



DEPARTMENT OF ZOOLOGY  
HONOURS  
IN  
PHYSIOLOGY  
PROSPECTUS  
  
2022

## DEPARTMENTAL CONTACT INFORMATION

Should you have any queries; the following people in the Department can be contacted for further information.

Secretary: **Ms Nomcebo Dunge**

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## INTRODUCTION

The Honours course is only presented on a full-time basis. Therefore, students must be available full-time from Monday to Friday for lectures from February until the end of November (should there be a change in the starting date, it will be communicated to successful applicants).

In the Zoology Department, it is assumed that no student should leave the University before obtaining at least four years of training (Honours). Therefore, courses are developed to run from the first year to the fourth. Since the application process is competitive, all potential students cannot be accepted and therefore should apply online for admission before the specified deadline in the year preceding the study year.

## APPLICATIONS

Applications open **1 April** and closes 30 September. The selection process is finalized after the final examinations of all applicants have been concluded. Students whose applications were successful, will be notified via email by the Department of Zoology.

### Conditions of acceptance

A restricted number of students will be accepted annually. This number is determined by the available places in the department. The conditions of acceptance are:

- a) A BSc degree with Physiology as major or equivalent
- b) An average of 65 % in Physiology or equivalent at graduate level
- c) As part of the application process, the department can, at its discretion, request an English proficiency test or a written essay, evaluated by the academic staff of the Department of Zoology.

### Students can apply online at:

<https://www.uj.ac.za/studyatUJ/sec/Pages/postgraduate.aspx>

UJ Students apply as a Returning or Internal Applicant (Right-hand side of screen). Students applying from other universities may use the same link but will apply as a New Applicant.

### Documents required for application:

South African students:

- Certified ID copy
- Certified copy of most recent Academic Record

Students applying from outside South Africa:

- Certified Passport copy
- SAQA evaluation of undergraduate degree
- Certified copy of most recent Academic Record

### Checklist for application:

- Valid CURRENT email address
- All documents must be certified
- All documents scanned separately as tiff, pdf, jpg or gif

- Maximum file size of 512KB

### **FINANCIAL AID**

Prospective students should note that a number of bursaries are available for students with merit and you must apply on the dates specified by the bursar.

Additional information is available here:

<https://www.uj.ac.za/postgraduate/Pages/Funding-for-Postgraduate-Studies.aspx>

You may also apply for an assistantship in the department.

### **RESEARCH PROJECT**

As part of the Honours programme, each student must complete a research project. Supervisors provide the various topics and under their supervision, each student must complete the project and present it at a departmental colloquium and hand in a written scientific report. Subject to approval, students are welcome to submit their own project topics for consideration.

### **HONOURS PROGRAMME**

**NQF Level:** 8  
**Credits:** 120  
**Rules of access:** BSc degree with Physiology or equivalent as major.

The BSc Hons Physiology (H2021Q) programme includes the following modules: PHS8X03, PHS8X04, PHS8X05, PHS8X06, PHS8X07, PHS8X08, PHS8X09 AND PHS8X00. Scientific Methodology (PHS8X09) is a prerequisite for the Research Project (PHS8X00).

The department annually determines the specific modules that will be presented.

### **Assessment**

Assessment of the modules will take place on a continuous basis throughout the year. Results will be published as it becomes available. The Academic Regulations with regard to continuous assessment will apply.

### Summary of modules in Physiology Honours

<b>Course</b>	<b>Module</b>	<b>Credits</b>
PHS8X03	Cell Physiology	8
PHS8X04	Morphometrics	8
PHS8X05	Endocrinology	16
PHS8X06	Cardiorespiratory Physiology	16
PHS8X07	Neurology	16
PHS8X08	Environmental Physiology	16
PHS8X09	Scientific Methodology	10
PHS8X00	Research Project	30
	<b>TOTAL</b>	<b>120</b>

## MODULE INFORMATION

### Module: PHS8X03 Cell Physiology

**NQF Level:** 8

**Credits:** 8

**Purpose:** The purpose of this module is to describe the relationship between the structure and the specialized functions of cells and tissues, compare the different transport mechanisms and explain the effect of toxicants on different cells and tissue types.

