

## **Systems Pathology VETM\*4490**

Fall/Winter 2016-2017

1.0 Credit

### **Calendar Description**

The course will contribute to students' achievement of selected elements of graduating competency in the context of pathobiology across the range of species. The primary emphasis is directed towards developing the skills, knowledge and attitudes that will permit the entry-level veterinarian to carry out post-mortem examinations, select and perform relevant ancillary diagnostic tests and procedures, interpret findings, and initiate and interpret results of further investigations.

The graduating competencies can be found on the OVC website at;

<https://ovc.uoguelph.ca/sites/default/files/users/ovcweb/files/The-Competency-Domains-of-the-OVC-DVM-Program.pdf>

### **Instructor-in-Charge/Course Coordinator**

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### **Instructors**

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Others as required

### **Administrative Information**

For questions regarding academic consideration, continuation of study, academic misconduct, safety, confidentiality, and experiential learning involving use of animals, please refer to the Phase information on the OVC website.

## Course Description

Systems Pathology concentrates on the diseases of the endocrine, cardiovascular, digestive including liver pancreas and peritoneum, hemolymphatic, integumentary, nervous, musculoskeletal, respiratory and urinary systems, and special senses, to meet basic competencies of an entry level veterinarian (<https://ovc.uoguelph.ca/sites/default/files/users/ovcweb/files/The-Competency-Domains-of-the-OVC-DVM-Program.pdf>). Those principles and diseases with a multisystemic or whole body involvement will be covered either initially as a separate segment or in the organ system where lesions are predominantly found.

This course builds on information gathered as prerequisites of the DVM program, and on information, skills and attitudes acquired in the first 2 phases, including Anatomy, Histology, Developmental Biology, Physiology, and Principles of Disease in Veterinary Medicine. It provides the opportunity to further enhance a knowledge base of diseases of veterinary importance and their pathogenesis. It will also allow the use of this information to formulate a diagnostic plan including determining the system affected, providing a differential diagnosis, selecting appropriate specimens for further diagnostic investigation, interpret findings, arrive at a tentative or final diagnosis, provide an appropriate prognosis, and understand the rationale of therapy. It includes the disciplines of clinical and anatomical pathology.

Much of this course is integrated with medicine and surgery, and the material covered in this and other courses is complementary to reduce repetition and enhance understanding. Diseases of the various systems are not therefore restricted to those covered in the contact time of this course, but rather this course concentrates on selected examples to assist in meeting the competencies of the DVM program.

## Course Objectives

### General Course Objectives

For each system of the body, and at a level greater than that of Phase 2, Principles of Disease in Veterinary Medicine

1. Describe the reactions of each organ to injury
2. Define terms used in disease of each organ
3. Outline the pathogenesis of major disease groups of each organ including inflammatory, degenerative, hyperplastic and neoplastic types
4. Describe the unique methods of sample collection for diagnosis of disease in each organ
5. Interpret a haematology, clinical biochemistry, endocrine profile or other clinical pathology report
6. Interpret a cytological, surgical biopsy, gross postmortem and histopathology report of disease of each system, and relay the information to a client
7. Interpret the information obtained in observations and reports of disease to provide a logical approach to further testing, therapy and prognosis
8. Critically evaluate information from the internet, textbooks and journal articles.

### Specific Course Objectives

#### Clinical Chemistry

1. Explain basic laboratory instrument quality assurance from the perspective of private practice and the practitioners' expectations of a veterinary reference laboratory
2. Explain the usual presentation of laboratory data and the appropriate terminology used to describe common laboratory abnormalities
3. Explain the usefulness and interpretive considerations of the following chemistry tests used for

the detection of disease in small and large animals:

- a. Diagnostic enzymes (AST, CK, ALT, GDH, GGT, amylase, lipase)
- b. Electrolytes (sodium, potassium, chloride)
- c. Tests of acid-base balance (carbon dioxide, pH, PCO<sub>2</sub>, HCO<sub>3</sub>)
- d. Minerals (calcium, phosphorus, magnesium)
- e. Lipids (nonesterified fatty acid, beta-hydroxy butyrate, cholesterol, triglycerides)
- f. Proteins (total protein, albumin, globulins)

## **Pathology of the Hemolymphatic System**

### **General**

1. Sample and preserve components appropriately, including the use of fine needle aspiration, incisional and excisional biopsy
2. Outline the limitations of sampling.
3. Remove and examine tonsils, lymph nodes, bone marrow, and spleen and identify their components at postmortem or biopsy.
4. Recognize abnormalities of the hemolymphatic system and identify their significance.
5. Define the terms used in and interpret a cytological, surgical biopsy, gross postmortem and histopathology report of disease of the hemolymphatic system.

