

# 2014-2015 Graduate Calendar

The information published in this Graduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2013-2014 academic years, including the Summer Semester 2014, Fall Semester 2014 and the Winter Semester 2015.

For your convenience the Graduate Calendar is available in PDF format.

If you wish to link to the Graduate Calendar please refer to the [Linking Guidelines](#).

The University is a full member of:

- The Association of Universities and Colleges of Canada

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## Disclaimer

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The Office of Graduate Studies has attempted to ensure the accuracy of this on-line Graduate Calendar. However, the publication of information in this document does not bind the university to the provision of courses, programs, schedules of studies, fees, or facilities as listed herein.

## Limitations

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The University of Guelph reserves the right to change without notice any information contained in this calendar, including any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs.

The university will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by the faculty, staff or students of the university or by others, civil unrest or disobedience, Public Health Emergencies, or any other cause of any kind beyond the reasonable control of the university.

The University of Guelph reaffirms section 1 of the Ontario Human Rights Code, 1981, which prohibits discrimination on the grounds of race, ancestry, place of origin, colour, ethnic origin, citizenship, creed, sex, sexual orientation, handicap, age, marital status or family status.

The university encourages applications from women, aboriginal peoples, visible minorities, persons with disabilities, and members of other under-represented groups.

# Introduction

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## Collection, Use and Disclosure of Personal Information

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Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) [http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90f31\\_e.htm](http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90f31_e.htm). This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Training, Colleges and Universities, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see <https://www.uoguelph.ca/registrar/>

## Statistics Canada - Notification of Disclosure

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For further information, please see Statistics Canada's web site at <http://www.statcan.gc.ca> and Section XIV Statistics Canada.

## Address for University Communication

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Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

### Email Address

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The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly.

### Home Address

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Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through the Office of Graduate Studies.

## Name Changes

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The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

## Student Confidentiality and Release of Student Information Policy Excerpt

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The University undertakes to protect the privacy of each student and the confidentiality of his or her record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Complete policy at <http://www.uoguelph.ca/policies>.



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## Pathobiology

The Department of Pathobiology offers programs in Veterinary Pathology, Comparative Pathology, Veterinary Infectious Diseases, and Immunology.

The department offers programs of study leading to MSc and PhD degrees and a Graduate Diploma. The department also participates in the inter-departmental Doctor of Veterinary Science (DVSc) program.

### Fields of Study

The Department of Pathobiology provides graduate programs in the following fields:

- **Comparative Pathology**
  - Avian pathology
  - Fish pathology
  - Wildlife and zoo animal medicine and pathology
  - Laboratory animal science
- **Immunology**
- **Veterinary Infectious Diseases**
  - Veterinary bacteriology
  - Veterinary parasitology
  - Veterinary virology
- **Veterinary Pathology**
  - Anatomic pathology
  - Clinical pathology

### Administrative Staff

#### Chair

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### Graduate Faculty

#### John R. Barta

BSc, PhD Toronto - Professor

#### Dorothee Bienze

DVM, MSc Guelph, PhD McMaster, Diplomate ACVP - Professor

#### Patrick Boerlin

DVM, PhD Bern - Associate Professor

#### Byram Bridle

BSc, MSc, PhD Guelph - Assistant Professor

#### Jeff Caswell

DVM, DVSc Guelph, PhD Saskatchewan, Diplomate ACVP - Professor and Graduate Coordinator

#### Robert A. Foster

BVSc (Hons) Queensland, PhD James Cook Univ. of North Queensland, MANZCVS, Diplomate ACVP - Professor

#### Robert M. Jacobs

BSc Toronto, DVM, PhD Guelph, Diplomate ACVP - Professor and Chair

#### Claire Jardine

BSc Guelph, MSc British Columbia, DVM, PhD Saskatchewan - Associate Professor

#### Brandon N. Lillie

DVM, PhD Guelph, Diplomate ACVP - Assistant Professor

#### John S. Lumsden

BSc, DVM, MSc, PhD Guelph, Diplomate ACVP - Professor

#### Janet I. MacInnes

BSc Victoria, PhD Western Ontario - Professor

#### Bonnie A. Mallard

BSc, MSc, PhD Guelph - Professor

#### Éva Nagy

DVM, PhD, DSc Budapest - Professor

#### Nicole Nemeth

DVM, PhD Colorado State University - Assistant Professor

#### Andrew S. Peregrine

BVMS, PhD, DVM (Hons.) Glasgow, Diplomate EVPC, Diplomate ACVM - Associate Professor