**Specific outcomes:** On completion of this learning event, the student should be able to:

- Discuss the relationship between the structure and the functions of the cell membrane.
- Explain and compare the processes of various transport mechanisms in the cell to facilitate the absorption or removal of substances.
- Explain the origin and significance of the transmembrane potential.
- Discuss the relationship between the structure and the functions in different tissue types.
- Assess the changes in the cell structure after the exposure to toxicants.

### Module: PHS8X04 Morphometrics

**NQF Level:** 8

**Credits:** 8

**Purpose:** As analytical methods, morphometric techniques are highly versatile. They can be applied on normal, pathological (abnormal), animate, inanimate, homogenous, and heterogeneous structures at gross or microscopic levels. This part of the course will expose students to techniques of nonbiased sampling of biological tissues and the various methods of determining sample size adequacy. It will comprise of 36 hours of lectures and 9 hours of practicals. The theoretical bases of morphometry will be presented in the lectures while hands on exposure to the analytical techniques will be given in the sessions.

The various methods of volume density determination like planimetry, line integration, and point counting will be outlined and the limitations and strengths inherent in them highlighted. Histological sections will be analysed using ocular graticules and electron micrographs using quadratic overlay acetate grids. Absolute volume will be calculated from volume densities. Surface area will be determined by intersection counting. It will be done on light microscopic sectional tissue preparations and electron micrographs. Numerical- and length densities will be determined by counting sectional profiles of discrete structures. The ways and means of avoiding bias during sampling and tissue analysis will be presented.

**Specific outcomes:**

At the end of the series of lectures, it will be expected that a student will:

- Appreciate the importance of quantitation of organisms and their tissues in understanding function.
- Be able to critically define the parameters in an organism or tissue that are needed to understand specific functions.
- Be able to critically sample and analyse an organism or its tissue components in a nonbiased way in order to generate concrete results.

**Module: PHS8X05 Endocrinology****NQF Level:** 8**Credits:** 16**Purpose:** The purpose of this module is to develop the student's reasoning in the functioning and application of the endocrine and Nervous system's role as a major regulatory system in living organisms.**Specific outcomes:** On completion of this learning event, the student should be able to:

- Describe the importance and functioning of the four classes of chemical messengers.
- Critically discuss the functioning and characteristics of hormones.
- Explain the control of hormone secretion and the receptors and mechanisms of action.
- Critically discuss endocrine glands, their hormones, functions and possible pathophysiology.

**Module: PHS8X06 Cardiorespiratory Physiology****NQF Level:** 8**Credits:** 16**Purpose:** The purpose of this module is to develop student's reasoning in the functioning and importance of the Cardiorespiratory system's role and application in animals.**Specific outcomes:** On completion of this learning event, the learner should be able to:

- Discuss the macro-, micro anatomy and histology of the heart
- Critically discuss the electrical activity of the heart
- Describe the cardiac cycle with reference to the pressure in each chamber, phases of the ECG and the heart sounds under load
- Discuss and interpret the physiology of circulation
- Discuss the macro-, micro anatomy and histology of the respiratory system
- Critically discuss the physiology of respiration
- Argue the effects of increased stress on the cardiovascular system and oxygen transport

**Module: PHS8X07 Neurology****NQF Level:** 8**Credits:** 16**Purpose:** A learner credited with this module will be able to understand the specialized functions of neurons, specify the routes by which different ions and molecules enter or leave a cell and understand how the brain functions. The objective of this module is also to enable the learner to explain the chemical, biochemical and cellular processes involved in the effects of drugs (i.e. pharmacology; integration with the nervous system). The practical work will enable learners to evaluate results obtained during practical work, analyse the results and compile a report on the results.**Specific outcomes:** On completion of this learning event, the student should be able to:

- Explain the role and structure of ion channels in signalling.
- Explain the transport of ions across the membrane and its role in determining the ionic basis of resting and membrane potentials.
- Explain how neurons act as conductors of electricity and the functions and properties of neuroglial cells.

