

Clinical Studies
Winter 2018, CLIN*6661
Respiratory Physiology

COURSE OUTLINE

Coordinators: Dr. A. Bersenas, Dr. A. Defarges
Email: bersenas@uoguelph.ca; adefarge@uoguelph.ca
Office: Department of Clinical Studies Rm 2121; Rm 2104

COURSE CONTENT:

1. Weekly reading group for residents (Guyton & CVT), day/time to be confirmed by residents
2. Weekly class meeting time, see schedule
3. Weekly journal club, ** with students' own specialty service
4. Clinical activities related to class topics

COURSE OBJECTIVES:

The objectives of the course are to review the physiology & pathophysiology of the respiratory system. The approach will be with a clinical emphasis focused on understanding the pathophysiology of respiratory disease & its management. A third of the course will be dedicated to mechanical ventilation.

FORMAT:

1 hour seminars led by OVC Faculty and enrolled students, with interactive discussion. Active participation of registrants will be expected (readings completed prior to lecture). Room 2152 from 8:30 to 9:30am.

	Date 8:30-9:30	Room	Topic	Class
1	Thursday January 11	2152	Functional Anatomy of The Lungs, Lung Volumes	Bersenas
2	Thursday January 18	2152	Pulmonary Circulation & Gas Transport	Bersenas
3	Thursday January 25	2152	Gas Exchange - Diffusion / Ventilation Perfusion Relationships	Resident
4	Thursday February 1st	2152	Imaging Of The Airways	Mackenzie
5	Thursday Feb 8	2152	Mechanics of Breathing & Regulation of Ventilation	Holowaychuk

6	Thursday Feb 15	2152	Airway Sampling	Defarges
7	Thursday Feb 22	2152	Respiratory Insufficiency / Failure / ARDS	Resident
8	Thursday March 1st	2152	Pulmonary Edema – Cardiogenic & Non-Cardiogenic	SAIM OR Cardio Resident
9	Monday March 5th	2152	Tracheal collapse	Brisson
10	Thursday March 15	2152	Respiratory system defense mechanisms and Bronchopneumonia	SAIM resident
11a	Tuesday March 20	2152	Positive Pressure Ventilation	ECC Resident
11b	Thursday March 22	2152	Pulmonary Thromboembolism	Abrams-Ogg/ Resident
12a	Tuesday March 27	2152	MV – Optimizing Ventilation, Lung Protective Strategies, Permissive Hypercapnia	ECC Resident
12b	Thursday March 29	2152	Asthma And Bronchitis In Cats	Johnson
13a	Tuesday April 3rd	2152	Bronchitis In Dogs	Defarges
13b	Thursday April 5	2152	Monitoring – Pulse Oximetry, Capnography, Blood Gas Analysis, & Co-Oximetry	Valverde
14a	Tuesday April 10	2152	MV – patient asynchrony & interpretation of loops and waveforms	TBA
14b	Thursday April 12	2152	What Is New In The Nose In Small Animals?	Defarges / SAIM resident
15a	Tuesday April 17	2152	Weaning from the Ventilator	ECC resident
15b	Thursday April 19	2152	Oxygen Toxicity	Resident
			Final Exam (Exam Period)	

METHOD OF EVALUATION (INCLUDE BREAKDOWN OF MARKS):

Students will be evaluated as follows:

- Lecture presentation – Students will select one of the lectures to present during the semester. They will be expected to present a 45 min -1 hour lecture to the class summarizing the readings. A power point presentation is mandatory for this presentation. (30%).
- Exam question development – Students will be expected to develop and provide 3 examples of multiple choice or short answer questions from their lecture topic. These may be used in subsequent years. (10%)
- Student participation based on contributions to group discussions and evaluation of seminars by student peers (10%).
- A final examination (50%) will take place during the exam period on a date to be announced. An essay style written examination will cover topics delivered throughout the semester. Guest lecturers can alternatively provide multiple choice or short answer questions.

LECTURE OUTLINE

(READINGS PROVIDED IN COURSELINK):

Lecture 1

FUNCTIONAL ANATOMY OF THE LUNGS, LUNG VOLUMES

West Physiology

- Chapter 1 – Structure & Function
- Chapter 2 – Ventilation
- Chapter 7 – Mechanics of Breathing

Guyton Chapter 37 – Pulmonary Ventilation

Lecture 2

PULMONARY CIRCULATION & GAS TRANSPORT

West Physiology

- Chapter 4 - Blood Flow and Metabolism
- Chapter 6 – Gas transport by the blood

Guyton Chapter 38 Pulmonary Circulation pg 477-481 ONLY

Guyton Chapter 40 Transport of O₂ and CO₂ in Blood and Tissues pg 163-173

Lecture 3

GAS EXCHANGE - DIFFUSION / VENTILATION PERFUSION RELATIONSHIPS

West physiology

- Chapter 3 – Diffusion
- Chapter 5 – Ventilation – perfusion relationships

Guyton Chapter 39 – Physical Principles of Gas Exchange; Diffusion of O₂ & CO₂

Lecture 4

IMAGING OF THE AIRWAYS

Thrall. Textbook of Veterinary Diagnostic Radiology.

