fluid separates the epicardium from the **parietal serous pericardium**. This parietal layer attaches to a connective tissue layer that "anchors" the heart within the thorax.

The heart is divided into four chambers; left and right **atria** and **ventricles**. Each atrium has a pouch-like extension: the left and right **auricles**. The coronary groove separates the atria and ventricles; whereas the interventricular grooves separate the right and left ventricles. The right and left **coronary arteries** arise from the **aortic sinus** to supply the heart itself. They can be seen within the coronary groove before branching and continuing into the interventricular grooves (*be aware that the branching patterns differ among species*).

The **cranial vena cava** and **caudal vena cava** carry deoxygenated blood from the tissues to the right atrium. The right ventricle pumps deoxygenated blood to the lungs via the **pulmonary trunk**, which branches into the **left and right pulmonary arteries**. Oxygenated blood returns to the left atrium of the heart from the lungs by way of the **pulmonary veins**. Oxygenated blood is pumped from the left ventricle to the tissues via the **aorta**. The aorta ascends cranially before bending caudally as the **aortic arch**, which gives rise to arteries that branch to supply the head, neck, and thoracic limbs. *The branching pattern from the aortic arch varies among species.*

During fetal development, a large anastomosis – the **ductus arteriosus** – exists between the pulmonary trunk and the aorta, allowing blood to bypass the lungs. At birth, the ductus contracts, closing its lumen. The remaining fibrous attachment is known as the **ligamentum arteriosum.**

Clinical interest: The ligamentum arteriosm is located on the left thorax and is clinically important due to its relationship to the left recurrent laryngeal n. The left recurrent laryngeal n. leaves the left vagus n. in the thorax, wraps around the aorta near the ligamentum arteriosum, ascends cranially along the dorsolateral aspect of the trachea, and terminates as the left caudal laryngeal nerve. The right recurrent laryngeal n. leaves the right vagus n. in the thorax, wraps around the right subclavian artery, also ascends cranially along the dorsolateral aspect of the trachea, and terminates as the right caudal laryngeal nerve. The ligamentum arteriosum is located farther caudad than the subclavian a., causing the *length* of the left recurrent laryngeal n. to be significantly longer than the right recurrent laryngeal n. We will revisit this clinical problem again during the Head Unit, but recognize that the increased length on the left may lend itself to a greater propensity to neurodegenerative disease, and clinical disease recognized more on the LEFT vs. RIGHT for the laryngeal mm. innervated (or lack thereof) by these nn.

Heart – Internal Anatomy

The interior structure of the heart is a result of its function. The muscular walls of the heart – the myocardium – are thicker in the left ventricle than in the right. This is due to the increased pressure required to pump blood from the left ventricle out to the tissues than from the right ventricle to the lungs.

Deoxygenated blood travels into the **right atrium** from the tissues via the cranial and caudal venae cavae. There is an opening within the right atrium for the **coronary sinus**, which is the dilated termination of the externally viewed **great cardiac vein**, that returns deoxygenated blood from the heart muscle itself.

The **pectinate muscles** are primarily visible in the right atrium as thin, raised, intertwining ridges radiating through the interior wall of the atrium and auricle. The **fossa ovalis** is a distinct, smooth depression visible in the dorsal part of the right atrium, a remnant of the **foramen ovale**. This foramen lies within the fetal interatrial septum (the “wall” between the two atria), allowing blood to pass from the right to the left atrium, but closes after birth.

In adult life, blood flows from the right atrium to the **right ventricle** through the **right atrioventricular** (**AV**), or **tricuspid valve**. Although it is called the *tri*cuspid valve, the right AV valve in the dog contains only two leaflets. The valve is tethered to resist increased pressure in the right ventricle during contraction by **chordae tendinae,** which are attached to **papillary muscles** in the right ventricle. A muscular band of tissue, the **moderator band,** or **trabecula septomarginalis**, crosses the lumen of the right ventricle to the **interventricular septum** – the “wall” between the two ventricles – to facilitate efficient contraction of the ventricular myocardium.

Blood flows from the right ventricle through the **pulmonary,** or **semilunar valve**, into the pulmonary trunk, which divides into the left and right pulmonary arteries, which bring deoxygenated blood to their respective lungs. After gas exchange takes place in the lungs, oxygenated blood returns to the heart via the **pulmonary veins** to the **left atrium.** The **left atrioventricular (AV) valve** (also known as the **bicuspid**, or **mitral valve**) is located between the left atrium and the **left ventricle.** Again, chordae tendinae, attached to the papillary muscles, secure the valve leaflets so they remain closed during contraction of the left ventricular myocardium.

Outflow from the left ventricle is through the **aortic,** or **semilunar valve** into the **ascending aorta**, where the **aortic sinus**, associated with the valve cusps, gives rise to the left and right coronary arteries, which supply the myocardium itself. The ascending aorta continues as the **aortic arch**, which gives off varying great vessels of the heart to the cervical, thoracic, and cranial regions, and finally as the **descending aorta** to the caudal thorax and body.

Lungs

The airway begins in the upper respiratory tract (nasal passages – to be covered in Head) and continues down the **trachea** to the lungs. The trachea divides into the **left** and **right principal bronchi.** The anatomical structure separating the origins of the principal bronchi from the trachea is the **carina**. Each principal bronchus branches out into the various left and right lung lobes.

Of interest is the bovine **tracheal bronchus**, which leaves the trachea cranial to the principal bronchi and goes to the right cranial lung lobe.

The various lung lobes are determined by the branches of the principal bronchi, and are accompanied by arteries and veins. Lung lobe patterns in the different species are as follows:

- **Bovine**
  Left lung:
  cranial lobe with cranial and caudal parts
  caudal lobe
  Right lung:
  cranial lobe w/ cranial and caudal parts, **tracheal bronchus**
  middle lobe
  accessory lobe
  caudal lobe

- **Equine**
  Left lung:
  cranial lobe
  caudal lobe
  Right lung:
  cranial lobe
  caudal lobe
  accessory lobe

- **Canine**
  Left lung:
  cranial lobe with cranial and caudal parts
  caudal lobe
  Right lung:
  cranial lobe
  middle lobe
  accessory lobe
  caudal lobe

Where the lungs are connected to the trachea and heart is termed the **root of the lung**. Lymph nodes surrounding the lungs include the **tracheobronchial**, or **hilar, lymph nodes**. The **thoracic duct** is a lymphatic vessel that carries lymph and chyle from the caudal half of the body, the left thoracic limb, and left side of the head and neck. It can be seen emptying into the left subclavian vein in the equine thorax. In all species, a conspicuous **cardiac notch** is present in the lung lobes, where the heart resides.

ANS

The motor limb of the autonomic nervous system consists of sympathetic and parasympathetic nerves that innervate smooth and cardiac muscles, and glands. Both the sympathetic and parasympathetic divisions reach their target organs using a sequential two-neuron efferent pathway: a **preganglionic** neuron always leaves the central nervous system to synapse onto a **postganglionic** neuron housed in a peripherally located ganglion which, in turn, influences the activity of a target organ. Sympathetic peripheral ganglia are grossly identifiable and therefore named whereas parasympathetic peripheral ganglia are embedded within the walls of their target organs; hence the term “intra-mural” (within-wall) ganglia. Parasympathetic activity increases anabolic, restorative processes like digestion (“rest and digest”). Sympathetic activity, however, changes physiology to meet stressors (“fight or flight”). It increases cardiac output and blood flow to skeletal muscles, mobilizes fuel molecules, and reduces gastrointestinal activity.

Sympathetic peripheral anatomy

Preganglionic sympathetic nerve fibers leave the thoracic and lumbar spinal nerves and assemble into a chain of interconnected ganglia that run parallel to the vertebral bodies in the **sympathetic trunk** or sympathetic chain - visible just deep to the parietal pleura within the thorax. The ganglia are called **sympathetic chain ganglia** or paravertebral ganglia. Postganglionic neurons within the sympathetic chain ganglia are destined to leave the sympathetic trunk entirely, piggy-backing on nearby spinal nerves to innervate structures in the skin. The sympathetic trunk continues caudally to the abdominal region, giving off **splanchnic nerves** (preganglionic neurons) to the celiacomesenteric ganglia and plexus. These sympathetic ganglia then distribute postganglionic fibers to various abdominal target organs.

Cranially, preganglionic sympathetic nerve fibers that have bypassed the chain ganglia while traveling in the sympathetic trunk may synapse on the first ganglion encountered, the **cervicothoracic ganglion**, and postganglionics will continue to innervate structures in the cervical region (neck) via the **vertebral nerve**. Preganglionics may continue past the cervicothoracic ganglion along the the **ansa** (loop) **subclavia** (around the subclavian artery), to synapse at the **middle cervical ganglion**, or continue cranially along the **vagosympathetic trunk** to the most cranial of sympathetic ganglia, the **cranial cervical ganglion**, located deep within the head (to be dissected later). Postganglionic sympathetic fibers that arise from the middle cervical ganglia are distributed to the thoracic viscera (heart, lungs, etc.).

Parasympathetic peripheral anatomy

The **vagosympathetic trunk** contains preganglionic sympathetic nerve fibers and vagal efferent and afferent nerve fibers. The **vagus nerve** is one fascicle, and the sympathetic trunk is a second fascicle, contained within a common "nerve" or epineurium. The vagosympathetic trunk is bundled with the **common carotid artery** and the **internal jugular vein** in the **carotid sheath**, a modification of the cervical fascia. At the middle cervical ganglion, the vagus nerve "separates" from the sympathetic fibers and continues caudally in the thorax. As the vagus nerve passes the heart, it sends preganglionic branches (cardiovagal branches) to an intermural ganglion within the heart. Dorsal to the base of the heart, each vagus nerve (left and right) divides into two distinct nerves, the **dorsal** and **ventral branches of the vagus nerve**, which course along the esophagus toward the diaphragm. Each branch unites with its fellow from the contralateral side (left and right) before reaching the **esophageal hiatus**. Right and left dorsal vagal branches unite to form the **dorsal vagal trunk**, and right and left ventral vagal branches become the **ventral vagal trunk**. These are then distributed, along with their preganglionic parasympathetic fibers, to various intermural ganglia embedded within the abdominal viscera.

Note:

While the sympathetic nervous system houses its preganglionic neurons in the thoraco-lumbar regions of the spinal cord, the parasympathetic nervous system houses its preganglionic neurons in two isolated regions of the central nervous system: the brainstem and sacral spinal cord (cranio-sacral origin). You are only responsible for identifying gross structures related to the cranial/brainstem origins of the parasympathetic nervous system (i.e. the vagus nerve – CN X). While the vagus nerve regulates activity in the thoracic and abdominal organs, the urogenital organs in the pelvic region are instead influenced by parasympathetic structures (such as the pelvic n.) originating in the sacral spinal cord.

Lab 7 Short Objectives

For all of these structures, be sure that you have reviewed the material provided in the text of the VCA and in lecture. This is not an “identify only” list.

External and internal intercostal mm.

Cranial vena cava

Caudal vena cava

Ansa subclavia

Dorsal vagal trunk

Papillary muscles

Ligamentum arteriosum

Brachiocephalic trunk

Azygous v. (Ca)

Visceral vs. parietal serous membranes (pleura/pericardium)

Diaphragm

Phrenic nn.

Lung lobes of the dog

Lab 8 Exercises

Abdominal Wall and Peritoneal Structures

The muscles of the abdominal wall form the abdominopelvic (both the abdominal and the pelvic) cavity and are essentially an extension of the muscles of the thoracic wall. These four muscles, when they contract, are able to aid in many physiologic processes; from superficial to deep, these muscles are:

external abdominal oblique m.
internal abdominal oblique m.
rectus abdominus m.
transversus abdominus m.

The rectus abdominis m. is enveloped in a 'sleeve' called the **rectus sheath**. This dense connective tissue is formed by deep (internal) and superficial (external) leaves from the aponeuroses of the internal abdominal oblique, external abdominal oblique, and transversus abdominus muscles.

The **linea alba** is the midventral raphe that consists of thoracolumbar fascia and the aponeuroses of the right and left lateral abdominal muscles. It is continuous with the **prepubic tendon**, which is a thick band of collagenous tissue attached to the ventral edge of the pelvis.

Within the abdominal and pelvic cavities, serous membranes known as **peritoneum** envelope the organs and form potential spaces or boundaries within the abdominopelvic cavity. The cavity is lined by **parietal peritoneum** and the organs that are located within the cavity (**intraperitoneal**) are covered with **visceral peritoneum**. The kidneys are described as being **retroperitoneal,** as they are located outside of the abdominopelvic cavity. Peritoneal folds that exist between neighboring organs, or between parietal and visceral layers of peritoneum, are known as **omenta, mesenteries,** or **ligaments**.

The **greater omentum** is the first thin, lacy structure encountered after reflecting the ventral abdominal wall. Its superficial and deep layers, or 'leaves,' form a potential space – the **omental bursa**. The greater omentum attaches from the greater curvature of the stomach to the dorsal body wall, and encompasses the left lobe of the pancreas in its path. The **lesser omentum** is small; connecting the lesser curvature of the stomach to the hilus of the liver. Different organs are associated with different portions of omentum.

The **mesentery** suspends the intestines from the body wall, and contains neurovascular and lymphatic structures. They are often named for the region of bowel or organ with which they are associated– e.g. mesentery of the colon = mesocolon. A short peritoneal attachment, the **root of the mesentery**, forms the actual connection to the dorsal abdominal wall. The length of the mesentery can vary depending on the region of bowel and the presence - or absence - of mesentery can be a distinguishing feature of a region.

There are several named **ligaments** that serve to fix organs in position. These can vary among different species; *refer to your list of structures for the ligaments you will be expected to identify*.

The **internal** and **external inguinal rings** form the **inguinal canal**, which is a slit between the abdominal muscles and the only natural passageway through the abdominal wall. A blind extension of peritoneum extends through the inguinal canal to a subcutaneous position in the inguinal region. In the male, this is the vaginal tunic, which contains the **spermatic cord**; in the female this is the **vaginal process**.

Four recesses or pouches are formed by invaginations of peritoneum within the caudal pelvic cavity. From dorsal to ventral, these are:

the **pararectal fossa,** between the dorsal body wall and the rectum,
the **rectogenital pouch**, between the rectum and reproductive organs,
the **vesiculogenital pouch**, between the reproductive organs and the urinary bladder, and
the **pubovesicular pouch**, between the urinary bladder and the ventral abdomen.

Canine Abdominal Viscera

We will address the basic flow of ingesta through the canine gastrointestinal tract, and the physical relationships among the organs, but you should also have an understanding of their basic physiologic functions.

The **esophagus** passes through the thorax within the mediastinum, and to the abdomen via the esophageal hiatus of the diaphragm. Just caudal to the **diaphragm**, the **liver** occupies the space within the ribcage, cranial to the **stomach** itself. The **gall bladder** fills a fossa between the quadrate and right medial lobes of the liver.

The esophagus enters the **cardia** of the stomach; ingesta then passes to the **fundus** of the stomach, then out the **pylorus**, where the **pyloric sphincter** regulates its movement into the **duodenum**. The duodenum is the proximal portion of the small intestine, where bile from the gall bladder and enzymes from the **pancreas** contribute to digestion. The pancreas itself sits between the pylorus of the stomach and the proximal duodenum, with two lobes that form a vague boomerang shape. The **spleen** occupies the space on the left side of the abdomen, just caudal to the stomach, to which it is attached via the **gastrosplenic ligament**.

The duodenum curves caudally from the stomach on the right side of the abdomen before transitioning into the **jejunum**, which is the longest portion of the small intestine and has a characteristic bouquet arrangement. The short, straight termination of the small intestine is the **ileum**. You will be able to see a small vessel on the anti-mesenteric surface of the ileum that will enable you to distinguish this transition. At the junction of the ileum and the colon is a small diverticulum of the colon, the **cecum**, which lies to the right of midline.

The initial portion of the colon is the **ascending colon**, which passes cranially from the cecum on the right side of the abdomen. As the colon bends, at the **right colic flexure**, it crosses midline as the **transverse colon**, before bending again at the **left colic flexure** and passing caudally on the left side of the abdomen as the **descending colon**. Beyond the pelvic inlet, the colon is continued by the **rectum**, which meets the **anus** at the most caudal part of the dog.

Equine Abdominal Viscera

The proximal GI tract of the horse is similar to the dog, with some notable differences.

The stomach is relatively small, given the size of the animal, and is internally divided into a non-glandular and glandular portion by a stepped edge, the **margo plicatus**. The combined effect of the sharp angle at which the esophagus meets the stomach and the well-developed cardiac sphincter is that the horse is effectively unable to eructate or vomit. The liver, pancreas, spleen, and small intestine of the horse are unremarkable, although it should be noted that horses lack a gall bladder.

The ascending colon of the horse is significantly different than that of the dog, beginning with the large **cecum**, which is modified to allow for fermentation. Its base lies within the right, dorsal abdomen; the body curves ventrally before tapering into the apex, which sits along the floor of the abdominal cavity.

The colon in the horse is designed to allow for fluid absorption; the **large colon**, or ascending colon, has been significantly elongated in to two c-shaped regions that occupy much of the ventral, lateral, and cranial abdomen. The ascending colon begins after the cecum as the **right ventral colon** (RVC) along the right ventral abdominal wall, which then curves to the left along the cranial abdomen as the **sternal flexure**, and becomes the **left ventral colon** (LVC) along the left ventral abdominal wall. The LVC luminal diameter and fluid content of the ingesta within the LVC both decrease dramatically as the LVC approaches the pelvic cavity. The LVC turns into the **pelvic flexure,** which allows the colon to take a dorsal turn and to continue cranially as the **left dorsal colon** (LDC). The LDC has a wide diameter and continues cranially and then across to the right just caudal to the liver as the **diaphragmatic flexure,** after which it becomes the **right dorsal colon** (RDC). The RVC, sternal flexure, and LVC are attached via a mesentery to the RDC, diaphragmatic flexure, and LDC, respectively.

The right dorsal colon then decreases in diameter and crosses from right to left as the **transverse colon**, which is the short termination of the large colon.

The **small colon** in the horse is the **descending colon** and this is where the last of fluid absorption will occur before the small colon becomes the rectum and anus.

Clinical Note: The longitudinal bands of smooth muscle that would normally surround the inner layer of circular smooth muscle of the GI tract are “concentrated” in regions called **teniae**, or **bands**, due to the increased diameter of regions of the equine colon.

These bands can be useful for identification of various regions of colon. For example: the pelvic flexure has only one band that is on the mesenteric side of the lumen and is therefore not palpable; the descending (small) colon has both a mesenteric and an “anti-mesenteric” band that is not associated with mesentery, is palpable, and therefore allows it to be distinguished from the pelvic flexure; the RVC has 4 bands, but one of the bands is mesenteric and is located where the RVC adjoins the RDC, the other three bands are “anti-mesenteric bands.”

When palpating per rectum, it is important to be able to distinguish between the small colon (palpable anti-mesenteric band) and the pelvic flexure (no anti-mesenteric band) in the caudal abdominal cavity. The pelvic flexure may also become displaced (left dorsal displacement) and become entrapped in the **nephrosplenic ligament**, a peritoneal ligament between the spleen and left kidney that is unique to the horse.

Ruminant Abdominal Viscera

To allow for fermentation in the foregut, the ruminant stomach is developed into different chambers with distinct internal properties. You will be expected to identify these chambers based on their relative locations as well as internal appearance.

The large ruminant stomach occupies much of the left half of the abdominal cavity. The **rumen** is the largest chamber; it is subdivided into regions, or **sacs**, by internal **pillars**, which are seen as **grooves** on the external surface of the rumen. *Refer to your lab guide for the names of the grooves/pillars/sacs.* The interior of the rumen is covered with **papillae**, giving it the appearance of a shag carpet. The smaller **reticulum** lies cranial to the rumen, and is functionally related; the two are often collectively referred to as the rumenoreticular compartment. Internally, the reticulum differs from the rumen by the presence of mucosal ridges that give it a distinct 'honeycomb' appearance. Because the reticulum presses against the diaphragm, ingested foreign bodies (wires, nails, etc.) can penetrate the reticulum and diaphragm, damaging the pericardium; this is known as traumatic reticulitis, or hardware disease.

The **omasum** lies to the right of the rumen and reticulum, and has large 'sheets' of mucosae, the **laminae**, that allow for some water resorption from the ingesta. A bypass exists in the nursing calf that allows milk to pass directly from the esophagus to the omasum, avoiding fermentation in the rumen and reticulum. This is the **reticular,** or **milk groove,** which crosses the dorsal part of the reticulum and opens into the omasum.

The **abomasum** is the 'true' stomach, in that it is the *only* glandular portion of the ruminant stomach. Acid and some digestive enzymes begin to work on the food at this point. The mucosal lining has multiple folds (gastric rugae) present. The junction of the abomasum (the pylorus) with the duodenum has an internal thickening in the wall that is easily palpated in a live animal. This is the **torus pyloricus,** and may be an aid in orientation in the case of abomasal displacement.

The bulk of the small and large intestines are loosely adhered together in an "intestinal mass" in the abdomen. This mass is found in the right flank region of the abdominal cavity, due to the large size of the stomach. The small intestine of the ruminant is unremarkable, as is the **cecum**. The colon is divided into the usual **ascending, transverse,** and **descending** parts; the first of these is modified into a distinct **spiral colon.**

Abdominal and Pelvic Vasculature

This brief list should provide basic directions for identification of the vessels you will be expected to find in lab.

➔ The following arteries are branches from the **abdominal aorta:**

Celiac artery: This is the first unpaired artery to the cranial viscera of the abdomen; it runs in the greater omentum and branches from the abdominal aorta almost immediately after emerging from the aortic hiatus.

There are three main branches from the celiac artery:
Hepatic a.: this large artery to the liver is first to leave the celiac artery;
Splenic a.: large artery to spleen. Tug on the spleen to find it;
Left gastric a.: the small, remaining vessel in the greater omentum

Cranial mesenteric artery: This unpaired artery runs in the root of the great mesentery to the intestines, and produces several branches:

Middle colic artery: 1st branch: to transverse colon
Ileocolic artery: to ascending colon & cecum & ileum
Pancreaticoduodenal artery: comes off after the first two, goes to right pancreas & duodendum
Jejunal arteries: many branches to jejunum
although we will not ask you to identify these individual branches, you will be expected to know the regions supplied by each of these branches.

Phrenicoabdominal arteries: These paired arteries pass over the middle of the adrenal glands to supply the cranial/dorsal abdominal wall.

Renal arteries: These large paired arteries go directly to the kidneys.

Testicular/ovarian arteries: These paired arteries go to the gonads; they are hard to find in neutered animals.

Lumbar arteries: There are a series of paired arteries that extend dorsally to the muscles and skin in the lumbar region.

Caudal mesenteric artery: This unpaired artery goes to the descending colon, near the deep circumflex iliac arteries.

Deep circumflex iliac arteries: These paired arteries go to the caudal/dorsal body wall.

External iliac arteries: These large arteries continue on to the hind limbs to become the femoral arteries.

Internal iliac arteries: These smaller arteries supply the pelvic viscera & gluteal region

Median sacral artery: This tiny unpaired artery is the most distal branch of the abdominal aorta, and can be seen along midline.

➔ **Veins**

Caudal vena cava: drains blood from hind limbs, abdominal wall, kidneys, and reproductive organs

Hepatic portal vein: transports imbalanced, nutrient-rich blood from *spleen, stomach, and intestines* to *the liver* for processing. Formed by two branches:

- **Splenic vein**: drains the spleen
- **Cranial mesenteric vein**: the biggest branch; drains the intestines.

Note: the **hepatic veins** (not the portal vein) bring filtered, nutrient-balanced blood from the liver back to the systemic vasculature by draining into the caudal vena cava. The hepatic vv. exit the craniodorsal aspect of the liver to access the caudal vena cava and are, therefore, difficult to identify grossly. Use the VCA to properly visualize the hepatic vv.

Lab 8 Short Objectives

Please remember that this quiz will primarily be image-based as we do not have enough specimens for tours as well as quiz this week. Be sure to review lecture material for ox/horse visceral structures and diagrams.

Viscera: Structures are comparative (dog, horse and ox)

Pathway of ingesta - from esophagus to anal sphincter

Cecum

Ascending colon (this includes the features of the equine large/small colon)

Stomach (this includes the internal and external appearance of the “stomach”)

Gall bladder and associated ducts

Adrenal glands

Linea alba

Rectus sheath

Internal abdominal oblique m.

Transversus abdominus m.

Inguinal canal (superficial and deep inguinal rings)

Teniae

Serosa – visceral vs. parietal, mesentery/omentum

Vasculature: identification and regions supplied/drained by these vessels

Celiac artery

Cranial mesenteric artery

Caudal Mesenteric artery

Renal arteries

Deep circumflex iliac arteries

Hepatic portal vein

Hepatic vein

Lab 9 Exercises

Male Reproduction

Testis and Scrotum

The male gonad is the **testicle** or **testis**. These paired structures are located external to the body, enclosed within the **scrotum**. During testicular descent, the testes (pleural of testis) must pass through the inguinal canals to reach their external position in the scrotum, and in the process bring their neurovascular supply (the **testicular artery, vein,** and **nerve**), lymphatics, and the **ductus deferens** which is the tubular passageway for sperm to travel from each testis to the ejaculatory duct. This structure is the **spermatic cord** and it suspends each testis in an outpocketing of peritoneum referred to as the **vaginal tunic**. As the testes slip through the inguinal canal, a slip of the internal abdominal oblique muscle contributes to form the **cremaster m**., which lies on the spermatic cord and is able to assist in positioning the testes for optimal temperature. Production of the male gametes, **spermatozoa**, requires that the testes (plural of testis) be 2-3°C below body temperature. Another mechanism for regulating temperature in the testis is the **pampiniform plexus**, a counter current heat exchange mechanism that consists of loops of testicular veins coiled with the testicular artery to cool arterial blood that is reaching the testis.

Each testis is a mass of seminiferous tubules that are surrounded by a fibrous capsule, the tunica albuginea. Support cells that produce the androgen hormones (e.g. testosterone) are located in between the seminiferous tubules. The production of sperm, spermatogenesis, occurs in the seminiferous tubules before the spermatozoa coalesce in to the efferent ductules. From there, they migrate to a single epididymal duct, followed by the **epididymis** for maturation. The epididymis is the long, convoluted tubule attached to one side of the testis that connects the efferent ductules to the **ductus deferens**. The epididymis is comprised of a **head**, **body**, and **tail.** By the time the spermatozoa reach the tail of the epididymis (10-15 days), they are "ready" to fertilize the female gamete, the oocyte. In order for fertilization to occur, the sperm must reach the female reproductive tract, which is achieved by ejaculation.

Accessory Sex Glands and Ejaculatory Path

Other important structures for survival of the sperm in the female reproductive tract are the accessory sex glands. Although the size and presence of these glands can vary in each species, their relative location and function is similar. The ampullae are paired glands associated with the terminal end of the ductus deferentia (plural for ductus deferens). The vesicular glands (formerly seminal vesicles) are also paired and are also associated with termination of the ductus deferentia. Here they help form the short ejaculatory duct, which then empties in to the pelvic urethra. The bulbourethral glands (formerly Cowpers glands) are the last of the paired glands on either side of the pelvic urethra and are particularly large in the boar (male pig). The only unpaired gland is the **prostate gland**, which is found surrounding the pelvic urethra and in older (intact) male animals can become enlarged and interfere with urination. The ejaculate, or semen, consists of the spermatozoa as well as fluid from these accessory sex glands that help activate the spermatozoa and buffer it from the harsh environment of the female reproductive tract.

Penis

The final portion of the male reproductive tract is the actual organ of copulation, the penis. The **penis** can be divided in to three main regions – the two **crura** (roots) that attach to the ischial arch of the pelvis; the **body**, or main portion; and the **glans**, or free extremity. The penis is typically housed in the **prepuce**, or a fold of skin surrounding the free end of the penis. The outer surface of the prepuce is typical skin, but the inner mucous membrane consists of a prepuce and a penile layer that covers the free end of the penis. The prepuce makes a double fold so two concentric layers cover the penis when it is not erect; the **fornix** of the prepuce is the transitional fold from the surrounding sheath of tissue vs. that which is on the body of the penis. The glans penis shows considerable variation with species and sex status (castrated vs. intact). The urethra is located along the middle of the penis and the stallion and billy goat each have an extension of the urethra that forms a free portion beyond the glans, the **urethral process**. A **urethral sinus** (diverticulum) dorsal to the urethral process can accumulate urine, secretions, dead cells, etc. and form a “bean”. This is also an important region for harboring disease and is often swabbed in stallions when looking for venereal disease.

Erection of the penis occurs when more blood enters the penis via the arterial supply than leaves by the veins. Domestic species either have a **fibroelastic** penis (ruminants, boars), or a **musculocavernous** penis (stallion, dog). These two categories refer the amount of tunica albuginea vs. erectile tissue present in the penis. The first is a heavy, fibroelastic capsule that surrounds the penis, whereas the latter is composed of the corpora cavernosa and spongiosa that are able to fill with blood to achieve the erection necessary for penetration. The fibroelastic penis of the bull does not significantly increase diameter during erection, but it does lengthen by straightening the **sigmoid flexure** via relaxation of the retractor penis m. This is to be compared with the musculocavernous penis of the stallion that becomes much larger in all directions during erection.

Female Reproduction

Ovary and Ovulation

The female reproductive cycle essentially has two phases – getting ready for fertilization, and pregnancy. If pregnancy does not occur, then the cycle repeats itself. The **ovary** is the female gonad and the site of gamete (**oocyte**) production. **Follicles** containing oocytes will mature with each cycle until they produce enough estrogen to induce ovulation. The oocyte then moves in to the reproductive tract and the site of hemorrhage or rupture that was ovulation becomes a corpus hemorrhagicum. This tissue then undergoes a change in steroid hormone synthesis and begins to produce progesterone (pro-gestation hormone) to support pregnancy. This new tissue is a **corpus luteum** ("yellow body), named for its yellow, waxy appearance. An old corpus luteum that is no longer producing progesterone is called a **corpus albicans** ("white body"). All of these structures can be found on/in the ovary of a female that is reproductively active. The ovaries are located caudal to the kidney and like all of the organs within the abdominal cavity are covered by peritoneum. This fold of peritoneum is the **broad ligament** and it connects the **uterus** to the walls and floor of the pelvis. The broad ligament is divided in to three subcomponents for each of the areas that it covers – uterus (mesometrium), oviduct/uterine tube (mesosalpinx), and ovary (mesovarium). Blood vessels reaching each of these three main parts of the female reproductive tract travel within the broad ligament. In most species, the follicle containing the mature oocyte can rupture anywhere along its surface of germinal epithelium to release the oocyte in any location. However, in the mare, the germinal epithelium is concentrated in to the **ovulation fossa** – the only site of ovulation in the mare.

Oocyte to Implantation – or Ovary to Uterus

The ovary is anchored by ligaments which also provide a route for blood supply to the ovary and uterus. These include the **suspensory ligament**, which suspends the ovary from the body wall, is covered by the broad ligament, and "brings" the **ovarian a.** (gonadal aa from abdominal aorta) and **ovarian v**. from the body wall to the ovary. The suspensory ligament must be broken during a spay. The **round ligament of the uterus** is found in the inguinal canal associated with the vaginal process. The **uterine tubes** are adjacent to the ovary and are the site of fertilization and early embryo development. The oocyte is ovulated and "caught" by the fimbriae at the distal end of the uterine tube. Some uterine tubes attach directly to the ovary, some do not, and some do not open in to the abdominal cavity. The paired uterine tubes open in to the **uterine horns**. The shape of the uterus varies by species in terms of **body** vs. horn size, but blood supply is provided by the **uterine aa.** (br. of internal iliac a.) which will anastomose with the ovarian aa. cranially and the **vaginal aa.** (br. of internal pudendal a.) caudally. The increase in blood supply to the uterine aa. during pregnancy can be used as a method of pregnancy diagnosis in cattle and is described as a "fremitus" during examination per rectum. In cows, the uterine horns are also very long with a short body; there is an **intercornual ligament** which is found in between the two horns adjacent to the body, and is a useful ligament for retracting the uterus for examination per rectum. The uterus has an inner glandular layer called the **endometrium**. This is the site of implantation of the conceptus and in some specimens the maternal site of implantation – the **caruncle** (Latin for "wart")– can be observed where the endometrium became modified to increase blood supply and nutrition via the placenta. The smooth muscle layer of the uterus is the **myometrium** and is essential for uterine contractions. The uterus terminates at the cervix, which is another muscular sphincter that is closed except in estrus (female in heat, ready to ovulate) and parturition. The **cervix** is the opening from the uterus to the vagina.

Vagina to Vulva

The **vagina** is the organ of copulation and the birth canal. It is located ventral to the rectum and dorsal to the urinary bladder and urethra. The mucous membrane of the vagina is a stratified squamous epithelium that changes in response to cycle stage (thickens, moist during estrus) and vaginal cytology can be used to determine cycle stage in females that are not showing "heat" (evidence of sexual receptivity). The caudal portion of the vagina is the **vestibule**. This area is not covered by the broad ligament due to the peritoneal reflections and its location in the pelvic canal. During development, the Mullerian duct will become the oviducts, uterus and cranial vagina. Where the external genitalia develop to meet the Mullerian duct, a vestigial piece of tissue remains – the hymen. This tissue is found in all female species at the interface of the vagina-vestibule and represents the development of internal and external genitalia. **Vaginal aa**. supply this region with arterial blood. The vestibule is the only common site of the female urogenital system as it is the site of the **urethral opening** to the vulva and the exterior for urine voiding (mitrication). A **suburethral diverticulum** is found in bovids and porcids and must be carefully avoided when passing a urinary catheter. The **vulva** is the external genitalia of the female. It is bound by left and right **labia**, with a **clitoris** found ventrally. The clitoris is erectile tissue, similar to the male penis, and becomes enlarged when there is increased blood flow during estrus also as a result of the estrogen produced by the mature follicle. As in the male, the clitoral fossa can be a site for harboring pathogens.