#### Brandon L. Plattner

BSc, DVM Kansas State, PhD Iowa State, Diplomate ACVP - Assistant Professor

#### Shayan Sharif

DVM Tehran, PhD Guelph - Professor

#### Dale A. Smith

DVM, DVSc Guelph - Professor

#### Patricia V. Turner

BSc McMaster, MSc Dalhousie, DVM, DVSc Guelph, Diplomate ACLAM, Diplomate ABT - Professor

#### J. Scott Weese

DVM, DVSc Guelph, Diplomate ACVIM - Professor

#### R. Darren Wood

DVM Prince Edward Island, DVSc Guelph, Diplomate ACVP - Associate Professor

#### Geoffrey A. Wood

DVM Guelph, PhD Toronto, DVSc Guelph - Associate Professor

#### K. Sarah Wootton

BSc, PhD Guelph - Associate Professor

### MSc Program

The primary objective of the MSc program is to provide students with training in conceptual and laboratory aspects of research, combined with advanced training in a field of knowledge relating to manifestations, basic mechanisms and host resistance for diseases of vertebrates.

### Admission Requirements

Applicants should have either a an honours degree in biological sciences with at least a 'B' average during the final 2 years of the program, or a DVM (or equivalent) degree with at least a 'B' average over the four years of the program. In either case, performance in relevant biomedical science courses, (e.g. microbiology, immunology, biochemistry, molecular biology, etc.) at a level above the minimum 'B' average is normally expected. Admission requires a statement of the applicant's interests and objectives and supportive letters of reference. An appropriate faculty advisor must be identified, as well as potential sources of funds for research and for provision of a stipend for the student. Applications may be submitted at any time. Initial enrolment can be in the Fall, Winter or Summer semesters, with a preference for the Fall.

### Degree Requirements

Students must complete at least 1.5 credits of prescribed courses with at least a 'B' average, and must satisfactorily write and defend a research thesis. Prescribed courses and additional courses are selected by the student in consultation with the advisor and advisory committee based on the student's background and their research and career objectives. The departmental Graduate Seminar course PABI\*6440 is prescribed for all MSc students. The thesis research is planned by the student in consultation with the advisor. Research plans and progress must be approved by the advisory committee. The thesis defence includes a seminar presentation and a final oral examination by a committee of graduate faculty members.

See also the MSc Degree Regulations in the Graduate Calendar.

### PhD Program

The PhD program is designed primarily for students who aspire to a career involving research on the biology of mechanisms of diseases in vertebrates. The program provides advanced training in conceptual and laboratory aspects of independent research, combined with advanced training in one or more fields of knowledge. The major emphasis is on the generation and critical evaluation of scientific knowledge relating to the causes, mechanisms and/or consequences of diseases affecting a particular species, organ system or biological process or to the understanding of host resistance and basic mechanisms of health or disease in vertebrates. DVM (or equivalent) graduates may obtain some of the practical experience required for specialty certification in veterinary anatomic pathology, clinical pathology, laboratory animal science, microbiology or parasitology.

### Admission Requirements

The usual requirement for admission to the PhD program is the completion of an approved MSc degree with a minimum 'B+' average and strongly supportive letters from referees familiar with the background of the applicant. Performance in relevant biomedical science courses, (e.g. microbiology, immunology, biochemistry, molecular biology, etc) at a level above the 'B+' average is normally expected. Students may apply for admission into the PhD program before completing the MSc program, providing that they have a minimum 'A' average and a demonstrated capacity for independent research. Some students with demonstrated potential for independent research and a superior academic record during their baccalaureate or DVM programs may be admitted directly into the PhD program.

Admission requires a statement of the applicant's interests and objectives and supportive letters of reference. An appropriate faculty advisor must be identified, as well as potential sources of funds for research and provision of a stipend for the student. Applications may be submitted at any time. Initial enrolment can be in the Fall, Winter or Summer semesters, with a preference for the Fall.