### **Lymph nodes and lymphatics**

1. Recognize and establish the pathogenesis of hyperplasia, lymphadenitis including caseous lymphadenitis and primary and secondary neoplasia
2. Cytologically distinguish between inflammation and hyperplasia/neoplasia.

### **Bone marrow**

1. Recognize and outline the dynamic nature of the bone marrow, including physiological response and timing of hematological and macroscopic changes.
2. Recognise and outline the processes and mechanisms of marrow aplasia, hypoplasia, hyperplasia, myelofibrosis, and necrosis.
3. Establish the pathogenesis of common and uncommon erythrocytic and leukocytic disorders, platelet disorders, coagulation disorders, and myeloid neoplasia.
4. List indications for bone marrow biopsy.
5. Interpret major changes in hematopoietic cell populations and response.

### **Spleen**

1. Name and identify common and uncommon diseases of each species, including infarcts, nodular hyperplasia, hematoma, hemangiosarcoma, siderotic plaques, nonangiomatic neoplasia.
2. Recognize and identify the causes of splenic enlargement including barbiturate administration, septicemia, extra medullary hematopoiesis, lymphoma, mast cell tumor and leukemia.

### **Thymus**

1. Identify diseases of the thymus of each species
2. Identify causes of reduced thymic mass and associated syndromes
3. Investigate the cause of thymic hemorrhage
4. Recognize thymic neoplasia (thymoma and lymphosarcoma)

## **Pathology of the Liver and Pancreas**

### **Clinical pathology**

1. Explain the usefulness and interpretive considerations of diagnostic hepatic enzyme activity (ALT, AST, GGT, ALP) in the context of clinical and other diagnostic data in small and large animals
2. Explain the metabolism and diagnostic usefulness and interpretive considerations for the following laboratory analytes used for diagnosis of hepatobiliary disease in small and large animals:
  - a. Bilirubin
  - b. Bile acids
  - c. Ammonia
3. Explain the usefulness and interpretive considerations of diagnostic pancreatic enzyme activity (amylase, lipase, TLI, PLI) in the context of clinical and other diagnostic data in small animals

### **Liver**

1. Explain the anatomic and physiologic features of the liver relevant to its participation in metabolism, host defense, susceptibility to insult, and processes of repair and regeneration.
2. Recognize and explain the significance of patterns of hepatic injury and repair.
3. Explain the pathogenesis of the major clinical signs/syndromes of hepatic dysfunction and failure.
4. Recognize, describe and interpret patterns of adaptive and pathologic change in the liver, and correlate with clinical laboratory medicine and postmortem findings.
5. Explain the pathogenesis, describe associated anatomic abnormalities, and relate clinical and veterinary laboratory medicine correlates of the following: hepatocellular necrosis (in its various patterns); hepatic lipidosis; hepatic glycogenosis (steroid hepatopathy); chronic passive congestion of the liver; portal hypertension/ascites; congenital portosystemic shunts; patterns of infectious, inflammatory and parasitic disorders (including etiologies); toxic and nutritional disorders; benign and malignant primary and metastatic neoplasia involving the liver.
6. Describe and explain appropriate specimen and test selection to support diagnostic investigation of liver disease; interpret the results of such tests in context, indicating their significance with respect to diagnosis and prognosis.

### **Exocrine Pancreas**

1. Describe and interpret appropriately lesions in the pancreas and adjacent tissues associated with atrophy, necrosis, healing, regeneration, benign nodular hyperplasia and malignant neoplasia
2. Explain the pathogenesis of acute pancreatic necrosis (necrotizing pancreatitis) and its sequelae, making correlations with the associated clinical and pathologic syndromes.
3. Explain the pathogenesis of chronic functional pancreatic exocrine insufficiency and associated pathologic and clinical syndromes.
4. Describe the usual behaviour and clinicopathologic outcomes of pancreatic exocrine carcinoma.
5. Describe and explain appropriate test and specimen selection in support of the diagnostic investigation of the morphologic entities or clinicopathologic syndromes listed above; interpret the results of such tests competently in context, indicating their significance with respect to diagnosis and prognosis of particular anatomic or etiologic syndromes.