Mammary glands

The mammary glands are actually (very) modified sweat glands that produce milk for the nourishment of the offspring. They are either found as a line of glands from the axilla to inguinal region (10-12 in bitches) or are closely associated regionally as an *udder* (4 glands cow; 2 glands mare). Each gland is a system of ducts connected to secretory epithelium and fat support in a fibrous capsule. The ducts coalesce in to a teat, which may have one or more teat canal or opening to the exterior. This tissue is finely regulated and incredibly hormone dependent, which lends itself to neoplastic processes. Blood supply to the udder in cattle is the external pudendal artery, which is a branch of the pudendoepigastric trunk. The superficial epigastric veins are the site of venous return. Lymphatics of the mammary tissue are also important, and in cattle can be visible just under the skin.

Thorax, Abdomen, and Pelvis

Thoracic wall and cavity

Thoracic wall

scalenus m.

serratus ventralis m.

latissimus dorsi m.

external intercostal mm.

internal intercostal mm.

intercostal n.

intercostal a.

intercostal v.

Lymph nodes/centers

tracheobronchial (hilar) lymph nodes

thoracic duct

Thoracic cavity

right and left lungs
caudal vena cava

mediastinum (space)

thymus
heart

aorta

- ascending
- arch

descending (thoracic)

cranial vena cava

azygos v.

esophagus

trachea

carina

tracheal bronchus (Bo)

internal thoracic a.

Serous membranes

parietal pleura

costal pleura

diaphragmatic pleura

mediastinal pleura

visceral (pulmonary) pleura

plica venae cavae (separates the caudal vena cava from the mediastinum)

Diaphragm

right and left crura

central tendon

aortic hiatus

esophageal hiatus

caval foramen

phrenic nerves

Lungs

describe lobation pattern of canine, equine, and bovine lungs

describe the names of the lobes of canine, equine, and bovine lungs

cardiac notch

root of the lung

Autonomic nervous system

Sympathetic nervous system

sympathetic trunk and chain ganglia

cervicothoracic ganglion
vertebral nn.

ansa subclavia

middle cervical ganglion

vagosympathetic trunk

splanchnic nn.

Parasympathetic nervous system

vagosympathetic trunk

vagus nerve

    dorsal and ventral branches

    dorsal and ventral vagal trunks

Recurrent laryngeal n., although not part of the parasympathetic nervous system, should be identified in both the left and right thorax. Review VCA for its association with the vagus n.

Heart

External

apex

base

right coronary a.

left coronary a.

- paraconal interventricular a.
- circumflex a.
  - subsinuosal a. (branch of circumflex a.)

right and left atria

- right and left auricles

right and left ventricles

cranial and caudal venae cavae

great cardiac vein

pulmonary trunk/arteries

ligamentum arteriosum / ductus arteriosus
aortic arch
pulmonary vv.

Internal

papillary mm.

pectinate mm.

Interventricular septum

right atrium

- cranial and caudal venae cavae
- fossa ovalis / foramen ovale
- coronary sinus

right atrioventricular valve

- valve cusps (leaflets)
- chordae tendinae

right ventricle

- moderator band (trabecula septomarginalis) - Eq, Bo
- pulmonary valve
- interventricular septum

left atrium

- pulmonary veins
- left atrioventricular valve
- valve cusps (leaflets)
- chordae tendinae

left ventricle

- aortic valve

ascending aorta

- aortic sinus
- right and left coronary aa.

Heart-great vessels

cranial vena cava
- azygos v.
- brachiocephalic vv. (right and left)
  - subclavian vv.
  - external jugular vv.

caudal vena cava
pulmonary trunk
- pulmonary aa. (left and right)

pulmonary vv.

ascending aorta

aortic arch (Canine)

brachiocephalic trunk
- left common carotid a.
- right common carotid a.
- right subclavian a.
  - vertebral a. (branch of subclavian)
  - costocervical trunk (branch of subclavian)
  - internal thoracic a. (branch of subclavian)

bicarotid trunk (Eq, Bo)
- right and left common carotid aa.

left subclavian a.
- branches same as right subclavian a.

Jugular furrow (Eq)

Borders:
- brachiocephalicus m.
- omohyoideus m.
- sternocephalicus m.

Abdominal wall and cavity

Abdominal wall

external abdominal oblique m.

internal abdominal oblique m.

transversus abdominus m.

rectus abdominus m.

    prepubic tendon

linea alba

internal inguinal ring

external inguinal ring

inguinal canal

vaginal process (female)

spermatic cord (male)

Abdominal cavity

Peritoneal structures

visceral peritoneum

parietal peritoneum

falciform ligament

greater omentum

lesser omentum

great mesentery

root of the great mesentery

omental bursa

pararectal fossa

rectogenital pouch

vesicogenital pouch

pubovesical pouch

Stomach

cardia

fundus

body

pylorus

  torus pyloricus (Bo, Sus)

gastric rugae
greater and lesser curvatures

Small intestines, pancreas, & liver

duodenum

- cranial duodenum
- cranial duodenal flexure
- descending portion
    - major and minor duodenal papillae
- transverse portion (caudal flexure)
- ascending portion

jejunum

ileum

Pancreas

right and left lobes

Spleen

gastrosplenic ligament
nephrosplenic ligament (Eq)

Liver

gall bladder

hilus

hepatic ducts

cystic duct

bile duct

hepatic portal v.
hepatic vv. – not easily identifiable on cadavers; view in VCA

caudal vena cava

Colon, rectum, and anal region

cecum

ascending colon

right colic flexure

transverse colon

left colic flexure

descending colon

rectum
anus

Kidney and urinary tract

kidneys

- cortex
- medulla
- renal pyramid

adrenal glands

ureters

urinary bladder

urethra
- pelvic and penile segments (male)

urethral opening / external urethral orifice

Abdominal and pelvic vasculature

Abdominal aorta

celiac a.

- left gastric a.
- hepatic a.
- splenic a.

cranial mesenteric a.

- middle colic a.
- ileocolic a.
- pancreaticoduodenal a.
- jejunal a.

phrenicoabdominal aa.
renal aa.

testicular/ovarian aa.

lumbar aa.
caudal mesenteric a.

deep circumflex iliac aa.

external iliac aa.

internal iliac aa.

median sacral a.

hepatic portal v.

- splenic v.
- cranial mesenteric v.

Hanging horse/fresh equine digestive tracts

Stomach

fundus (saccus cecus)

non-glandular region

margo plicatus

glandular region

Nephrosplenic ligament
Small intestine

Cecum

Ascending colon (great colon)

bands (teniae coli)

sacculations

right ventral colon

sternal flexure

left ventral colon

pelvic flexure

left dorsal colon

diaphragmatic flexure

right dorsal colon

Transverse colon

Descending colon (small colon)

Rectum

Hanging ox/fresh bovine tracts/special preps

Rumen

dorsal sac

caudodorsal blind sac

ventral sac

caudoventral blind sac

left longitudinal groove (pillar internally)

right longitudinal groove (pillar internally)

left and right cranial grooves (pillars internally)

cranial sac (atrium)
caudal groove (pillar internally)

right and left dorsal coronary grooves (pillars internally)

right and left ventral coronary grooves (pillars internally)

Reticulum

reticular groove (rumino-reticular fold internally)
honeycomb mucosal lining

Omasum

laminae

Abomasum

torus pyloricus
gastric rugae

Small intestine

Large intestine

cecum

ascending colon

- proximal loop
- spiral loop
- distal loop

transverse colon

descending colon

rectum

Pig GI
torus pyloricus
spiral colon

Pelvic cavity and viscera

Male

cavernous type penis (Ca, Eq)

fibroelastic type penis (Ru)

Penis

- os penis (Ca)
- urethral sinus (Eq)
- urethral process (Eq, Ru)
- sigmoid flexure (Bo)

prepuce

- fornix

scrotum

testis

pampiniform plexus

epididymis

- head
- body
- tail

ductus deferens

testicular aa.
cremaster m.

urethra (pelvic vs. penile segments)

Question: what structures are contained within the spermatic cord?

Accessory Sex Glands (Male)

prostate gland (find in Ca cadavers)

FYI (no need to identify grossly):
- vesicular glands (Bo, Eq)
- bulbourethral glands (Bo, Eq)
- ampullae (Bo, Eq)

Female

ovary

- suspensory ligament of the ovary
- ovulation fossa (Eq)
- follicles
- corpora lutea/albicans

uterus

- broad ligament
- horns
- body
- intercornual ligaments (Bo)
- caruncles (Bo)

cervix

vagina

urethral opening / external urethral orifice
vestibule

- suburethral diverticulum (Bo)

vulva

ovarian aa.

uterine aa.

vaginal aa.

NOTES

Head and Neck Laboratory "Exercises"

Lab 10 Exercises

There is a lot of information on these Exercises regarding bony features and some of the more intricate cavities, sinuses, etc. The only remaining Exercises for next week will be brain, dentition, pharynx, and larynx. Information for Cranial Nerves can be found in your Laboratory Guide. The Cranial Nerve information that you are responsible for is in these pages and will not be duplicated in the Exercises. *Clinically relevant information is in italics.*

Bones & Structures

Know the pathway each cranial nerve takes to/from the cranial vault.

Note the following arrangement:

cribriform plate: CN I

optic canal: CN II

orbital fissure: CN III, IV, V_1, and VI

round foramen $\boxed{?}$ alar canal $\boxed{?}$ rostral alar foramen: CN V_2

oval foramen: CN V_3

internal acoustic meatus $\boxed{?}$ stylomastoid foramen: CN VII

internal acoustic meatus: CN VIII

jugular foramen $\boxed{?}$ tympano-occipital fissure: CN IX, X, and XI

hypoglossal canal: CN XII

Some of these nerves also exit with vessels. For example: the maxillary artery enters the **caudal alar foramen**, passes into the **alar canal** where it is joined by CN V_2, and passes with this nerve out of the canal via the **rostral alar foramen**.

The bones in the skull are joined by fibrous joints called **sutures**, which are visible on an articulated skull. The cranial cavity, or cranial vault, is the space where the brain resides – the 'braincase' – and is formed by several bones that are collectively referred to as the **neurocranium**. These include the **ethmoid, frontal, interparietal, occipital, parietal, pterygoid, sphenoid, temporal,** and **vomer** bones. Many of these bones will contain named foramina through which the cranial nerves will pass.

The **sphenoid bone**, or complex, is actually two unpaired bones, the **basisphenoid** and **presphenoid** bones. Within the sphenoid complex are several of these foramina:

The **optic canal,** for the transmission of CN II and the internal ophthalmic artery;

The **orbital fissure** for the transmission of CN III, CN IV, CN V_1, and CN VI;

The **round foramen** (foramen rotundum) is visible only from inside the cranial vault and opens into the roof of the horizontally oriented **alar canal**, which is bound by the **rostral** and **caudal alar foramina**. CN V_2 passes from the cranial vault into the alar canal via the round foramen;

The **oval foramen**, which transmits CN V_3.

The **foramen lacerum** is an irregular foramen formed within the suture between the sphenoid complex and the temporal bone. In the dog, it is occupied in life by a loop of the internal carotid artery.

The temporal bone is another complicated bone that forms parts of the ventrolateral aspects of the braincase, houses the inner ear, and articulates with the mandible. It is anatomically divided into a flat part and a dense petrous part, as well as a ventral tympanic portion. Visible from the inside of the cranial cavity are the **internal acoustic meati** (plural form of meatus) in the petrous part of the temporal bone, through which CN VII and VIII exit the brain case. The tympanic part of the temporal bone has a large spheroid portion ventrolaterally, the **tympanic bulla**, which encloses an air-filled space that is part of the middle ear. The **external acoustic meatus** is a large foramen of the lateral temporal bone found just dorsal to the **tympanic bulla**; it provides attachment for the annular cartilage of the pinna. In life, it is bridged by the tympanic membrane, defining the boundary between external and middle ears.

Just caudal to the external acoustic meatus is the **stylomastoid foramen**, through which the facial nerve emerges. A large portion of the lateral and dorsal aspects of the braincase is formed by the **parietal bone**. Ventrolaterally, an obvious cleft divides the tympanic bulla of the temporal bone from the occipital bone. This is the **tympano-occipital fissure**; deep within it, the **jugular** and **carotid foramina** provide a passage to the cranial vault. It is here that the internal carotid artery enters the braincase while the internal jugular vein and cranial nerves IX, X, and XI exit.

The occipital bone is an unpaired bone forming part of the caudal portion of the cranial vault. The **foramen magnum** is the large opening on midline of the caudal aspect of the skull, where the spinal cord exits the brain case. *When "swelling of the brain" (really an in increase in fluid surrounding the brain) occurs, the brain can be pushed out of the foramen magnum. This puts pressure on the brainstem, which is responsible for important functions like respiration, and causes them to cease in function (aka, death). This is why swelling of the brain is so dangerous and must be relieved before the brain herniates via the foramen magnum.*

Adjacent to the foramen magnum on each side is a rounded articular process, the **occipital condyle**, which forms a synovial joint with the cranial articular fovea of the **first cervical vertebra** (C1, atlas). Lateral to the condyle is the **jugular process** (a portion of which is called the paracondylar process). The jugular process is the attachment site for cervical muscles of the transversospinalis system (remember, I Love Tacos!). The **hypoglossal canal** is a small tract that opens onto the ventral surface of the occipital bone and is the exit point for CN XII.

Bones that form the "face" and house the starting points of the respiratory and gastro-intestinal tracts are collectively called the **viscerocranium**. These include the **incisive, lacrimal, mandible, maxilla, palatine, nasal, turbinates, zygomatic**, and **hyoid** apparatus. Features of the face include the rostrally projecting **zygomatic process of the temporal bone;** it unites with the **zygomatic bone** to create the **zygomatic arch**. The combined width of the zygomatic arches on a given skull is an indication of the biting strength of the dog, as the masticatory muscles (e.g. temporalis m.) lie within the arches.

The **infraorbital canal** is bound by the maxillary foramen caudally and the **infraorbital foramen** of the maxilla bone is the rostral opening of the **infraorbital canal.** This feature is dorsal to the 3^{rd} upper premolar and below the orbit (infra-orbit) and transmits the infraorbital nerve, a large sensory branch of CN V_2 (provides sensory innervation to the lateral aspect of the muzzle, including the tactile hairs) and the maxillary artery, which exits the infraorbital foramen as the infraorbital artery. *This nerve is important for "blocking" innervation to the upper arcade of teeth. When blocking this nerve, one has to be careful not to hit the maxillary a.*

The **mandible** is an important bone for the external facial features. The ramus of the mandible has three processes. The most dorsal of these, the **coronoid**

process, is thin, blade-like and provides attachment for masticatory muscles. The **condylar process** is a caudally projecting articular process that participates in the temporomandibular joint. Carnivores possess an **angular process**, projecting ventrocaudad from the angle of the mandible. The **masseteric fossa** is a prominent depression in the lateral aspect of the ramus and is filled with the *m. masseter*. The body of the mandible houses the lower arcade of teeth. On the medial aspect of the ramus, the **mandibular foramen** conveys the inferior alveolar nerve and artery to the body of the mandible and roots of the mandibular teeth. These sensory nerves travel rostrad in the body of the mandible to emerge as the mental nn. via the **mental foramina** (located laterally). *The mental nerves provide sensory innervation to the skin of the chin. These nerves are the terminal branches of the inferior alveolar nerve (sensory to lower arcade of teeth), which in turn arises from the lingual branch of the mandibular nerve (CN V3). These are very important nerves to "block" when doing dental procedures on the mandibular teeth or when repairing the soft tissue of the jaw after trauma.*

Nasal cavity: Bones form a solid wall around the nasal cavity, otherwise the rapid movement of air would cause it to collapse. The major bones of the nasal cavity include the **maxilla** (laterally), **nasal** (dorsally), **palatine** (ventrally), and **ethmoid** (caudally). Within the nasal cavity, **conchae** (**dorsal**, **ventral** & **ethmoidal**) are scrollworks (turbinates) of bone covered by mucosae to warm & humidify the air before it enters the lungs. The olfactory receptors (sensory portion of CN I) are found on the ethmoidal turbinates. The nasal septum separates the nasal cavities in to left and right, and spaces lie between each of the dorsal and ventral conchae that form **meati**. *The junction of the common meatus with the ventral meatus is the space where a nasogastric tube is placed in horses.*

Communicating with the nasal sinuses are diverticula known as the **paranasal sinuses**. These air-filled sinuses are prominent in large animals, named for the bones that contain them. The paranasal sinuses functionally decrease the weight of these large heads by allowing them to be large air-filled regions. In dogs, the **maxillary recess** is found medial to the maxillary foramen and opens in to the nasal cavity via the roots of the 4th upper premolar tooth. In larger animals, this recess is considered the maxillary sinus because it is much larger, but is often still associated with the upper arcade of teeth.

*CLINICAL NOTES: In dogs, the maxillary recess is where the lateral nasal gland is found, whose duct opens in to the oral cavity and prevents desiccating caused by panting in the dog. In horses, the maxillary sinus is often involved with abscesses of the 1st upper molar. The **frontal sinus** in cattle has a **cornual diverticulum** that extends into the **cornual process** and may therefore be exposed by dehorning mature cattle.*

Ear: The middle & inner ears are protected by the **temporal** bones. The **external acoustic meatus** is the external ear canal, and includes the hole into the air-filled middle ear contained within the **tympanic bulla** (in life, this hole is covered by the tympanic membrane). The inner ear is within the bony labyrinth of the petrous ("rock-like") portion of the temporal bone. CN VIII reaches the inner ear by passing through the **internal acoustic meatus** within the cranial cavity. The middle ear is filled with air and contains three bones, the malleus (or hammer, adjacent to the tympanic membrane), the incus (or anvil), and the stapes (or stirrup, smallest bone in the body). These three bones, or ossicles, allow sound to be amplified before arriving at the inner ear. The **auditory tube**, or pharyngotympanic tube (also called the Eustachian tube), links the nasopharynx to the middle ear. *Normally the auditory tube is closed, but it gapes open both with swallowing and with positive pressure (why chewing gum is helpful during airplane takeoff). In horses, a diverticulum of this tube is called the guttural pouch.*

Eye: The bony orbit surrounding the eye is incomplete in the dog and complete in the horse/ox. The bony orbit is formed by the **frontal** bone, the **zygomatic** bone and some other smaller bones. The orbit in the dog is completed by the **orbital liagment**, which runs from the zygomatic process of the frontal bone to the frontal process of the zygomatic bone. There are several muscles that move the eye itself, including the *m. retractor bulbi*, which is a single muscle with four separate bellies (to retract the eye in the socket: CN VI); the *ventral rectus m.* (to look ventral: CN III); the *lateral rectus m.* (abduct the eye: CN VI); the *medial rectus m*. (adduct the eye: CN III); the *dorsal rectus m*. (to look dorsad: CN III); a *ventral oblique m.* (rotates the globe laterally: CN III); *dorsal oblique m.* (rotates the globe medially: CN IV).

Dogs possess a third eyelid or nictitating membrane. This is a fold of mucous membrane arising from the ventromedial aspect of the eye, between the eyeball and palpebrae. It is given rigidity by a T-shaped cartilage, and possesses at its base a seromucoid gland. *This gland may occasionally evert, producing a condition commonly referred to as Cherry Eye. The lacrimal ducts (for draining tears) are found along the medial canthus of the eye and empty via the nasolacrimal duct in the ventral distal opening of the nasal cavity. The openings of a row of tarsal glands (Meibomian glands) are readily visible in a shallow furrow immediately superficial to the mucocutaneous junction of each palpebra. These glands produce an oily substance that prevents the "tear film" from drying out*. The palpebrae are the eyelids and are lined by the conjunctiva, a mucous membrane. Sensation to the eyelids and orbit is provided by the frontal nerve (from CN V_1) and the orbicularis oculi muscle allows for closing of the eyelids (motor palpebral n., br. auriculopalpebral of CN VII).

Oral Cavity: The oral or mouth portion of the skull is formed by the **incisive** and **maxilla** bones as the upper jaw, with an **upper arcade** of teeth. These bones also form the **hard palate** of the oral cavity (along with the palatine bone). The rostral part of the hard palate, formed by the incisive bones, is interrupted by two narrow foramina, the **palatine fissures**. The lower jaw, with the **lower arcade** of teeth, is formed by the **mandible**. The **temporomandibular joint** is the synovial joint of the jaw where the mandible articulates with the **mandibular fossae** of the temporal bones just rostral to the opening of the ear. The incisive bones, maxillae, and mandible feature **dental alveoli**, which are sockets for the roots of the teeth.

The configuration of bone tissue around the alveoli constitutes trabecular bone, which has a characteristic reticulated appearance on dental radiographs. The synchondrosis between the two mandibles is referred to as the **mandibular symphysis**. It is an immovable joint in the median plane where the two mandibles meet. In most dogs, it is **filled with fibrocartilage**, thus a synchondrosis type of joint. Even in elderly dogs the joint generally does not fuse into a synostosis.

Soft tissue structures of the oral cavity are defined by the vestibule (cavity lying outside of the teeth and gums, but inside the cheeks and lips) and the oral cavity proper. The oral cavity proper is bounded by the hard palate and a small part of the **soft palate** – the mucomuscular caudal continuation of the hard palate –

which divides the **oropharynx** (oral portion of the pharynx) from the **nasopharynx** (nasal portion of the pharynx). The thick mucous membrane on the oral side of the hard palate is thrown into transverse ridges called **palatal rugae**. At the rostral end of the palate, just caudal to the superior incisors is a median elevation, the **incisive papilla**, onto which the incisive duct opens. This duct connects oral and nasal cavities (via the palatine fissure), and features a diverticulum, the vomeronasal organ, which functions as a pheromone detector. In ruminants, there are no upper incisors as part of the rostral hard palate. This modification of the hard palate, called the **dental pad**, allows ruminants to be efficient at eating grass, or grazing. The tongue possesses a free apex, a fleshy body, and a short root attached to the hyoid apparatus. The ventral aspect of the apex is tethered to the floor of the mouth by a fold of mucous membrane called the frenulum. The intrinsic muscles of the tongue, innervated by the hypoglossal nerve, permit a wide variety of tongue movements. The tongue is attached to the rostral aspect of the mandible by a fan-shaped muscle, the m. genioglossus. The tongue of the ox is also modified to have a large protuberance caudally called the **lingual torus** (torus = ring shape).

Hyoid apparatus: The hyoid apparatus is a box of fine bones, rostral to the larynx, and caudal to the base of the tongue. It provides a solid framework to support the pharynx and provide attachment to muscles of the throat region. The bones of the hyoid apparatus articulate with the thyroid cartilage of the larynx, with one another, and with the mastoid process of the skull via synchondroses. Of these bones, all are paired except the **basihyoid**, which connects the two sides of the hyoid apparatus. The basihyoid bone of the equid and bovid also features a **lingual process** which is buried in the root of the tongue. The bones of the hyoid apparatus, from craniad to caudad, are the **stylohyoid** (articulates with mastoid process of the temporal bone as the temporohyoid joint, found just dorsal to the stylomastoid foramen), the **epihyoid**, the **ceratohyoid**, the **basihyoid** (unpaired), and **thyrohyoid** (articulates with the rostral cornu of the thyroid cartilage of each the corresponding side of the larynx). You will only be responsible for some of these structures, but it is important to which articulate and which are (un)paired.

Comparative skull:

Horse: Know the clinical landmarks for accessing the guttural pouch (Viborg's triangle) and recall the jugular furrow. We will discuss their clinical relevance in lecture.

Foramen lacerum: large foramen incorporating the jugular foramen, carotid canal, and oval foramen in the horse (for better illustration see Dyce & Wensing, 4th Ed. Figure 2-37).

Paranasal sinuses have large openings connecting them and are often referred to as pairs in the horse, e.g. **sphenopalatine** sinus. The **conchofrontal sinus** is the combined sinus of the frontal sinus together with the dorsal conchal sinus. In the horse and cattle, the dorsal concha forms a completely enclosed air filled space or sinus.

Facial crest is present in horses and used as a landmark for opening the maxillary sinus to remove (punch out) teeth or taking blood from a venous sinus ventral and deep to the facial crest.

Supraorbital foramen *is located dorsal to the orbit (supra-orbit). The* ***supraorbital n.*** *(br. of the frontal nerve from CN V_1) provides sensory innervation to the medial two thirds of the upper eyelid. The palpebral n. is found along the zygomatic arch in the horse and provides motor innervation to the upper orbicularis oculi muscle, which controls upper eyelid function. By blocking both of these nerves, the eye of the large animal can be examined or treated for disease.*

Cattle:

Foramen orbitorotundum: incorporates the orbital fissure (CN III-VI, V_1) and the round foramen (CN V_2).

Paranasal sinuses do not connect with each other and the frontal sinus has two chambers (rostral & caudal). The **cornual diverticulum** of the frontal sinus is found in the **cornual process** of the frontal bone. **Lacrimal bullae** from the maxillary sinus are present ventral to the eye where they can be crushed easily in eye removal (enucleation) for "cancer eye" (squamous cell carcinoma of the eye).

A **facial tuberosity** is present in cattle rather than a facial crest.

Superficial and Deep Structures of the Head:

Muscles of the Head: The muscles of the head are divided into the muscles of mastication (chewing) and the muscles of facial expression. The 4 muscles of mastication originate on the skull and are primarily innervated by the mandibular n (CN V_3). The 3 closers of the jaw (**mm. masseter, temporalis, pterygoids**) insert on the **ramus of the mandible**.

The **digastricus muscle** is the only one that opens the jaw and it inserts on the **body of the mandible**. The temporalis and masseter muscles are large muscles that are visible upon superficial dissection (temporalis m. lies just deep to the frontalis m.). The **medial** and **lateral pterygoid** muscles are visible upon deep dissection. The lateral pterygoid muscles are not usually well exposed in our dissections and *will not be tagged in the BMS305 lab exam*.

The muscles of facial expression do just that – cause the features of the face/ head to move – and are innervated by the facial n. (CN VII). Much of the face is covered by a thin sheet of muscle called the **m. platysma**. The platysma muscle is a thin sheet of skeletal muscle attached to the skin of the neck and head, and is able to pull the lips caudad. It is frequently lost during skinning, although our dissectors will try to preserve it…

The muscles are named for their location or action. The **zygomaticus muscle** (over the zygomatic arch) pulls the mouth caudad, the **orbicularis oris muscle** (around the mouth) closes the mouth, and the **buccinator muscles** tense the cheeks (buccinate = Latin for trumpet). The **levator nasolabialis muscle** acts to lift the upper lip (labia) as well as dilate the nostril (naso). The ears are moved by the **rostral** and **caudal auricular muscles**. Superficial to the temporalis muscle is the **frontalis muscle**, which pulls the scutiform cartilage of the ear rostrad. The **orbicularis oculi muscle** (around the eye) forcefully closes the eyelids.

Salivary glands and lymph nodes: The **parotid** and **mandibular salivary glands** are visible on superficial dissection and are a great landmark for identifying the maxillary and linguofacial veins, which feed into the external jugular vein. The parotid salivary gland (par-otid = around the ear) is visible on superficial dissection rostral to the external ear canal. The mandibular salivary gland is visible caudal to the angle of the mandible and is more solid than the parotid gland when palpated. The **parotid duct** is of clinical interest and should be distinguished from the dorsal and ventral buccal branches of CN VII. The parotid duct carries saliva from the parotid salivary gland into the oral vestibule. In the dog, the parotid duct courses across the lateral aspect of the masseter muscle between the dorsal and ventral buccal nerves. In the horse and bovid, the parotid duct lies on the ventral border of the masseter muscle, running separately from the dorsal and ventral buccal nerves. The **sublingual salivary gland** requires dissection rostral to the mandibular salivary gland. It lays rostral to the mandibular sg. and deep to the mandibular lymph nodes. The part of the sublingual salivary gland near the mandibular salivary gland is called the monostomatic portion of the sublingual salivary gland. The **zygomatic salivary gland** is located near the eye, deep to the rostral zygomatic arch.

The **mandibular lymphocenters** are found ventral and rostral to the mandibular salivary glands. They are normally about 1 cm in diameter and are separated from one another by the linguofacial vein. These nodes primarily drain the tongue and tissues associated with the floor of the mouth and mandible. They are palpable in the normal animal. The **retropharyngeal lymphocenter** consists of a medial and an inconsistent lateral lymph node. The large medial retropharyngeal lymph node is elongated, and found ventral to the wing of the atlas and dorsal to the pharynx. This lymphocenter receives afferents from the majority of head structures. The efferent lymphatic flow from the retropharyngeal lymphocenter flows through the tracheal trunk on the medial aspect of the carotid sheath (not generally visible). *The retropharyngeal lymphocenter is clinically important in the horse associated with Strangles (infection with* Streptococcus equi *subspecies* equi*).* A parotid lymph node is sometimes seen in the rostral border of the parotid sg., but need not to be identified.

Guttural pouch of the horse: The Guttural Pouch is present only in members of the order Perissodactyla and a few other random mammals. These are paired ventral diverticula of the auditory tubes with a capacity of 300-500ml in the domestic horse, though they are normally air filled.

These pouches (left and right) are located below the cranial cavity, towards the caudal end of the skull. The lateral boundaries on each side are the pterygoid muscles, and parotid and mandibular salivary glands. The floor is the pharynx and beginning of the esophagus. The **medial retropharyngeal lymph node** lies between the pharynx and the ventral wall of the pouches. **Each pouch (right and left) is separated in to medial and lateral compartments by the stylohyoid bone.** The guttural pouch also covers the temporohyoid joint. The medial guttural pouch has close association with many major structures including CN IX, X, XI, XII, the sympathetic trunk, and the internal carotid artery. The lateral guttural pouch is associated with the external carotid arteries (becoming maxillary aa.), the maxillary v. and CN VII. The pouch has an extremely thin wall, which is lined by respiratory epithelium that secretes mucus. This normally drains into the pharynx via a ventral slit when the horse is grazing. The function of the guttural pouch is unknown, but presumed to be either an influence on carotid artery blood pressure or a cooling mechanism for blood to the brain during times of physical exertion. *The presence of pathology, due to infection with Strep. equi or fungal species, or arthritis of the temporohyiod joint, can cause significant clinical signs in horses including massive hemorrhage (which vessels?) and loss of motor/sensory innervation to the face and other structures (which nerves?).*

Cranial nerves:

The lecture notes provide a good summary of function for all cranial nerves and list the holes of the skull from which they emerge. Students should then be able to imagine how the nerves project from the holes to where they perform their function. Two cranial nerves (V & VII) have functions spread over the entire head, and identifying branches of these nerves deserves special consideration.

Facial n. (CN VII): Be able to find the branches listed in the lab guide.

- **Ventral and dorsal buccal branches of the facial n.** are readily identified by their position on the masseter m. Note the parotid duct between the two nerves in the canid (not the case in equids and bovids!)
- **Auriculopalpebral n.:** lies caudal/dorsal to the dorsal buccal br. of VII. Gives rise to a branch **(palpebral n.)** to the muscle of the eyelids (orbicularis oculi). The other branch of the auriculopalpebral n., the **rostral auricular n.**, innervates the rostral auricular mm. The **caudal auricular n.** branches from the main part of the facial n. deep under the parotid sg. and innervates the caudal auricular mm. The **chorda tympani n.** is a branch of the facial n. that joins with the lingual n. (from the trigeminal n. – CN V) to provide taste sensation to the rostral 2/3 of the tongue. To find the chorda tympani on deep dissection, locate the mandibular division of the trigeminal n. near the oval foramen. If the main part of the mandibular division is gently lifted up, the chorda tympani is often visible underneath running toward the most rostral nerve, the lingual n.

Trigeminal n. (CN V): Be able to find the peripheral branches listed in the lab guide. Anytime we discuss CN V, *always specify the division* (CN V_1, V_2, or V_3). It is worth noting that the identifiable branches of CN V_3 listed below all have little to no involvement in innervating muscles of mastication. The CN V_3 branches that are responsible for innervating these muscles are not anatomically distinct. Other CN V_3 branches that can bee seen on deep dissection are often characterized by a mnemonic “B-LIM” for buccal, lingual, inferior alveolar, and mental nn.

-**Supraorbital n.** (of V_1): general sensation to the upper eyelid. Clinically important in horses where it is easy to find passing through the supraorbital foramen.

-**Infraorbital n.** (of CN V_2): found in the infraorbital canal and exiting the infraorbital foramen. Touch sensation to whiskers of the upper jaw.