## Degree Requirements

Students must have successfully completed the department's graduate seminar course, PABI\*6440, and have obtained at least a 'B' average in all courses prescribed by the advisory committee. There are no other specific course requirements. Prescribed courses and additional courses are selected by the student in consultation with the advisor and advisory committee based on the student's background, their research and career objectives. Students are required to satisfactorily complete a qualifying examination before the end of the fifth semester if they possess an MSc degree, or before the end of the seventh semester if they possess an honours baccalaureate or DVM degree. The qualifying examination is conducted by a committee of graduate faculty members with expertise in the areas of study, and includes written and oral components. The qualifying examination covers a breadth of knowledge of topics related to the student's research area, and depth of knowledge within this research area. To successfully complete the examination, students must have a broad general understanding of one of the departmental fields of study, and a current and detailed understanding of one or two additional areas in their field of study. The advisory committee identifies selected areas of study by the end of the second semester. In addition, the advisory committee is required to confirm that the student has demonstrated both ability and promise in research. This is based on performance in the research project and in courses and other academic activities.

The thesis research is planned by the student in consultation with the advisor. The proposed thesis research is developed and defended as part of the course PABI\*6440, Graduate Seminar in Pathobiology. Research plans and progress must be approved by the advisory committee. The program is completed with the satisfactory presentation and defence of a thesis, which includes a seminar presentation and a final oral examination by a committee that includes an external examiner and members of the graduate faculty.

See also the Degree Regulations in the Graduate Calendar.

## DVSc Program

The Department of Pathobiology participates in the DVSc program which provides advanced training in a specialty discipline of veterinary medicine, combined with course work and a thesis-based research project. Specialty training is offered in the areas of veterinary anatomic pathology, veterinary clinical pathology, veterinary clinical microbiology, laboratory animal science, wildlife and zoo animal medicine and pathology, avian medicine and pathology, and fish pathology. The research project addresses an applied aspect of an important disease problem in vertebrates. The program provides practical training towards specialty certification in veterinary anatomic pathology, veterinary clinical pathology, laboratory animal science, veterinary clinical microbiology or veterinary parasitology. Refer to the Degree Regulations in the Graduate calendar for more information.

## Admission Requirements

Applicants require a DVM (or equivalent) degree with high academic standing from a program that provides eligibility for the practice of veterinary medicine in Ontario. Alternatively, applicants with a DVM (or equivalent) degree can be admitted after completion of an acceptable graduate diploma, MSc, or PhD degree with an upper 'B' average. Admission requires the identification of a faculty advisor and a source of personal support for the student. If these have not been arranged by the applicant, a statement of the applicant's interests and objectives and supportive letters of reference are required to assist with the identification of an appropriate faculty advisor and potential sources of funds for research and student stipend. Several stipends for DVSc candidates are available intermittently for training in some disciplines. As these funds become available, stipends are awarded to the most qualified applicant(s) based on completed applications for admission to the DVSc program. Applications may be submitted at any time. Initial enrolment can be in the Fall, Winter or Summer semesters.

## Degree Requirements

The degree requires a minimum of nine semesters of full-time study; the completion of at least 2.5 credits in courses prescribed by the student's advisory committee including completion of the department's graduate seminar course, with an overall average of at least 'B-', and satisfactory completion of a qualifying examination, thesis and final oral examination.

See also the Degree Regulations in the Graduate Calendar.

## Graduate Diploma Program

The objective of the diploma program is to provide advanced practical training in a field of veterinary pathology to veterinarians working in industry, government or in private practice. The program emphasizes practical and course-based applied training in anatomic pathology, clinical pathology, avian medicine and pathology, laboratory animal science, or wildlife and zoo animal pathology. The Diploma program does not normally result in eligibility for specialty certification.

## Admission Requirements

Applicants require a DVM (or equivalent) degree with acceptable academic standing. Admission requires the prior identification of a faculty advisor and a source of personal support for the student.

## Diploma Requirements

The Graduate Diploma requires three semesters of full time study and completion of 1.5 credits of prescribed courses, including 0.5 credits in an applied course and no more than 0.5 credits in a Special Topics course. The remaining credits may be in the defined area of study, as prescribed by the faculty advisor. Diploma students must satisfactorily pass a final oral comprehensive examination on knowledge in their field of study. It will be conducted by faculty members in the Department of Pathobiology. There is no thesis, but students are required to write a paper that the advisor considers ready for submission to a peer reviewed scientific journal.

See also the Graduate Diploma Regulations of the Faculty of Graduate Studies.

## Courses

### General

#### PABI\*6440 Graduate Seminar in Pathobiology S,F,W [0.50]

Following discussions of approaches to scientific research and communication, students will develop and submit a thorough written critical review of the literature on an agreed upon topic, and a detailed research proposal in the same topic area. This material will also be presented in the form of a public seminar.