## **Pathology of the Digestive System**

### **General**

1. Recognize the major presenting problems or clinical syndromes and, where present, related morphologic abnormalities, associated with disease of the alimentary system, and explain their

pathogenesis and sequelae. These include anorexia; inanition; dysphagia; physical or functional obstruction; secretory dysfunction; malassimilation of nutrients and malabsorption of electrolyte, nutrients and water, including diarrhea; gastrointestinal blood loss; gastrointestinal protein loss.

2. Describe a systematic, thorough approach to postmortem examination of the alimentary tract and associated organs in carnivores, swine, horses, and ruminants.
3. Describe, interpret appropriately and correlate with clinical, laboratory medicine and autopsy findings involving the alimentary system and other body systems/organs, relevant abnormalities examined in post-mortem specimens or illustrated visually, listed in the Range Indicators (any tissue/system/ whole body) for Veterinary Competency V6.23 "Carry out post-mortem examinations...", including those associated with post-mortem change.

#### **Oral Cavity**

1. Recognize, describe the gross appearance and explain the clinical significance of the following congenital or conformational anomalies: cleft palate; hare lip, brachygnathia superior and inferior in all species; dentigerous cysts in horses.
2. Recognize, describe and briefly explain the pathogenesis and clinical significance of the following dental abnormalities and their sequelae in ungulates and carnivores: enamel hypoplasia; malocclusion; abnormalities of wear; dental plaque and calculus; periodontitis; dental caries; abscessation.
3. Recognize, describe and explain the etiopathogenesis and clinical significance of oropharyngeal foreign bodies and trauma; uremic glossitis/stomatitis; superficial and deep stomatitis due to infectious agents; sialocele in dogs.
4. Describe the gross appearance, behaviour and prognosis of the common tumors and tumor-like conditions of the oral cavity in domestic carnivores.
5. Be able to formulate an appropriate list of diagnostic hypotheses for oropharyngeal problems, in the context of the species, presenting syndrome and gross abnormalities recognized; select appropriate tests and specimens in support of a diagnosis, and correctly interpret their outcome.

#### **Esophagus, Ruminant Forestomachs and Stomach**

1. Recognize and discuss the pathogenesis of primary and secondary esophageal dilation, and associated sequelae, in dogs.
2. Recognize, describe the gross appearance, explain the pathogenesis and discuss the sequelae of lesions associated with obstruction and erosion/ulceration of the esophagus.
3. Describe the anatomic and associated physiologic characteristics of the simple monogastric stomach; the fermentative monogastric stomach; and the ruminant forestomachs and abomasum, in the context of predisposition to functional and physical disease states.
4. Explain the pathogenesis and discuss the diagnosis at autopsy of acute carbohydrate engorgement (rumen overload) and ruminal typany (bloat).
5. Recognize, describe and explain the pathogenesis and sequelae of uremic gastritis; clostridial abomasitis, mycotic abomasitis; vagal indigestion and abomasal emptying defects of ruminants; chronic gastritis of domestic carnivores; peptic ulcer; esophago-gastric ulcer; gastric/abomasal dilation/volvulus; and gastric neoplasia in species in which they are significant.
6. Be able to formulate an appropriate list of diagnostic hypotheses for esophago-gastric problems, in the context of the species, presenting syndrome and gross abnormalities recognized; select appropriate tests and specimens in support of a diagnosis, and correctly interpret their outcome.

#### **Small and large intestine**

1. Recognize; describe the gross appearance and species or breed association; and explain the clinical significance of the following congenital anomalies: segmental aplasia; atresia coli; atresia ani; aganglionosis.

2. Recognize, describe the gross appearance, explain the pathogenesis and discuss the sequelae of intestinal lesions associated with displacement and/or obstruction.
3. Recognize, describe the gross appearance, explain the pathogenesis and discuss the sequelae of intestinal lesions associated with ischemia.
4. Explain the etiopathogenesis of villus atrophy and typhlocolitis associated with damage to the progenitor compartment of enterocytes; with primary exfoliation of the functional compartment of enterocytes; and with abnormalities in enterocyte kinetics and differentiation in chronic inflammatory bowel disease.
5. Recognize, describe, where appropriate list common etiopathologic associations, and explain the sequelae of erosive, ulcerative and necrotizing lesions of the intestinal mucosa; granulomatous enteritis; and lymphangectasia.
6. Discuss the major mechanisms by which gastrointestinal disease affects general homeostasis: physical and functional obstruction; vomiting; nutrient malassimilation and malabsorption; diarrhea (pathogenesis and clinical correlates of small bowel and large bowel diarrhea); protein-losing gastroenteropathy; hemorrhage into the alimentary tract; systemic effects of bacterial toxins released into the gut; systemic viral or bacterial invasion from the alimentary tract; reduced feed and water intake.
7. Describe and explain appropriate clinicopathologic test selection in support of the diagnostic investigation of diseases of the small and large intestine; interpret the results of such tests competently in context, indicating their significance with respect to diagnosis and prognosis of particular anatomic or etiologic syndromes.

