



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences

Fakulteit Natuur- en Landbouwetenskappe
Lefapha la Disaense tša Tlhago le Temo



2016/17

www.up.ac.za/nas



Undergraduate
faculty brochure

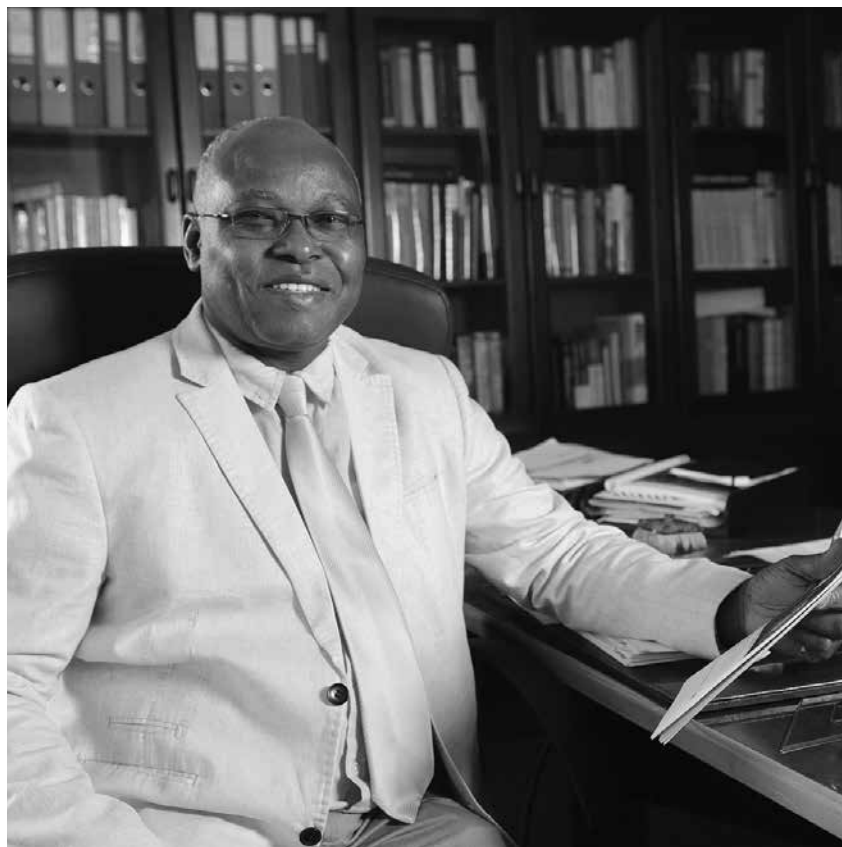
Message from the Dean

Have you ever wondered who is responsible for the quality of the chocolate, canned beverages or pancake mixture you buy in the shops? What is the science behind a cricket ball or pitch? What is nanotechnology? How do specialists treat cancer patients with nuclear technology, or tuberculosis with phyto medicine? Why are actuaries the highest paid profession in the world?

The Faculty of Natural and Agricultural Sciences is one of the most diverse science faculties in South Africa, hosting various disciplines within the broader fields of agricultural, biological, mathematical and physical sciences. We offer graduate programmes that are not only at the forefront of the various disciplines, but also equip graduates to be leaders and problem-solvers in their chosen professions. The key to the Faculty's success is the high premium it places on quality education, research and innovation and this is embodied in the Faculty's approach to training and research.

The University of Pretoria aims to be internationally competitive, while at the same time being locally relevant. Local relevance is assured through close cooperation with industry. In this field, the University has deployed a number of innovations. Its strategic alliance with the Council for Scientific and Industrial Research (CSIR), known as the Southern Education and Research Alliance (SERA), creates unequalled training and research opportunities for students and staff. The Innovation Hub right next to the University's experimental farm is a project of SERA and the Gauteng Provincial Government. Some of the world's foremost high-technology firms are establishing research and development laboratories at the Innovation Hub.

The Faculty is currently associated with nine South African Research Chairs Initiative (SARChI), and has the largest number of researchers at the University who are recognised for excellence by their peers through the National Research Foundation (NRF), including seven A-rated professors. National and international accreditation is the norm for both graduate programmes and research laboratories. The Faculty is serious about ensuring that the market value of the degrees it awards will always give its



Prof Jean Lubuma
Dean: Faculty of Natural and Agricultural Sciences

students a competitive advantage. The Faculty adds value to its degrees, and has a good reputation in the market, which makes its students sought after.

The degree programmes of the Faculty of Natural and Agricultural Sciences are accessible to everybody who meets the Faculty's academic standards. All undergraduate degree programmes with adequate student numbers are presented in both English and Afrikaans (except in certain instances, such as Actuarial Sciences, where programmes are only

presented in English). The University has various financial aid schemes to assist deserving students with bursaries and loans.

The Faculty is involved in several outreach programmes, such as the well-known UP with Science Programme and the BSc – Extended programme. Learners with a love for the unknown, a curious mind and a will to work hard are welcome to apply.

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Large cover photograph courtesy of Simon Elwen.

Produced by the Department of Enrolment and Student Administration in December 2015
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Introduction

The Faculty of Natural and Agricultural Sciences is a diverse faculty with 17 departments, supported by more than 20 centres and institutes that form an integral part of the departments. More than 5 000 students register in this Faculty annually, of which 70% are undergraduate and 30% are postgraduate students.

All degree programmes are designed to produce problem-solving individuals who can easily adapt to changing circumstances and take the lead in their chosen fields of specialisation. The qualifications awarded are of world-class quality and provide access to a multitude of career opportunities for dynamic and creative people. Some of the Faculty's degree programmes are unique to the University of Pretoria, while other programmes are also offered at a few other institutions.

Undergraduate and postgraduate degrees are presented in the following fields:

Biological Sciences <ul style="list-style-type: none"> ▪ Anatomy (Medical Sciences) ▪ Biochemistry ▪ Biotechnology ▪ Ecology ▪ Entomology ▪ Genetics ▪ Human Genetics ▪ Human Physiology ▪ Human Physiology, Genetics and Psychology ▪ Microbiology ▪ Plant Science ▪ Zoology 	Agricultural and Food Sciences <ul style="list-style-type: none"> ▪ Agricultural Economics/Agribusiness Management ▪ Animal Science ▪ Food Sciences and Technology ▪ Food Management ▪ Nutrition ▪ Plant Pathology ▪ Plant and Soil Sciences ▪ Wildlife Management (Postgraduate) Programmes in Consumer Science <ul style="list-style-type: none"> ▪ Food: Retail Management ▪ Hospitality Management ▪ Clothing: Retail Management
Physical Sciences <ul style="list-style-type: none"> ▪ Chemistry ▪ Environmental and Engineering Geology ▪ Environmental Sciences ▪ Geography ▪ Geoinformatics ▪ Geology ▪ Meteorology ▪ Physics 	Mathematical Sciences <ul style="list-style-type: none"> ▪ Actuarial and Financial Mathematics ▪ Applied Mathematics ▪ Mathematical Statistics ▪ Mathematics

Unique programmes in the Faculty:

BSc (Nutrition)	This is the only degree of its kind in South Africa that is offered on an undergraduate and postgraduate level.
BSc (Meteorology)	This is the only degree of its kind offered in sub-Saharan Africa on an undergraduate and postgraduate level.
MSc in Applied Mineralogy	In South-Africa this postgraduate qualification is only offered at the University of Pretoria.