-**Buccal n.** (of CN V_3): general sensation (touch, pain) to the cheek. Found ventral to the maxillary n. on deep dissection (B of B-LIM)

-**Lingual n.** (of CN V_3): most rostral of 3 branches of CN V_3 that are visible on deep dissection. General sensation to rostral 2/3 of the tongue.(L of B-LIM)

-**Inferior alveolar n.** (of CN V_3): middle the 3 branches of CN V_3 generally visible on deep dissection. Enters the mandible at the mandibular foramen. General sensation to the lower arcade of teeth. (I of B-LIM)

-**Mental nn.** (of CN V_3): continuation of inferior alveolar nn. exiting the body of the mandible via mental foramina. General sensation to skin of the lower jaw. (M of B-LIM)

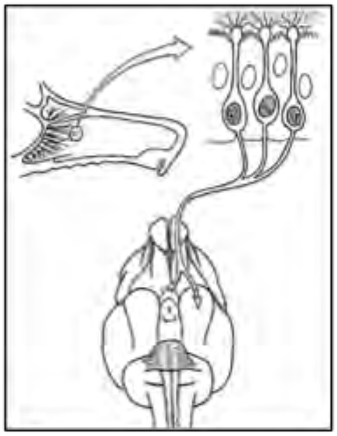
-**Mylohyoid n.** (of CN V_3): most caudal of the 3 parts of CN V_3 generally visible on deep dissection. General sensation to skin between the left and right parts of the mandible. Motor to digastricus (rostral belly) and mylohyoideus mm.

Accessory n. (CN XI): Visible on deep dissection by the tympano-occipital fissure. Branches go to trapezius m. and the 2 muscles that attach to the nearby mastoid process (pars mastoideus of the brachiocephalicus and sternocephalicus mm.)

Hypoglossal n. (CN XII): A large motor nerve to the tongue that curves rostrad deep to the digastricus m. It runs with the lingual a.

Cranial nerves as they leave the brain: In some brains it may be possible to find almost all of the cranial nerves as shown in the VCA. However, for test purposes we will test on the most obvious nerves identifiable on almost any brain. These nerves include CN I, II and V. Others likely to be found are CN VII and VIII just caudal to CN V and caudal to the pons and CN III just rostral to the pons.

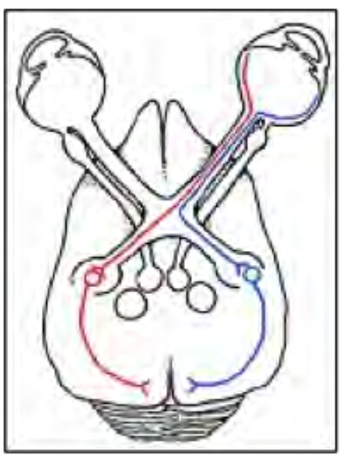
Olfactory Nerve: Cranial Nerve I:



FUNCTION: The olfactory nerve is a special sensory nerve that is involved only in smell. The olfactory nerves consist of numerous unmyelinated axons whose cell bodies are located in the olfactory epithelium covering the ethmoidal labyrinth and the dorsal part of the nasal septum. The cell bodies of the olfactory cells (present in the lining of the caudal nasal cavity) send their axons through the cribriform plate of the ethmoid bone into the cranial cavity where they terminate by synapsing on neurons in the olfactory bulbs. The olfactory system is part of the rhinencephalon ("smell brain") of the telencephalon. It is the only sensory system that does not synapse in the thalamus for relay to the cerebral cortex.

CRANIAL EXIT: Foramina of ethmoid bone (cribriform plate).

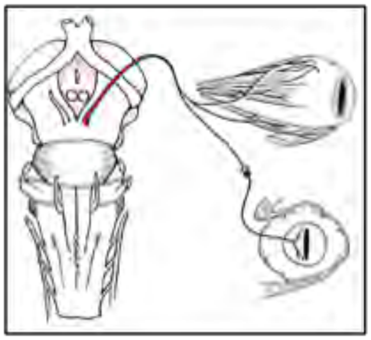
Optic Nerve: Cranial Nerve II:



FUNCTION: The optic nerve (CN II) is a special somatic afferent nerve that provides vision. The cell bodies of the optic nerve are in the retina of the eye with the axons combining to form the optic nerve (CN II). The optic nerve courses in the orbit to the optic canal, where it passes through the skull into the cranial cavity. The right and left optic nerves join at the optic chiasm where most of the fibers cross over (decussate) to the opposite side (degree of decussation is species-specific). The visual impulses travel along the optic tract to the lateral geniculate nucleus in the thalamus, which relays the visual impulses through the optic radiations in the internal capsule (blue arrow) to the visual cortex in the occipital lobe of the cerebrum.

CRANIAL EXIT: Optic canal

Oculomotor Nerve: Cranial Nerve III:



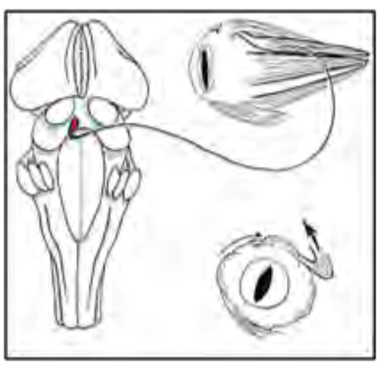
FUNCTION: The oculomotor nerve (CN III) carries both autonomic and motor fibers.

Autonomic Component (Parasympathetic): The oculomotor nerve contains autonomic nervous system (ANS) motor fibers that control the smooth (involuntary) muscles of the eye. These are the ciliary muscles that adjust the shape of the lens for focusing (accommodation) and the pupillary sphincter muscles. These ANS fibers are the efferent part of a reflex arc for which the optic nerve serves as the afferent part.

Motor: The oculomotor nerve is motor to the following skeletal (voluntary) muscles of the eye: dorsal, medial and ventral rectus muscles and ventral oblique muscle. It is also motor innervation to the levator palpebrae superioris, the muscle that raises the upper eyelid.

CRANIAL EXIT: Orbital fissure

Trochlear Nerve: Cranial Nerve IV:

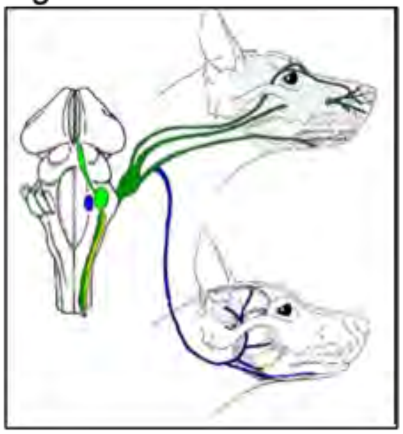


FUNCTION: The trochlear nerve is motor to the dorsal oblique muscle of the contralateral side from its brainstem cell bodies of origin.

The trochlear nerve is unique in three aspects:
1. It is the smallest of the cranial nerves.
2. It is the only cranial nerve to emerge from the dorsal side of the brainstem.
3. It is the only cranial nerve to cross the midline entirely and innervate the contralateral side.

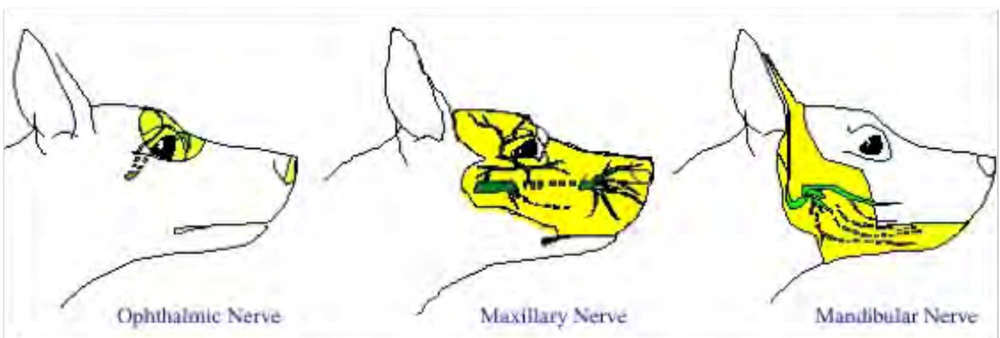
CRANIAL EXIT: Orbital fissure

Trigeminal Nerve: Cranial Nerve V:

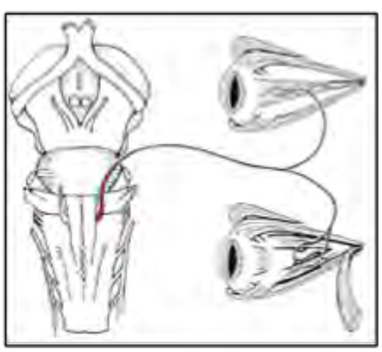


FUNCTION: The trigeminal nerve is sensory to the head. One of the three branches of the trigeminal nerve, the mandibular branch (V3), is motor to the muscles of mastication (masseter, temporalis, medial and lateral pterygoid, mylohyoid, and rostral belly of the digastricus muscles). The trigeminal nerve divides into a trio of branches giving the nerve its name. The ophthalmic branch (V1) and maxillary branch (V2) are purely sensory, and the mandibular branch (V3), while having a sensory component, is also motor innervation to the muscles of mastication (except caudal belly of digastricus m.).

CRANIAL EXIT: Distal to the trigeminal ganglion, the trigeminal nerve divides into the three branches, the ophthalmic branch (V1) that passes through the orbital fissure, the maxillary branch (V2) that passes into the round foramen and out the rostral alar foramen and the mandibular branch (V3) that passes through the oval foramen.



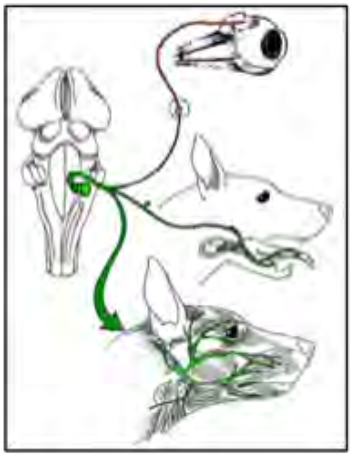
Abducent Nerve: Cranial Nerve VI:



FUNCTION: The abducent nerve (CN VI) provides motor innervation to two skeletal (voluntary) muscles of the eye: the lateral rectus and the retractor bulbi muscles. The name abducent is derived from the Latin word which means, "drawing away", a reference to the lateral pulling away of the eye by the lateral rectus muscle.

CRANIAL EXIT: Orbital fissure

Facial Nerve: Cranial Nerve VII:



FUNCTION: The facial nerve has motor, sensory and autonomic components.

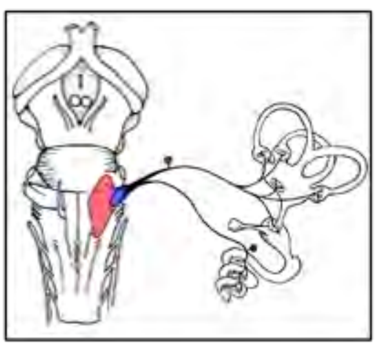
Motor - All the superficial muscles of the head and face as well as the caudal belly of the digastricus, platysma, stylohyoideus and stapedius muscles.

Sensory - Taste to the rostral 2/3 of the tongue and palate through the chorda tympani nerve. [The internal auricular branches are sensory to the concave surface of the ear and ear canal. However, the central course of these sensory fibers is with the vagus nerve rather than with the facial nerve.]

Autonomic (Parasympathetic) - Preganglionic parasympathetic innervation to the lacrimal, nasal and palatine glands. These preganglionic fibers synapse in the pterygopalatine ganglion. The facial nerve also provides preganglionic parasympathetic innervation to the mandibular and sublingual salivary glands. These fibers synapse in the mandibular and sublingual ganglions.

CRANIAL EXIT: Internal acoustic meatus, facial canal, stylomastoid foramen

Vestibulocochlear Nerve: Cranial Nerve VIII:



FUNCTION: The vestibulocochlear nerve (CN VIII) is a special sensory nerve that deals with hearing and equilibrium. It is divided into two branches, the cochlear and vestibular, which enter the petrous temporal bone through the internal acoustic meatus. In the petrous temporal bone they enter into the membranous labyrinth of the inner ear.

CRANIAL EXIT: Internal acoustic meatus

Glossopharyngeal Nerve: Cranial Nerve IX:

FUNCTION: The glossopharyngeal nerve is a mixed nerve supplying, as its name suggests, the tongue and pharynx. This nerve serves taste, swallowing and salivation. Functionally, this nerve can be divided as follows:

Taste: Taste sensation from the taste buds in the caudal 1/3 of the tongue.

Sensory: Sensation from the mucosa of the caudal 1/3 of the tongue, palate and pharynx. CN IX also innervates the baroreceptors and chemoreceptors of the carotid sinus.

Motor: Motor to the striated voluntary muscles of the pharynx.

Autonomic (Parasympathetic): Parasympathetic autonomic innervation to the parotid gland (through the otic ganglion) causing secretion of the parotid gland. Also innervates the baroreceptors and chemoreceptors of the carotid sinus.

CRANIAL EXIT: Jugular foramen to tympano-occipital fissure

Vagus Nerve: Cranial Nerve X:

FUNCTION: The vagus nerve has the following functions:

Motor: The vagus nerve is motor to the pharyngeal muscles through the pharyngeal plexus. The vagus nerve is motor to the intrinsic muscles of the larynx (except the cricothyroideus muscle) through the recurrent laryngeal nerve and motor to the cricothyroideus muscle through the external branch of cranial laryngeal nerve.

Sensory: The vagus is sensory from the pharynx, larynx, and thoracic and abdominal viscera, including baroreceptors in the aortic bodies. It also carries sensory fibers from the external ear via its auricular branch to the facial nerve.

Autonomic nervous system: The vagus nerve carries parasympathetic fibers to the pharynx, larynx, trachea, esophagus and thoracic and abdominal organs.

CRANIAL EXIT: Jugular foramen to tympano-occipital fissure

Accessory Nerve: Cranial Nerve XI:

FUNCTION: The accessory nerve innervates the muscles of the neck and forelimb, which are of branchial arch origin.

CRANIAL EXIT: Jugular foramen to tympano-occipital fissure

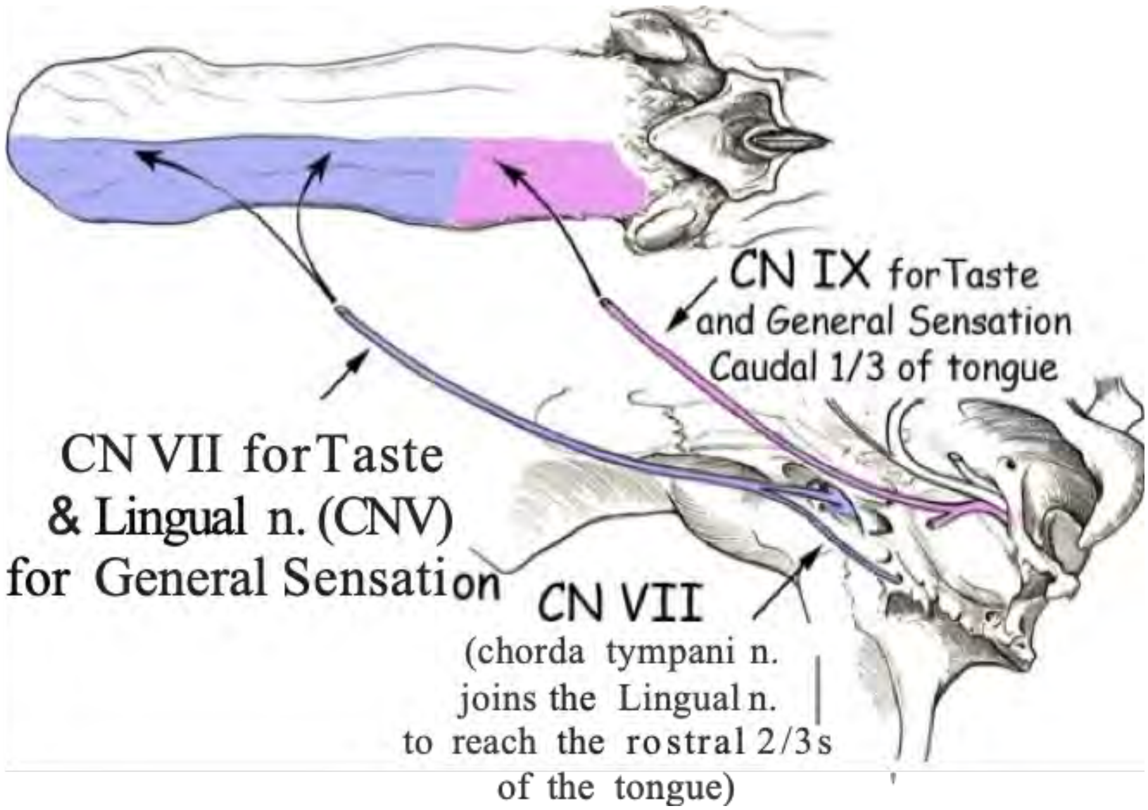
Hypoglossal Nerve: Cranial Nerve XII:

FUNCTION: The hypoglossal nerve is motor to the muscles of the tongue.

CRANIAL EXIT: Hypoglossal canal

This table represents the major functional components for each of the cranial nerves:

CRANIAL NERVE	**SENSORY**	**MOTOR**	**PARASYMPATHETIC**
Olfactory n. (CNI)	**X**		
Optic n. (CNII)	**X**		
Oculomotor n. (CNIII)		**X**	**X**
Trochlear n. (CNIV)		**X**	
Trigeminal n. (CNV)			
Ophthalmic n. (V1)	**X**		
Maxillary n. (V2)	**X**		
Mandibular n. (V3)	**X**	**X**	
Abducent n. (CNVI)		**X**	
Facial n. (CNVII)	**X**	**X**	**X**
Vestibulocochlear n. (CNVIII)	**X**		
Glossopharyngeal n. (CNIX)	**X**	**X**	**X**
Vagus n. (CNX)	**X**	**X**	**X**
Accessory n. (CNXI)		**X**	
Hypoglossal n. (CNXII)		**X**	


CN IX for Taste
and General Sensation
Caudal 1/3 of tongue
CN VII for Taste
& Lingual n. (CNV)
for General Sensation
CN VII
(chorda tympani n.
joins the Lingual n.
to reach the rostral 2/3s
of the tongue)

Lab 10 Short Objectives

For all features or CN be sure to know foramina and function associated with this structure. Which features are used to distinguish species? What innervates the muscles? What goes through particular foramen? – Just think, if you know these things, this is more than half of your test!

Cerebrum

Cerebellum

Optic chiasm

Basilar a.

Cerebral arterial circle

Olfactory bulb

Trochlear n.

Rostral alar foramen

Orbital fissure

Ramus of the mandible

Stylomastoid foramen

Tympano-occipital fissure

Supraorbital foramen (Eq/Bo)

Cornual diverticulum (Bo)

Facial tubercle (Bo)

Facial crest (Eq)

Incisor teeth (Ca/Eq)

dental pad (Bo)

lingual torus (Bo)

temporalis m.

masseter m.

digastricus m.

pterygoid mm.

orbicularis oris m.

orbicularis oculi m.

mandibular salivary gland

duct of the parotid salivary gland (parotid duct) (can)

levator nasolabialis m.

frontalis m.

conchae

choanae

oral and nasal cavity

bones of the viscero- and neurocranium

bones of the orbit and zygomatic arch

lingual a.

internal carotid a.

linguofacial v.

Lab 11 Exercises

Brain: Students should focus on the structures listed in the lab guide. Most of the venous sinuses are found in the falx cerebri and tentorium cerebelli as described in lecture and may be tested in lab.

The brain can be divided into the **cerebrum, the cerebellum** and the **brainstem**. The cerebrum has 2 hemispheres, each with an outer **cortex** (**gray matter** with **neuronal cell bodies**), deeper **white matter** and **subcortical gray** matter. The surface of the cortex has ridges (gyri) and grooves (sulci). The 2 cortical hemispheres are separated dorsally by a **longitudinal fissure**. The **falx cerebri**, a fold of dura mater, is contained within the longitudinal fissure.

The cerebellum is separated from the cerebrum by a transverse fissure that contains the **tentorium cerebelli**. The cerebellum has thin parallel ridges on its surface that are called folia. The cerebellum together with the pons makes up the bulk of the metencephalon (a vesicle of the developing brain).

When the cerebrum and cerebellum are removed, the remaining portion of the brain is called the brainstem. It can be divided into the **mesencephalon** (midbrain), **pons**, and **medulla**. Be able to find these regions on a ventral view of the brain and on a midsagittal section of brain seen in lecture notes and the VCA. The **diencephalon** is located dorsal to the **pituitary gland** approximately between CN II and the mammillary bodies near CN III. Major parts of the diencephalon include the thalamus and hypothalamus. The mesencephalon is best seen on a midsagittal section. The mesencephalon contains the **mesencephalic aqueduct,** which runs between the 3rd and 4th ventricles. The pons is seen ventrally on the brainstem and contains fibers running to the cerebellum as the cerebellar peduncles.

The locations of the 4 **ventricles** are seen on diagrams in the lectures and the VCA. The two **lateral ventricles** are found in the cerebral hemispheres. The **3rd ventricle** is found on midline in the diencephalon surrounding the interthalamic adhesion. The **4th ventricle** is found ventral to the cerebellum. Cerebrospinal fluid (CSF) flows mostly from the choroid plexuses located in each ventricle out through the **mesencephalic aqueduct** to the 4th ventricle, where foramina lead to the **subarachnoid space**. From the subarachnoid space located near the longitudinal fissure, CSF is absorbed into the blood of the dorsal sagittal sinus by passing through arachnoid villi.

<u>Vessels of the head & neck:</u>

Students should know the arteries and veins of the head and brain listed on in the lab guide. (See lecture notes, Evans and deLahunta, 7th Ed. Fig. 5-51, or your VAA to assist in your study of the ventral aspect of the canine brain and vascular supply).

Arteries of the head & neck: The **common carotid aa.** run up the neck. Near the occipital bones of the skull and the larynx, each of the common carotid aa. split into an **internal carotid a**, which goes to the brain via the tympano-occipital fissure, and an **external carotid a** which supplies essentially the rest of the head. The internal carotid artery can often be distinguished from the external carotid artery by a small dilation at its origin, the **carotid sinus**, which acts as a baroreceptor organ. Next to the internal carotid a, the external carotid artery also gives off the **occipital a**, which runs dorsally and supplies structures near the occipital bones. The **lingual a.** is a ventral branch of the external carotid a. which runs to the tongue together with the large hypoglossal n. The next ventral branch is the **facial a.,** which runs over the angle of the mandible where a pulse can be taken in horses. The next dorsal branch just caudal to the external ear canal is the **caudal auricular a**. The **superficial temporal a.** is the next dorsal branch just rostral to the ear. After the superficial temporal a. leaves the external carotid a., the name of the main arterial trunk is changed to **maxillary a**. The maxillary a. dives deep under the mandibular ramus and passes first through the **caudal alar foramen**, then into the alar canal where it joins the maxillary division of the trigeminal n. Together the maxillary a. and n. exit the rostral alar foramen and pass over the medial pterygoid m. before entering the infraorbital canal.

Veins of the head & neck: The **external jugular v.** is a superficial vein lying in the jugular furrow between the brachiocephalicus and sternocephalicus mm. With the exception of the pig, domestic species do not have a substantial internal jugular v. that would travel with the internal carotid a. Near the larynx and the caudal part of the mandibular salivary gland, the external jugular v. branches to form the **linguofacial v.** and the **maxillary v**. The branches of the linguofacial vein are the **lingual v.** (draining the tongue) and the **facial v.** (draining the face). The facial vein has numerous branches including the **angularis oculi v.**, which is found coursing near the medial canthus (corner) of the eye.

Pharynx

The **pharynx** is the soft tissue conduit through which both air and food will pass. Both the oral and nasal cavity regions of the pharynx are defined by their non-pharyngeal boundaries. In essence, the **oropharynx** and **nasopharynx** are divided by the **soft palate**. The rostral boundary of the oropharynx is defined by the **palatoglossal arch**, a fold of mucous membrane extending from the soft palate to the base of the tongue. The **palatine tonsil** lies within the oropharynx just caudal to this arch. The **nasopharynx** begins at the **choanae**, and its caudal boundary is marked by the **palatopharyngeal folds** that extend from the caudal edge of the soft palate to the dorsal wall of the pharynx. The openings of the **auditory tubes** (and thus the **guttural pouch** in horses) are found in the nasopharynx, as are the **pharyngeal tonsils**. The rostral boundaries of the **laryngopharynx** are the caudal boundaries of the nasopharynx and orophyarnx, and its caudal border is defined by the presence of the opening into the proximal **esophagus**. The muscles of the pharynx are innervated by **CN IX and X** and act to constrict (**mm. palatopharyngeus, hyopharyngeus, thyropharyngeus, cricopharyngeus**) or dilate (**stylopharyngeus m.**) the pharynx. Note that all of these muscles are named for where they are attached and where they are going. If you have a good understanding of the larynx/pharynx/hyoid apparatus, then you should be able to identify these muscles in the laboratory. The pharyngeal muscles aid in **swallowing** – which is really a reflex and requires the coordination of several more cranial nerves (**CN V, VII, IX, X, XII**).

Clinical note – horses are obligate nose breathers – as in, they cannot breathe through their mouths. Their soft palate is very long, and essentially reaches the larynx. In horses, the soft palate normally sits ventral to the epiglottis, but in some cases the soft palate can become displaced (dorsal displacement of the soft palate – DDSP) and this will impede the airway as the soft palate will now act like a sail cranial to the airway during exhalation. Surgical correction requires resection of the caudal portion of the soft palate. (*PS – the pharynx allows you to squirt milk out our nose when you are laughing! Milk enters the oral cavity, and as it is trying to get down the oropharynx and laryngopharynx to the esophagus, you start giggling and force it back up rostrad through the nasopharynx, choanae, nasal meati, and then out the nostril. Do not try this at home ☺).*

Larynx

The larynx is the semi-rigid gatekeeper and entrance to the **trachea**. The primary functions of the larynx are 1) to prevent food/fluid from entering the airway by controlling the size of the proximal airway (closed when swallowing, open wide when breathing hard during exercise); as well as 2) phonation (vocalization for humans, which is why we sometimes call it the “voice box”!). There are several intrinsic muscles to the larynx and their contraction will cause ligaments within the larynx to tighten, which when air passes over them produces a vibration that is the sound of an animal’s “voice”. As with the pharynx, these ligaments and intrinsic muscles are named for their attachment points. Be sure to use the VCA and your lecture notes to establish a solid understanding of the cartilages of the larynx and the bones of the hyoid apparatus. The cartilages of the larynx articulate with each other via synovial joints and from rostral to caudal are the **epiglottis** (unpaired cartilage of the larynx, shaped like a spade, lies caudal to the base of the tongue and folds caudad during swallowing to cover the rostral opening of the larynx), the **thyroid cartilage** (comprised of two lamina joined on the ventral midline to form a taco shell-like shape and serves as an attachment point for several intrinsic and extrinsic muscles of the larynx), the **cricoid cartilage** (the left and right halves form a signet ring shape that is most easily found attaching to the first tracheal ring), and the **arytenoid cartilages** (paired irregular, wing-like structures). Each of the arytenoid cartilages has four named processes: 1) the **corniculate process**, which forms an important visual landmark in the per os approach to the larynx; 2) the wedge-shaped **cuneiform process**, to which is attached the vestibular ligament and muscle; 3) the **vocal process**, to which is attached the vocal ligament (true vocal cord); and 4) the **muscular process**, located on the lateral aspect of the arytenoid and to which is attached the muscles whose actions produce movements of the arytenoid cartilage and corresponding changes in the size of the **rima glottidis** and tension in the vocal ligaments. The rima glottidis is the space between the vocal folds through which air passes during respiration; beyond the rima glottidis is the infraglottic cavity, which leads to the trachea.

There are four important ligaments in the larynx and from caudal to rostral they are: 1) the **cricotracheal ligament** (from the caudal margin of the cricoid cartilage to the first ring of the trachea); 2) the **cricothyroid ligament** (between the arch of the cricoid cartilage and the caudal margin of the thyroid cartilage); 3) the **vocal ligament** (from the vocal process of arytenoid cartilage to the thyroid cartilage); and 4) the **vestibular ligament** (from the cuneiform process of arytenoid cartilage to the thyroid cartilage). Both the vocal and the vestibular ligaments are covered by membranes and are then called the **vocal fold** and **vestibular fold**, respectively. Each is also associated with a muscle; the **m. vocalis** is associated with the vocal ligament/fold and is considered the "true" vocal cord, whereas the vestibular ligament/fold is associated with the **ventricularis m.** Lying in between these two folds is an evagination of the mucosa within the region of the thyroid cartilage, the **laryngeal ventricle**. A similar sounding, but very different structure is the **laryngeal vestibule** (remember vestibule = entry space) – the space between the epiglottis, corniculate process of the arytenoid, and the glottis. One last membrane is the one that actually connects the larynx to the hyoid apparatus – the thyrohyoid membrane. This membrane is easy to visualize in the laboratory as it is the fibroelastic connection between the thyroid cartilage of the larynx to the caudolateral hyoid bones.

Muscles of the larynx are important as there are both **extrinsics** (**mm. sternothyroid, sternohyoid, thyrohyoid,** and **geniohyoideus**) that move the cervical "viscera" during swallowing/phonation, and **intrinsics** that are responsible for the articulations within the larynx. The cricothyroid articulation changes the length/tension of the vocal cords and is facilitated by the **cricothyriod mm**. (innervation: **external branch of the cranial laryngeal n.**). The cricoarytenoid articulation allows for abduction/adduction of the vocal cords, which functionally changes the size of the rima glottidis. The **dorsal cricoarytenoid m**. (CAD m.) is the **<u>ONLY abductor</u>** of the vocal cords and the **lateral cricoarytenoid m.** – **<u>adducts</u>** the vocal cords. Both are innervated by the **caudal (recurrent) laryngeal n.** Both the caudal and cranial laryngeal nerves are branches of CN X, but the caudal laryngeal n. branches off of CN X in the thorax and "recurs" cranially to reach the larynx. Remember, the mm. vocalis and vestibularis are also part of the intrinsic muscles. In the larynx it is easy to tell the cranial and caudal laryngeal nerves apart due to their motor and sensory functions. The caudal laryngeal n. will be seen innervating the dorsal and lateral cricoarytenoid muscles, providing motor innervation to all of the other intrinsic laryngeal muscles, and providing sensory innervation caudal to the vocal cords (infraglottic cavity). The **cranial laryngeal nerve** actually has a **deep (internal) branch** that dives between the **mm. hyopharyngeus** and **thyropharyngeus** (this is a great landmark in the lab!) to provide sensory innervation to the area rostral to the vocal cords (laryngeal ventricle and vestibule). The superficial (external) branch will innervate the cricothyroid m. and although the nerve is easily discerned, the muscle is often buried in most specimens under other extrinsic muscles attaching to the thyroid cartilage of the larynx. *Clinical note – abduction of the larynx is absolutely critical for adequate ventilation and movement of air in/out of the lungs. Paralysis of the CAD m. causes "roaring" in horses and "larpar" in dogs. Surgical fixation of the affected arytenoid cartilage is commonly performed as a surgical procedure, but increases the patients' risk for aspiration pneumonia.*

Dentition

All mammals have two "sets" of teeth: "baby" or "milk teeth" that are actually termed **deciduous** teeth and adult or permanent teeth. If an animal has too many teeth (**hyperdontia**), these are termed **supernumary** teeth. The dental arcade is defined by the shape that the teeth make on the top row – often associated with the incisive (**incisors**) and maxillary (**cheek teeth**) bones. When the tooth first emerges from the gum, it "erupts" and then "comes in to wear" as it makes contact with the opposing teeth. The tooth itself has a **crown** (made of calcified tissue called **enamel**) and a **root** (made of non-calcified tissue called **cement**). There is a **central cavity** called **dentin** where ivory is located, and the **pulp** of the tooth (where vessels and nerves are found) is the innermost portion of the central cavity. The length of the crown in mammals defines what type of teeth they have. Short crowned teeth, as in carnivores, are brachydont; high crowned teeth in horses and ruminants are hypsodont. The root of the tooth is where the nerves and vessels enter the tooth and is located in the **alveolus** of the bone that supports the tooth. Some animals also have open rooted teeth such that they produce enamel throughout life – these are the tusks of pigs and the incisor teeth of rodents and rabbits. It is often a misconception that horses are included in this group. Due to the hypsodont nature of their teeth, the adult teeth of horses slowly erupt throughout life, until there is simply no more tooth.

The naming and numbering of teeth can be terrifying for the first time and we are not going to emphasize this beyond lecture material. You may find that clinicians use an abbreviated dental formula or chart for identification of teeth. Many clinicians use the abbreviated adult dental formula of I3-C1-P4-M3/ I3-C1-P4-M3 (or 3143/3143) to indicate the incisor, canine, premolar, and molar teeth for the upper/lower arcade of teeth. The **carnassial teeth** of dogs and cats are PM4/M1 and are unique in that they have multiple, deep roots and can be the longest lasting tooth in a carnivore's mouth – a good thing too, since they are used for shearing meat! The oral cavity of the horse and ruminant were designed for mastication of grasses. There is a gap in the dental arcade that is referred to as a "**diastema**" and the premolars and molars are cheek teeth. The continuous eruption of horse teeth can lead to irregular wear and significant problems in masticatory function. Another problem can be the presence of "wolf teeth" in horses as they can potentially interfere with the bit that normally will sit in the diastema of the mouth. These are not to be confused with canine teeth, which are often only seen in male horses. The first large cheek tooth in horses is premolar 2 (PM2), but the wolf teeth are PM1 and therefore sit rostral to PM2, interfering and becoming painful if the bit is rubbing against them while the horse is being ridden. These teeth are usually removed by a veterinarian when the horse is young. Ruminants on the other hand, not only lack upper incisors (**dental pad**), but they do not have continually erupting teeth and often have their teeth wear out in their teens.