*Department(s):* Department of Pathobiology

#### PABI\*6960 Special Topics in Pathobiology F,W,S [0.50]

In-depth independent study of subjects related to student's principal area of interest. Major paper(s), laboratory studies, and/or written and oral examination, with or without seminar preparation.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

### Comparative Pathology

#### PABI\*6050 Applied Avian Pathology I F [0.50]

Examination and interpretation of gross and microscopic lesions of domestic poultry.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6060 Applied Avian Pathology II W [0.50]

A continuation of PABI\*6050, emphasizing seasonal differences in diseases as well as diseases more commonly associated with winter conditions.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6070 Applied Avian Pathology III S [0.50]

A continuation of PABI\*6060, emphasizing seasonal differences in diseases as well as diseases more commonly associated with summer conditions.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6221 Comparative Veterinary Pathology I U [0.50]

Pathological changes associated with diseases of amphibia, reptiles, wild and captive non-domestic birds, and wild mammals including fur-bearers.

*Offering(s):* Offered in even-numbered years.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6222 Comparative Veterinary Pathology II U [0.50]

Pathological changes associated with diseases of poultry and pet birds, fish and various laboratory animals.

*Offering(s):* Offered in even-numbered years.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6630 Applied Comparative Pathology I S,F,W [0.50]

Introductory course in the diagnostic pathology of mammals, birds, reptiles, amphibians, and fish. Cases may be restricted by animal taxa or context (e.g., free-ranging Canadian wildlife, zoological collections, aquaculture). The three Applied Comparative Pathology courses build in expected level of accomplishment.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

#### PABI\*6640 Applied Comparative Pathology II S,F,W [0.50]

Intermediate course in the diagnostic pathology of mammals, birds, reptiles, amphibians, and fish. Cases may be restricted by animal taxa or context (e.g., free-ranging Canadian wildlife, zoological collections, aquaculture). The three Applied Comparative Pathology courses build in expected level of accomplishment.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology



**PABI\*6650 Applied Comparative Pathology III S,F,W [0.50]**

Advanced course in the diagnostic pathology of mammals, birds, reptiles, amphibians, and fish. Cases may be restricted by animal taxa or context (e.g., free-ranging Canadian wildlife, zoological collections, aquaculture). The three Applied Comparative Pathology courses build in expected level of accomplishment.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6700 Laboratory Animal Science U [0.50]**

Basic information on various aspects of laboratory animal science, including IACUC function, regulatory oversight, ethics, historical review of animal research, animal models and alternatives, experimental design and considerations, biology, management and use of common species in research.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6710 Applied Laboratory Animal Science I U [0.50]**

This course will emphasize practical aspects of laboratory animal science including research protocol review, writing and reviewing standard operating procedures, animal monitoring, pathology procedures, and case management.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6720 Applied Laboratory Animal Science II U [0.50]**

Continuation of I with emphasis on biohazard and personnel safety, monitoring for disease, quality control and diagnostic procedures.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6730 Applied Laboratory Animal Science III U [0.50]**

Continuation of I and II, with emphasis on a comparison of programs and procedures in other facilities in Canada, nonhuman primate medicine, and surgical, clinical and necropsy procedures.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6740 Avian Diseases U [0.50]**

Detailed study of recent concepts of preventive medicine, diagnosis and therapeutics as applied to clinical recognition and control of avian diseases.

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**Immunology****PABI\*6100 Immunobiology F [0.50]**

Major areas of immunology, including initiation, regulation, receptors, genetics, immune system development and function.

*Department(s):* Department of Pathobiology

**PABI\*6190 Topics in Immunology W [0.50]**

Aspects of immune and non-specific host resistance, diagnostic immunology and immune-mediated disease.

*Department(s):* Department of Pathobiology

**Veterinary Infectious Diseases****PABI\*6000 Bacterial Pathogenesis F [0.50]**

An overview of key concepts in bacterial pathogenesis with emphasis on veterinary and zoonotic pathogens.

*Department(s):* Department of Pathobiology

**PABI\*6180 Clinical Bacteriology U [0.50]**

Current techniques and approaches in diagnostic bacteriology.

*Department(s):* Department of Pathobiology

**PABI\*6330 Viral Diseases F [0.50]**

A study of important viral diseases of animals, with emphasis on etiology, host responses, diagnosis and control.