Chapter 25: Interpretation paradigms for the small animal thorax

Chapter 34 (5th edition) or 33 (6th edition): The canine and feline lung

Johnson E and Wisner E. Advances in Respiratory Imaging. Vet Clinics of NA 37: 2007 pp879-900. (Airway-Oriented Disorders and Pulmonary Parenchymal Disorders sections)

Reinero CR and Cohn LA. Interstitial lung diseases. Vet Clinics of NA 37; 2007 pp937-47.

Lecture 5

MECHANICS OF BREATHING AND REGULATION OF VENTILATION

West Physiology

- Chapter 7 – Mechanics of Breathing
- Chapter 8 – Control of Ventilation

Guyton Chapter 41 – Regulation of Respiration

TO READ ON YOUR OWN – FYI

VENTILATION AND PULMONARY FUNCTION TESTING (Difficult to apply to Vet Med)

West Respiratory Physiology

- Chapter 10 – Tests of pulmonary function

West Pulmonary Pathophysiology

- Chapter 1 – Ventilation

Veterinary Clinics of North America, Small Animal Practice

- Respiratory Physiology, Diagnostics and Disease September 2007
 - o Airway Physiology and Clinical Function Testing

Lecture 6

AIRWAY SAMPLING

Textbook of Small Animal Internal Medicine- 8th edition, Ettinger SJ.

Chapter 240: Clinical Evaluation of the Respiratory Tract

Zhu, B. Y., et al. (2015). "Tracheobronchial brush cytology and bronchoalveolar lavage in dogs and cats with chronic cough: 45 cases (2012-2014)." J Vet Intern Med **29**(2): 526-532.

JVECC 2011; 21(5):515-520: use of deep oral swabs as surrogate for transoral tracheal wash

Supplemental readings:

Ybarra, W. L., et al. (2012). "Interpretation of multisegment bronchoalveolar lavage in cats (1/2001-1/2011)." J Vet Intern Med **26**(6): 1281-1287.

Lecture 7

RESPIRATORY INSUFFICIENCY / FAILURE / ARDS

West Pulmonary Pathophysiology

- Chapter 2 – Gas Exchange

Guyton Chapter 42 Respiratory Insufficiency

L. King. Textbook of Respiratory Diseases in Cats & Dogs (Saunders) pg 53-60

Journal Articles ACVECC ARDS Consensus Statements

- Wilkins PA, Otto CM, et al. ALI and ARDS in Vet Med: consensus definitions JVECC 2007 14(4): 333-339
- DeClue AE, Cohn LA. ARDS in cats and dogs JVECC 2007 14(4) 340-347
- Balakrishnan Retrospective evaluation of the prevalence, risk factors, management, outcome and necropsy findings of ALI and ARDS in dogs and cats: 29 cases. JVECC 2017
- Acute Respiratory Distress Syndrome the Berlin Definition JAMA 2012
- Acute Respiratory Distress Syndrome Lancet 2016

Lecture 8

PULMONARY EDEMA – CARDIOGENIC & NON-CARDIOGENIC

To be determined. See Courselink

PREVIOUS READINGS:

Guyton Chapter 38 - Pgs 481-484, pulmonary edema and pleural fluid
West Pulm Pathophysiology Chapt 6 Vascular Diseases (Pulmonary Edema pg 95-104)
Rose BD, Post TW. Clinical Physiology of Acid Base and Electrolyte Disorders-
Chapter 16 - Edematous States select pages dealing with pulmonary edema fluid
King L. Textbook of Respiratory Diseases in Cats & Dogs (Saunders) pg 487-495

Lecture 9

TRACHEAL COLLAPSE

Textbook of Small Animal Internal Medicine- 8th edition, Ettinger SJ.
Chapter 241: Diseases of the Trachea and Small Airways
Tracheal and Airway collapse in dogs. Vet Clin Small 44(2014) 117-127

Lecture 10

RESPIRATORY SYSTEM DEFENSE MECHANISMS AND BRONCHOPNEUMONIA

Textbook of Small Animal Internal Medicine- 8th edition, Ettinger SJ.
Chapter 242: Disease of the Pulmonary Parenchyma
Pathologic Basis of Veterinary Disease, 4th ed. Chapter 9: Respiratory system
(limited to p463-473)

Lecture 11a

POSITIVE PRESSURE VENTILATION

Chang - Clinical application of Mechanical Ventilation

Effects of MV on organs - Ch. 2

Classification of ventilators; Ch. 3, p. 51-76

Operating modes of MV - Chp 4

Indications for MV (very small section) - Chp 8

Journal Articles:

- Hopper K, Haskins SC, Kass PH, et al. Indications, management, and outcome of long-term positive-pressure ventilation in dogs and cats: 148 cases (1990-2001). J Am Vet Med Assoc. 2007 Jan 1;230(1):64-75.