Head and Neck

Bones of the skull

Nasal

conchae *(outgrowths of nasal or maxillary bones)*
nasal aperture

Incisive

dental alveoli
palatine fissure

Frontal

zygomatic process

supraorbital foramen (Eq & Bov)
frontal sinus

Maxilla

infraorbital foramen & canal

maxillary foramen
zygomatic process

maxillary recess (Can)

dental alveoli

Palatine

choanae

Ethmoid

cribiform plate
ethmoturbinates

Sphenoid

sella turcica

optic canal

orbital fissure

round foramen

alar canal

- rostral alar foramen
- caudal alar foramen

oval foramen

Temporal

internal acoustic meatus
stylomastoid foramen

external acoustic meatus

tympanic bulla
zygomatic process

mandibular fossa

Occipital

foramen magnum

occipital condyle

hypoglossal canal

tympano-occipital fissure

jugular process

Mandible

ramus

- coronoid process
- condylar process
- mandibular foramen & canal
- masseteric fossa
- angular process (Car)

body

- dental alveoli
- mental foramina

Parietal

Zygomatic

Pterygoid

Vomer

Lacrimal

Hyoid apparatus

Stylohyoid bone (Eq)
Basihyoid bone with lingual process (Eq and Bov)

Articulations of the skull

sutures of skull

temporomandibular joint

mandibular symphysis

Features of the skull

calvaria

choanae

cranial cavity

hard palate

- palatine, maxillary, and incisive bones

nasal cavity

nuchal crest

orbit

temporal fossa

sagittal crest

zygomatic arch

- zygomatic process of temporal bone + zygomatic bone

Equine skull features

foramen lacerum

composed of jugular foramen, carotid canal, oval foramen

facial crest

maxillary sinus

conchofrontal sinus
closed orbit
supraorbital foramen

Bovine skull features

foramen orbitorotundum

composed of orbital fissure & round foramen

facial tuberosity

cornual process of the frontal bone

cornual diverticulum of the frontal sinus

lacrimal bulla of maxillary sinus

maxillary sinus

frontal sinus

caudal frontal sinus

rostral frontal sinus

sphenoid sinus

palatine sinus
closed orbit

Superficial and deep structures of the head

Muscles of facial expression

auricular mm.

- rostral
- caudal

orbicularis oris m.

buccinator m.

levator nasolabialis m.

zygomaticus m.

orbicularis oculi m.

frontalis m.

platysma m.

Muscles of mastication

masseter m.

temporalis m.

digastricus m.

pterygoid mm.

- medial
- lateral

Salivary glands and lymph nodes

parotid salivary gland

- parotid duct

mandibular salivary gland
sublingual salivary gland (monostomatic)

zygomatic salivary gland

mandibular lymphocenter

retropharyngeal lymphocenter

Veins

external jugular v.

- maxillary v.
- linguofacial v.
  - lingual v.
  - facial v.
    - angularis oculi v.

Nerves

facial n.

- chorda tympani n.
- ventral buccal n.
- dorsal buccal n.
- auriculopalpebral n.
    - palpebral n.
    - auricular n. (rostral and caudal)

trigeminal n.

- ophthalmic n.
    - supraorbital n.
- maxillary n.
    - infraorbital n.
- mandibular n.
    - buccal n.
    - lingual n.
    - inferior alveolar n.
        - mental n.
    - mylohyoid n.

accessory n.

hypoglossal n.

vagus n.

- vagosympathetic trunk
- recurrent laryngeal n.
    - caudal laryngeal n.
- cranial laryngeal n. (internal and external brr.)

Arteries

common carotid a.

- internal carotid a. (carotid sinus)
- external carotid a.
    - lingual a.
    - facial a.
    - maxillary a.

Guttural pouch (Eq)

medial & lateral compartments

stylohyoid bone

Viborg's triangle (external boundaries)

- rostral: mandibular ramus
- dorsal: tendon of sternomandibularis m.
- ventral: linguofacial v.

Brain

Brain overview

cerebrum

- hemispheres
- longitudinal fissure
  corpus callosum

cerebellum

brainstem

- pons
- medulla
- mesencephalon (midbrain)

diencephalon

olfactory bulbs

optic nerves

- optic chiasm

pituitary gland
cranial nerves

Ventricular system

lateral ventricles

3rd ventricle

mesencephalic aqueduct

4th ventricle

Venous sinuses

dorsal sagittal sinus

straight sinus

cavernous sinus

transverse sinus

Meninges

dura mater

- falx cerebri
- tentorium cerebelli

arachnoid

pia mater

Arteries

vertebral aa.

- basilar a.

internal carotid aa.

- middle cerebral aa.
- rostral cerebral aa.
- caudal communicating aa.
- caudal cerebral aa.

Neck, oral & nasal cavity, pharynx & larynx

Neck structures and muscles

thyroid gland (right and left lobes)

sternohyoideus m.

sternothyroideus m.

thyrohyoideus m.

digastricus m.

geniohyoideus m.
genioglossus m.

sternocephalicus m.

- sternomastoideus m. (Ca & Bov)
- sternooccipitalis m. (Ca)
  sternomandibularis m. (Eq & Bov)

stylohyoideus m.

Equine neck

jugular furrow

sternomandibularis m.

omohyoideus m.

Oral cavity

oral cavity proper

oral vestibule

hard palate

- palatine rugae
- dental pad (Ru)
- incisive papilla

soft palate

Tongue

lingual torus (Bo)

Nasal cavity

nasal conchae

- dorsal & ventral ethmoid conchae
- dorsal, middle, & ventral meati (Eq)

Pharynx

nasopharynx

- auditory tube opening
- pharyngeal tonsils

oropharynx

- palatine tonsil

laryngopharynx

guttural pouch (Eq)

- medial compartment
- lateral compartment

Pharyngeal mm.

constrictors

- hyopharyngeus m.
- thyropharyngeus m.
- cricopharyngeus m.

dilators

- stylopharyngeus m.

Larynx

epiglottic cartilage
thyroid cartilage

cricoid cartilage

- dorsal lamina

arytenoid cartilage

- vocal process
- muscular process

cricothyroid m.

lateral cricoarytenoid m.

dorsal cricoarytenoid m.

laryngeal vestibule

laryngeal ventricle

infraglottic cavity

cricothyroid ligament

cricotracheal membrane
vocal fold

vestibular fold

cranial laryngeal n.

external branch

internal branch

recurrent laryngeal n.
caudal laryngeal n.

Mammalian teeth and dental formulae

Dental anatomy

carnassial teeth (Ca)

wolf teeth (Eq)

diastema (Eq, Bo)

Teeth

crown

neck

root

enamel

cementum (cement)

dentin (dentine)

pulp (dental) cavity

dental alveolus - skull

Heterodonty-different teeth specialized for different tasks

Diphyodonty-1st set of teeth (deciduous) replaced with a stronger set (permanent)

Generic formula

$$\frac{\text{incisors, canines, premolars, molars}}{\text{incisors, canines, premolars, molars}}$$