Undergraduate programmes

Important information on undergraduate programmes for 2017

- The following persons will be considered for admission: a candidate who is in possession of a certificate that is deemed by the University to be equivalent to the required Grade 12 certificate with university endorsement; a candidate who is a graduate from another tertiary institution or has been granted the status of a graduate of such an institution; and a candidate who is a graduate of another faculty at the University of Pretoria.
- Life Orientation is excluded in the calculation of the Admission Point Score (APS).
- Grade 11 results are used for the provisional admission of prospective students. Final admission is based on the Grade 12 results.

University of Pretoria website www.up.ac.za/nas
National Benchmark Test website www.nbt.ac.za

Programme	Minimum requirements for 2017													APS
	Achievement level													
	Afrikaans or English				Mathematics				Physical Science					
BIOLOGICAL SCIENCES	NSC/ IEB	HIGCSE	AS- Level	A- Level	NSC/ IEB	HIGCSE	AS- Level	A- Level	NSC/ IEB	HIGCSE	AS- Level	A- Level	30	
	BSc (Biochemistry) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C		C
Careers: Biochemistry offers virtually unlimited opportunities for exciting and challenging careers in industry (fine chemicals, food and pharmaceutical industry and waste processing firms) and research councils, such as the Medical Research Council (MRC), the Agricultural Research Council (ARC), the Cancer Association of South Africa and the Water Research Commission, as well as institutes, academic institutions, the Council for Scientific Research (CSIR) and forensic and pathology laboratories. Career opportunities include those of researchers, teachers, lecturers and medical representatives. Bioinformatics graduates are comfortable in work environments such as universities, research institutes, pharmaceutical companies, biotechnology companies and related industries.														
BSc (Biological Sciences) Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
This is a generic first-year programme in Biological Sciences. Students, who are not sure which specialisation degree programme to choose, may apply for this programme. Students who intend on applying for admission to MBChB or BChD in the second semester when places become available in those programmes may register in the first semester for BSc (Biological Sciences) modules, replacing Mathematics (WTW134) with Science and World Views (FL 155), People and their Environment (MGW112) and Medical Terminology (MTL180), with the provision that these students, should they not be selected and should they wish to continue with one of the Biological Sciences programmes, must complete Mathematics (WTW134) in the second semester of their first year. NB: The minimum admission requirement for MGW112 is an APS score of 34 and a minimum of 70% for Grade 12 Mathematics. Students who wish to apply for admission to one of the BVSc places that become available in the second semester of the same year may register for the prescribed subjects of Biological Sciences and for MTL 181 in their first semester. These students must register for WTW 134 in the first semester.														
BSc (Biotechnology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Graduates find work mostly as laboratory-based researchers or bio-entrepreneurs using medical, animal, plant or microbe-based technologies to develop products and services. If students combine biotechnology with additional qualifications such as law, they will be equipped for success in careers such as patent law, pharmaceutical sales and marketing, project management, computer programming (natural computation) and science journalism. Please note that the level of training/qualification plays an important role in determining what type of work a qualified biotechnologist can become involved in.														
BSc (Ecology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Environmentally based statutory and private conservation organisations, organisations involved in the direct or indirect use of natural resources, and academic and training institutions														
BSc (Zoology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Graduates of the Department of Zoology and Entomology can look forward to a range of exciting career prospects. They could be employed at nature conservancies, environmental consultancies, conservation planning agencies, medical and veterinary research institutions, biochemical and biotechnology industries, educational institutions, IT-related fields and the corporate sector. Career opportunities include the full spectrum of potential activities involved in modern research, development and training. These range from full-time involvement in the field or laboratory to full-time training activities, and usually include a stimulating combination of analytical work, fieldwork and human resources-related work.														

Undergraduate programmes

Programme	Minimum requirements for 2017												
	Achievement level												APS
	Afrikaans or English				Mathematics				Physical Science				
NSC/ IEB	HIGCSE	AS- Level	A- Level	NSC/ IEB	HIGCSE	AS- Level	A- Level	NSC/ IEB	HIGCSE	AS- Level	A- Level		
BIOLOGICAL SCIENCES BSc (Entomology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Employment at nature reserves, environmental consultancies, conservation planning agencies, the biochemical and biotechnology industries, medical and veterinary research, pest management, quarantine and inspection services, museums, educational and research institutions, IT-related fields and the corporate sector. Graduates with expertise in Entomology are particularly highly sought after in the agricultural sector as insect management specialists or researchers.													
BSc (Genetics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
BSc (Human Genetics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Graduates in Genetics generally choose to work as molecular biologists, medical or clinical geneticists, cytogeneticists, biotechnologists, agricultural scientists, molecular ecologists, forensic scientists, genetic counsellors, bioinformaticists and computational analysts, veterinary scientists, teachers or lecturers at various institutions and in bioscience-related industries. If students combine genetics with additional qualifications such as law, they will be equipped for success in careers such as patent law, pharmaceutical sales and marketing, project management, computer programming (natural computation) and science journalism. Please note that the level of training/qualification plays an important role in determining what type of work a qualified geneticist can become involved in.													
BSc (Human Physiology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
BSc (Human Physiology, Genetics and Psychology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Research is performed in cooperation with medical teams in private and government research laboratories (such as the CSIR and the MRC), the SABS, pharmaceutical firms, universities, veterinary and industrial institutions and state departments (for example, the Department of Health). Physiologists are also found in various other fields, such as education (teachers, lecturers and instructors), sport physiology, biostatistics, bioengineering, industrial hygiene, journalism, medical technology and in the industry as representatives of pharmaceutical firms. Graduates with Genetics and Psychology as subjects also have access to postgraduate programmes offered by the departments of Genetics and Psychology (Faculty of Humanities).													
BSc (Medical Sciences) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Postgraduate studies are highly recommended. Honours, master's and doctoral degrees can be obtained in any of the sub disciplines of anatomy, namely neuro-anatomy, clinical anatomy, cell biology, physical and forensic anthropology, histology and embryology. Students who obtain this degree can also continue with postgraduate studies in Physiology, Genetics and Pharmacology. Career opportunities include research in any of the anatomy sub disciplines, academia, forensic sciences and the health science industry. Other careers that can be considered are in the sport sciences, virology, chemical pathology, immunology, health administration or ergonomics. Technical careers, for example, in the anatomy or physiology departments of universities, are also possible. There are only 72 places in the first year of BSc (Medical Sciences). Students who apply for BSc (Medical Sciences) as their first choice before 30 September and who meet the minimum entrance requirements will be admitted until the places are full. Students who indicate it as their second choice and who meet the minimum entrance requirements will be put on a waiting list and will be considered in January of the first year of study, if places are available.													
BSc (Microbiology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Microbiologists can pursue a variety of careers, ranging from practical applications to basic research. Career opportunities are available in the food, dairy, beer, wine and baker's yeast industries, in the fermentation industry, and at mines with regard to corrosion control. Graduates can also follow careers as medical or veterinary microbiologists, as researchers at organisations such as the CSIR, the MRC or the ARC, or as lecturers and researchers at various academic institutions.													

Undergraduate programmes

Programme	Minimum requirements for 2017												APS
	Achievement level												
BIOLOGICAL SCIENCES	Afrikaans or English				Mathematics				Physical Science				APS
	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
BSc (Plant Science) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30
Careers: Careers range from working in a laboratory to studying plants in their natural environment. Employment could be at biotechnology and pharmaceutical firms, South African National Parks, private ecological companies, research institutions such as the CSIR, the ARC, the South African National Biodiversity Institute, etc.													
Candidates who do not comply with the minimum admission requirements for the Biological Sciences programmes above, may be considered for admission to the BSc – Extended programme below. The BSc – Extended programme takes place over a period of four years instead of the normal three years.													
BSc – Extended programme for the Biological and Agricultural Sciences	4	3	D	D	4	3	D	D	4	3	D	D	24
Please note: The BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will soon resort under one School. The curriculum may change. For the most recent information, please consult our website at www.up.ac.za/nas .													