Lecture 11b

PULMONARY THROMBOEMBOLISM

To be determined (See Courselink)

PREVIOUS READINGS:

West Pulm Pathophysiology Chapt 6 Vascular Diseases (Pulmonary Embolism pg 104-112)

New H, Byers CG. Pulmonary Thromboembolism. Compendium on Continuing Education for the Practicing Veterinarian September 2011;

Current Vet Therapy XIV

- Chapters 155 (PTE), 156 (Pulmonary hypertension)

Ettinger's Textbook of Internal Medicine

- Chapter 233 (pulmonary hypertension & PTE).

Lecture 12a

MV – OPTIMIZING VENTILATION, LUNG PROTECTIVE STRATEGIES, PERMISSIVE HYPERCAPNIA

Chang - Clinical application of Mechanical Ventilation

Initiation of MV - Chp 8

Management of MV - Chp 12

Journal Articles

- ARDSNet NEJM 2000 (Seminal paper)
- Effects of hypercapnia and hypercapnic acidosis on hospital mortality in MV patients CCM 2017
- Roch, A, et al. Pharmacological interventions in acute respiratory distress syndrome. *Annals of Intensive Care*; 2013, 3:20.
- Bourenne J, et al. Sedation and Neuromuscular blocking agents in ARDS. *Ann Transl Med* 2017;5(14):291

Lecture 12b

ASTHMA & BRONCHITIS IN CATS

Update on feline asthma. Trzil JE, Reinero CR. *Vet Clin North Am Small Anim Pract.* 2014 Jan;44(1):91-105

Supplemental readings:

Association between pet-keeping and asthma in school children. *Pediatr Int.* 2013 Apr;55(2):133-7.

Evaluation of biomarkers in bronchoalveolar lavage fluid for discrimination between asthma and chronic bronchitis in cats. Nafe LA, DeClue AE, Lee-Fowler TM, Eberhardt JM, Reinero CR. *Am J Vet Res.* 2010 May;71(5):583-91

Lecture 13a

BRONCHITIS IN DOGS

Textbook of Small Animal Internal Medicine- 8th edition, Ettinger SJ.

Chapter 97: Respiratory and Inhalant Therapy

Canine Chronic Bronchitis. *Vet clin Small Anim* 44(2014) 107-116

Lecture 13b

MONITORING – PULSE OXIMETRY, CAPNOGRAPHY, BLOOD GAS ANALYSIS, & CO-OXIMETRY

See Courselink for Readings

- Pang D, et al. Partial pressure of ET_{CO₂} sampled via intranasal catheter as a substitute for PaCO₂ in dogs. *JVECC* 2007; 17 (2). (ACVECC reading list 2017)

Lecture 14a

MV – PATIENT ASYNCHRONY & INTERPRETATION OF LOOPS AND WAVEFORMS

Ventilator waveform analysis- Chp 11 Chang

American Thoracic Society Tutorial

<https://www.thoracic.org/professionals/clinical-resources/critical-care/clinical-education/mechanical-ventilation/ventilator-waveform-analysis.php>

Journal Articles:

- Ventilator waveform interpretation in MV small animals Corona JVECC 2011
- Ventilator waveform interpretation Mellema bTopics in Comp Anim Med 2013

Lecture 14b

WHAT IS NEW IN THE NOSE

See Courselink for Readings

Lecture 15a

WEANING FROM THE VENTILATOR

Management of MV, Weaning - Chp 12, 16 Chang

Journal Articles:

- [Executive SUMMARY liberation from MV in critically ill adults Chest 2017](#)
- [Liberation from MV for critically ill adults Clinical Practice Guidelines Chest 2017](#)
- [Girard et al-2016- American Journal of Respiratory and Critical Care Medicine](#)
- [Cuff leak test to predict post extubation airway obstruction in adults metaanalysis CCM ABSTRACT 2017](#)

Lecture 15b

OXYGEN TOXICITY

Previous Readings:

Oxygen Supplementation and O₂ toxicity

Vet Clinics of N Am, Sm An Pract

Critical Care: Respiratory Focus Sept 2002

O₂ Therapy and Toxicity

Advanced Therapies in Respiratory Disease

VCNA Sept 2007 Respiratory

EXAM

General information for graduate courses:

E-mail Communication

As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id#, and e-mail contact. [See the undergraduate calendar for information on regulations and procedures for Academic Consideration.](#)

Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day (Friday November 3, 2017). The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

Copies of out-of-class assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

[The Academic Misconduct Policy is detailed in the Undergraduate Calendar.](#)

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.