Canine

<u>3-1-4-2</u>

3-1-4-3

Feline

<u>3-1-3-1</u>

3-1-2-1

Equine

<u>3-1-3-3</u>

3-1-3-3

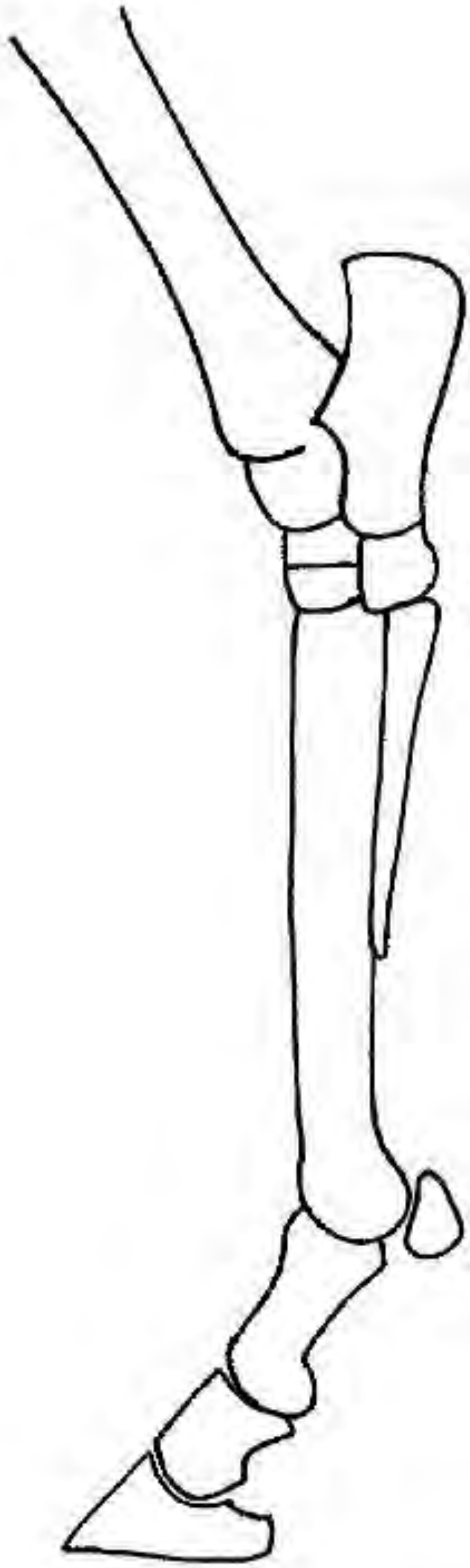
Bovine

<u>0-0-3-3</u>

3-1-3-3

NOTES

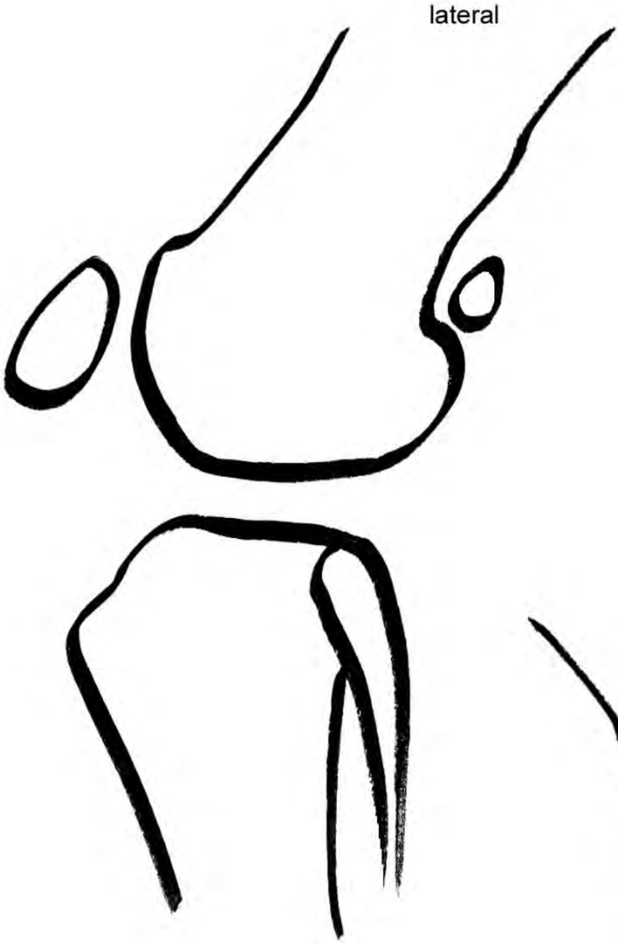
Equine Distal Pelvic Limb: Lateral



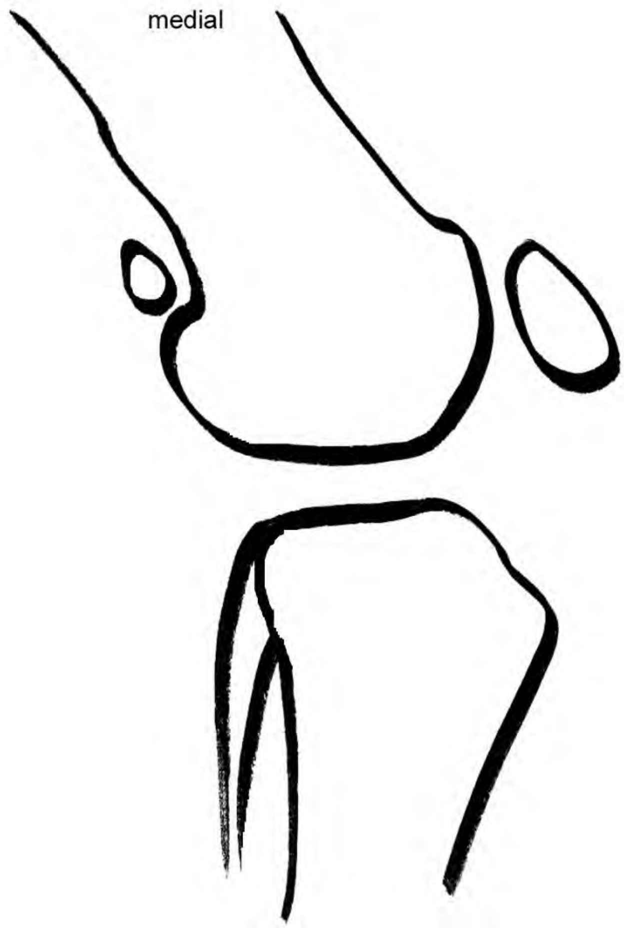
Canine Stifle Joint

Canine Stifle Joint

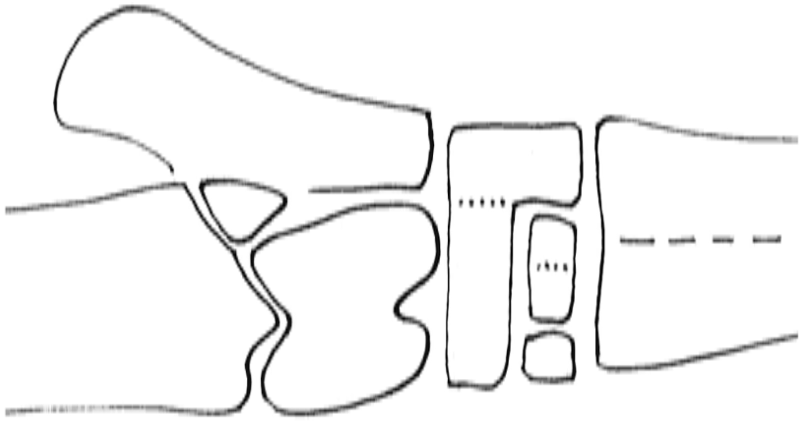
lateral



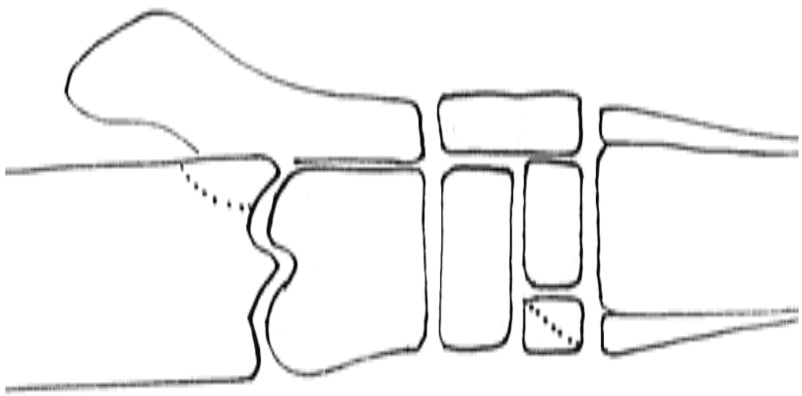
medial



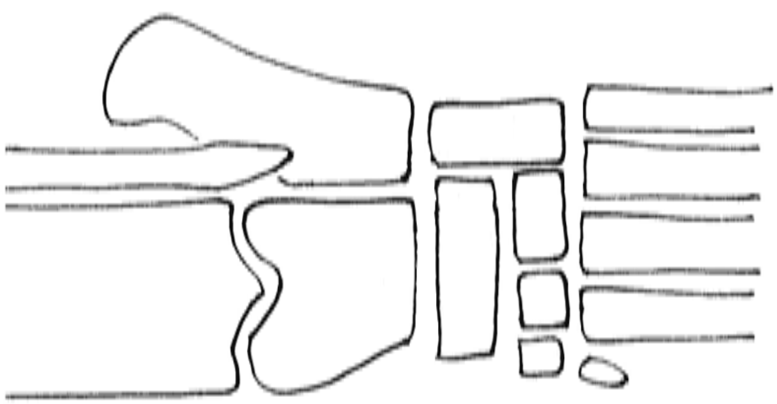
Bovine



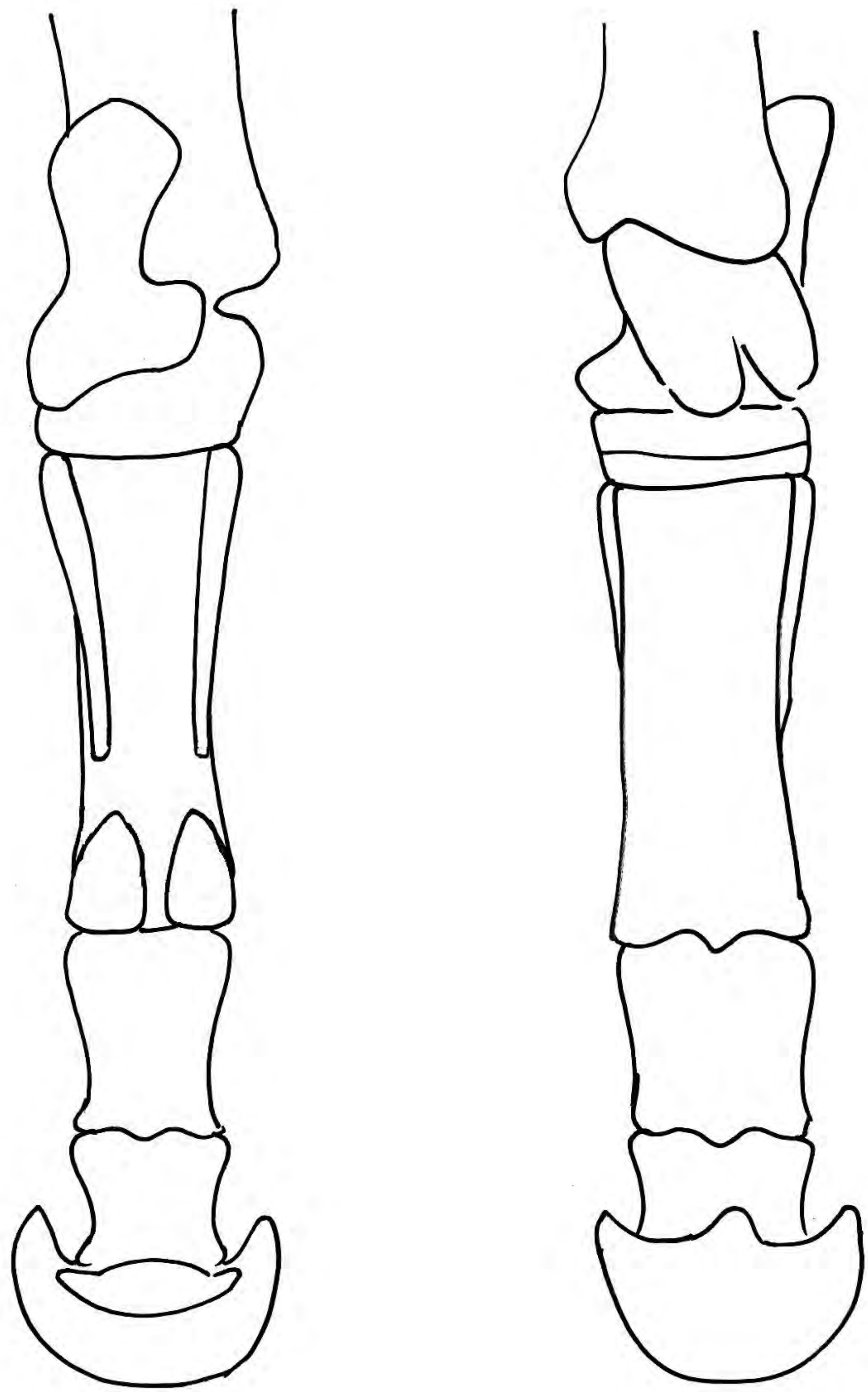
Equine



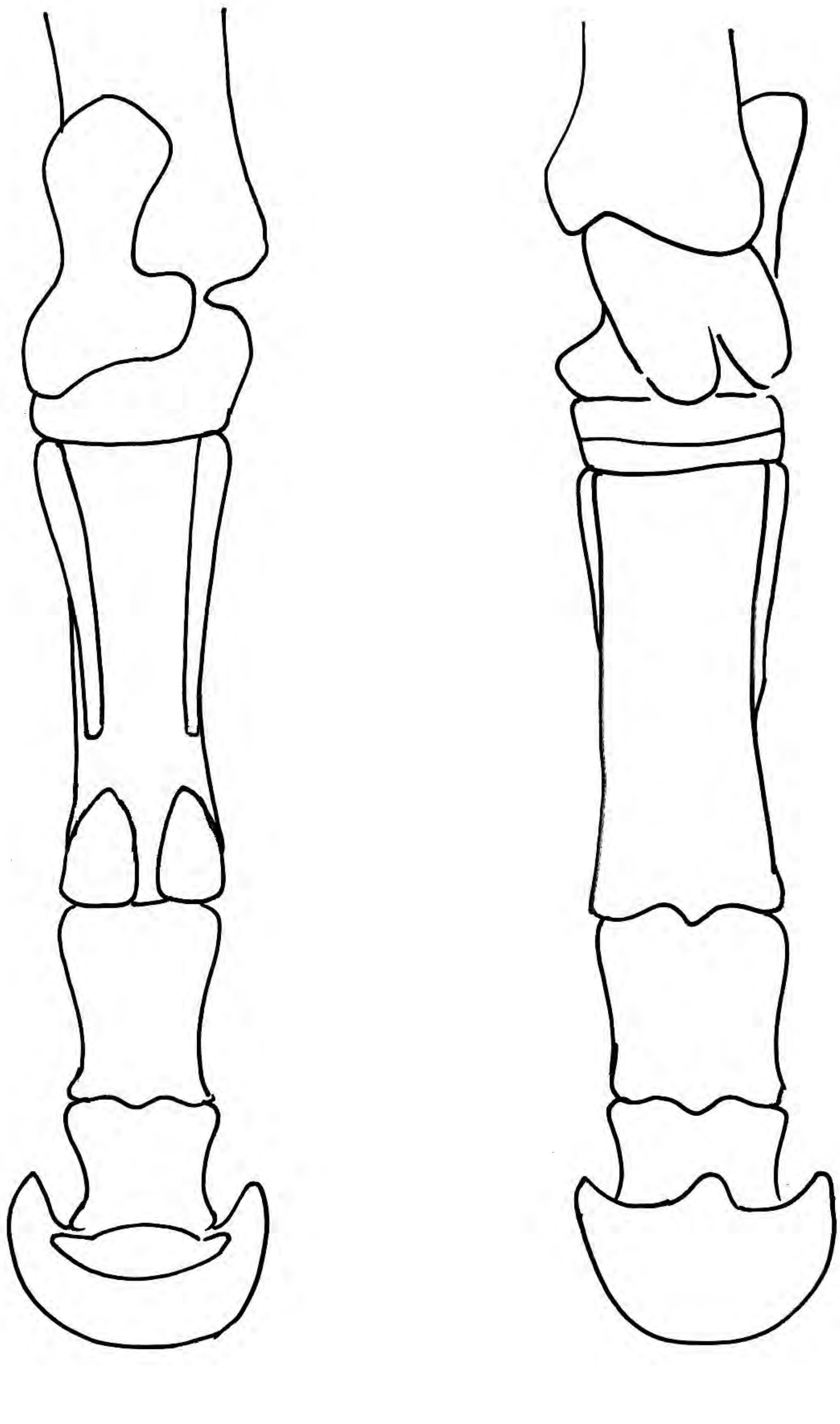
Carnivore



Distal Equine Pelvic Limb

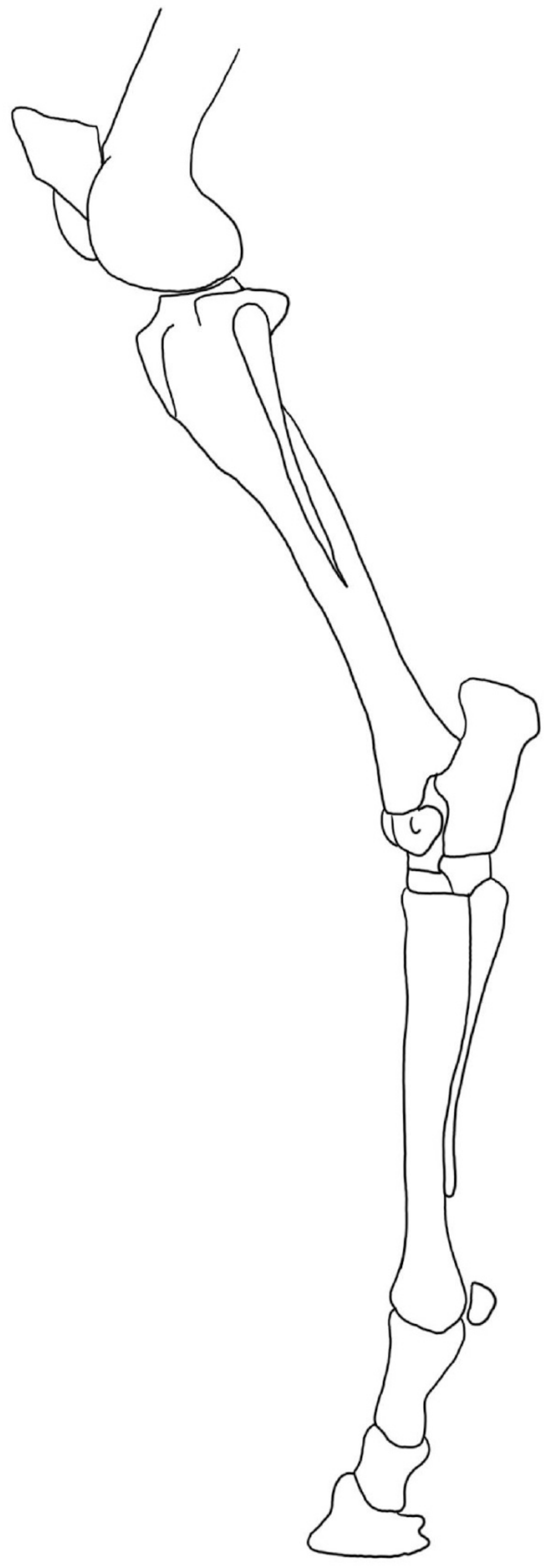


Distal Equine Pelvic Limb

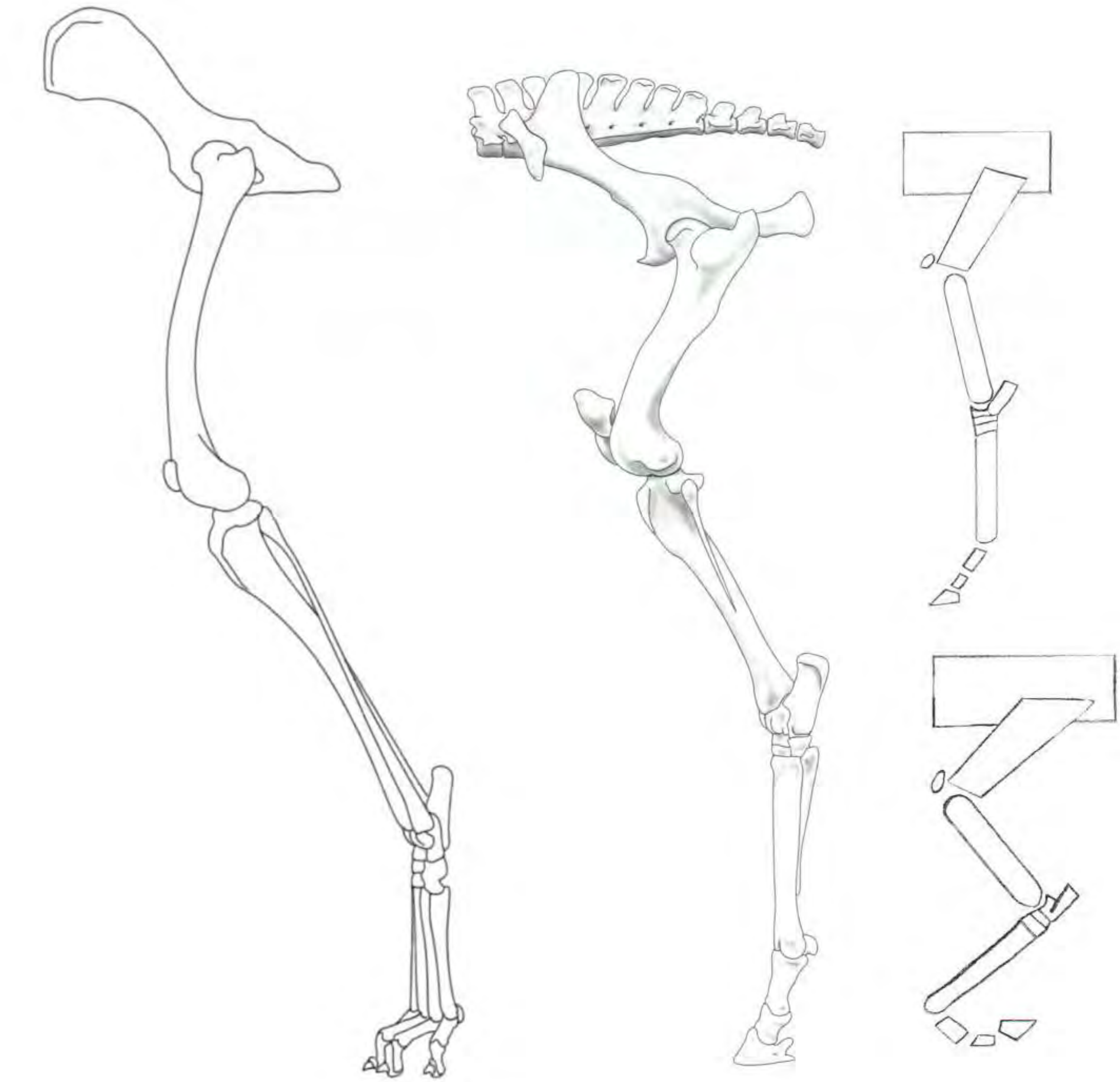


Equine Pelvic Limb

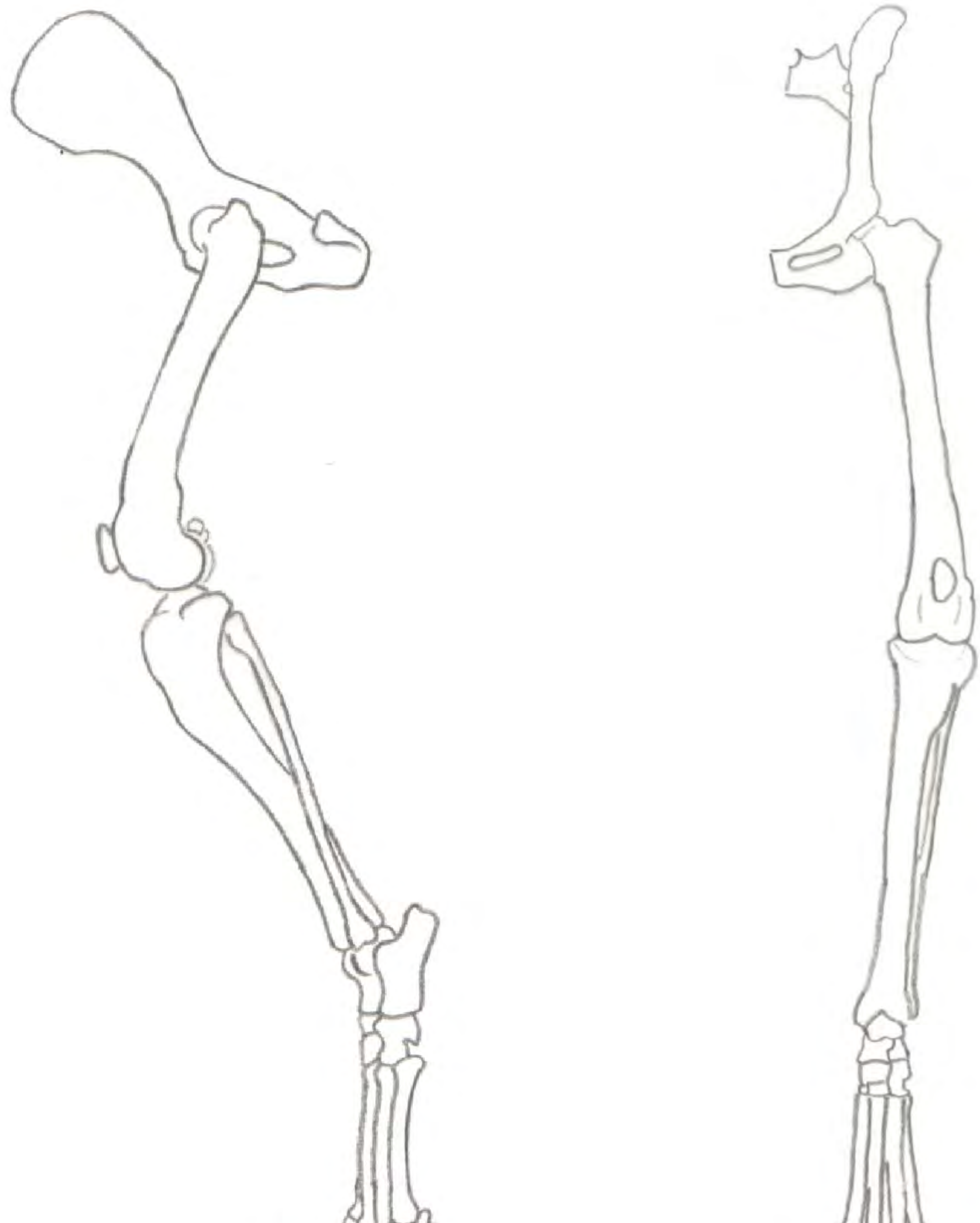
Equine Pelvic Limb



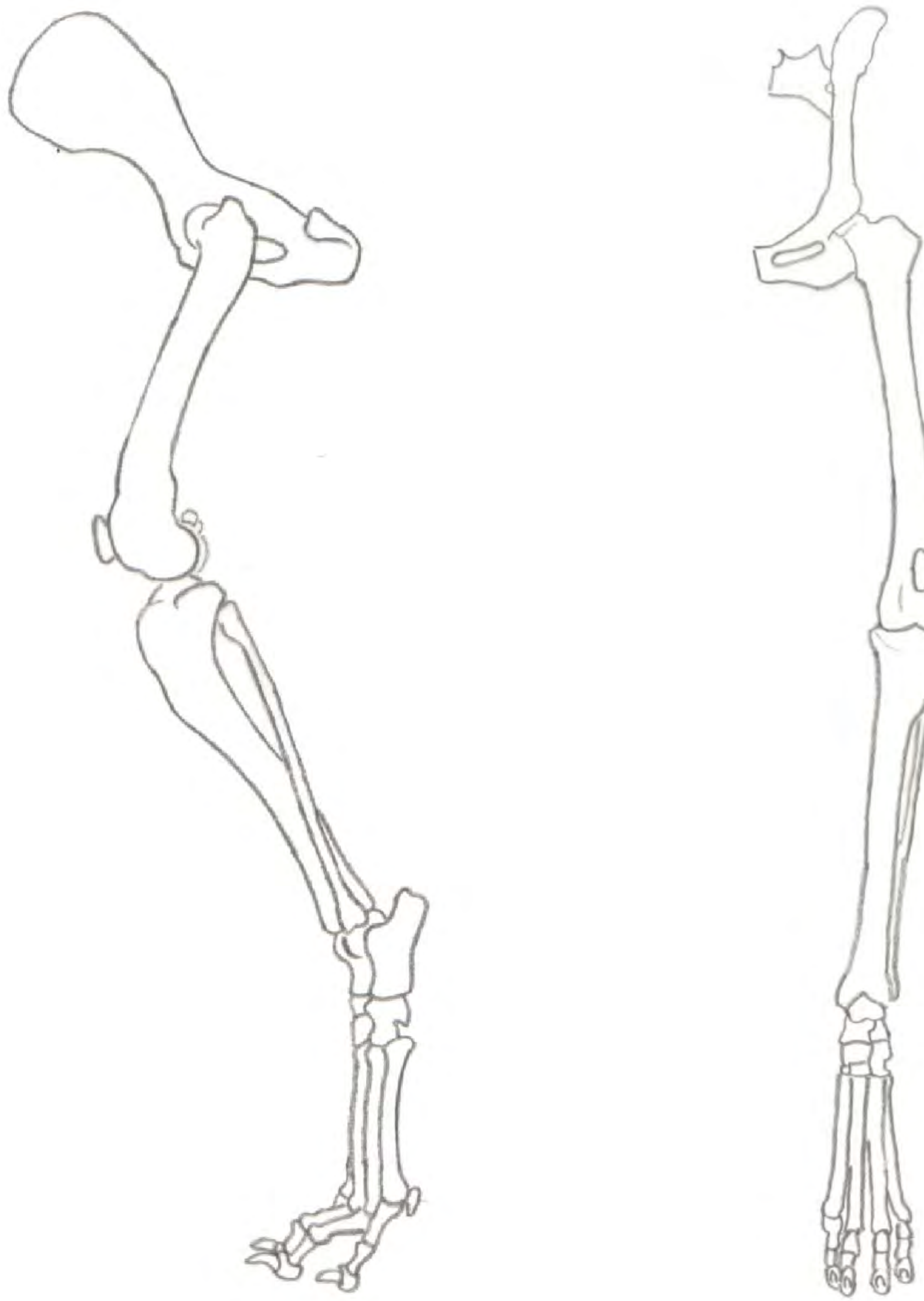
Comparative Pelvic Limb



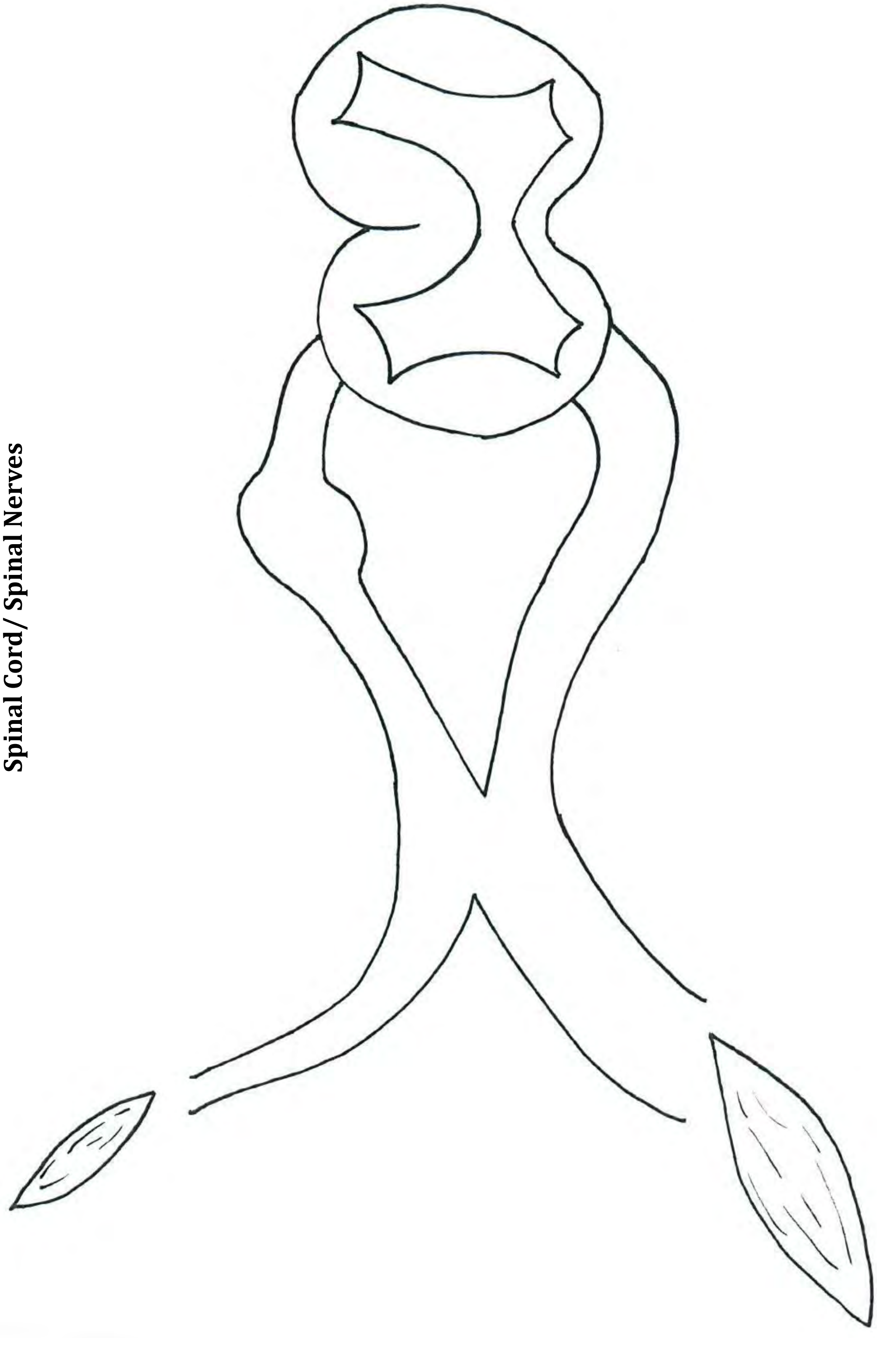
Canine Pelvic Limb: Lateral and Cranial Views



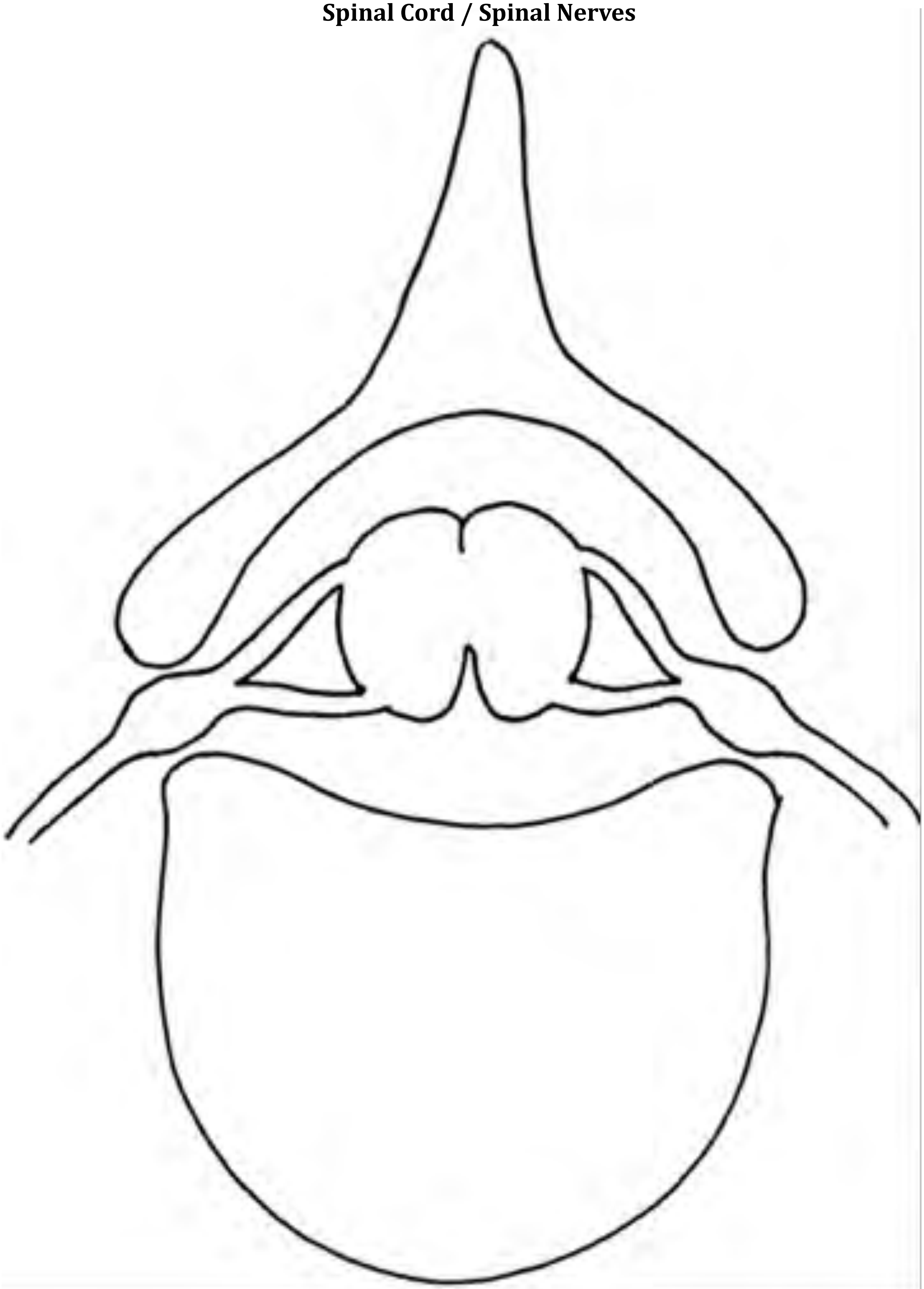
Canine Pelvic Limb: Lateral and Cranial Views