**Infectious and Parasitic Diseases**

1. Discuss in depth the importance, etiology, pathogenesis, presenting clinico-epidemiologic and pathologic syndromes, differential pathologic diagnosis, gross lesions, laboratory diagnosis and test interpretation of the major diseases/agents (Veterinary Competencies V6.10, V6.23 and Range Indicators) listed below.
2. Discuss to a moderate depth the etiology, pathogenesis, presenting clinico-epidemiologic and pathologic syndromes, differential pathologic diagnosis, gross lesions, laboratory diagnosis and test interpretation of the minor diseases/agents (Veterinary Competencies V6.11, V6.23 and Range Indicators) listed below.
3. List the etiology, presenting clinico-epidemiologic and pathologic syndromes, gross lesions, laboratory diagnosis and test interpretation of the minor diseases/agents listed below.
4. Name, and list the etiology and presenting clinico-epidemiologic and pathologic syndromes, including host range, of the relevant Reportable Diseases under the Health of Animals Act of Canada: bluetongue, cysticercosis, foot and mouth disease, peste des petits ruminants, rinderpest, swine vesicular disease, vesicular stomatitis.

	<b>Major diseases/Agents</b>	<b>Minor diseases/agents</b>	<b>Other diseases/agents</b>
Dogs	Ascarids; Coronavirus; Giardia; Hookworms; Isospora; Parvovirus; Tapeworms; Whipworms	Bacterial enteritis (Campylobacter, Clostridial, Salmonella,)	Rotavirus, Histoplasma, Prototheca
Cats	Ascarids; Coronavirus; Giardia; Isospora; Parvovirus; Tapeworms		Salmonellosis

Swine	Ascariasis; Neonatal diarrhea (Isospora, E. coli, Rotavirus, TGE, PED); Edema Disease; Postweaning diarrhea; Lawsonia; Swine dysentery: PCV2.	Salmonellosis	Clostridial enteritis
Horses	Colitis – Clostridial, Potomac Horse Fever, Salmonellosis, NSAIDS; Rhodococcus; Gasterophilus; large and small strongyles; Parascaris; Anoplocephala		Eimeria leuckarti
Cattle	Actinomycosis; Bovine Papular Stomatitis; Bovine Virus Diarrhea; coccidiosis; Gastrointestinal parasitism; Malignant Catarrhal Fever; Neonatal diarrhea (Coronavirus, Cryptosporidium, E. coli, Rotavirus); Necrobacillosis; Johne's Disease; Winter Dysentery	Actinobacillosis; Salmonellosis	
Sheep/ goats/ deer	Clostridial enterotoxemia (sheep, goats); Coccidiosis (sheep, goats); Contagious ecthyma (sheep, goats); Gastrointestinal parasitism; Neonatal diarrhea (Cryptosporidium, E. coli, Rotavirus); Johne's Disease; Necrobacillosis (deer); Yersiniosis (deer)	Necrobacillosis (sheep); Salmonellosis (sheep, goats); Tapeworms (sheep); cysticerciasis (sheep, goats); Yersiniosis (goats)	

### Endocrine pathology

1. Describe the basic anatomical structure and hormone production of pituitary, adrenal, thyroid and parathyroid gland and endocrine pancreas.
2. Discuss and explain the usefulness of clinical pathology tests in the diagnosis of endocrine diseases in large and small animals.
3. Interpret common endocrine test results.
4. Describe pathophysiological changes that alter the structure and/or function of the pituitary, adrenal, thyroid and parathyroid gland and pancreatic islets and the physiological alterations expected based on the nature and the extent of the changes.
5. Outline primary and secondary functional changes that occur with disease of endocrine organs
6. List the common neoplasms of the endocrine organs and their functional outcomes
7. Interpret a postmortem, biopsy, or cytology report of a submission from the endocrine system