- Explain the cellular and molecular biochemistry processes involved in direct and indirect synaptic transmission, transmission release, and synaptic plasticity.
- Explain the functioning of the autonomic nervous system.
- Explain the transduction of mechanical and chemical stimuli, processing of somatosensory and auditory signals.
- Specific outcomes: The objective of this module is to enable the learner to explain the chemical, biochemical and cellular processes involved in signal generation and conductance in the nervous system and to discuss the integrative processes involved in the nervous system. The effects of drugs (i.e. pharmacology) will be utilised in the latter part of the module.
- • Demonstrate a workable knowledge of the pharmacology of the neuromuscular junction, signalling in the nervous system and all integrative mechanisms.

### **Module: PHS8X08 Environmental Physiology**

**NQF Level:** 8

**Credits:** 16

**Purpose:** The physiological responses of animals in the field to changes in the environment are important for their survival. This course focuses on the physiological adaptations by organisms in different environments with the emphasis on extreme conditions such as deserts, polar regions and the ocean depths. Questions were asked on how animals survive under these extreme conditions e.g. very cold, little water and great depths. Physiological adaptations take place to ensure survival and growth under these environmental conditions. The mechanisms used by the different organs and organ systems to maintain homeostasis in the body, are studied.

**Specific outcomes:** After successfully completing the course a candidate will:

- Understand the nature and levels of adaptation of animals in their environment.
- Explain the fundamental mechanisms of adaptation.
- Identify the problems animals experience with size and scale in adaptation.
- Discuss how organisms survive in special aquatic habitats.
- Discuss physiological adaptations by organisms in terrestrial habitats
- Demonstrate an understanding of animal survival in extreme terrestrial habitats.
- Explain the mechanisms used to adapt to habitats in the marine, shoreline and estuarine environments.
- Identify and describe the mechanisms of adaptation used by organisms to survive in fresh water environments.

### **Module: PHS8X09 Scientific Methodology**

**NQF Level:** 8

**Credits:** 10

**Purpose:** The purpose of this module is to prepare students for scientific research methods and scientific reasoning. The aspects of scientific methods will include animal housing for research, preparing and analysing tissue samples, photographic techniques in the field and in the laboratory, working with data sets and scientific writing. The aspects of scientific reasoning will include the origin and development of the scientific method and its application in biological studies.



**Specific outcomes:** After successfully completing the course a candidate will:

- Criticize and evaluate the use, function and management of the aquarium and controlled environmental facilities and other animal housing methods.
- Practically demonstrate techniques for preparing animal tissues for microscopic investigation employing standard techniques. Discuss other tissues used in scientific study
- Demonstrate photographic techniques in the laboratory and in the field, show awareness of GIS applications.
- Create a data set in excel.
  - o Distinguish between nominal, ordinal and continuous graphs.
  - o Interpret univariate and multi-variate descriptive statistics and graphs.
  - o Formulate a null and alternative hypothesis.
  - o Test basic statistical hypotheses and interpret the results.
  - o Determine a simple linear regression equation and interpret the results.
  - o Interpret the results of logistic regression and chaid.
- Discuss the origin and further development of ideas and concepts related to the scientific methods and the contributions of 21st century science philosophers to the modern scientific method.
- Write a scientific manuscript according to the prescriptions of the scientific method, create figures and tables and add it to the manuscript.

**Module: PHS8X00 Research Project**

**NQF Level:** 8

**Credits:** 30

**Prerequisite:** PHS8X09

**Purpose:** Students have the opportunity to select a project of their choice, plan a project, generate and collect experimental data on a specific research topic in the research focus areas of the department, interpret results in terms of current subject information, make inferences and recommendations and present it as a written report and an oral presentation.

**Specific outcomes:** On completion of this learning event, the student should be able to:

- Gain theoretical and practical knowledge of the field of the specific project.
- Collect experimental data on the aspects motivated in the project proposal.
- Interpret the results obtained.
- Generate inferences and recommendations.
- Present the results in an understandable format at a colloquium.