*Offering(s):* Offered in odd-numbered years.  
*Department(s):* Department of Pathobiology

**PABI\*6350 Molecular Epidemiology of Bacterial Diseases W [0.50]**

This is a basic introduction to molecular epidemiology of bacterial diseases. It provides an understanding of molecular epidemiology methodologies and of their use for improving our understanding of infectious diseases epidemiology and control.

*Prerequisite(s):* STAT\*2040 Statistics I  
*Restriction(s):* Lab component: limited number of participants and WHIMIS certificate compulsory.  
*Department(s):* Department of Pathobiology

**PABI\*6550 Epidemiology of Zoonoses W [0.50]**

Characterization and distribution of diseases common to people and animals.

*Department(s):* Department of Pathobiology

MCB\*6330 [0.50] Molecular Biology of Viruses

**Veterinary Pathology****PABI\*6030 Applied Clinical Pathology I F,W,S [0.50]**

Introduction to laboratory procedures and interpretation of data arising from hematology, cytology, clinical chemistry, urinalysis and hemostasis analysis of clinical material (Intended for students training in clinical pathology.)

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6040 Applied Clinical Pathology II U [0.50]**

A continuation of PABI\*6030 with greater depth in the interpretation of data and increased understanding of ancillary diagnostic methods applied in clinical case material. (Intended for students in training in clinical pathology.)

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6041 Applied Clinical Pathology III U [0.50]**

A continuation of PABI\*6040 with independent and comprehensive interpretation of diagnostic test results, and analysis of laboratory quality assurance quality control procedures. (Intended for students training in clinical pathology)

*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6080 Diagnostic Pathology I S,F,W [0.50]**

An introductory course of diagnostic pathology, including all body systems but emphasizing diseases affecting the whole body and respiratory, urinary and digestive (including liver and pancreas) systems. (Intended for students in training in anatomic pathology.)

*Restriction(s):* Instructor consent required. Veterinarians licensed by CVO, engaged in applied anatomic pathology training  
*Department(s):* Department of Pathobiology

**PABI\*6090 Diagnostic Pathology II S,F,W [0.50]**

An intermediate course that builds on the skills acquired in PABI\*6080 and further enhances diagnostic veterinary pathology skills to include diseases of the nervous, endocrine and musculoskeletal systems. (Intended for students training in anatomic pathology.)

*Restriction(s):* Instructor consent required. Veterinarians licensed by CVO, engaged in applied anatomic pathology training  
*Department(s):* Department of Pathobiology

**PABI\*6091 Diagnostic Pathology III S,F,W [0.50]**

An advanced course that builds on the skills acquired in PABI\*6090 and further enhances diagnostic veterinary pathology skills to include diseases of all organ systems. (Intended for students training in anatomic pathology.)

*Restriction(s):* Instructor consent required. Veterinarians licensed by CVO, engaged in applied anatomic pathology training  
*Department(s):* Department of Pathobiology

**PABI\*6104 Mechanisms of Disease W [0.50]**

Molecular, cellular and tissue processes involved in the pathogenesis of adaptive, degenerative, inflammatory, infectious, proliferative and neoplastic diseases.

*Department(s):* Department of Pathobiology

**PABI\*6105 Integrative Pathology U [0.50]**

Basic and interpretive tissue and biochemical concepts of disease in the liver, pancreas, kidney, endocrine and hemolymphatic systems.

*Offering(s):* Offered in even-numbered years.  
*Restriction(s):* Instructor consent required.  
*Department(s):* Department of Pathobiology

**PABI\*6110 Pathology I W [0.50]**

Disease processes of the respiratory, integumentary, reproductive and skeletal systems.

*Offering(s):* Offered in even-numbered years.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

**PABI\*6130 Pathology II W [0.50]**

Disease processes of the alimentary, central nervous, cardiovascular and muscular systems and special senses.

*Offering(s):* Offered in odd-numbered years.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

**PABI\*6300 Clinical Pathology I U [0.50]**

Principles and applications of veterinary hematology and cytology, with emphasis on the hematopoietic systems.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology

**PABI\*6320 Clinical Pathology II W [0.50]**

In depth study of principles and applications of biochemical tests to evaluate the function of selected organ systems, including the renal, hepatic, pancreatic and endocrine systems.

*Restriction(s):* Instructor consent required.

*Department(s):* Department of Pathobiology