Programme	Minimum requirements for 2017												APS
	Achievement level												
PHYSICAL SCIENCES	Afrikaans or English				Mathematics				Physical Science				APS
	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	
BSc (Chemistry) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32
Careers: Graduates in Chemistry are employed in most technology based institutions and work in a laboratory environment as part of an industrial, research or academic institution. A chemist must be able to participate in teamwork in a multidisciplinary environment in a wide variety of enterprises in both the private and public sectors. It is important to note that the type of work available to a graduate in chemistry depends on the level of the qualification obtained. Advanced qualifications will eventually lead to positions in research and/or production management and require management skills and financial planning. Many career opportunities are found in the sectors of education, research, journalism, environmental protection, food and beverages, energy, water, health, sport, pharmaceuticals and cosmetics, geology, mining and law enforcement. These include the well-known professions of synthetic chemists, materials scientists, chemical pathologists, forensic chemists, analytical chemists, drug analysts, patent lawyers, environmental chemists, geochemists, food chemists, polymer chemists and soil chemists.													
BSc (Physics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32
Careers: University academics, whose duties include lecturing, research and the supervision of postgraduate students, researchers in national laboratories such as the Nuclear Energy Corporation of South Africa (NECSA), the South African Astronomical Observatory or iThemba LABS (Laboratory for Accelerator-based Sciences), researchers in industry such as at the CSIR or Element Six, science advisors for non-governmental organisations, industry or government, radiation scientists, medical and biophysicists, atmospheric scientists and climatologists, developers of renewable energy sources, geophysicists, innovators and entrepreneurs, computational scientists, etc. International collaboration with experts from abroad also takes place.													
BSc (Geography) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32
Careers: There are three main career fields in geography: teaching, research and the application of geographical knowledge and skills in practice. Geographers can focus on environmental management, urban issues such as squatting, regional and rural development, or environmental issues, including pollution and the destruction of ecosystems through activities such as mining, agriculture and tourism. Geographers in the private sector are generally employed by real estate, planning, architecture and engineering firms, banks, tourism organisations, environmental conservation bodies and industry. Government departments involved in forestry, water and land affairs, the environment, tourism and education also employ geography graduates. Parastatal organisations such as the SABS and the CSIR offer career opportunities in the various specialised fields related to the earth and environmental sciences. Many geographers are self-employed. They are mainly involved in areas such as marketing, planning, development, tourism, cartography, geographic information systems (GIS), remote sensing, environmental analysis and environmental auditing. Graduates can also pursue academic careers.													
BSc (Geoinformatics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32
Careers: Graduates are employed, among others, in agriculture, mineral exploration, engineering, forestry, water resource management, weather forecasting, environmental impact assessment (EIA), land-use planning, land development, rural community development, transport planning, tourism, market research, crime prevention, vehicle tracking, cartography, GIS technology, environmental planning and analysis, and disaster and environmental management. Graduates can apply for professional registration as GIS technologists with the South African Council for Professional and Technical Surveyors (PLATO).													

Undergraduate programmes

Programme	Minimum requirements for 2017													APS
	Achievement level													
	Afrikaans or English				Mathematics				Physical Science					
PHYSICAL SCIENCES	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level		
BSc (Geology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32	
<p>Careers: Large international mining companies are major employers of geologists and other geoscientists in research, exploration and mining projects. However, employment is increasingly to be found in smaller, entrepreneurial firms ("Juniors"). Interesting careers are also offered by the Council for Geosciences, the CSIR, the Council for Mineral Technology (MINTEK), the Department of Water Affairs and at museums, engineering firms and consulting companies. Graduates may even operate as self-employed consultants in their own firms. Laboratory specialists like mineralogists identify and examine minerals using sophisticated instruments and analytical equipment. Environmental and engineering geologists study the interaction between human activities and the geological environment, such as the pollution of soil and groundwater. They investigate geological structures and soil, and rock properties at construction sites, for example, dams, tunnels and mines, in order to provide valuable information prior to construction. They also locate and evaluate suitable construction materials. The task of the hydro geologist is to look for groundwater and monitor the responsible exploitation of that water.</p>														
BSc (Meteorology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32	
<p>Careers: Meteorologists are employed by institutions involved in the study, interpretation and prediction of weather and phenomena relating to the climate. The South African Weather Service (SAWS), the CSIR, some universities, agricultural institutions and general industries employ meteorologists who mainly practise as specialists in the following areas:</p> <ul style="list-style-type: none"> ▪ Researchers: They research all aspects of the weather and climate in order to improve understanding of atmospheric phenomena. Atmospheric modellers use supercomputers to solve complex flow dynamic equations of the atmosphere. The monitoring of air quality and the modelling of the impact of air pollution on society are two important aspects that need to be addressed. Research into climate change is receiving increasing attention. ▪ Weather forecasters: It is the duty of the forecaster to analyse data and predict the weather by using models that are run on supercomputers. Weather forecasts are issued on different time scales, from very short-range forecasting to forecasts valid for months ahead, as well as seasonal forecasts. There are also some private weather forecasting positions, such as presenting the weather on television. ▪ Climatologists: They manage important data sets that contain large volumes of information gathered by the SAWS and other organisations. ▪ Consultants: Some meteorologists who work as consultants in the private sector and at universities provide specialised research services. ▪ Lecturers: A few academic positions are available for meteorologists and climatologists at South African universities. They ensure that the training of meteorologists meets international standards. 														
BSc (Environmental Sciences) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32	
<p>Careers: Environmental consultants, air quality managers, environmental impact analysts, environmental protection agents, hazardous material specialists, public health educators, researchers, water quality specialists, natural resource managers, risk managers, environmental educators, wetlands scientists, wildlife conservationists, environmental planners and analysts, wastewater treatment experts, programme and project managers, natural resources experts, researchers</p>														
BSc (Environmental and Engineering Geology) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	32	
<p>Careers: Geologists, mineralogists, extraction metallurgists, economic geologists, geochemists, environmental and engineering geologists, geohydrologists, laboratory specialists, consultants</p>														
Candidates who do not comply with the minimum admission requirements for the Physical Sciences programmes above, may be considered for admission to the BSc – Extended programme below. The BSc – Extended programme takes place over a period of four years instead of the normal three years.														
BSc – Extended programme for the Physical Sciences	4	3	D	D	4	3	D	D	4	3	D	D	26	
<p>Please note: BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will soon resort under one School. The curriculum may change. For the most recent information, please consult our website at www.up.ac.za/nas.</p>														