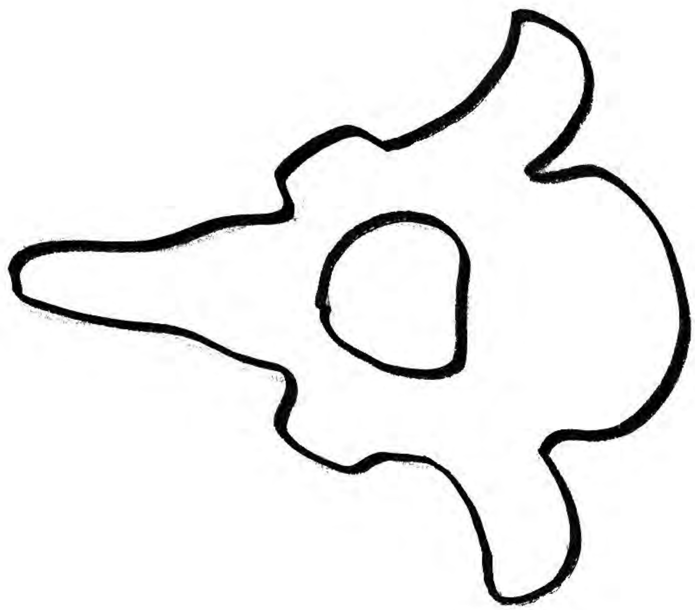
Spinal Cord/ Spinal Nerves

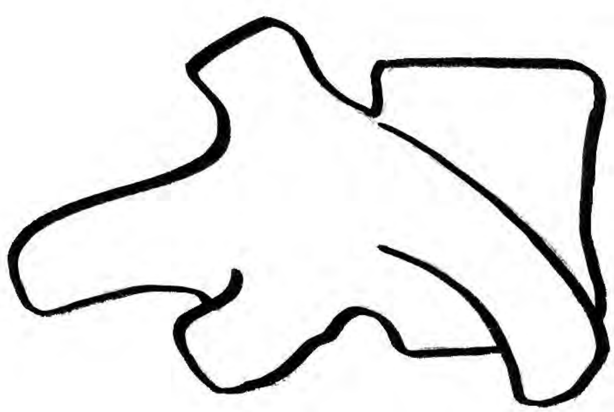


Spinal Cord / Spinal Nerves

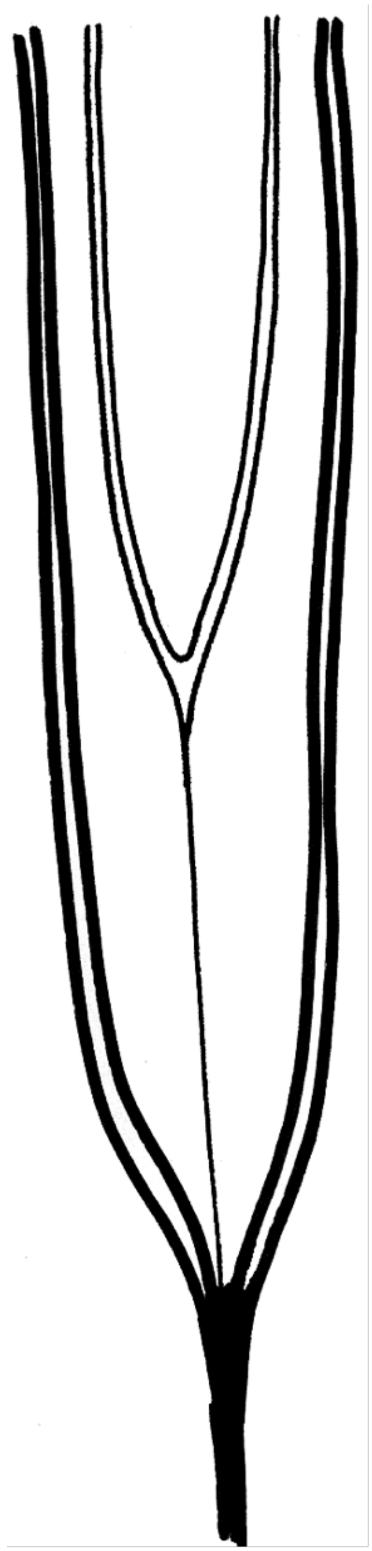


Vertebrae

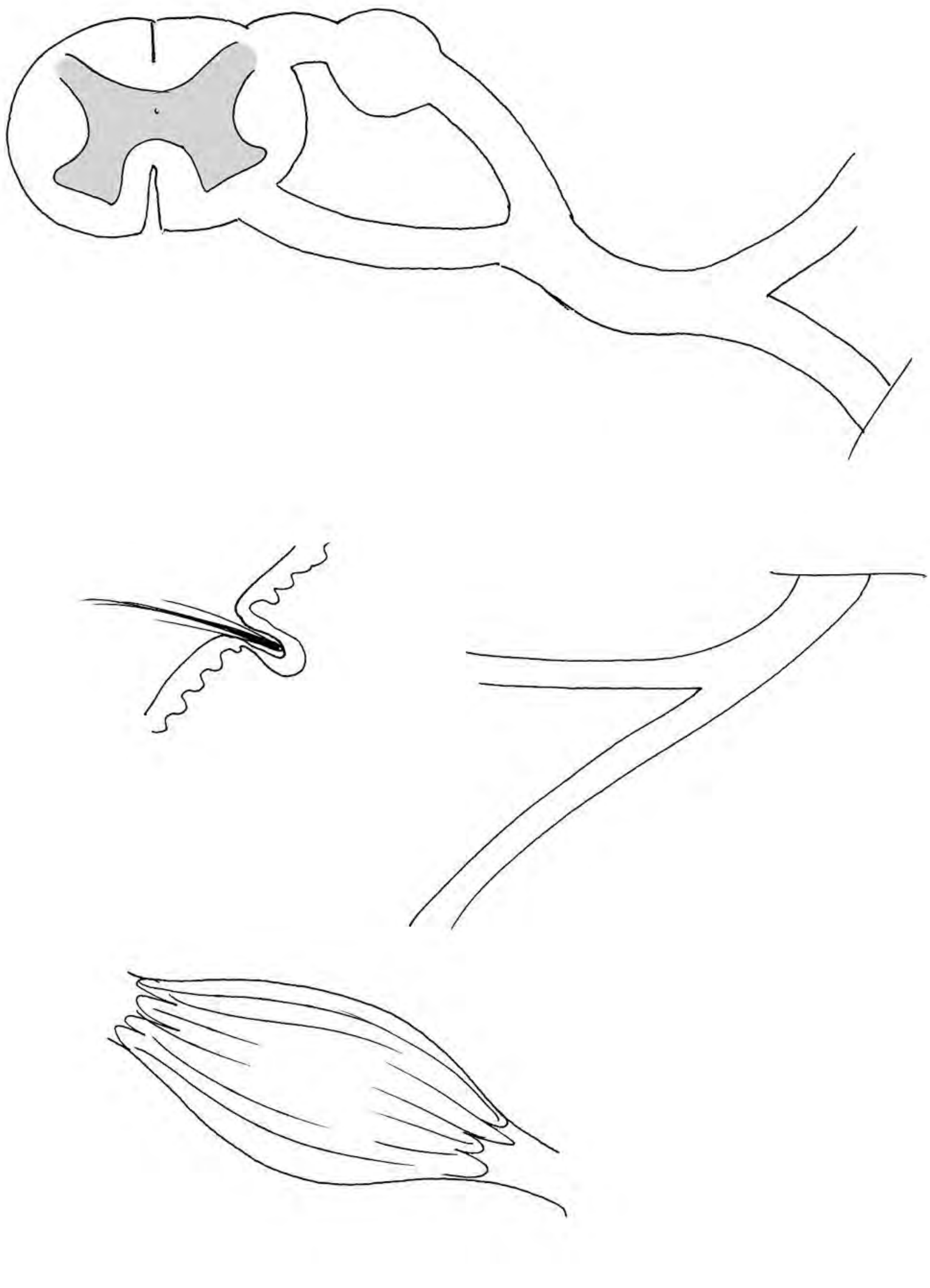




Caudal Spinal Cord

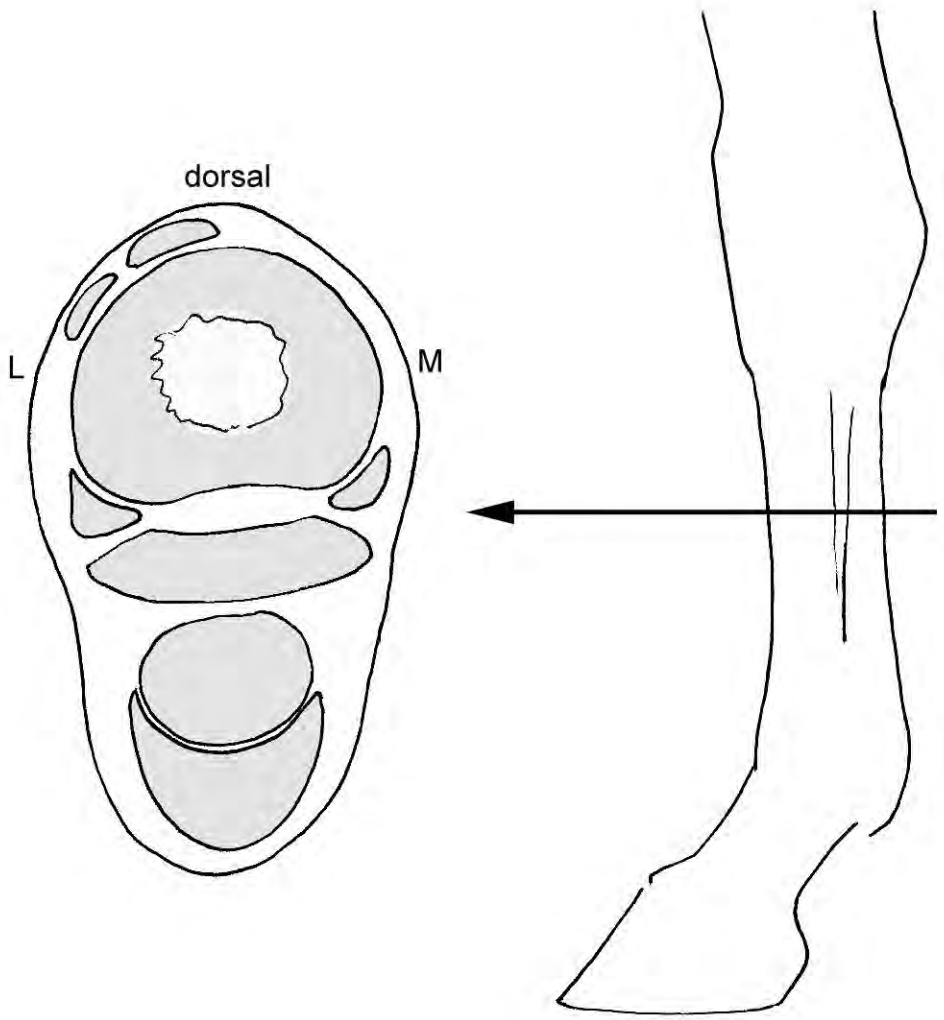


Spinal Reflex

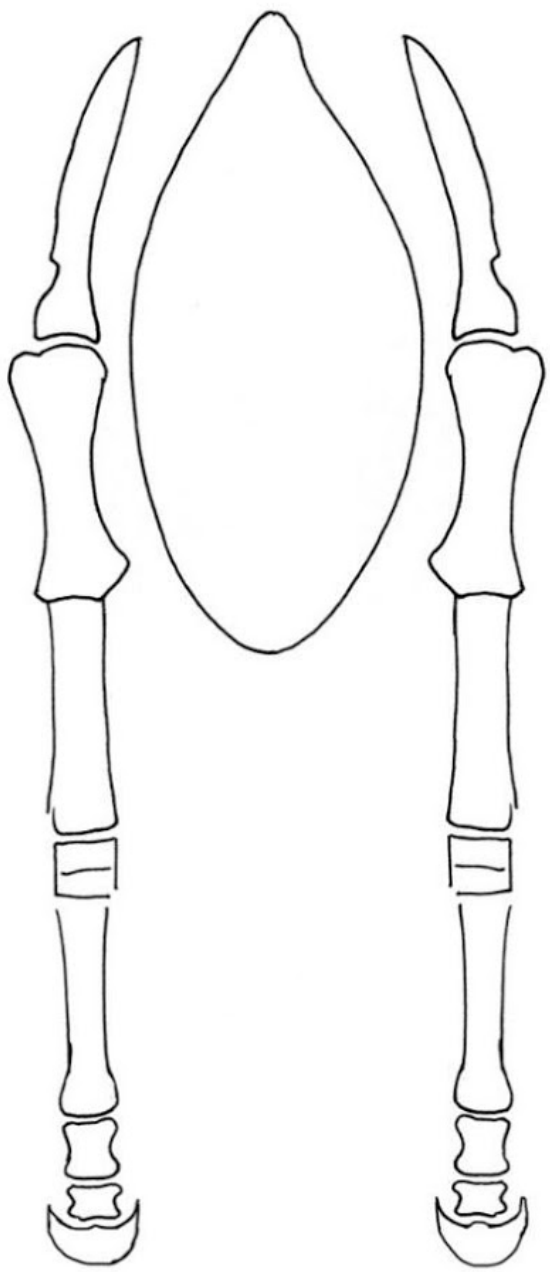


Spinal Cord Injury

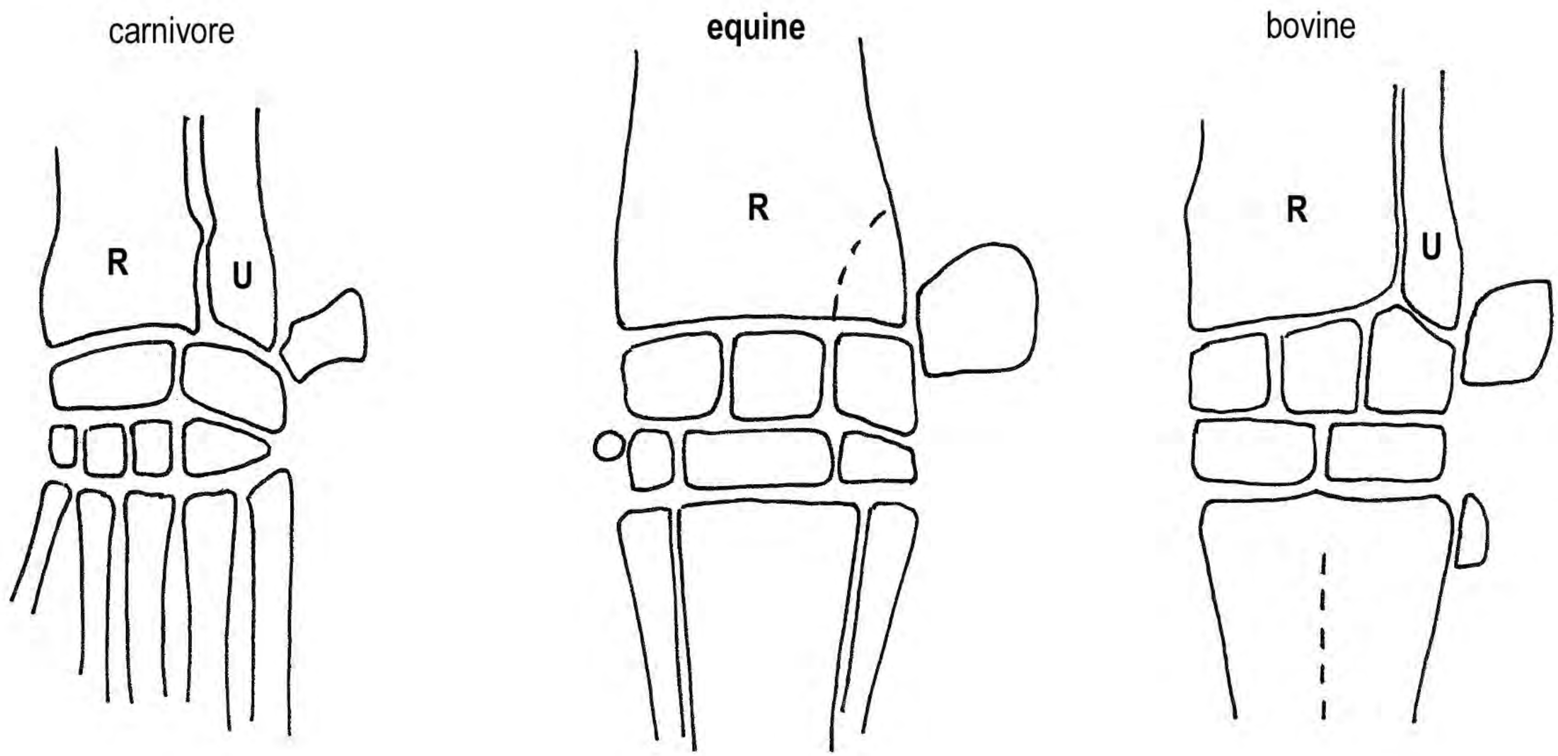
Distal Equine Limb—Cross Section



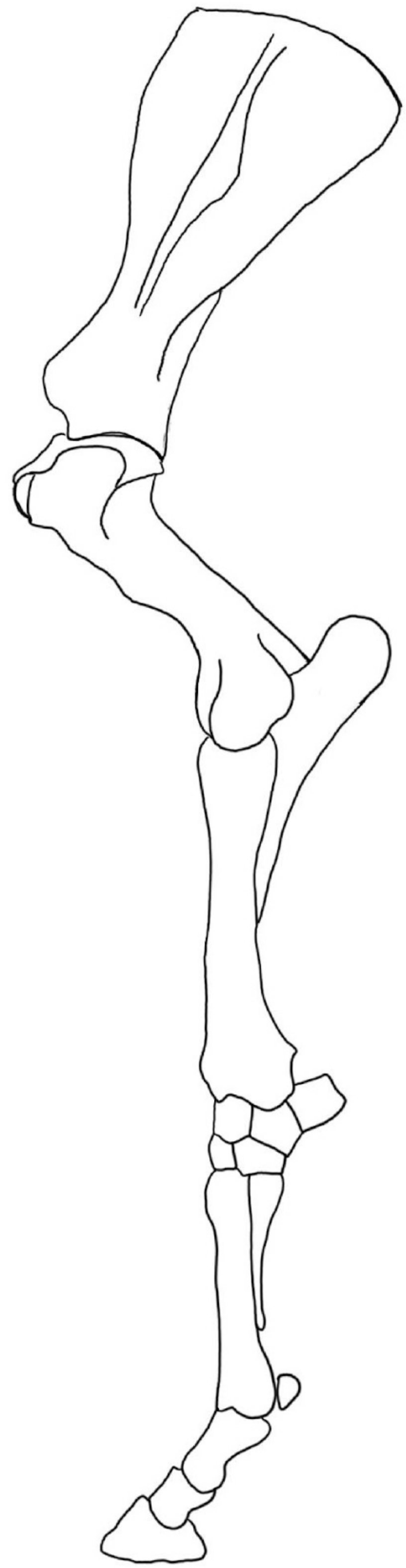
Equine Thoracic Limbs and Trunk



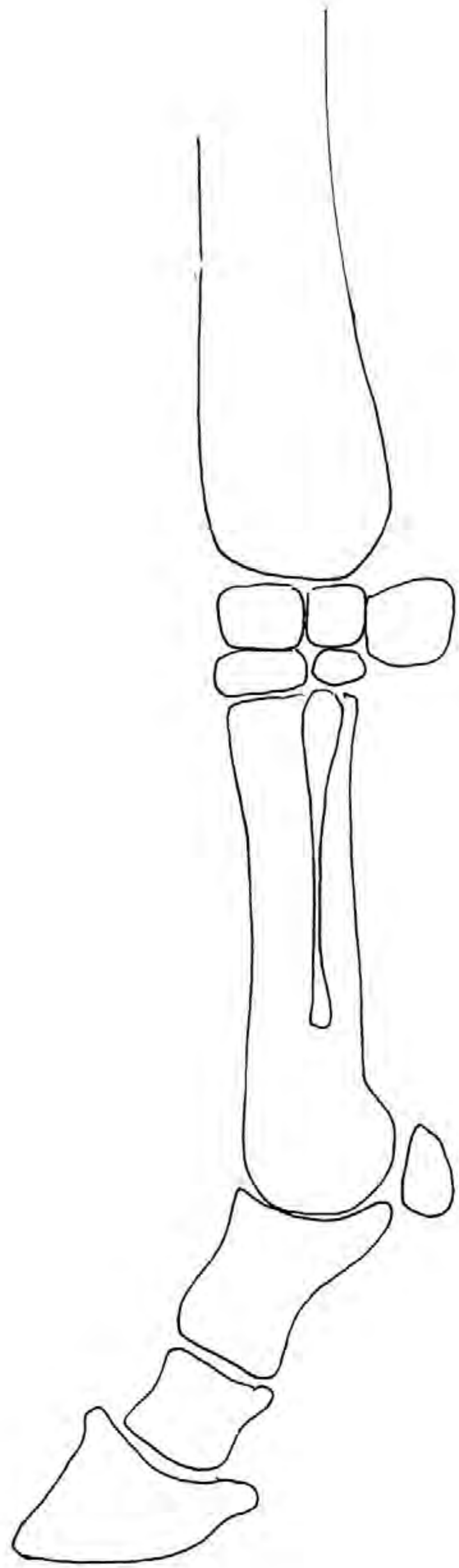
Comparative Carpal Bones



Distal Equine Thoracic Limb



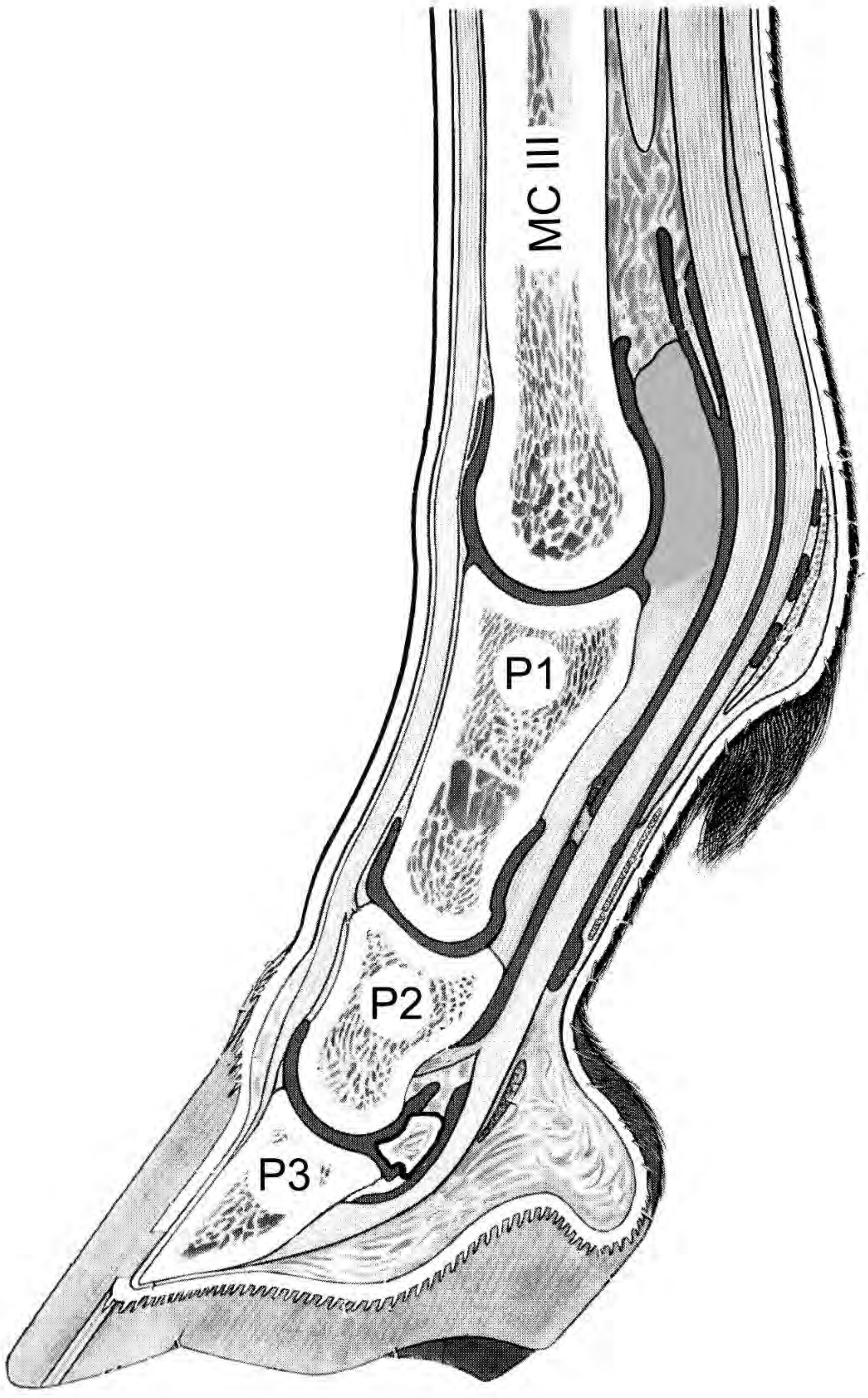
Equine Thoracic Limb



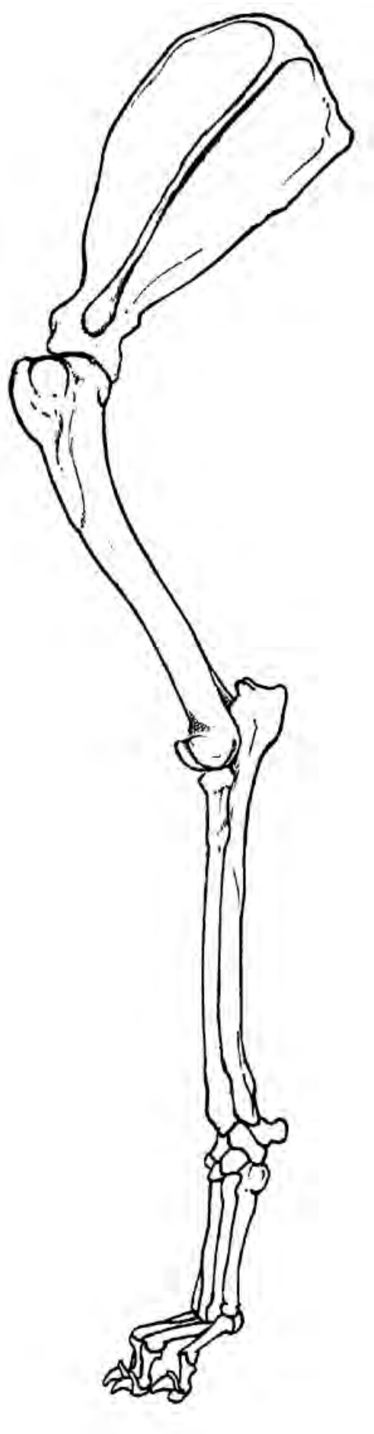
Distal Equine Thoracic Limb

Distal Equine Thoracic Limb

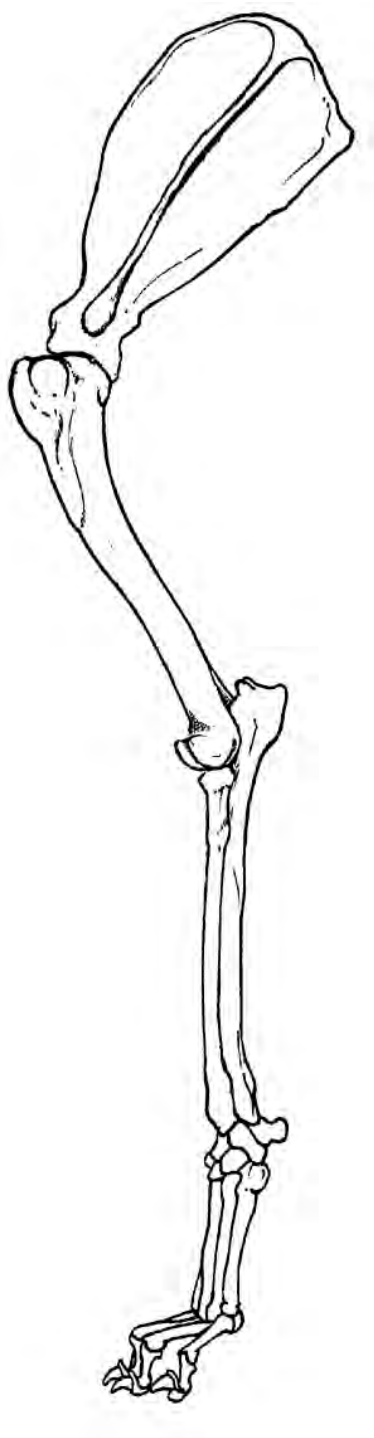
Distal Equine Thoracic Limb



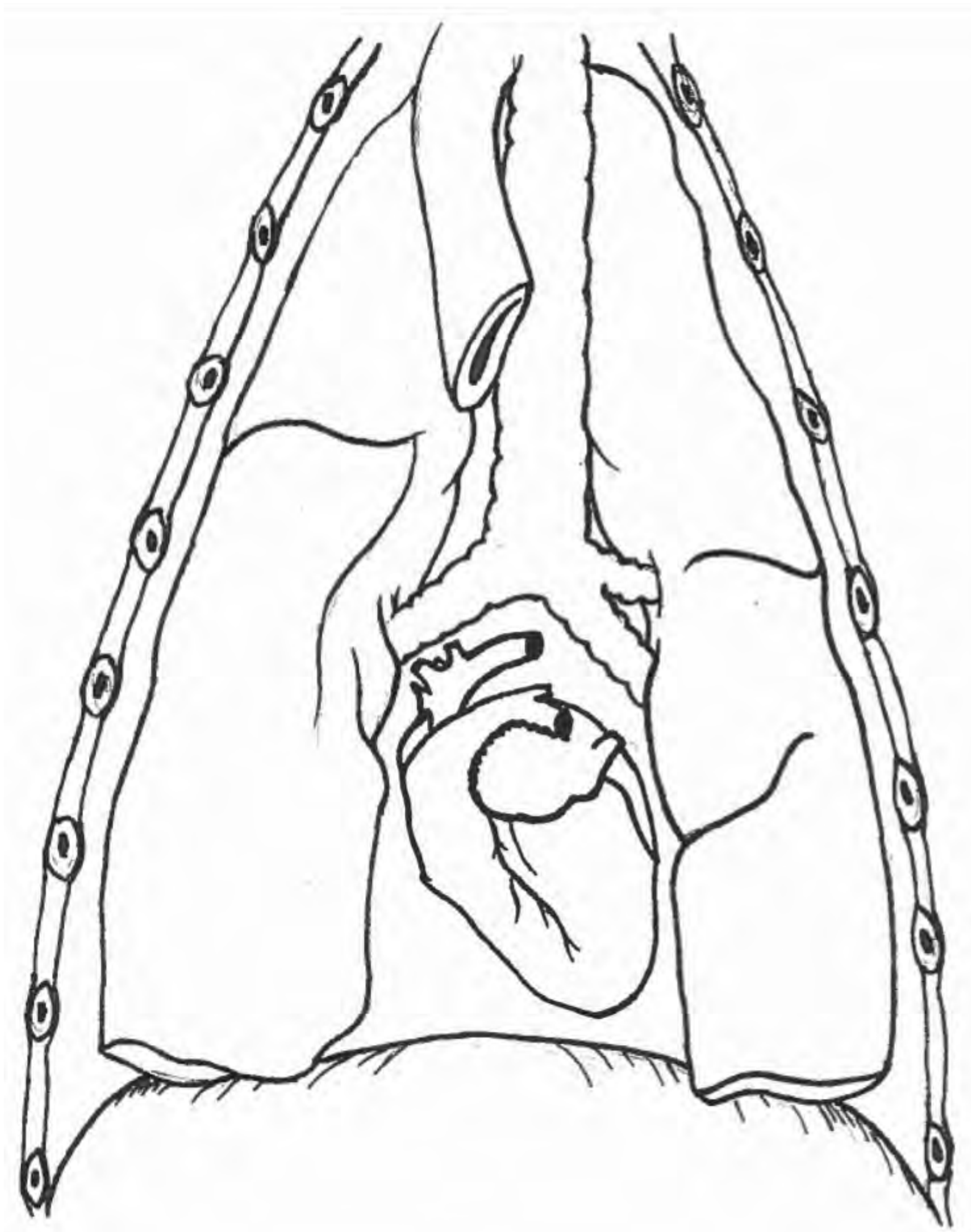
Comparative Thoracic Limb



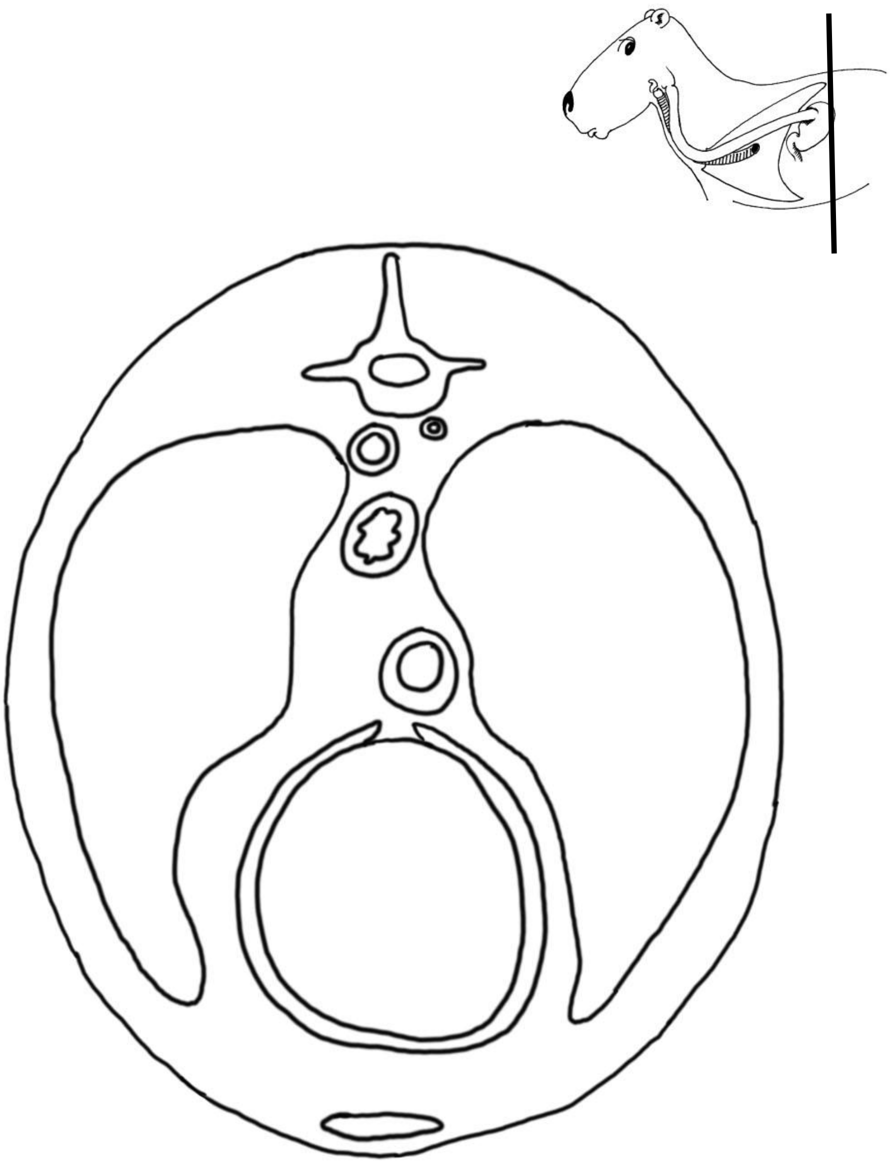
Comparative Thoracic Limb



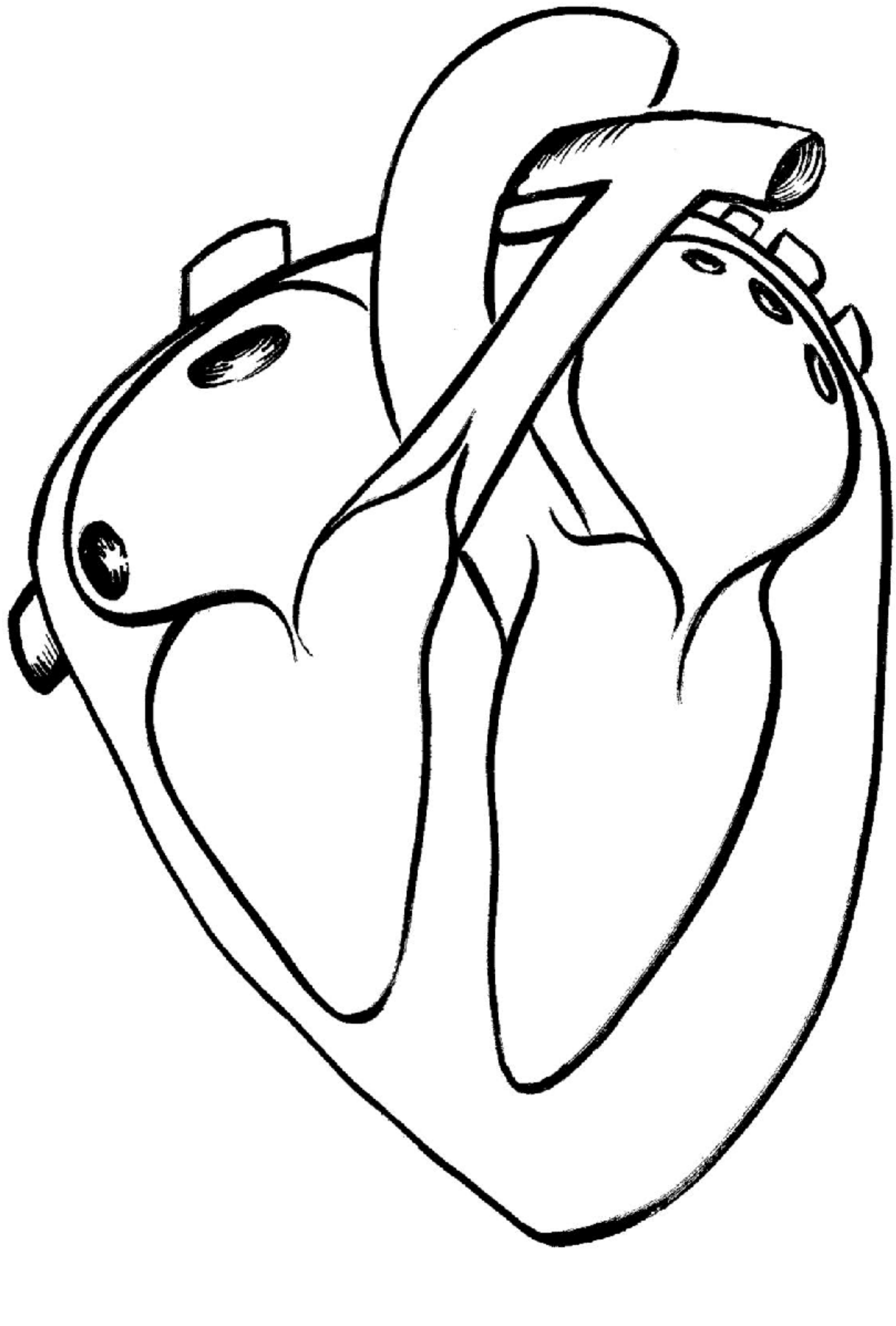
The Thorax



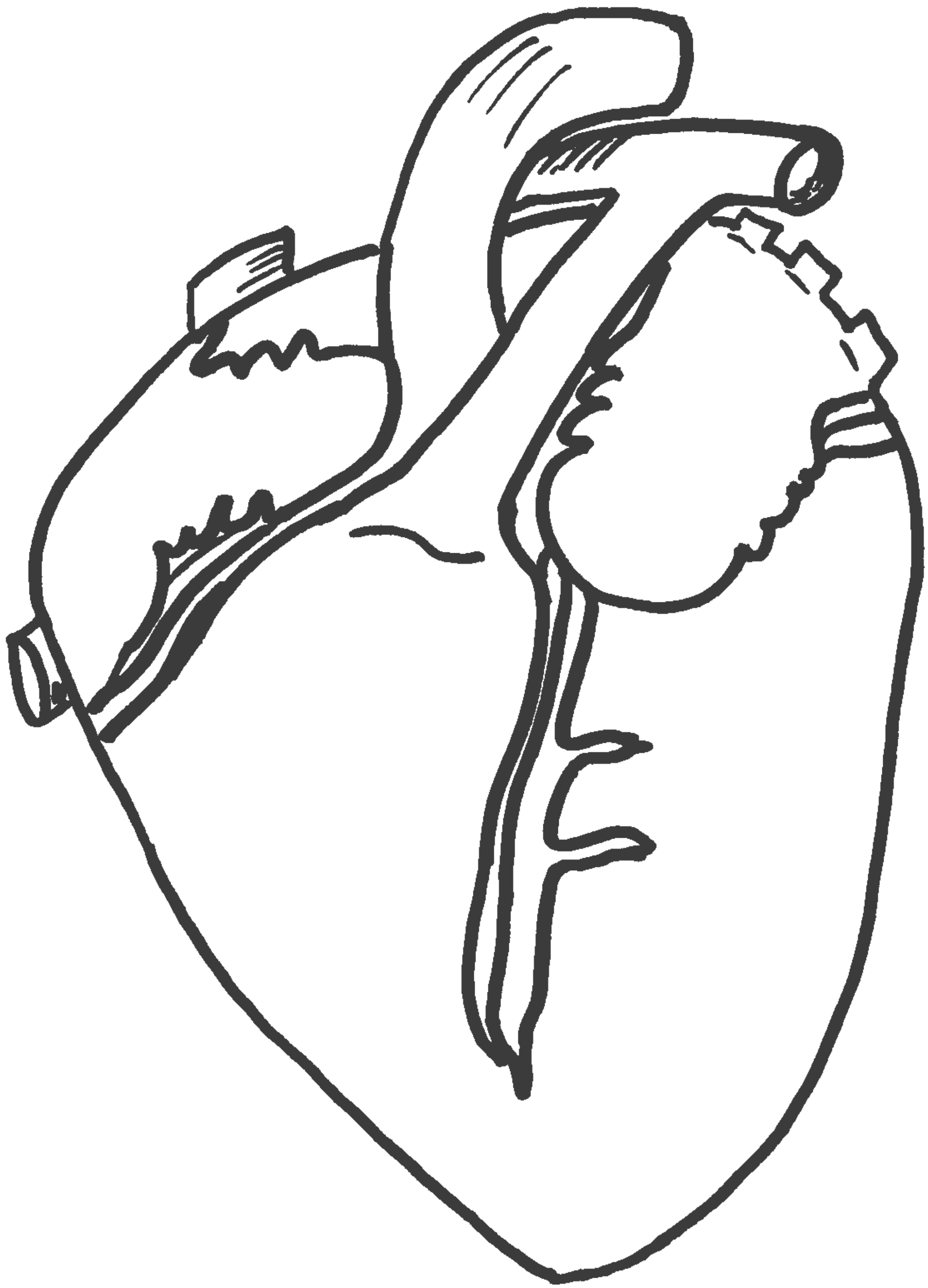
Serous Membranes of the Thorax



Heart (internal)

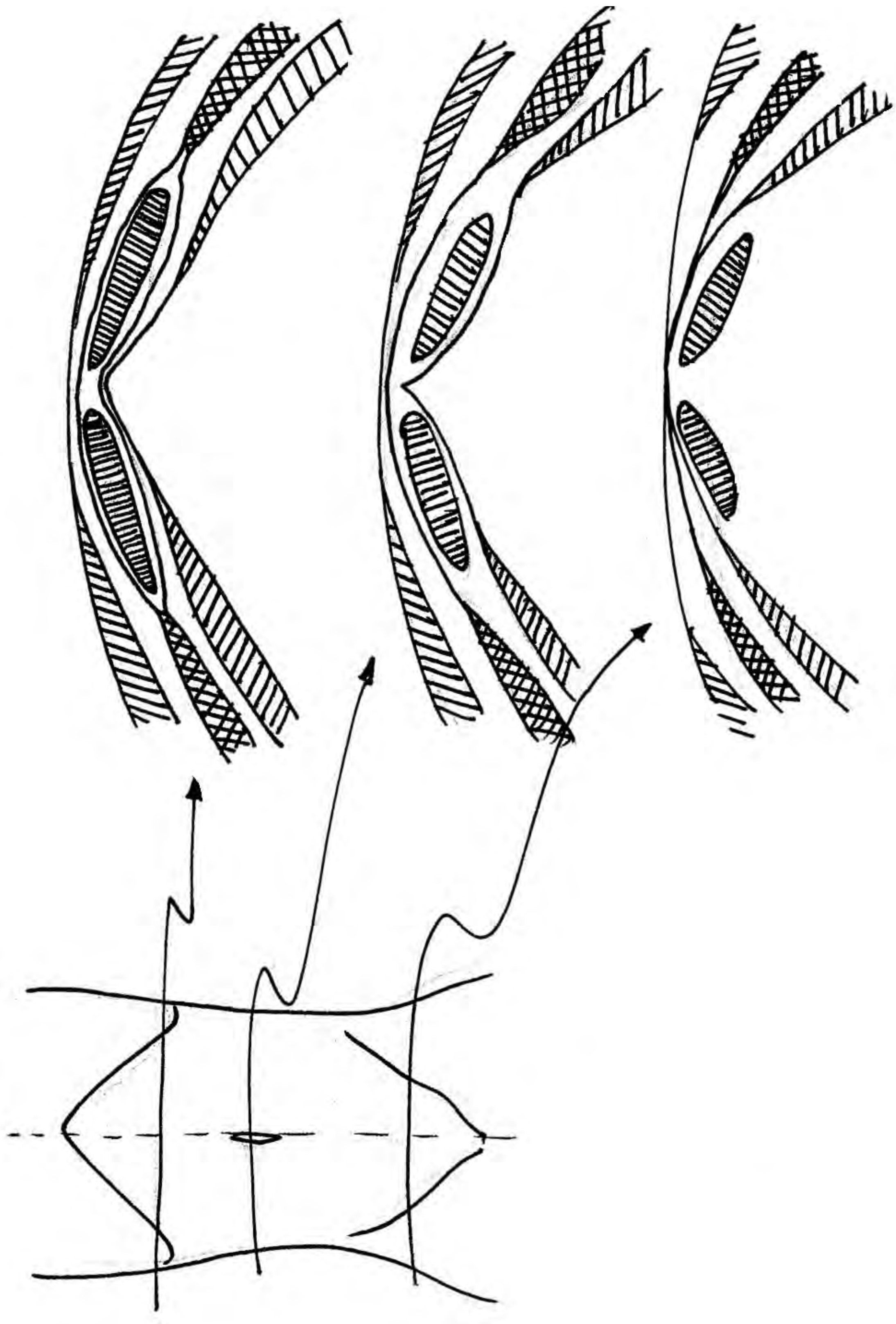


Heart (external)

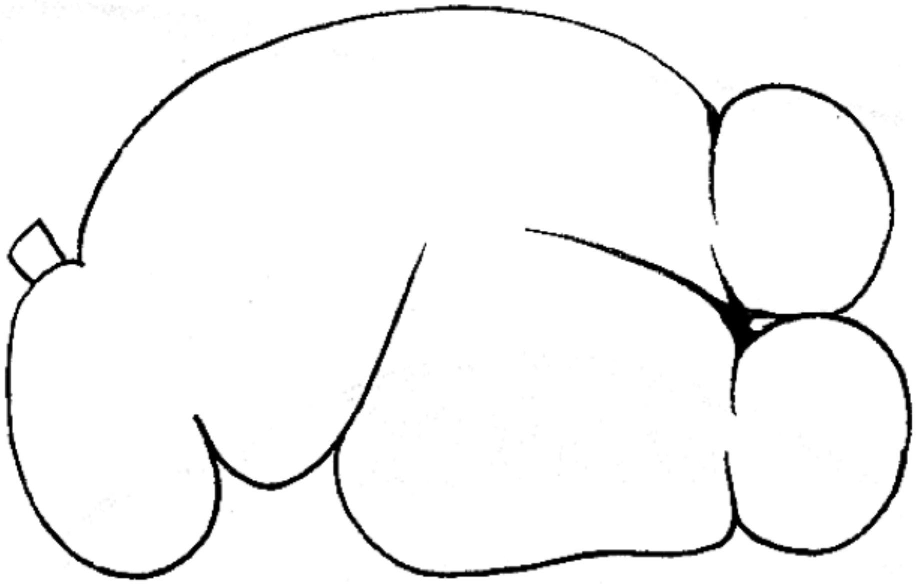


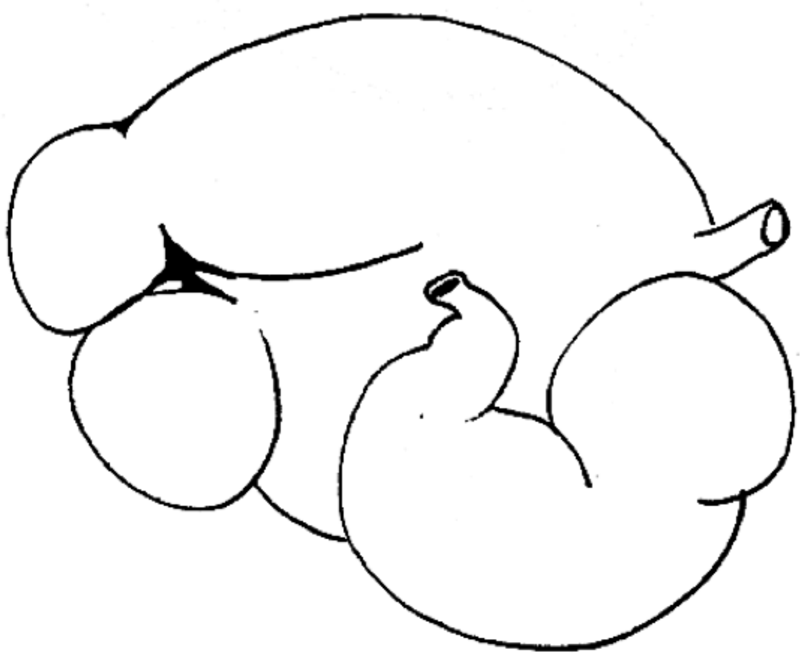
ORGAN/SYSTEM	PARASYMPATHETICS (Cranio-sacral)	SYMPATHETICS (Thoracolumbar)
BLOOD VESSELS		
EYE		
HEART		
LUNGS		
GI TRACT		
ADRENAL GLANDS		
SALIVARY GLANDS		
PELVIC VISCERA		

Rectus Sheath/Abdominal Muscles

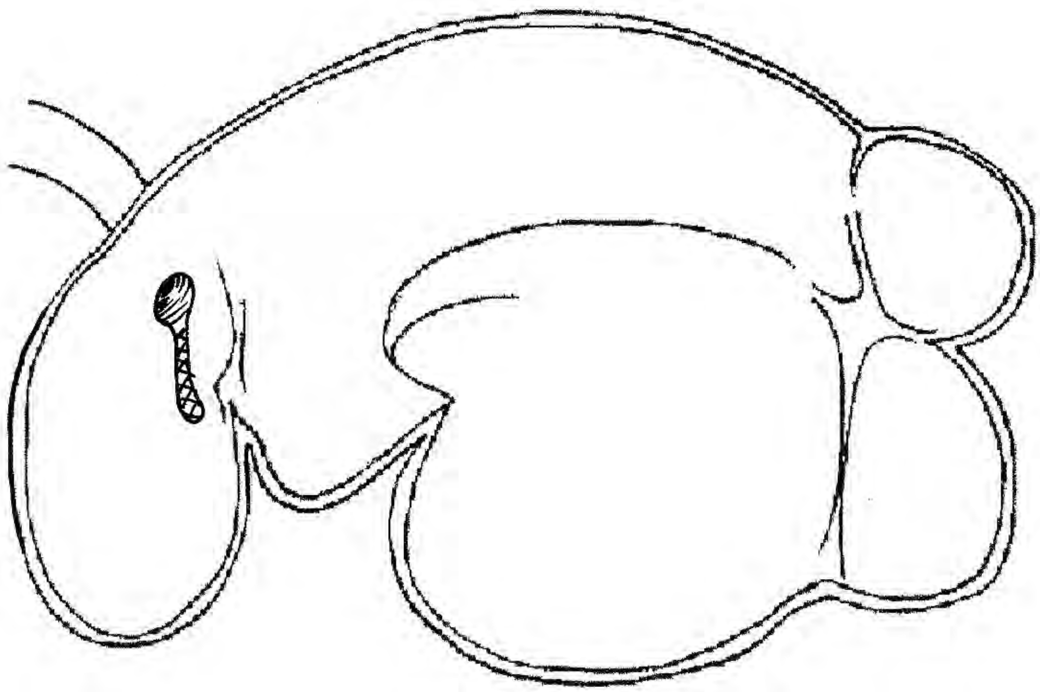


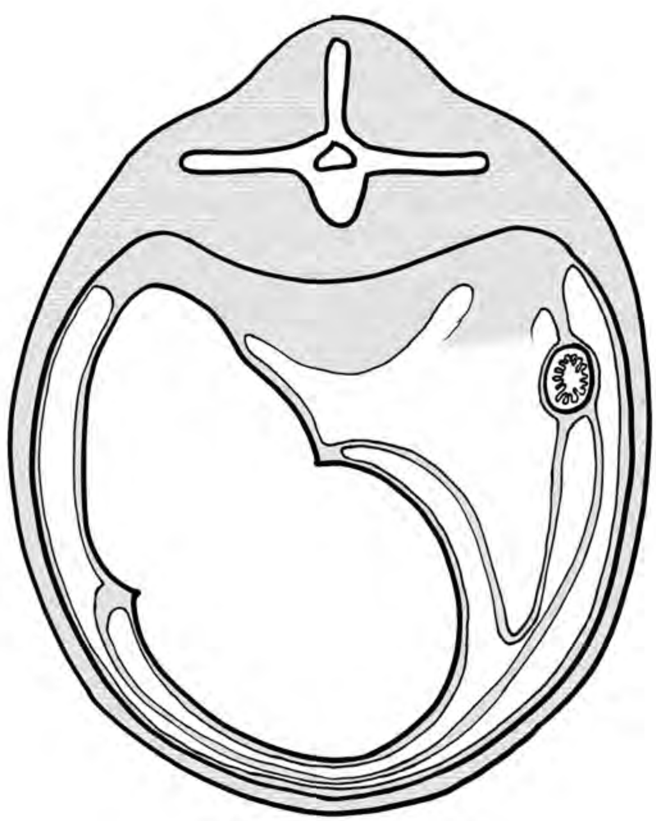
Ruminant Stomach (external)