### Dermatopathology

The student will

1. Describe skin lesions at the macroscopic level using appropriate terminology.
2. Define commonly used dermatological terms including macule, papule, plaque, nodule, tumour, vesicle, bulla, wheal, pustule, crust, scale, atrophy, alopecia, purpura, erythema, leukoderma, leukotrichia, lichenification, excoriation, ulceration and fissure.
3. Explain how to choose appropriate macroscopic lesions for biopsy and fine needle aspiration and know what information must be relayed to the pathologist to maximize a useful report

4. Define the common histological changes of the epidermis and their clinical correlates including
  - a. Hyperkeratosis (orthokeratotic hyperkeratosis)
  - b. Parakeratosis (parakeratotic hyperkeratosis)
  - c. Acanthosis
  - d. Spongiosis
  - e. Ballooning degeneration
5. Define and outline the pathogenesis of the patterns of the pattern analysis approach to non neoplastic skin disease, and list common disease examples of each pattern including
  - a. Inflammatory patterns
    - i. Superficial perivascular dermatitis
    - ii. Cytotoxic (interface) dermatitis
    - iii. Vasculitis
    - iv. Nodular and diffuse dermatitis
    - v. Intraepidermal vesiculopustular dermatitis
    - vi. Subepidermal vesiculopustular dermatitis
    - vii. Folliculitis, furunculosis and sebaceous adenitis
    - viii. Panniculitis
  - b. Noninflammatory patterns
    - i. Alopecia and follicle cycle arrest/endocrine/atrophy
    - ii. Necrosis and physiochemical injury
    - iii. Collagen disorders
    - iv. Keratinising defects
6. List the major groups, provide specific examples and indicate the prognosis of neoplasms and tumour like lesions of the skin including
  - a. Epithelial cysts, hamartomas, and seroma.
  - b. Epithelial neoplasms including those of the epidermis and adnexa
  - c. Mesenchymal neoplasia including soft tissue sarcoma
  - d. Round cell tumours including histiocytic neoplasms, mast cell tumour, plasmacytoma, lymphoma and canine transmissible venereal tumour.
  - e. Neuroectodermal neoplasms including melanoma.
  - f. Perianal gland tumours including hepatoid tumours and carcinoma of the apocrine gland of the anal sac.
  - g. Nail bed tumours including melanoma and squamous cell carcinoma
  - h. Mammary neoplasia of the dog and cat.
7. List skin masses suitable for cytological assessment, and distinguish cytologically between inflammation, infection and neoplasia.
8. Interpret a postmortem, biopsy, or cytology report of a submission from the skin.

## **Pathology of the Urinary System**

### **General**

1. Remove and examine the urogenital tract and identify its components.
2. Recognize abnormalities of the urinary tract.
3. Preserve and sample components of the urinary tract appropriately.
4. Understand the limitations of sampling the urinary tract.
5. Understand and interpret a urinalysis, clinical biochemistry, gross postmortem and histopathology report of disease of the urinary tract.
6. Recognize the lesions associated with acute or chronic renal failure including renal and extrarenal changes.
7. Explain the mechanism of development of lesion associated with acute and chronic renal

failure.

8. Interpret a postmortem, biopsy, or cytology report of a submission from the urinary system

#### **The kidney**

1. List common and uncommon diseases of the kidney of each species.
2. Recognize congenital disease including renal cysts.
3. Recognize the patterns of disease including segmental (infarction and pyelonephritis) embolism (inflammatory and metastatic), generalized (cortical necrosis, tubular necrosis), medullary papillary, and pelvic (pyelonephritis, hydronephrosis) types.
4. Identify and detail the pathogenesis of glomerulonephritis, interstitial nephritis, pyelonephritis, and renal cortical and medullary necrosis.

#### **The lower urinary tract (ureter, bladder, urethra)**

1. Identify the changes in and detail the pathogenesis of urolithiasis and cystitis including infectious and idiopathic types
2. Name the common neoplasms of the urinary tract and identify their cause and prognosis

### **Respiratory pathology**

#### **Clinical pathology**

1. Describe the cytological findings in health in each of these samples: transtracheal wash, bronchoalveolar lavage, pleurocentesis, lung aspirate
2. Choose the appropriate antemortem sample from the respiratory tract to investigate lesions
3. Interpret abnormal cytological findings in relation to disease processes.