Undergraduate programmes

Programme	Minimum requirements for 2017													APS
	Achievement level													
	Afrikaans or English				Mathematics				Physical Science					
AGRICULTURAL AND FOOD SCIENCES	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level		
BSc (Food Management) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Food service managers, quality controllers, teachers, researchers, food product developers, marketers, entrepreneurs, consultants, food journalists, teachers and trainers														
BSc (Food Science) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Food scientists with highly marketable training and professional skills work as food risk investigators, quality and safety assurance managers, food chemists, food microbiologists and biotechnologists, packaging and shelf life specialists, safety auditors, product and process development managers, technical sales and marketing advisors, sensory scientists, food bio-scientists (brew masters, flavourists) in the food, food agro processing and related industries. The work environment of food scientists includes laboratories, food production sites and business premises, training areas, retail, government institutions and research organisations. Food scientists also work in industries and companies that manufacture and supply materials (packaging and food additives, such as colourants and flavourants) for the food industry or that have secondary involvement in food production and sales.														
BSc (Nutrition) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Students will be able to register as natural scientists with SACNASP and may continue with a research-based MSc in Nutrition. Careers: The need for graduates with training in nutrition is driven by the worldwide recognition that food does not only meet basic nutrition needs, but also plays a key role in the promotion and maintenance of long-term good health. Career opportunities include working in food or related industries (such as pharmaceutical companies), government departments, international organisations (such as the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO)) or research organisations, and as account managers and advisors in the food, health and consumer sectors.														
BScAgric (Food Science and Technology) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Food scientists with highly marketable training and professional skills work as food risk investigators, quality and safety assurance managers, food chemists, food microbiologists and biotechnologists, packaging and shelf life specialists, safety auditors, product and process development managers, technical sales and marketing advisors, sensory scientists and food bio-scientists (brew masters, flavourists) in the food, food agro-processing and related industries. The work environment of food scientists includes laboratories, food production sites and business premises, training areas, retail, government institutions and research organisations. Food scientists also work in industries and companies that manufacture and supply materials (packaging and food additives, such as colourants and flavourants) for the food industry or that have secondary involvement in food production and sales.														
BScAgric (Agricultural Economics and Agribusiness Management) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Agricultural economists are involved in many different areas of the economy. Some are involved in analysing and understanding consumers' behaviour in terms of their wants, needs and willingness to pay for food and clothing. Other agricultural economists are involved in environmental management and assisting government and businesses to ensure the sustainable use of scarce resources such as water and arable land. Some agricultural economists are traders on global financial markets and work at the Johannesburg Stock Exchange (JSE) in Sandton or at Wall Street in New York. Some other agricultural economists work for banks and in finance, at food processors such as bakers and brewers, while others advise farmers and input suppliers. Some agricultural economists work for the government, advising them on how to ensure that there is enough food for all the people in the country, while other agricultural economists work in commercial banks, advising clients and managers how to manage finance, risk and commodity markets. Agricultural economists also play a vital part in research and development in the agricultural sector. Agricultural economists travel a lot and meet many interesting people. They travel both locally and to most other parts of the world, such as Africa, the USA, China, South America, Australia and Europe. They do this to buy the best inputs to produce food and clothing, but also to identify and understand markets for products. Therefore an agricultural economist is somebody who is interested in people and their culture, in nature, but also in business and management. An agricultural economist needs to be able to interact with people, but also use statistics and mathematics to understand the interaction between people, nature and the economy.														

Undergraduate programmes

Programme	Minimum requirements for 2017													APS
	Achievement level													
	Afrikaans or English				Mathematics				Physical Science					
AGRICULTURAL AND FOOD SCIENCES	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	APS	
BScAgric (Animal and Pasture Science) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Animal science is a career that makes an important contribution to agriculture in South Africa. This career is focused on the application of the scientific aspects of animal production and quality control of the products to ensure consumer satisfaction. It is a field of science, subject to the most recent research and needs of both animals and humans. There are numerous career opportunities for animal and wildlife scientists in research, commercial farming, the public sector and for professionals in the animal science industry. Animal scientists can work on different levels in these sectors, ranging from researchers, animal nutrition or breeding consultants, technical representatives, game managers and policy-makers. The BScAgric (Animal Science) degree is acknowledged as a professional qualification by the South African Council for Natural Scientists in terms of Act 106 of 1993, and is recognised internationally.														
BScAgric (Plant Pathology) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Seed cultivators, farmers, researchers, lecturers, consultants														
BScAgric (Applied Plant and Soil Sciences) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	5	3	C	C	5	3	C	C	30	
Careers: Education and training at schools and academic institutions. Research and management at various public and private institutions														
<ul style="list-style-type: none"> ▪ Public sector: The Agricultural Research Council (ARC), Department of Water and Environmental Affairs, Department of Tourism, Department of Agriculture, Forestry and Fisheries, Department of Mineral Resources, Department of Energy, the CSIR, provincial agriculture and nature conservation departments, the South African National Biodiversity Institute, municipalities, South African National Parks, national farming and food production agencies, etc. ▪ Private sector: Companies involved in seed, fertilizer and plant protection research and development, environmental planning and management, nurseries, vegetable, fruit and ornamental cut flower production, irrigation, etc. ▪ Extension services involving knowledge transfer: Nature conservation, national and provincial departments of agriculture and the environment, environmental management and rehabilitation, nurseries, crop, turf grass and weed management, private companies servicing field crops, vegetables, medicinal and aromatic plants, fruit, ornamental and cut flower production, etc. ▪ Entrepreneurial: Consultants in crop, pasture, vegetable, medicinal and aromatic plants, ornamental and cut-flower production systems and landscaping enterprises. Management of own farms and nurseries for extensive (field) or intensive (tunnel/greenhouse) production systems involving various crops. Managing companies specialising in irrigation, reclamation and soil conservation 														
Candidates who do not comply with the minimum admission requirements for the Agricultural and Food Sciences programmes above, may be considered for admission to the BSc – Extended programme. The BSc – Extended programme will take one year longer to complete.														
Please note: BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will soon resort under one School. The curriculum may change. For the most recent information, please consult our website at www.up.ac.za/nas .														

Programme	Minimum requirements for 2017													APS
	Achievement level													
	Afrikaans or English				Mathematics									
CONSUMER SCIENCES	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	NSC/IEB	HIGCSE	AS-Level	A-Level	APS	
BConsumer Science (Clothing: Retail Management) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	4	3	D	D					28	
Careers: Retail management: Floor or store managers, visual merchandisers, buyers in the fashion industry, fashion advertising, fashion journalists, textile technologists (quality controllers) and entrepreneurs														
BConsumer Science (Foods: Retail Management) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	4	3	D	D					28	
Careers: Managers in restaurants, catering, food service, marketing or sales managers, educators and trainers, journalists, consumer consultants, entrepreneurs, and marketing or sales managers														
BConsumer Science (Hospitality Management) [4 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	4	3	D	D					28	
Careers: Hotel and restaurant managers, hotel chefs de cuisine (executive chefs), hotel executive housekeepers, marketing, sales or catering managers, educators and trainers, journalists, consumer consultants, entrepreneurs														