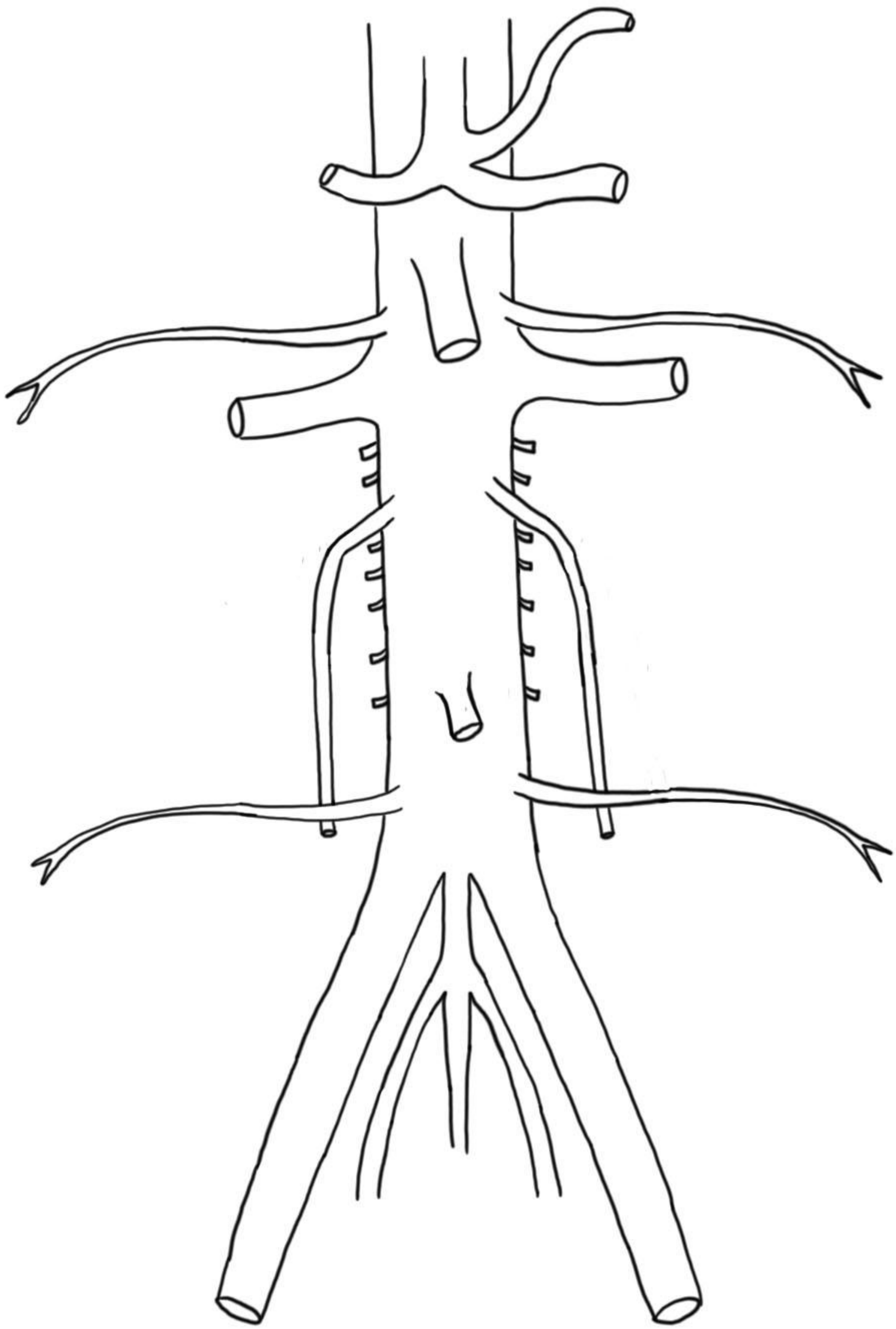


Ruminant Stomach (internal) & Greater Omentum

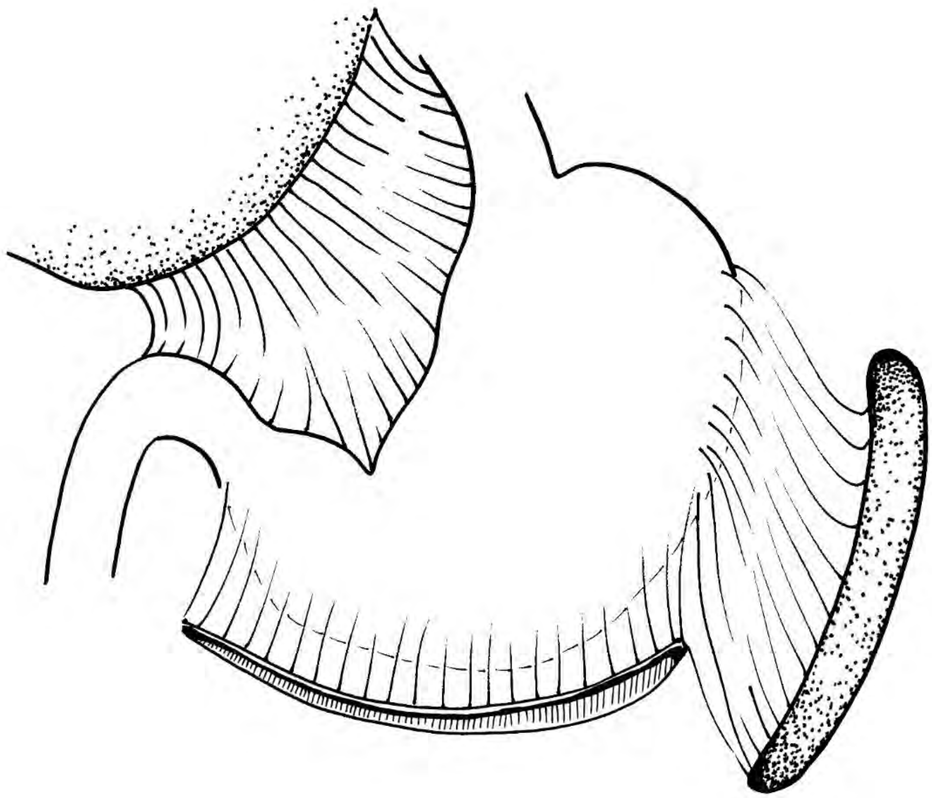


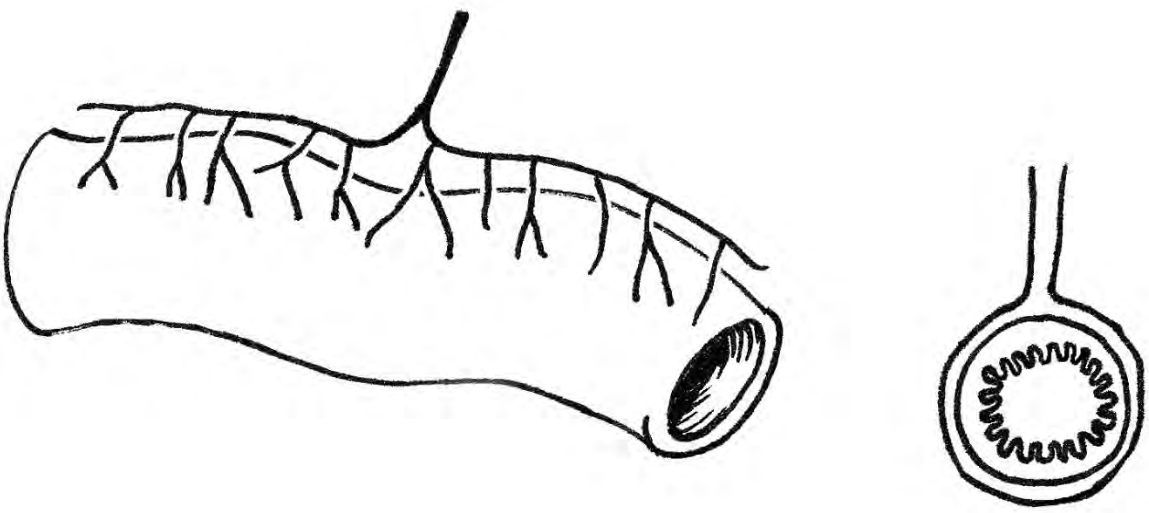


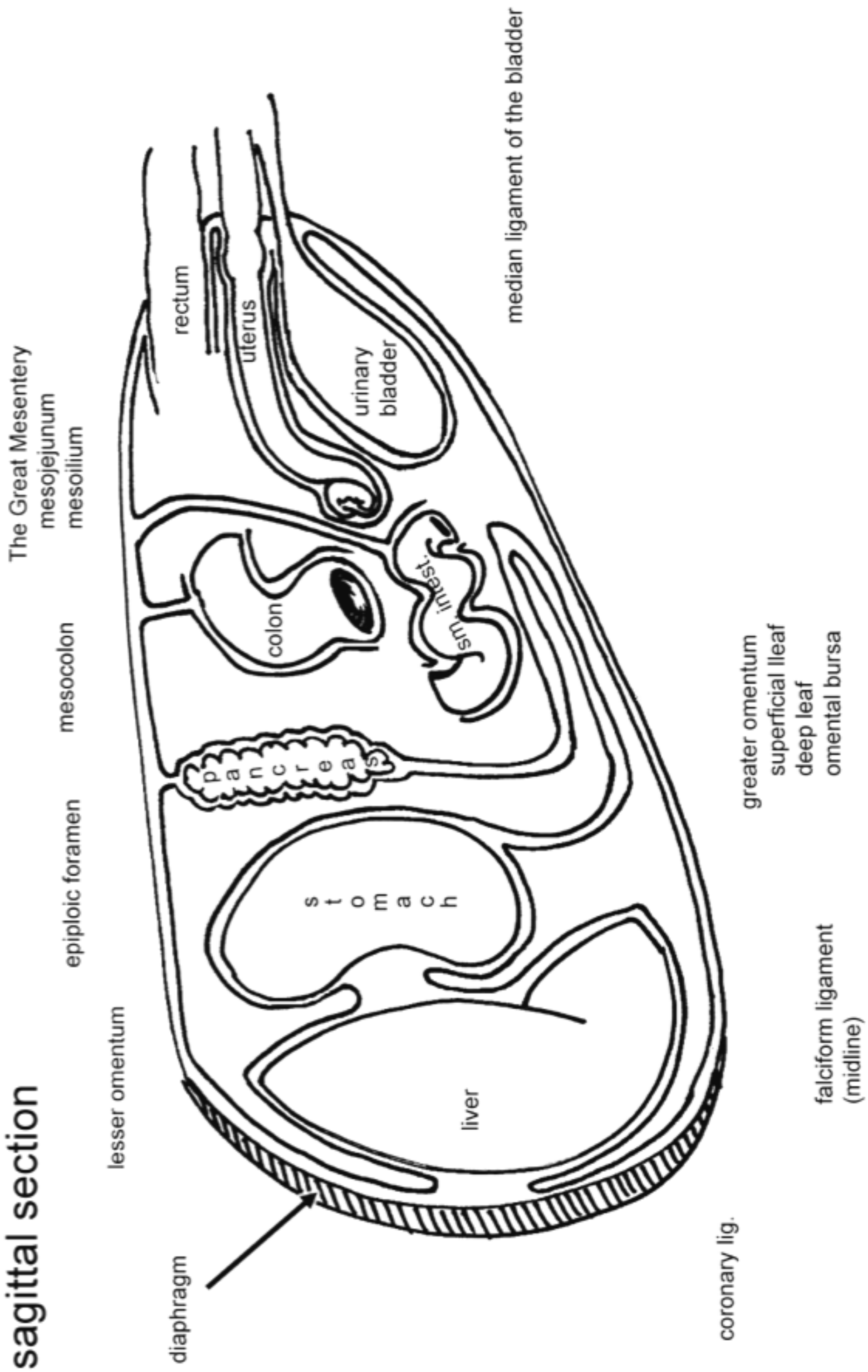
Abdominal Aorta



Mesenteries

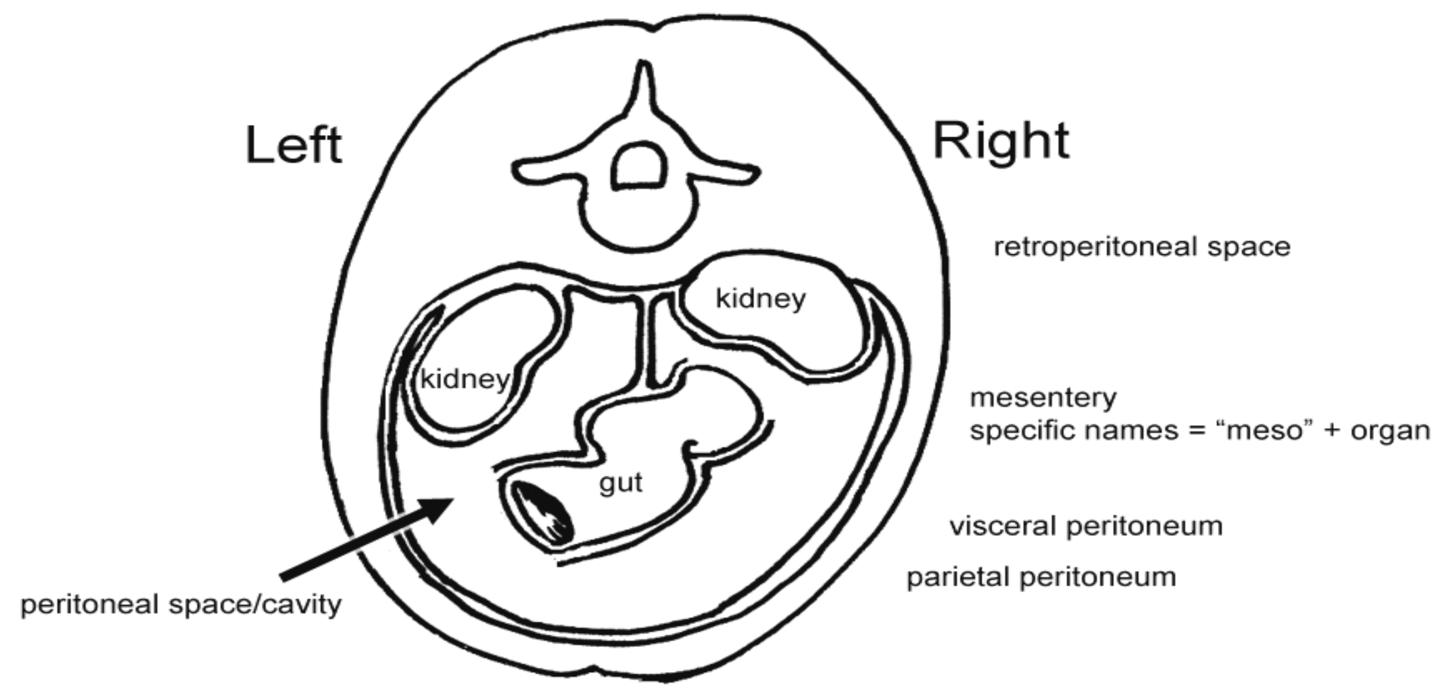




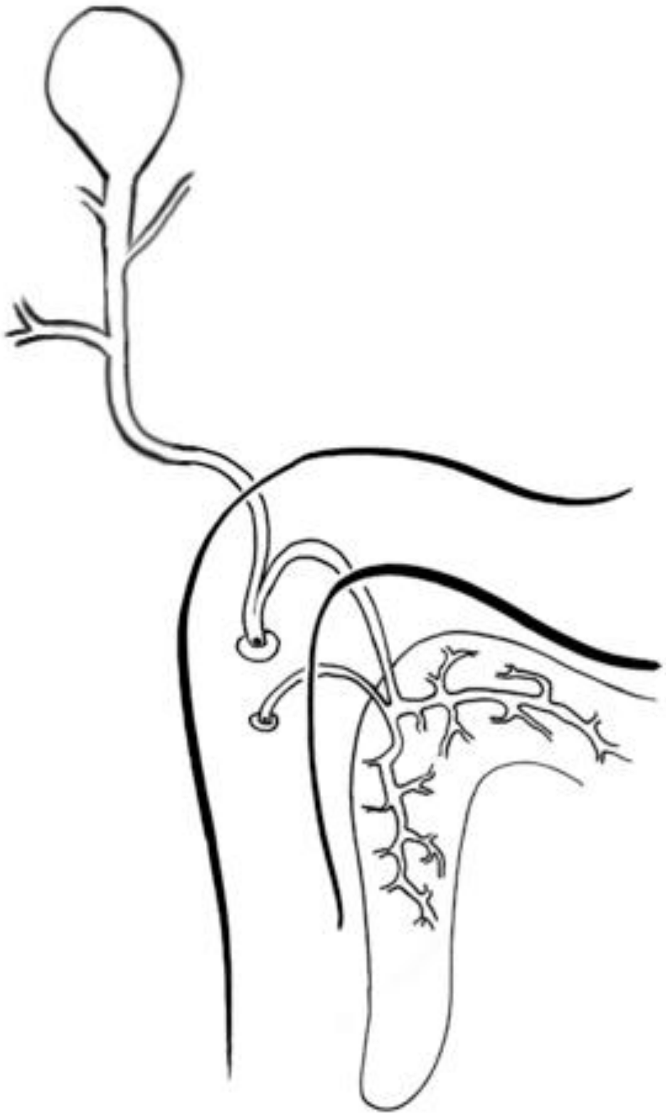

sagittal section
diaphragm
lesser omentum
epiploic foramen
mesocolon
The Great Mesentery
mesojejunum
mesoilium
rectum
uterus
urinary bladder
median ligament of the bladder
colon
sm. intest.
pancreas
stomach
liver
greater omentum
superficial lleaf
deep leaf
omental bursa
falciform ligament
(midline)
coronary lig.

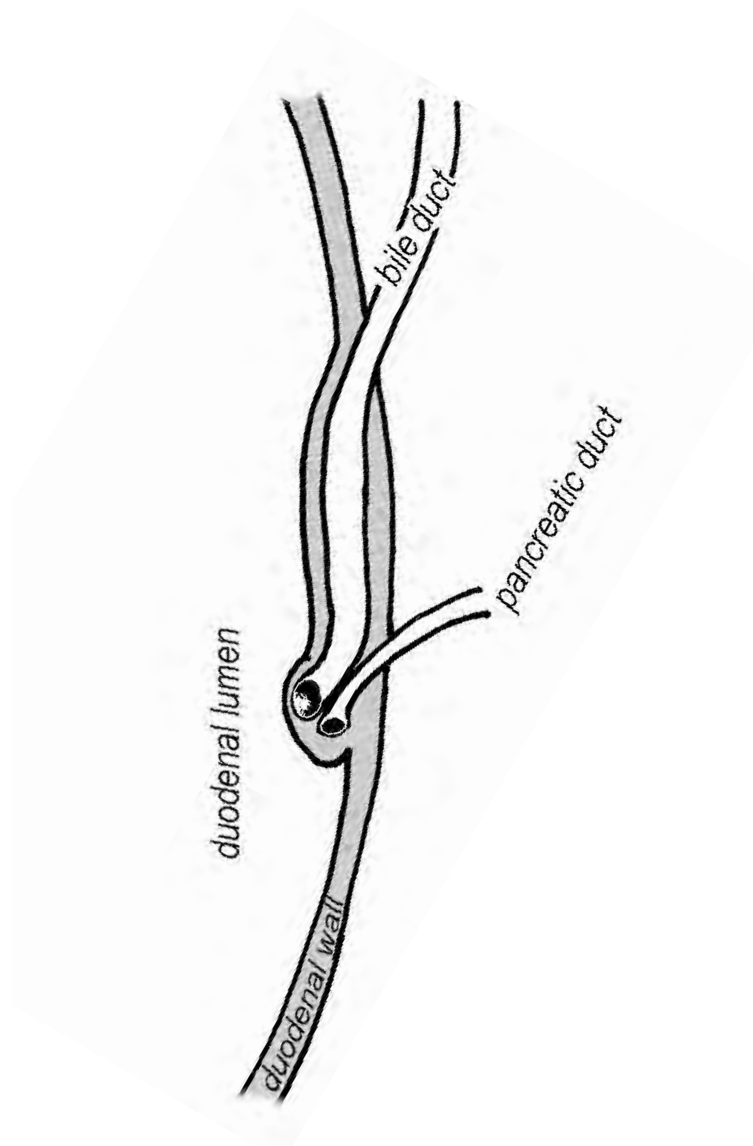
Organization of the Peritoneum

transverse section

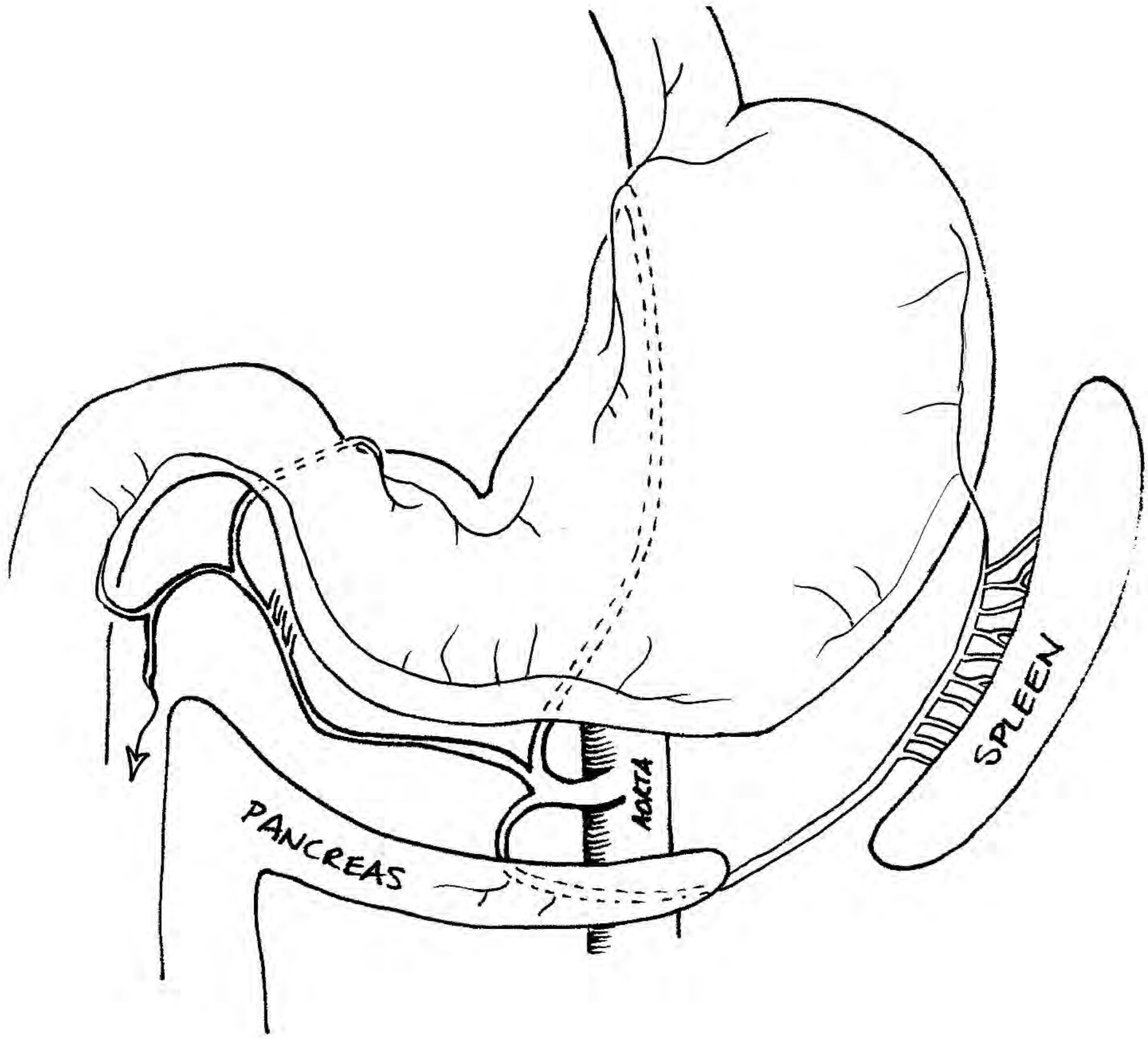


Bile Duct System

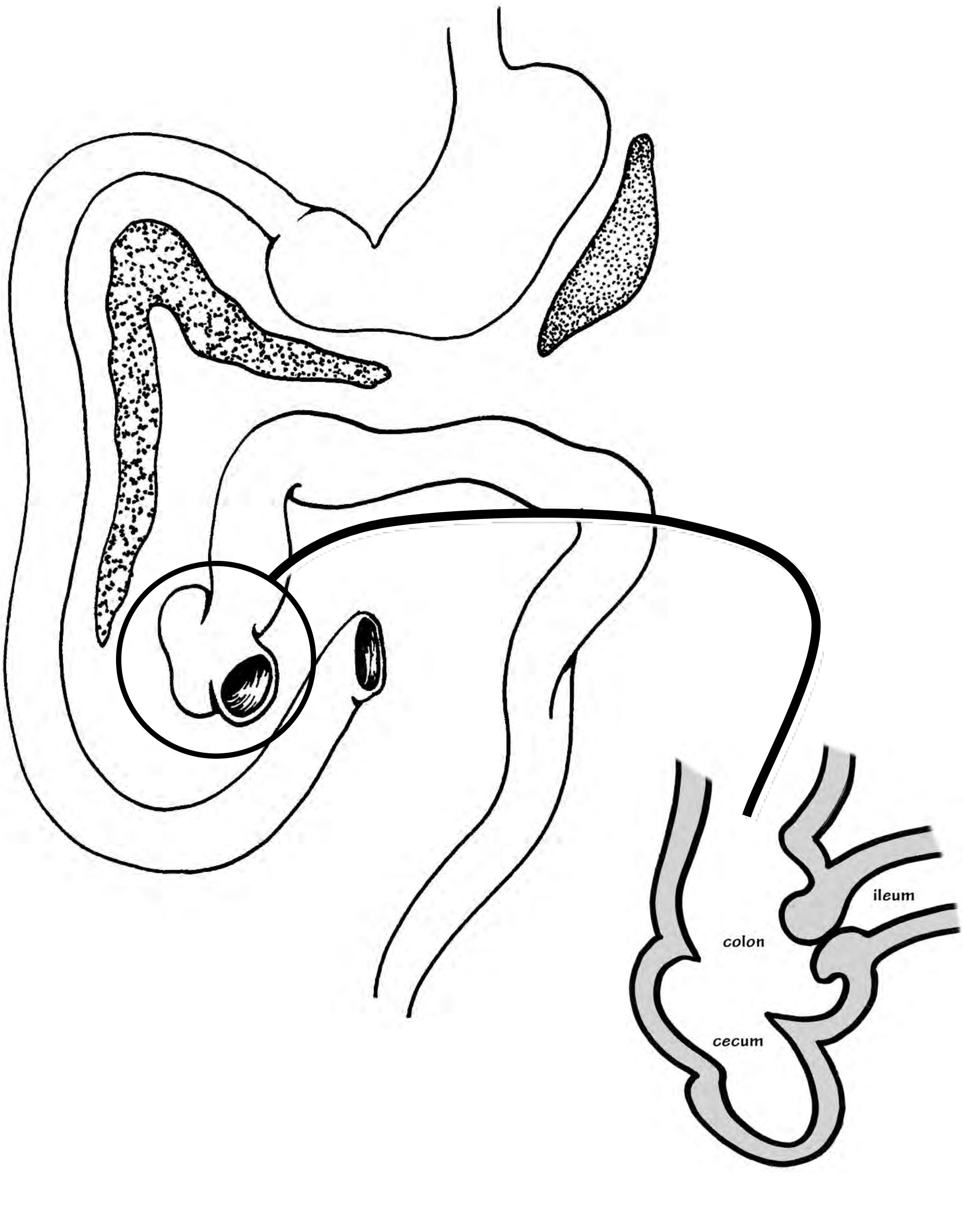




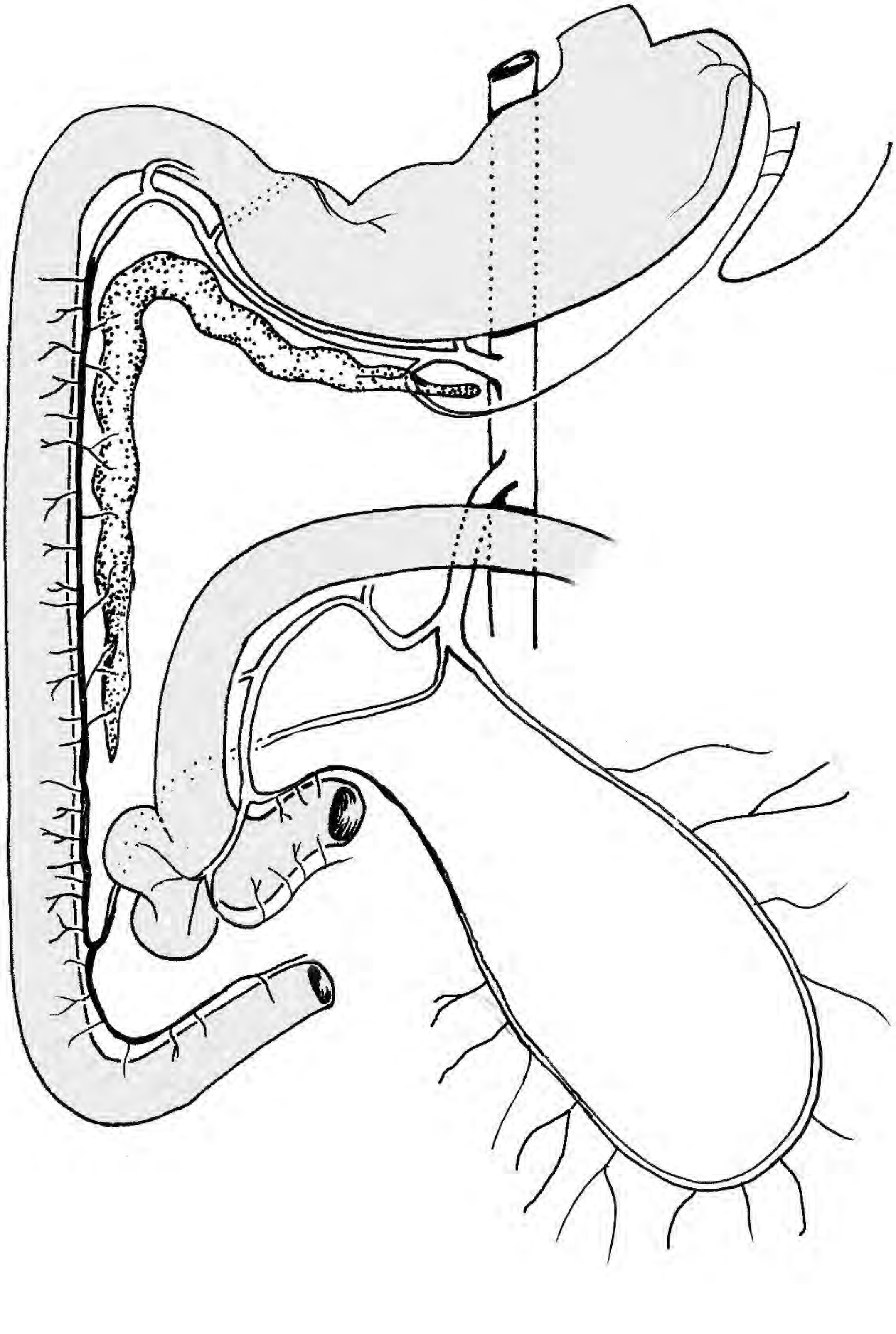
Branching of the Celiac a.