#### **General**

1. Discuss the differences between bronchopneumonia, interstitial pneumonia, bronchointerstitial pneumonia, and embolic pneumonia; with regard to cause, route of infection, pathogenesis, and gross and histologic lesions. List the causes of each of these types of pneumonia in dogs, cats, cattle, swine, sheep, goats, and horses.
2. By examining specimens or images of lung lesions from the species of animals listed above, classify the type of pneumonia (bronchopneumonia, interstitial pneumonia, bronchointerstitial pneumonia, and embolic pneumonia), formulate a list of differential diagnoses, and list which additional tests would be useful to make a definitive diagnosis.
3. Identify and interpret cytological findings in transtracheal washes, broncho-alveolar lavages, pulmonary aspirates and pleural fluid with respect to the underlying disease processes, including infectious, allergic, and neoplastic diseases of the lung.
4. Describe the sequelae of injury to bronchiolar or alveolar epithelium, and predict the functional and clinical changes that result from these lesions.
5. Discuss the cause, pathogenesis, morphology, and functional and clinical significance of the following conditions: atelectasis, bronchiectasis, bronchiolitis obliterans, emphysema, hydrothorax, pneumothorax, pulmonary edema, pulmonary hemorrhage, sequestrum.
6. Describe how the lung is normally defended against bacterial infection, and list several causes whereby these defences are impaired.

#### **Specific diseases.**

1. Discuss the importance, etiology, pathogenesis, clinico-epidemiologic presentation, gross and histologic lesions, and diagnostic tests for the major respiratory diseases listed in the table below.
2. Describe the cause, gross lesions, type of pneumonia, and diagnostic tests (where appropriate) for the minor respiratory diseases listed in the table below.
3. List the cause, importance, and type of pneumonia for the other respiratory diseases listed in the

table below.

	Major diseases	Minor diseases	Other diseases
Dogs	Blastomycosis Pulmonary neoplasia Bacterial pneumonia Aspergillosis Nasal carcinoma Herpesvirus	ARDS Pulmonary thromboembolism Pyothorax	Eosinophilic lung disease Kennel cough Tracheal collapse Oslerus oslerii Crenosoma vulpis Canine distemper
Cats	Viral respiratory infections Bacterial pneumonia FIP Paragonimus	Aleurostrongylus abstrusus Empyema Cryptococcosis Calicivirus Bordetella	Mycoplasma felis Toxoplasmosis
Horses	Rhodococcus equi Strangles/ Streptococcus equi Equine influenza Equine viral rhinotracheitis Heaves	Interstitial pneumonia of foals Guttural pouch mycosis Exercise-induced pulmonary hemorrhage Pleuropneumonia	Equine rhinoviruses Equine adenovirus Dictyocaulus arnfieldi Pneumocystis carinii
Cattle	Pneumonic pasteurellosis Mycoplasma bovis Bovine respiratory syncytial virus Infectious bovine rhinotracheitis 3-MI toxicity Aspiration pneumonia	Parainfluenza, coronavirus Embolic pneumonia Dictyocaulus Tuberculosis Interstitial pneumonia of feedlot cattle Histophilus pleuritis	Ascaris suum larval migration Contagious bovine pleuropneumonia
Sheep and goats	Maedi-visna/ ovine progressive pneumonia Muellerius capillaris Pasteurellosis	Respiratory syncytial viruses Mycoplasma spp. Oestrus ovis Transmissible nasal carcinoma	Pulmonary adenomatosis Peste des petits ruminants
Swine	Porcine reproductive and respiratory syndrome Mycoplasma hyopneumoniae Swine influenza Actinobacillus pleuropneumoniae Polyserositis	Porcine circovirus/ Postweaning multisystemic wasting syndrome Pasteurellosis Atrophic rhinitis	Pseudorabies Porcine respiratory coronavirus Metastrongylus spp. Inclusion body rhinitis Actinobacillus suis embolic pneumonia

### Cardiovascular pathology

At the end of the course, students will be able to:

1. Dissect the heart of domestic mammals, recognizing the anatomic features, and describe the lesions that are present.
2. Discuss the pathophysiology and the gross and histologic lesions of heart failure, and describe how a diagnosis of heart failure can be made at postmortem.
3. Describe the response of the myocardium to increased demand and to injury, the changes in these responses over time, and their functional significance.
4. Discuss the gross lesions and pathophysiologic consequences of the following common developmental anomalies affecting the heart of domestic mammals. Ventricular septal defect, patent ductus arteriosus, and pulmonic and subaortic stenosis.
5. Describe the appearance, differential diagnoses, significance, and sequelae of hydropericardium, hemopericardium, and pericarditis in domestic animals.