Undergraduate programmes

Programme	Minimum requirements for 2017								
	Achievement level								APS
	Afrikaans or English				Mathematics				
NSC/ IEB	HIGCSE	AS- Level	A- Level	NSC/ IEB	HIGCSE	AS- Level	A- Level		
MATHEMATICAL SCIENCES BSc (Actuarial and Financial Mathematics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	7	1	A	A	34
Careers: Actuarial and financial mathematics is a popular field, with career opportunities in the business market and at investment institutions like banks and insurance companies. The skills of mathematicians are essential in portfolio management and the modelling of financial risk. This programme prepares students for professional careers as actuaries or financial engineers. For actuaries or actuarial technicians, activities include long-term capital projects, designing the benefits of medical schemes, the management of pension funds, the determination of contributions and financial management on a sound long-term basis, the evaluation of investments in shares, property and other transactions, and the determination of the premiums and reserves for outstanding claims of insurers. Financial engineers can be employed by banks and financial institutions, brokerage firms and investment institutions. The mathematical skills of financial engineers are essential in portfolio and risk management. Activities include asset management (trading in bonds, futures and derivative instruments such as options), designing new financial products, and devising strategies to control credit risk.									
BSc (Mathematics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	6	2	B	B	32
BSc (Applied Mathematics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	6	2	B	B	32
Careers: Graduates in mathematics and applied mathematics are employed by research institutions, educational bodies (universities and schools), the public sector (government, medical institutions, etc) and the private sector (engineering companies, financial institutions, the computer industry, etc). These graduates' training in abstract, analytical and computational thinking provides them with the background to easily adjust to changing circumstances in the professional environment and to construct mathematical models of natural, technological and financial phenomena. Mathematicians and applied mathematicians apply, evaluate and adapt existing problem solving techniques or develop new techniques to solve problems.									
BSc (Mathematical Statistics) [3 years] Closing dates: SA – 30 September Non-SA – 31 August	5	3	C	C	6	2	B	B	32
Careers: <ul style="list-style-type: none"> ▪ Financial institutions: Statisticians specialising in economic applications of statistics (econometrics) deal with aspects such as national production and expenditure, international economic relations, employment, public finance and related issues. In the insurance business, statisticians are employed in areas such as actuarial work, marketing, share investments and property investments. Market research organisations play an indispensable role in the gathering of information that is used to improve the quality of decision-making in various industries. ▪ Industry: Statisticians are increasingly employed in industries such as mining and production, and government corporations, for example, Eskom, Sasol, AECI, and the pharmaceutical industry in general. Organised agriculture is another vitally important industry where sophisticated statistical techniques are used to meet the growing demand for food and services. ▪ Research councils: Research councils and educational institutions are well-known large employers of scientists of diverse disciplines and employ statisticians to ensure scientifically founded research outputs. These include the MRC, the CSIR, the ARC and the HSRC. Statisticians are also involved in the training of students at universities. The challenges of modern education and good research are of great relevance, especially in South Africa. ▪ The public sector: The government employs statistically proficient people in many of its departments, the most prominent being Statistics South Africa. This department is responsible for the five-yearly population census and the calculation of well-known economic indicators like the inflation rate. 									
Candidates who do not comply with the minimum admission requirements for the Mathematical Sciences programmes above, may be considered for admission to the BSc – Extended programme below. The BSc – Extended programme takes place over a period of four years instead of the normal three years.									
BSc – Extended programme for Mathematical Sciences	4	3	D	D	5	3	C	C	26
BSc (Actuarial and Financial Mathematics): Admissions from the BSc – Extended programmes to the BSc (Actuarial and Financial Mathematics) programmes will only be considered if students have passed all their first-year modules with an average percentage of at least 60% as well as a minimum percentage of 60% for WTW 143 and WTW 153.									

BSc – Extended programmes/Biological Sciences

BSc – Extended programmes

The BSc – Extended programmes have lower entrance requirements and are designed for students who are not academically prepared, but who shows the potential to succeed. The programmes include an additional year of study which will enhance students' basic knowledge and skills before progressing onto more specialist studies in the later years of the programmes.

These programmes are gateways into science and science-based programmes, and will be presented in English only. Students admitted to the BSc – Extended programmes will attend classes at Mamelodi Campus during their first year. There is accommodation available close to Mamelodi Campus at the Tuks Naledi Residence, situated in the Savannah Estate. Students who successfully complete their first year, will attend lectures on the Hatfield Campus from their second academic year onwards.

The programmes have two phases. The duration of the first phase is 18 months (three semesters), during which students are trained and developed academically and psychologically for further studies. Students who successfully complete the first phase will obtain credits equivalent to the first semester of the first year of the BSc and BScAgric programmes and may register for the modules of the second semester of a preferred first year in BSc or BScAgric. Transfer to the second year of these specific BSc or BScAgric programmes takes place in the third year of registration.

Features of the BSc – Extended programmes

- In the first phase, the academic content is delivered at a pace that is slower than in the normal degree programmes.
- There are extra modules and support to help students cope with university life.
- Most of the teaching and learning takes place in smaller groups.
- A variety of methods are used to deliver subjects content to remedy possible gaps in school knowledge.

Subject fields in the BSc – Extended programmes

- Mathematical Sciences
- Biological and Agricultural Sciences
- Physical Sciences

Students who wish to follow a career in engineering, should apply for the BSc – Extended programme for the Physical Sciences, and those who wish to study in health sciences or veterinary science, should apply for the BSc – Extended programme for the Biological and Agricultural Sciences.

Biological Sciences

Anatomy (Medical Sciences)

The Department of Anatomy forms part of the School of Medicine in the Faculty of Health Sciences and offers a BSc degree in Medical Sciences within the Faculty of Natural and Agricultural Sciences. The aim of this degree is to train students in the basic medical sciences and this includes clinical anatomy, physical and forensic anthropology, histology and cell biology as well as embryology. Students can combine these subjects with elective modules from the subjects physiology, pharmacology and genetics.

Postgraduate studies

A three-year degree provides a graduate with broad background knowledge and it is strongly advised that students continue

their postgraduate ie honours, master's and doctoral studies in anatomy, physiology, pharmacology or genetics although direction of study is dependent on subjects chosen at a pre-graduate level. Postgraduate studies in sub-disciplines of Anatomy include neuro-anatomy, clinical anatomy, cell biology, physical and forensic anthropology, histology and embryology.

Careers

Graduates are sought by institutes in the academic, government and private sectors. In these sectors our graduates are employed as lecturers, researchers, medical and forensic scientists, and sales representatives in the medical sciences and pharmaceutical industry. Several of our graduates are furthering their postgraduate studies at international research facilities in North America and Europe.

Biochemistry

The role of biomolecules in all living systems is studied in order to explain life processes, and structural and functional aspects of the macromolecules of the cell. By using modern techniques of genome analysis, determination of selective gene expression and metabolic profiles, challenges of national and international scope are addressed, such as HIV/AIDS, malaria, tuberculosis and animal diseases. Students who are interested in this field will be able to apply their knowledge in the fields of agriculture, veterinary science, industry and medicine.

Description of the programme

Biochemistry consists of different areas of specialisation. During the first year of study, students are exposed to a broad range of subjects in the biological and agricultural sciences. In the second and third year, they specialise in chemistry and biochemistry, and their fundamental knowledge is supplemented by appropriate practical studies that give them the opportunity to learn the principles and methodology of research. In the third year, macromolecules, including DNA, proteins and the immune system, are studied in detail in subjects such as proteome analysis, xeno-biochemistry, enzymology, and molecular basis of disease. Meaningful subject combinations are chemistry, microbiology, genetics and physiology. All subjects include theoretical and practical aspects. Students are provided with the opportunity to include elective modules of interest in the programme.

Postgraduate studies in this programme include honours, master's and doctoral degrees. The one-year honours degree generally includes a strong self-study component, exposure to a broad range of applicable technologies and a research project. At master's and doctoral level, students are required to complete research projects in one of the research fields of the Department, which include HIV/AIDS, malaria, tuberculosis, tick-related diseases and plant medicines.

Bioinformatics

Bioinformatics is the application of computer science, mathematics, statistics and informatics techniques to biological data. The biological data may be in the form of protein or nucleic acid sequences, whole genomes, macromolecular structures, expression levels, transcription levels or metabolic pathway models. Bioinformatics has applications at various levels, from pure application to biological problems, to software and algorithm design. Bioinformatics may be applied to the fields of agriculture, veterinary science, medicine, environmental sciences and to information technology-related fields.

Biological Sciences

Bioinformatics is based on biological, mathematical and computer sciences. Postgraduate studies in this programme include honours, master's and doctoral degrees. The one-year honours degree is open to students with degrees in biological sciences, computer science, mathematical statistics or other related fields. Additional biology, computer science or mathematics subjects may be prescribed. At master's and doctoral levels, students are required to complete research projects in bioinformatics.

Careers

Biochemistry offers virtually unlimited opportunities for exciting and challenging careers in industry (fine chemicals, food and pharmaceutical industry and waste processing firms) and research councils, such as the Medical Research Council (MRC), the Agricultural Research Council (ARC), the Cancer Association of South Africa and the Water Research Commission, as well as academic institutions, the Council for Scientific Research (CSIR) and forensic and pathology laboratories. Career opportunities include those of researchers, teachers, lecturers and medical representatives. Bioinformatics graduates are comfortable in work environments such as universities, research institutes, pharmaceutical companies, biotechnology companies and related industries.