**A written and oral presentation of the project and results will have to be prepared and compiled.**

## PREVIOUS PROJECTS

The following projects were done over the past three years in the Department:

### 2019

1. Hatching success of *Clarias gariepinus* eggs after the exposure to the organochlorine pesticide methoxychlor
2. The effects of the organochlorine pesticide Aldrin on the hatching success of *Clarias gariepinus* eggs
3. An investigation on the occurrence of renal amyloidosis in *Clarias gariepinus* in the Roodeplaat Dam and Klipspruit System
4. A comparison of biomarker responses of *Labeobarbus kimberleyensis* in the Upper and Lower water management areas of the Vaal River
5. A histological assessment of the heart of *Clarias gariepinus* from two polluted aquatic ecosystems in Gauteng Province, South Africa
6. Bioaccumulation of vanadium (V) in the tissue of African Clawed Frog *Xenopus laevis* after chronic exposure
7. Determining population dynamics using age and growth rates of *Labeobarbus* spp. Along the Vaal River catchment
8. Branching: a naturally conserved structural design of life
9. The structure of the respiratory system (lungs-air sacs) of the domestic fowl, *Gallus gallus* variant *domesticus*
10. The investigation on the feeding preferences of blowfly adults, larvae and female oviposition in a cave environment
11. Using ecological niche modelling to understand *Afrolittorina* distribution
12. An assessment of biomarkers in *Clarias gariepinus* in the Lower Vaal River System
13. Using Ecological Niche Modelling to predict the global extent of the European Starling invasion under current and future climates
14. Biomarker response of Smallmouth yellowfish *Labeobarbus aeneus* to water within the Vaal Dam
15. Bioaccumulation of vanadium (V) in the tissues of the African Clawed Frog, *Xenopus laevis* after acute exposure
16. Assessment of sediment toxicity using the Ostracodtoxkit with specific focus on metal accumulation
17. Describing preliminary spermatogenesis in the male Scalloped Hammerhead shark, *Sphyrna lewini*, from the coast of Kwa-Zulu Natal, South Africa
18. Re-description of *Cichlidogyrus papernastrema* Price, Peebles and Bamford, 1969 infecting *Tilapia sparmanii* Smith 1840 in Padda Dam, Gauteng using morphological and molecular approaches
19. Determining population dynamics using age and growth rate of *Clarias gariepinus* along Vaal River Catchment

### 2020

1. The effect of increased salinity on the heart rate of Red-rimmed melania (*Melanooides tuberculata*)

2. Physiological effects of metals found in coastal waters on the Mediterranean mussel (*Mytilus galloprovincialis*)
3. The effects of pharmaceuticals in water on aquatic and human health and the associated pathological changes
4. The effect of anesthetics on the cardiac physiology of *Xenopus laevis*
5. The effect of anesthetics on the hematological parameters of *Xenopus laevis*
6. A histopathological study of an indicator fish species used for active biomonitoring in the highly polluted, hyper-eutrophic Roodeplaas Dam
7. DNA barcoding of Kenya's *Macrobrachium* prawns
8. Improving sponge taxonomy using mitogenomics
9. The dirty secrets of clean clothing: A case study on the release of microplastics from washing selected garments
10. Bio-indicators to determine the effect of water pollution
11. Investigating the ecology of temporary streams
12. Assessing the upper thermal tolerance of the mayflies *Demoreptus* and *Baetis*

## 2021

1. Pathological effect of camallanid nematodes on the gastrointestinal tract of *Clarias gariepinus* from Lake Heritage, Crocodile River, South Africa.
2. Differences in gene expression between Sardine Run participants and non-running sardines
3. Connectivity assessments of groundwater fauna using environmental DNA
4. A neurological assessment of *Clarias gariepinus* after acute exposure to MC-LR
5. A renal assessment of *Clarias gariepinus* after acute exposure to MC-LR
6. The dirty secrets of clean clothing: A case study on the release of microfibers from washing selected garments.
7. ABT determination in *Melanoides tuberculata*
8. The use of the indigenous *Eudrilus eugeniae* for vermicomposting rather than the red wiggler (*Eisenia fetida*)
9. Assessing water quality of different water sources in the Johannesburg area using a duckweed test.
10. Investigating the ecology of temporary streams
11. Assessment of microplastic pollution in Magaliesberg streams
12. Ultrasound as a noninvasive tool for monitoring reproductive physiology in female *Oreochromis mossambicus*
13. The use of an ultrasound device to determine sex and to perform gonad biopsy in the *Oreochromis mossambicus*
14. Do microplastics present in fish guts have an effect on the parasite load?
15. Phylogeography of an endemic springtail on sub-Antarctic Marion Island