6. Describe the cause, appearance, and significance of thrombosis, embolism, and vasculitis affecting arteries or veins in domestic mammals.
7. For the following important diseases affecting the heart and vessels, recognize the gross lesions, describe the pathogenesis, and explain the pathologic basis for the clinical findings.

Important cardiovascular diseases:

- All species: Bacterial endocarditis, endocardiosis, congestive heart failure, thrombosis and embolism, monensin toxicity
- Cattle: *Histophilus somni* myocarditis, vitamin E / selenium deficiency, monensin toxicity, pericarditis due to hardware disease
- Horses: *Strongylus vulgaris* mesenteric arteritis, aortoiliac thrombosis
- Dogs: Endocardiosis, dilated cardiomyopathy, hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, heartworm disease, hemangiosarcoma
- Cats: Aortoiliac thromboembolism, hypertrophic cardiomyopathy
- Swine: Mulberry heart disease, erysipelas

## **Musculoskeletal pathology**

1. Define and correctly spell the terminology of pathology of the musculoskeletal system.
2. Describe the structural elements of bone and summarize the contribution of each to bone integrity and/or remodelling.
3. Interpret the results of postmortem procedures conducted on specimens from the musculoskeletal system.
4. Outline the pathogenesis of chondrodysplasia and osteochondrosis.
5. Outline the pathogenesis of common metabolic alterations in bone such as rickets, osteomalacia, fibrous osteodystrophy, growth arrest lines, and hypertrophic osteopathy.
6. Outline the common causes and possible sequelae of osteitis.
7. Name the common neoplasms of bone and identify the species in which they commonly occur.
8. Outline the reaction of joints to injury
9. Outline the common causes of muscle atrophy.
10. Describe the normal sequence by which structural elements of muscle are altered in degeneration.
11. List the common causes of myositis and where appropriate identify the species in which they occur.
12. Describe the normal constituents of synovial fluid.
13. Describe the changes in synovial fluid constituents that occur in inflammatory and degenerative joint diseases.
14. Define the terms used in and interpret a cytological, surgical biopsy, gross postmortem and histopathology report of disease of the musculoskeletal system.

## **Neuropathology**

### **Clinical pathology**

1. Describe the unique composition of cerebrospinal fluid with respect to obtaining diagnostically useful samples.
2. Identify the cytological and biochemical findings typical of infectious, inflammatory and neoplastic diseases of the central nervous system as reflected in the cerebrospinal fluid.

### **General**

1. Know how and when to take precautions to avoid zoonotic disease.
2. Know when to remove the brain spinal cord and nerves
3. Know how to remove and examine the brain, spinal cord and some peripheral nerves.

3. Recognize abnormalities of brain, spinal cord and peripheral nerves.
4. Fix and sample brain, spinal cord and peripheral nerves appropriately.
5. Outline the limitations of sampling the central and peripheral nervous systems.
6. Interpret a postmortem and a histopathology report of a disease of the nervous system

**Peripheral nervous system**

1. Describe the 3 levels of injury to nerves
2. Recognize Wallerian degeneration and its significance
3. Recognize axonopathy and its significance
4. Outline the difference between a primary and secondary axonopathy and provide examples of both
5. List common diseases of the peripheral nervous system and outline their pathogenesis
6. Name the common neoplasms of the PNS and indicate their prognosis.

**Central Nervous system**

1. Name common malformations of the CNS including differentiating hydranencephaly from hydrocephalus
2. Name neurotropic viruses that induce malformations and outline their pathogenesis
3. Differentiate between infectious congenital malformations from those of hereditary or environmental causation.
4. List the common neurotropic viruses that cause inflammatory disease of the CNS
5. Outline the pathogenesis of common neurotropic viruses and the chief histological features
6. List the common bacteria that cause central nervous system disease
7. Outline the pathogenesis of the important bacterial pathogens of the CNS
8. Outline the pathogenesis of the transmissible spongiform encephalopathies.
9. Identify the commonality of lesions of the degenerative, ischemic and metabolic causes of CNS injury.
10. Outline the pathogenesis of the degenerative, ischemic and metabolic causes of CNS disease
11. List the common toxicants of the CNS and the pathogenesis of each.
12. Name the common CNS neoplasms and identify the species in which they commonly occur.