Genetics

Genetics and Human Genetics

Genetics is the study of how the genetic material that occurs in the cells of all living organisms, is transmitted from parent to offspring across the generations, and how that genetic material is encoded and decoded to provide the blueprint of all life on earth. This vibrant, pioneering discipline is therefore at the core of the biological, agricultural, veterinary and medical sciences and has become essential in fields as diverse as virology and epidemiology, biodiversity conservation and sustainable agriculture. The advent of advanced technologies continues to enhance existing research strategies. This allows for dynamic interdisciplinary collaboration, not only within the life sciences, but also with fields such as informatics and mathematics. The genomes of numerous animals, plants and pathogens, as well as that of humans have been decoded. This has led to new informative methods for studying gene interactions at various cellular levels. Computational modelling has proven invaluable to novel gene discovery, understanding the origins and spread of emerging viruses (eg H1N1).

Biotechnology

Molecular biotechnology involves the use of in vitro genetic manipulation and recombinant DNA methods to genetically alter plants, animals and microbes for commercial gain. Molecular biotechnologists aim to correct, modify, enhance or exploit specific genetic traits in their target organisms for a wide range of practical purposes. This includes improving food production, managing diseases, conservation and bioremediation. Biotechnology will play a pivotal role in the future of the medical, agricultural, veterinary and ecological sciences.

Description of the programme

The Department of Genetics is an active player on the international scientific stage and offers internationally recognised undergraduate and postgraduate degrees. Our degrees are research oriented and have a strong emphasis on developing analytical skills. The Department of Genetics offers both single and dual major options in our Genetics and Human Genetics programmes. This allows our students the choice to specialise in genetics as a single major, or to combine their genetics subjects with a second multidisciplinary major, such as biochemistry,

microbiology, plant science or zoology, as well as human physiology in the Human Genetics programme.

At undergraduate level, students are provided with a thorough background in the principles of genetics, as well as the applications of these principles in fields as diverse as genomics, plant and animal biotechnology, diagnostics and risk determination, bioethics, conservation ecology, as well as population, behavioural and evolutionary studies, all of which are also topics for further research.

The programme in Biotechnology is an interdepartmental programme aimed at empowering students to pursue their interest in biotechnology with particular emphasis on molecular biology. Undergraduate training in this programme includes exposure to aspects of biochemistry, genetics and microbiology, in addition to the other subjects of their choice. Biotechnology students are encouraged to decide on their postgraduate research direction and to choose their electives accordingly.

Careers

Our graduates acquire skills in numeracy, analytical and critical thinking, as well as creativity in problem-solving and data-handling, all of which equips them for success in both scientific and non-scientific careers. Biotechnologists function in both the science and business spheres enabling graduates to have a competitive advantage for employability in the biological industries. There are an increasing number of opportunities available in privately owned biotechnology laboratories that specialise in contract work. Graduates are, however, encouraged to advance their studies to include postgraduate degrees such as honours, master's and doctoral degrees in Genetics or Biotechnology, as such degrees are usually essential in scientific careers.

Human Physiology

Physiologists study the mechanisms by which the body functions – from molecular and cellular level through progressive differentiation to tissues, organs, systems and eventually the integrated interactions and control of the various body functions. This knowledge is applied in the research investigations of normal and abnormal life processes. Basic and clinical research can be entered into at various levels, such as molecular, cellular, structural and diagnostic. Human physiology is a major for two programmes in biological sciences: BSc (Human Physiology) and BSc (Human Physiology, Genetics and Psychology). Other special physiology modules form part of the training in medicine, dentistry, nursing, dietetics, biokinetics, communication pathology, food science, occupational therapy, physiotherapy, radiography and some consumer science courses. In human physiology, students study the functioning of the human body.

Description of the programme

During the first year of study for BSc (Human Physiology), students are exposed to a generic, basic range of subjects in biological and agricultural sciences. In the second year, various physiological systems (neurophysiology, haematology, cardiovascular physiology, pulmonary physiology, renal physiology, nutrition and digestive physiology, endocrinology and reproductive physiology) are studied with biochemistry as a compulsory subject. The programme is concluded in the third year with a selection of integrated physiology modules such as sport physiology, nutrition and development, psychoneuroimmunology and cell physiology, as well as industrial physiology. At third year level there is an opportunity to select some elective modules in the programme. In addition to the above, psychology and genetics are compulsory subjects in all three years of study of BSc (Human Physiology, Genetics and Psychology).

Biological Sciences

Postgraduate degrees

Students may enrol for a BScHons, MSc and PhD in Human Physiology after completion of BSc (Human Physiology) or BSc (Human Physiology, Genetics and Psychology). After completion of the latter degree, postgraduate degrees in genetics or psychology can also be taken. To be accepted for the honours degree in physiology, an average of 60% is required for the human physiology third year modules. An entrance examination in general physiology also has to be written before selection. A maximum of 12 honours students will be accepted per annum. The one-year honours degree comprises self-study of basic physiology, writing of a seminar, exposure to a series of research techniques, and a research project in sport physiology, cellular physiology or neurophysiology. At master's and doctoral levels, students are expected to complete a research project on one of the research areas in the Department for their MSc dissertation or PhD thesis.

Careers

Research is performed in cooperation with medical teams in private and government research laboratories, such as the CSIR and the MRC, the South African Bureau of Standards (SABS), pharmaceutical firms, universities, veterinary and industrial institutions, state departments (for example, the Department of Health) and health farms.

Physiologists are also found in various other fields, such as education (teachers, lecturers and instructors), sport physiology, biostatistics, bioengineering, industrial hygiene, journalism, medical technology and in the industry as representatives of pharmaceutical firms. Graduates who completed their degrees with Genetics and Psychology also have access to postgraduate programmes offered by the departments of Genetics and Psychology (in the Faculty of Humanities).

Microbiology and Plant Pathology

Microbiology and the associated applied disciplines such as Plant Pathology provide a large diversity of interesting study opportunities. Micro-organisms (viruses, bacteria and fungi) form an essential part of our planet and students are trained to study their functions and roles, as well as how microbes could be used or controlled in our everyday lives.

Micro-organisms are important to health and agriculture due to the diseases they cause. In this regard, microbiologists study the pathogens responsible for serious infectious diseases of humans, animals, wildlife and plants in order to treat and control them. There is also a focus on the different applications where beneficial micro-organisms are used for food production, water purification and other industrial applications.

Microbiology

The basic training of a Microbiologist is a three year BSc degree. Apart from exposure to a broad range of subjects in the biological sciences, there is also a focus on specialised microbiology subjects such as mycology, bacteriology, virology, microbial ecology, clinical microbiology, plant pathology, molecular microbiology, microbial interactions as well as food microbiology. The opportunity also exists for students to combine microbiology with genetics, biochemistry, zoology or plant sciences as part of a dual major degree.

For a career as a researcher, postgraduate studies (Hons, MSc and PhD) are essential. The University of Pretoria has several internationally recognised research programmes and postgraduate students form an integral part of all these

programmes. At the molecular and cellular level the focus is on issues such as the design of new vaccines, understanding pathogenicity, as well as the development of new and improved ways to detect and quickly identify microbes. There is also a focus on the discovery and description of new micro-organisms, and on gaining a better understanding of their evolution and diversity.