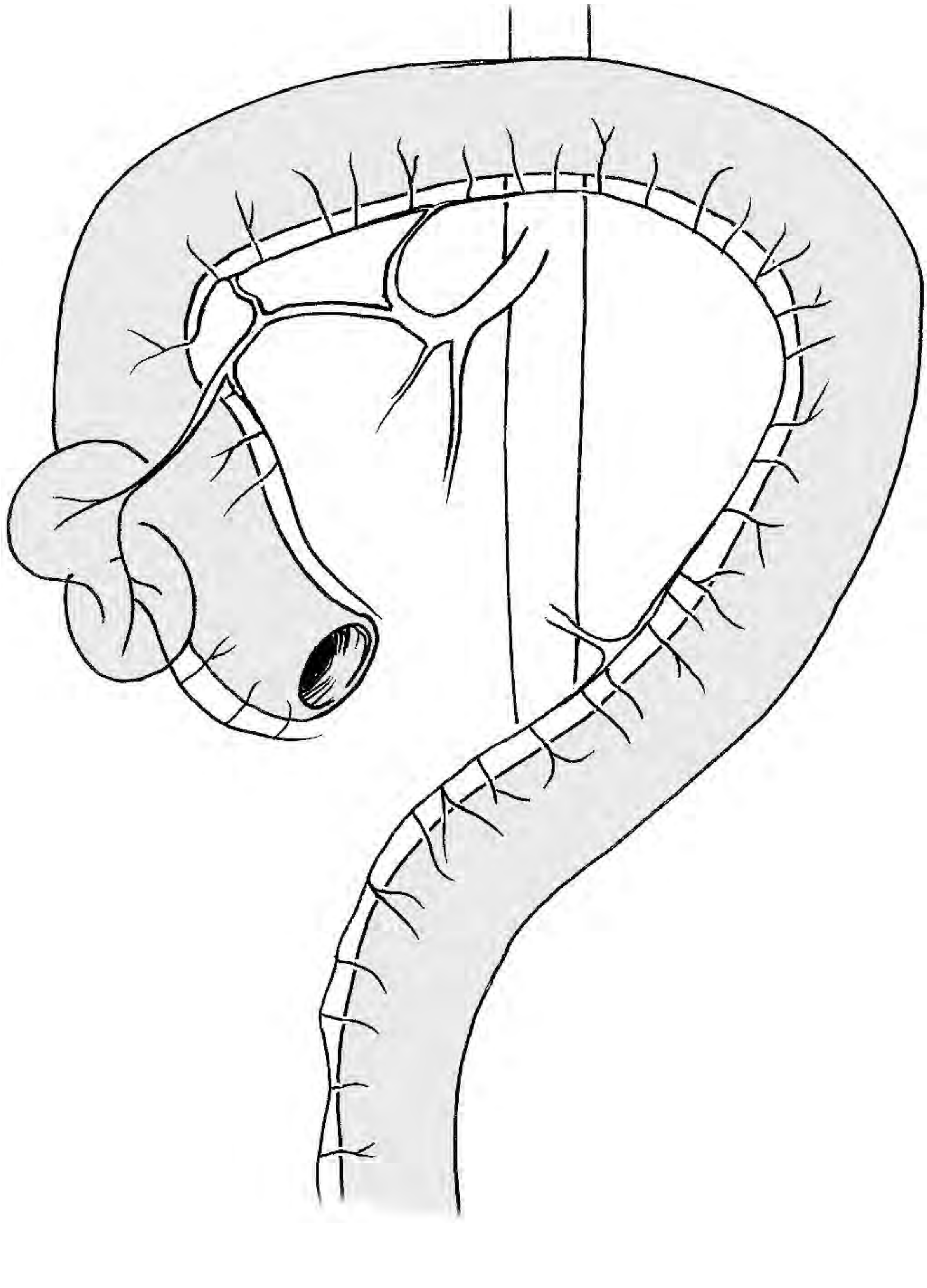
Abdominal Viscera



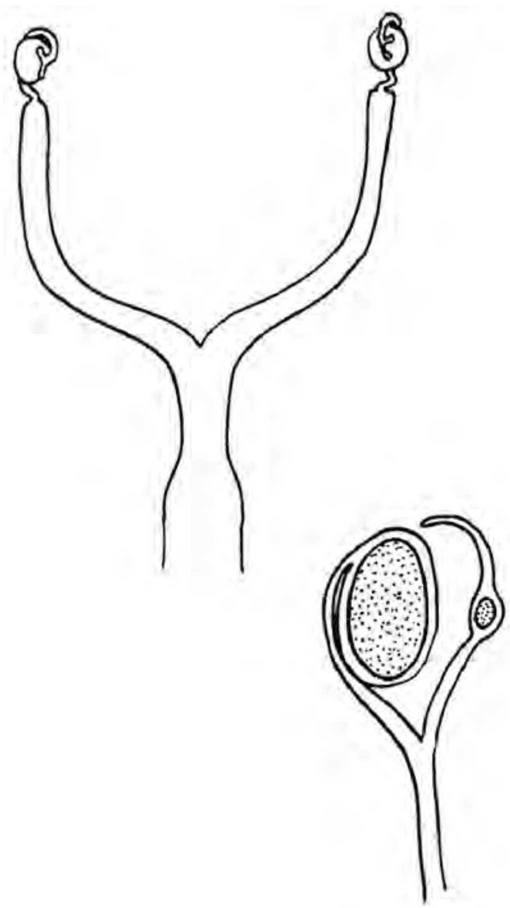
Branching of the Celiac and Cranial Mesenteric aa.



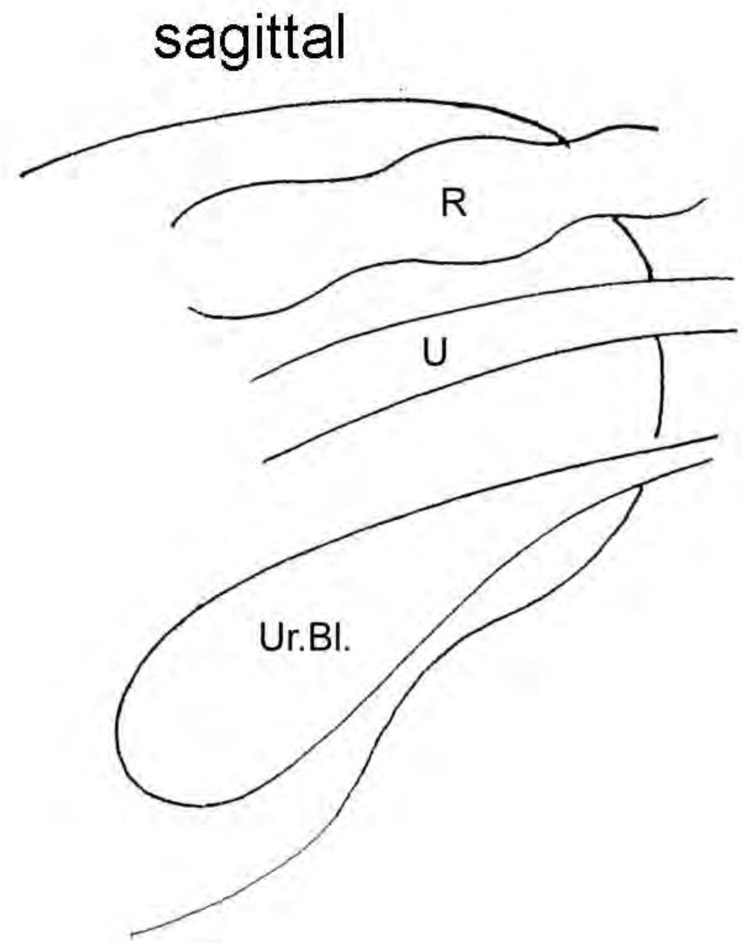
Branching of the Caudal Mesenteric a.



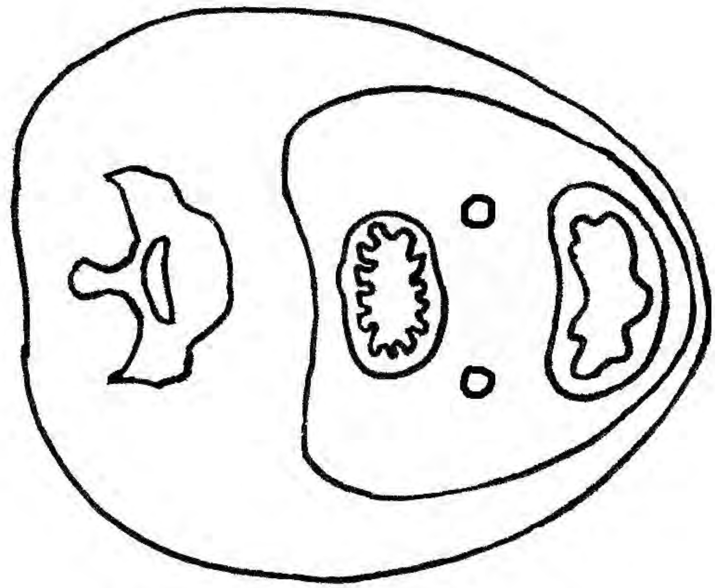
Peritoneal Structures of the Female Reproductive Organs

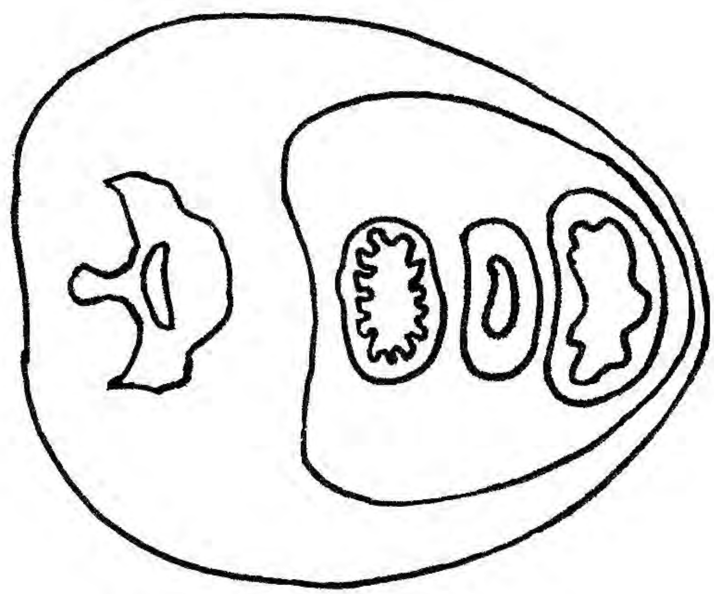


Pouches of the Pelvic Cavity



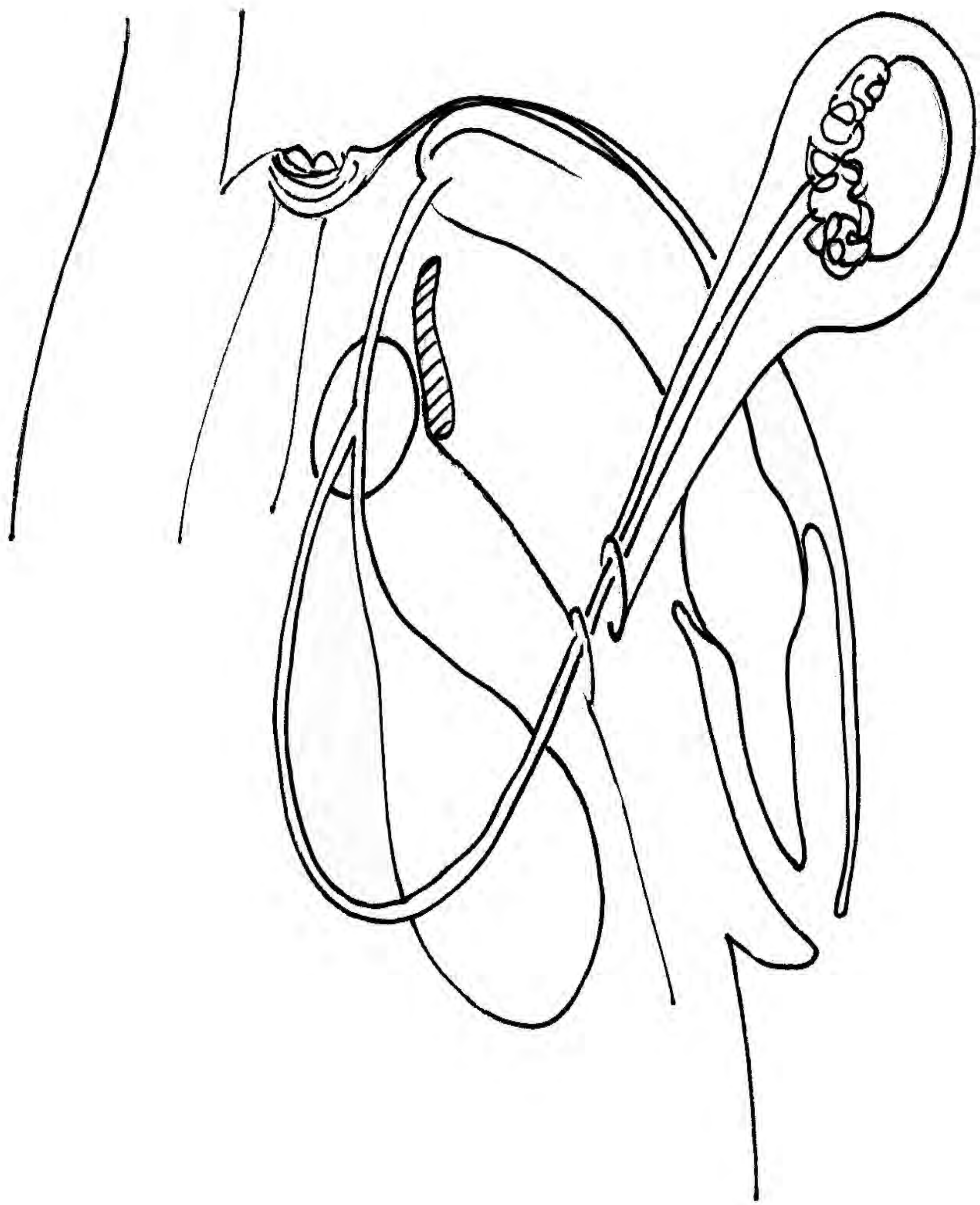
Serosal Attachments and Potential Spaces





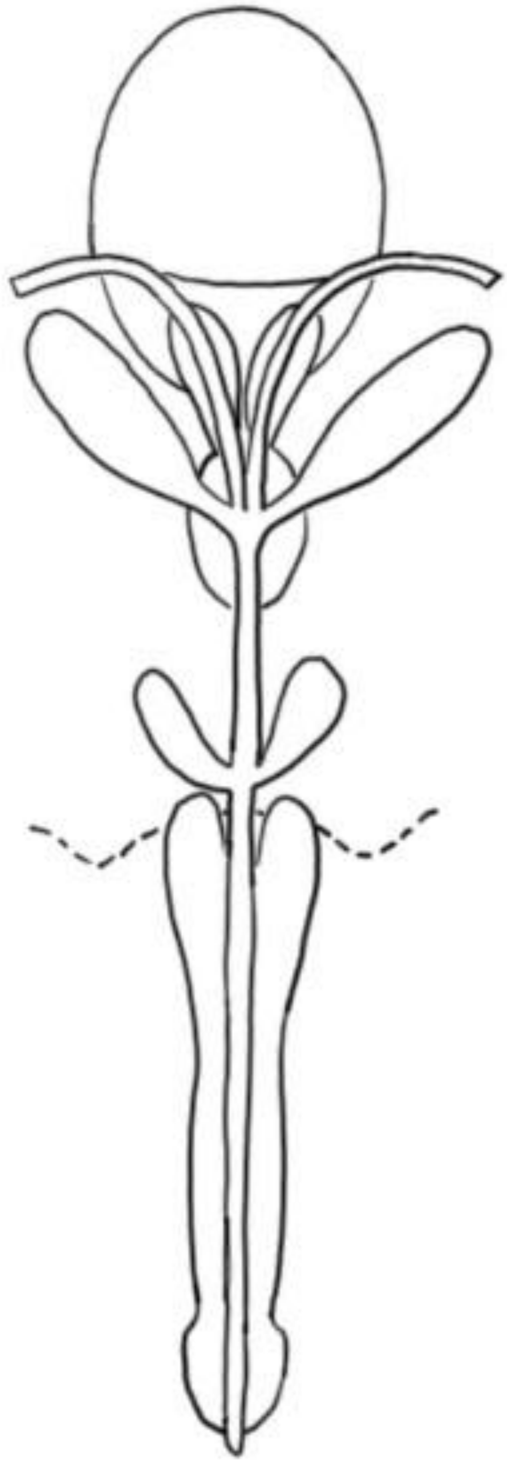
Female Reproductive Tract

Male Reproductive Tract

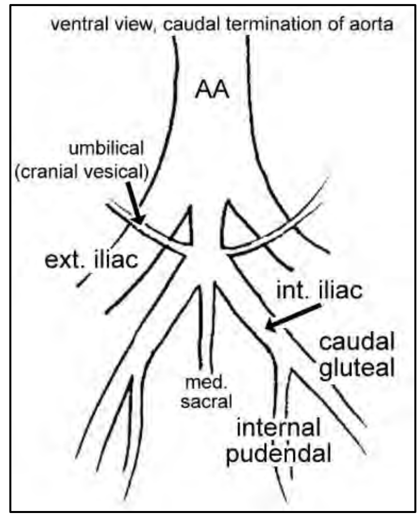


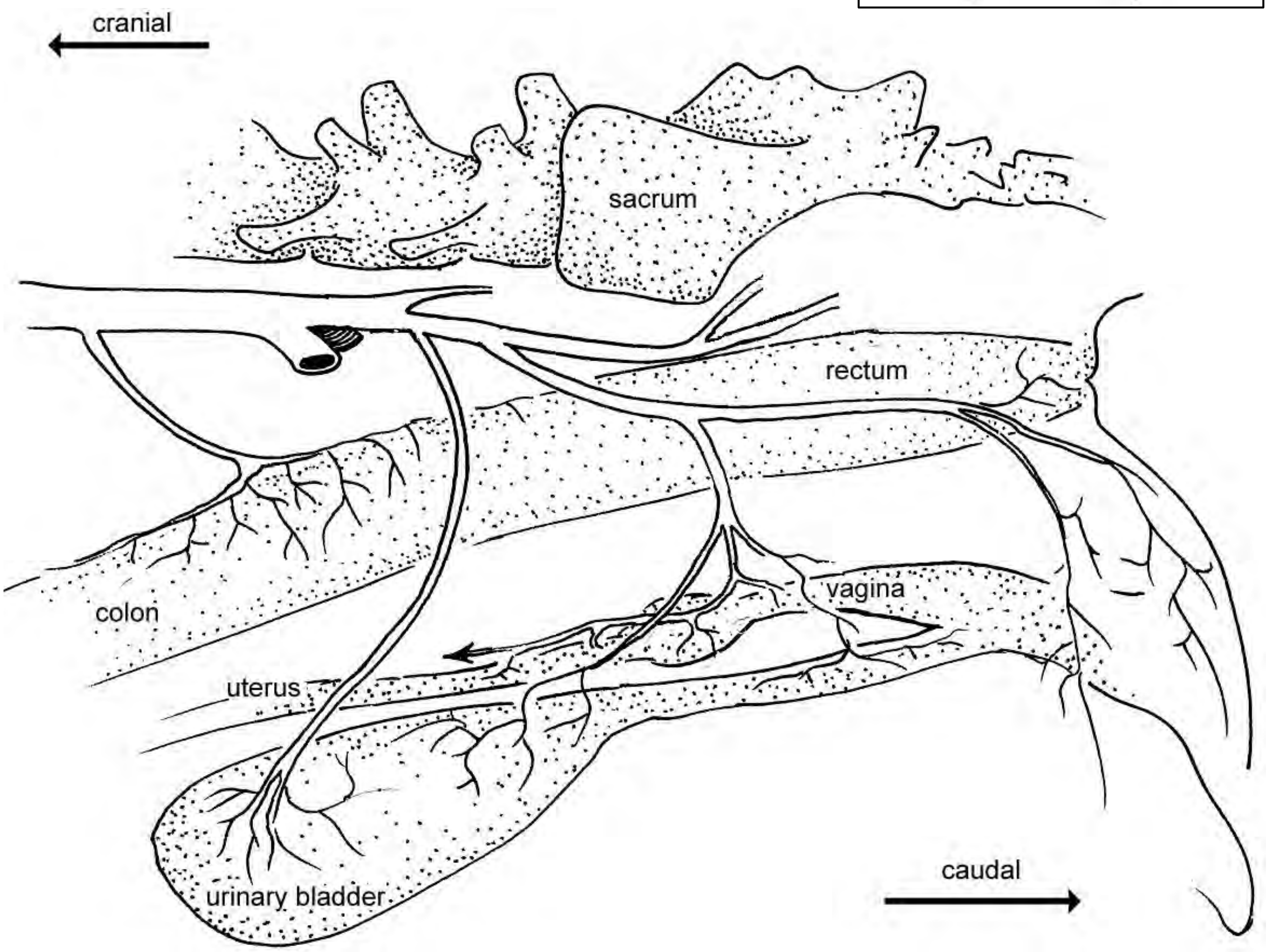
Accessory Sex Glands (male)				
Species	**Ampullae**	**Prostate**	**Vesicular glands**	**Bulbourethral glands**
Dog	Small	Large body fully surrounds urethra: scant, disseminated	Absent	Absent
Tomcat	Absent	Large body partly surrounds urethra: scant, disseminated	Absent	Very small
Stallion	Large	Body has two undisseminate d lobes	Large and sac-like; aka "seminal vesicle"	Present
Bull	Small	Small body, disseminated covered by urethralis muscle	Moderate size, lobulated	Present
Ram/ Buck	Small	Disseminated part only	Moderate size, lobulated	Present
Boar	Absent	Small body, disseminated covered by urethralis muscle	Very large size, lobulated	Very large

Vascular Supply to the Pelvic Canal

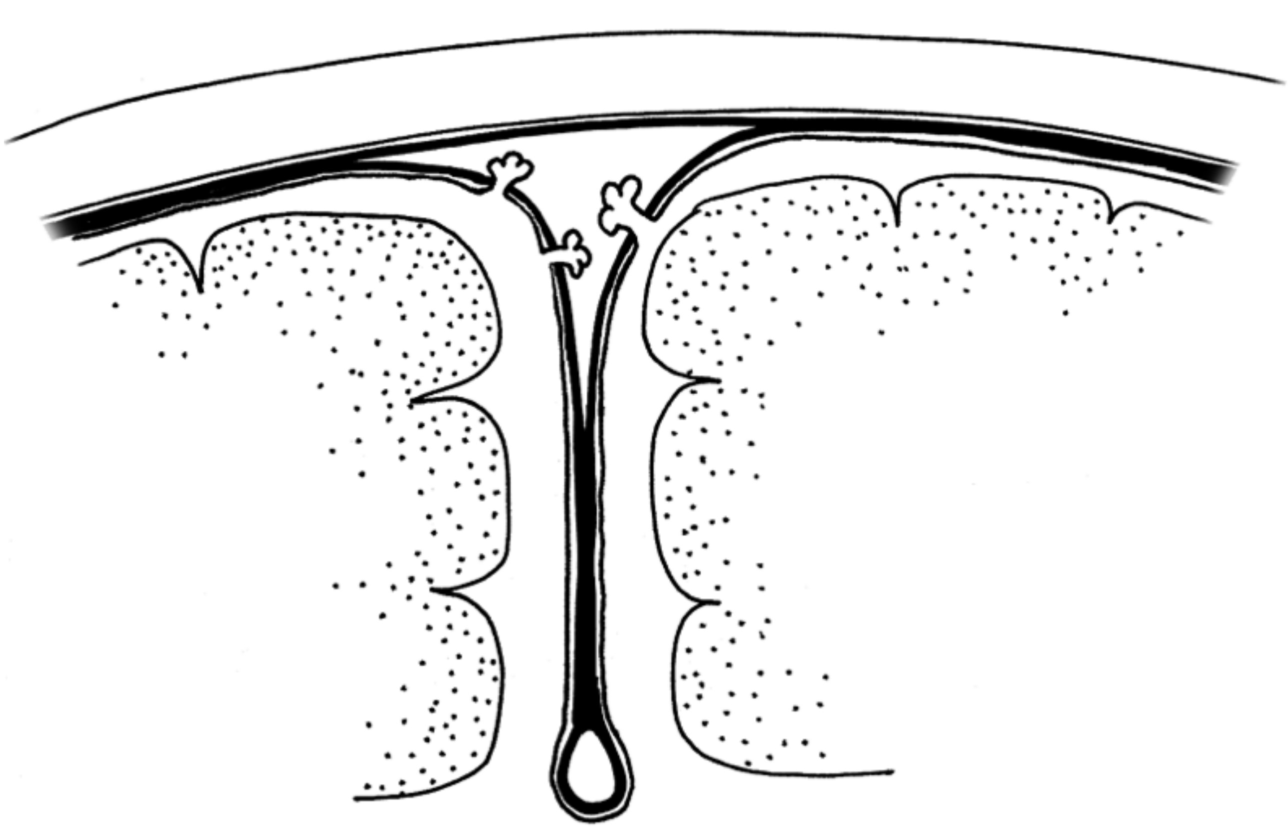


Vascular Supply to the Pelvic Canal

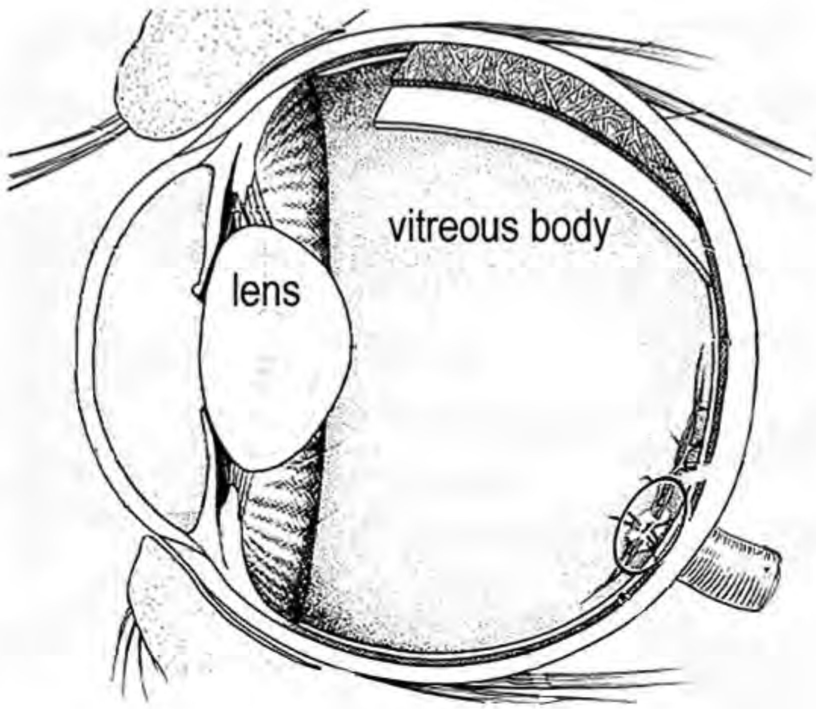




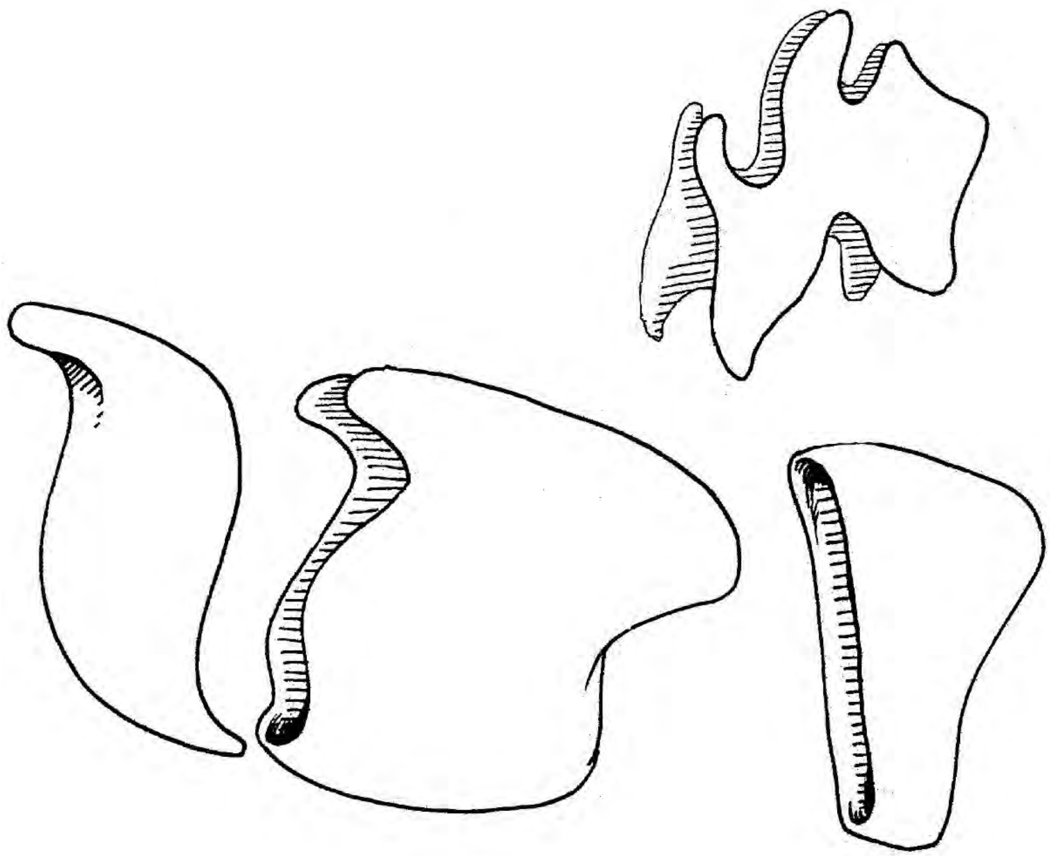
Meninges/CSF Return

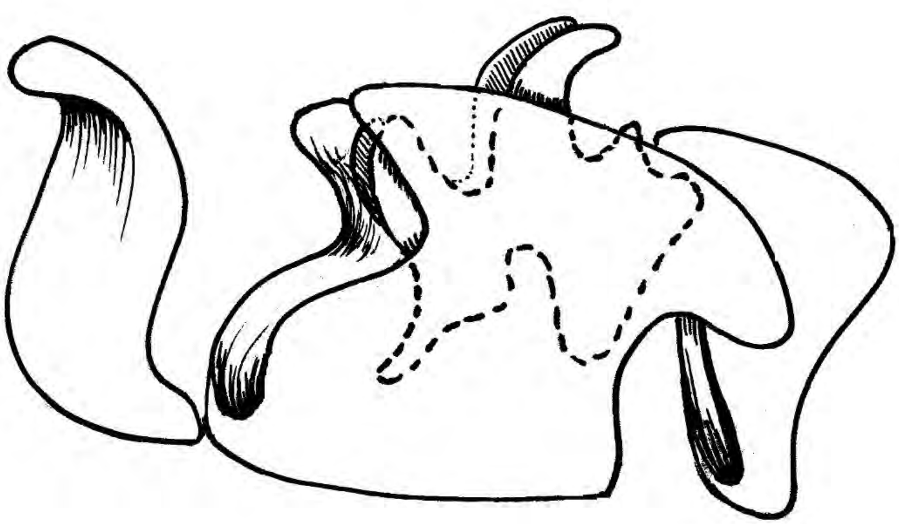


Eye

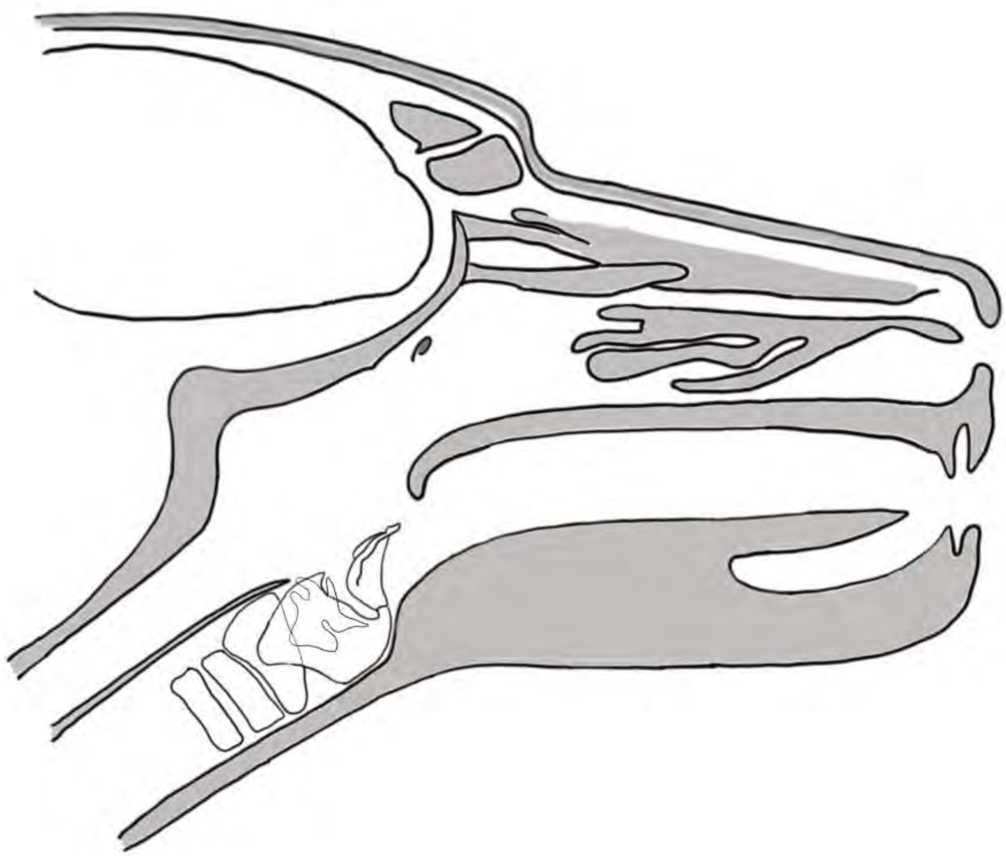


Larynx





Oral and Nasal Cavities



Thank you for getting to the end of this!