**Pathology of the Special Senses**

1. Know the terms used in the description and diagnosis of disease of the eye and ear.
2. Know how to remove and prepare the globe for fixation.
3. Know how the globe is prepared for histological evaluation
4. Outline the response of the globe (cornea, uvea and retina) and external, middle and in are ear to injury
5. Outline the pathogenesis of the common and uncommon diseases of the eye and ear including and especially the pathogenesis, including causes, of glaucoma and otitis.
6. Know the prognosis of common neoplasms of the eye and ear

**Gross laboratories**

These laboratories are designed to prepare Veterinary Students for the practical aspects of investigating disease and to assist in meeting basic competencies outlined in the DVM Program objectives for an entry-level veterinarian, in particular

1. comply with ethical principles, legislation and regulations for the licensed veterinarian, and any other contractual or legal arrangements.
2. know which diseases have zoonotic potential and identify which ones are reportable
3. know the presenting history, clinical signs, appropriate diagnostic tests, treatment options and prevention strategies of common diseases in a variety of domestic and non-domestic species

relevant to the Canadian context

4. appropriately identify, validate and analyze a problem based on scientific methodology, in a manner that can be critically reviewed.
5. Obtain accurate and valid information about a situation in order to identify areas of veterinary responsibilities, and the expectations of parties involved.

In the pathology context this includes

1. Identify the potential role of post-mortem examination (e.g. diagnostic, medico-legal, quality control)
3. Ensure that examinations are thorough and systematic giving adequate, but not exclusive, emphasis to the purpose of the examination, the presenting complaints, and the containment of disease.
4. Recognize and describe abnormalities effectively
5. Recognize artifacts
6. Establish a tenable list of common differential diagnoses, and/or recognize the possibility of an uncommon or notifiable disease
7. Communicate tentative diagnoses effectively.
8. Collect and preserve specimens for appropriate ancillary diagnostic tests, correctly
9. Comply with transport and import/export regulations
10. Interpret the results of ancillary diagnostic tests correctly
11. Reach tenable conclusions and communicate them effectively
12. Apply post mortem findings in the management of the presenting problems

## Evaluation

### **Term tests (formative evaluation) - 25% of final grade**

Ongoing formative evaluations will be 25% of the final grade. They will involve multiple CourseLink@Guelph quizzes intended for self-evaluation (totalling 5% of final grade), and two formative midterm examinations (8 and 12% of final grade). The midterm examinations are cumulative.

### **Final examination (summative evaluation) - 75% of final grade**

The final (summative) examination will be worth 75% of the final grade.

Instructors set the questions and mark the questions on all evaluations, and the course coordinator administers midterm and final examinations.

Online quizzes must be your own work.

## Resources

### **Instructor supplied course related materials**

Electronic copies of the lecture presentation files are available on CourseLink@Guelph unless indicated by the instructor.

### **Textbooks**

#### ***Required***

Duncan & Prasse's Veterinary Laboratory Medicine: Clinical Pathology, KS Latimer, 5th edition, 2011. (also available as an eBook from Wiley (www.wiley.ca, ISBN 978-1-118-30146-3)  
Pathological Basis of Veterinary Disease. D McGavin and J Zachary, 6th ed, 2016

***Recommended***

Canine and Feline Endocrinology and Reproduction, EC Feldman, RW Nelson, C Reusch, J. Catharine Scott-Moncrieff, E. Behrend, 4<sup>th</sup> ed, 2014

**Web materials**

CourseLink@Guelph: VETM\*4490

**Laboratory Safety Issues**

"Within the laboratory setting, serious accidents can occur if students do not act responsibly or (fail to) follow the appropriate procedures. To ensure the safety of all participants, students must at all times abide by the directions given by the instructor or assistant. Failure to do so could result in being dismissed from the lab, and given a grade of zero for that component of the course."

"Safety in the laboratory (studio, etc.) is a priority at all times. In order to ensure safety of all participants, the safety procedures/guidelines provided by the instructor must be followed. It is the responsibility of each student to attend any safety orientation that is provided"

"All students in contact with large animals are required by U. of G. safety policy regulations to wear approved safety boots or shoes. Students will not be permitted to participate in scheduled activities involving large animals if they do not comply".

This

**Schedule**

Please see Phase 3 schedule for actual times and dates.