Plant Pathology

The undergraduate Plant Pathology degree is a four-year BScAgric degree. During the first two years of study students are exposed to a broad range of subjects in agricultural and biological sciences including more fundamental subjects such as Biochemistry, Genetics and Biotechnology as well as the more applied subjects in agriculture. The main focus of the programmes at undergraduate as well as postgraduate level is the study of organisms that cause diseases, how plants are affected by diseases, and how plant diseases can be controlled. At postgraduate level students have the opportunity to specialise in areas such as post-harvest pathology, food safety and plant protection.

Careers

- **Microbiology:** Microbiologists can pursue a variety of careers, covering the whole spectrum of practical applications to basic research. Career opportunities are available in the medical and veterinary sector as well as in the food, fermentation, agriculture, environmental and water sector. Research can be conducted at organisations such as the CSIR, the Medical Research Council or the Agricultural Research Council. Microbiologists are also employed as lecturers and researchers at various academic institutions.
- **Plant Pathology:** Plant pathologists play an important role in assisting commercial growers and small-scale growers to control plant diseases by various means, including integrated pest and disease management. Several career opportunities for plant pathologists exist with agricultural producers, seed companies and national or international companies such as Bayer and Syngenta that are involved in biological and chemical control of plant diseases. The opportunity also exists for entrepreneurs who want to start their own business or consultation services. Careers in research and training exist with various private companies in the food and agricultural fields as well as the Agricultural Research Council and academic institutions.

Note: From October 2015 BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will resort under one School. The curriculum may change. Stay informed by visiting our website at www.up.ac.za/nas.

Plant Science

Plants are amazing organisms and we actually know very little about their potential uses. It is, however, well known that plants are the best factories for synthesising valuable natural products.

In medicinal plant science, students learn about the discovery and use of plant medicines and phytotherapeutically important molecules obtained from plants. In plant biotechnology, molecular tools and the use of model plants are discussed to study whole-plant physiology. Gene and promoter identification, transfer techniques for plant improvement, and the analysis of plant transcriptomes for plant improvement by using micro-arrays are investigated. In the study of plant diversity and ecology, students learn about South Africa's rich and diverse vegetation and how to facilitate conservation and management strategies for future generations.



'I think I can honestly say that I've never met a zoologist or entomologist who is not enthusiastic about his/her field of study to the point of bizarreness (or at least within that range). Students who have had contact with the Department of Zoology sometimes see me as a bit masochistic when I tell them what my major is, since it is well known that zoology involves the study of many scientific names, evolutionary classifications, characteristics, etc.

However, I cannot help but feel that this is, for lack of a better way of putting it, 'where it happens'. All biological fields aim to investigate life's big questions (How?, When?, Why?) and I cannot picture occupying myself with anything else. From time to time a lecturer gives the class an insight into the research he or she is currently conducting right under our noses and then I am baffled at how cutting-edge it seems. I aspire to one day make a successful entrance into this intimidating world.

Even with this wonderful scientific input in my studies, I still itch for a weekly dose of culture and so I do French as an extra subject. Not all prospective students are aware of the fact that they can take any subject in addition to their compulsory modules or as an elective module. I feed on this weekly change of scenery and mind-set and would advise anyone to take a random subject that interests them (having of course taken into account the extra work involved). I have also done mathematics modules on the side since my first year because I love its fundamental and abstract quality. I find that mathematics is linked to and useful in almost any other field of study.

I am grateful to the University and to my Faculty for giving me the freedom to do what I want in order to satisfy my range of interests.'

Laura Meyer

Biological Sciences/Physical Sciences

Although the Department of Plant Science at the University of Pretoria is one of the oldest in the country, it is dynamic, innovative and houses world-class researchers (70% of academic staff have National Research Foundation (NRF) ratings). In the latest survey done by the ISI Web of Knowledge, the plant and animal sciences of the University of Pretoria were rated number one in South Africa, based on the number of publications and the number of citations in ISI-accredited journals.

Description of the programme

During the first two years of study, students are exposed to a broad range of subjects in biological sciences. They will be able to specialise during the third year. The Department specialises in plant diversity and ecology, plant biotechnology, and medicinal plant science. In the third year, students will get the opportunity to do several practical sessions, as well as experience plants in their natural habitat during a field excursion. The postgraduate study options in this programme are honours, master's and doctoral degrees. The one-year full-time or two-year part-time internet-based honours degree includes a research project and some theoretical modules. At master's and doctoral levels, students are required to complete research projects in one of the research fields of the Department.

Careers

Careers range from working in a laboratory to studying plants in their natural environment. Employment could be at biotechnology and pharmaceutical firms, South African National Parks, private ecological companies, research institutions such as the CSIR, the ARC, the South African National Biodiversity Institute, and universities etc.

Note: From October 2015 BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will resort under one School. The curriculum may change. Stay informed by visiting our website at www.up.ac.za/nas.

Zoology and Entomology

Zoology is the scientific study of animals. The majority of animals, in terms of individuals and species, are insects, and their study is termed Entomology. Zoology and Entomology are large umbrella fields that incorporate many more specialised disciplines like anatomy, behaviour, conservation biology, ecology, evolutionary biology, genetics, physiology, epidemiology of wildlife diseases, and plant-insect interactions. Zoologists and entomologists work closely with agriculturalists, economists, engineers, mathematicians, physicists, plant scientists and veterinarians, among others. Their work is multidisciplinary and of interest to an array of people.

In our BSc programmes, students are exposed to a broad range of subjects during the first two years of study to provide a firm foundation for further study. In the third year, students take specified modules to qualify in one of the following majors: Zoology, Entomology or Ecology. Laboratory- and field-based practical experience in all the modules provide opportunities for students to engage with the methods used to gain new knowledge in Zoology or Entomology, and learn skills required in the workplace and for postgraduate study.

Zoology: This major is ideal for students with a passion for the biology, diversity, and conservation of wild animals. Students cover topics including physiology, behaviour, diversity and evolution, population and community ecology, and animal conservation in the face of human disturbance and exploitation.

Entomology: This major is for students with a fascination for insects, wanting to control insect pests of agriculture, forestry, and households, wishing to reduce transmission of vector-borne diseases, or want to become forensic entomologists, quarantine officials, or environmental consultants and managers. Topics covered are similar to those in a Zoology major, but there is a focus on insect diversity and management.

Ecology: This major is for students who want to understand how animals and plants interact with each other and the natural and human environment. In addition to modules on animals, students take a number of modules on plant diversity and ecology in the third year. Postgraduate study in Zoology or Entomology opens more doors for employment and makes it possible for students to pursue a passion for animal biology and management. For example, an honours degree is the minimum requirement for accreditation as a practising natural scientist and to work as an environmental consultant in South Africa. The Department offers postgraduate programmes in Zoology or Entomology at the levels of BSc honours, master's and PhD.

Careers

Graduates of the Department of Zoology and Entomology can look forward to a range of exciting career prospects. They could be employed at nature conservancies, environmental consultancies, conservation planning agencies, medical and veterinary research institutions, and in biochemical and biotechnology industries, educational institutions, IT-related fields and the corporate sector. Career opportunities include the full spectrum of potential activities involved in modern research, development and training, and natural resources policy formulation. These usually include a stimulating combination of analytical work, laboratory or fieldwork, and human resources management.

Physical Sciences

Chemistry

Everything around us involves chemistry, and as chemists, we recognise the major role this science plays in supporting modern lifestyles. The clothes we wear are made from synthetic fabrics produced by chemical processes. The drugs used for curing many illnesses are the result of intensive chemical research. A chemical process produces the paper we write on, and the ink we write with is a mixture of many chemicals. Chemistry assures the quality of the food we eat, the air we breathe and the water we drink. Our bodies are a complex mixture of chemicals. The principles of chemistry are fundamental to the understanding of the processes involved in all living organisms and the development of new medications and materials. It is the interaction and collaboration of chemistry with the other sciences and engineering that meet the ever-increasing demands, challenges and opportunities of a modern society.

Chemistry has been described as the central science; its impact on our lives and society is all-pervasive. Since 1901, the Nobel Prize for Chemistry has been awarded to 153 individuals for work covering all aspects of the chemical sciences. The concepts of sustainable growth, including the reduction of carbon emissions, renewable fuels, secure food and fresh water supplies, material recycling, environmentally responsible manufacture and waste disposal, are all firmly embedded in chemical know-how. Chemistry is also at the heart of cutting-edge research in biotechnology, nanotechnology and new materials required for faster computers and improved solar voltaic cells.

Physical Sciences

Description of the programme

This programme focuses on the fundamental aspects of the discipline and aims to provide students with a thorough background in the chemical sciences. Undergraduate training in this programme provides an opportunity to combine chemistry with other fields of interest, such as physics, geology, mathematics and computer science, or subjects from the biological sciences, such as biochemistry, microbiology and botany. In the first year of study, students are given an introduction to chemistry, which is followed by a more in-depth study of analytical, inorganic, organic and physical chemistry in the second and third years. All subjects have both theoretical and practical components.

First-year modules in mathematics and physics are compulsory subjects for the BSc degree in chemistry. More advanced modules in mathematics and programming are recommended if students want to pursue postgraduate studies in the computer modelling of molecules, materials or processes.

Postgraduate studies in a chemistry-based programme includes honours, master's and doctoral degrees, and are research-orientated. The one-year honours degree consists of advanced modules in analytical, organic, inorganic and physical chemistry, including two practical projects with departmental research teams of the student's choice. MSc and PhD studies involve research projects in the specialised fields of organic and organometallic synthesis, electrochemistry, nanotechnology, the computer modelling of compounds and materials, chemical education and separation science, with the emphasis on industrial, environmental, food, forensic and clinical applications. Experienced research leaders and excellent research facilities are available to expand the international research profile of the Department of Chemistry and expose students to the frontiers of research in their field of choice.

Careers

Graduates in Chemistry are employed in most technology based institutions and work in a laboratory environment as part of an industrial, research or academic institution. A chemist must be able to participate in teamwork in a multidisciplinary environment in a wide variety of enterprises in both the private and public sectors. It is important to note that the type of work available to a graduate in chemistry depends on the level of the qualification obtained. Advanced qualifications will eventually lead to positions in research and/or production management and require management skills and financial planning. Many career opportunities are found in the sectors of education, research, journalism, environmental protection, food and beverages, energy, water, health, sport, pharmaceuticals and cosmetics, geology, mining and law enforcement. These include the well-known professions of synthetic chemists, materials scientists, chemical pathologists, forensic chemists, analytical chemists, drug analysts, patent lawyers, environmental chemists, geochemists, food chemists, polymer chemists and soil chemists.

Geology

Geology is the scientific study of the dynamic system of the Earth, and includes the atmosphere, hydrosphere, lithosphere and biosphere. The study of geology integrates the principles of mathematics and physics as well as chemistry and biology in studying the history and processes of the earth. The ever-growing human population is continuously exerting pressure on natural resources, such as water, energy, minerals, and building materials that are required to meet the basic needs of humankind.

The BSc programme is offered over a period of three years on a full-time basis. This programme is both theoretically and practically orientated and leads to different fields of specialisation, such as mineralogy, igneous petrology, metamorphic petrology, sedimentology, engineering and environmental geology, geochemistry, hydrogeology, economic geology, structural geology, and geophysics and geostatistics.

Students who have successfully completed their undergraduate programmes have the option to register for an honours degree in geology, engineering geology, or hydrogeology. The BSc honours degree is a one-year full-time programme that serves as a minimum requirement for employment and to practise as a professional geologist.

The Department offers two major undergraduate programmes:

- Geology
- Engineering Geology and Hydrogeology

Geology

Diverse topics of importance for our daily life and for the general well-being of our society, such as the study of minerals and rocks, flowing water (such as rivers, beaches, lakes and glaciers), groundwater, volcanoes, earthquakes, plate tectonics, global climatic changes and the evolution of life are covered during undergraduate studies.

Engineering Geology and Hydrogeology

- Engineering Geology is the study of geological structures as well as soil and rock properties at construction sites (such as dams, tunnels, mines, roads, buildings and stadiums) in order to provide accurate information prior to the erection of such structures.
- Hydrogeology is the study of water in the subsurface, and focuses on groundwater and soil moisture, for example, water quality (pollution, mine water), quantity for abstraction and the influence of water on engineering projects.

Careers

- **Geologists** are involved in fieldwork, laboratory work, office work, and computer modelling work and require written and/or oral reports on the completed task. Employment is often offered by small exploration and larger mining companies, in addition to the government, independent research laboratories, universities and other tertiary educational institutions. In general, geologists can work as environmentalists, mineralogists, geochemists, and exploration geologists. They can also work in the mines (production geologists), in the ocean (marine geologists), and in computer laboratories (databases, including GIS; 3D modelling) and as consultants when needed.
- **Engineering geologists** are employed by organisations such as the Council for Geosciences, the CSIR and mining companies, usually in the rock mechanics departments of these organisations. Consulting civil engineering firms design dams, tunnels, roads, bridges, railway lines and industry- or infrastructure-related slopes. Graduates may operate their own consulting practices where general site investigations for urban development and infrastructure construction will comprise a large part of their scope of work.
- **Hydrogeologists** are employed by the government (Department of Water Affairs), the Council for Geosciences, the CSIR, and mining companies and also by consulting practices. The four major focus areas are water resource evaluation, groundwater resource development, modelling mine water and contaminant transport problems. Consulting hydrogeologists are typically involved in water supply, groundwater quality, monitoring and remediation, and water licence applications.

Physical Sciences

Geography, Geoinformatics and Meteorology

Geography and Environmental Science

Geography as a bridging science is the link between the natural and human components of our environment. Location and spatial distribution of settlements and other human activities, such as agriculture and tourism are also studied as well as the processes, patterns, problems and potential answers associated with these activities. Geography is a planning and management science aimed at improving the quality of life of all communities. The Environmental Science programme studies the multitude of interactions between the living (including humans) and non-living components of the Earth. As a result of an increase in human population and technological advances, our impressions on the Earth (environment) have become more widespread and create complex challenges that are multidisciplinary, for example the impact on ecosystems, natural resources, human health and wellbeing.

Both the programmes BSc (Geography) and BSc (Environmental Sciences) comprise fundamental modules that develop general skills. Training in spatial analytical techniques include geographical information science (GIS) and Remote Sensing and enable our graduates to analyse complex environmental issues. Students can also select modules from other disciplines.

At honours level students can enrol for a BScHons (Geographical Sciences) Option: Geography and Environmental Science. Geographical and environmental principles and the research project are fundamental modules. Electives include environmental impact assessment, applied geomorphology, urban geography, environmental change, aspects of land reform and the environment and a self-study selected theme. Appropriate modules from other departments can also be taken. At master's level one can choose between a research master's in Geographical Sciences, and a research or coursework master's in Environment and Society. Both fields offer a PhD.

Careers

Geographers and environmental scientists' main career fields are in education, research and the application of geographical knowledge and skills in practice.

Graduates are employed by private companies such as TomTom South Africa, ESRI South Africa, the Council for Scientific and Industrial Research (CSIR), banks, tourism industries and other environmental conservation bodies. Due to the geographer's holistic nature of its training he is sought after by government departments for policymaking and developing of strategies on many managerial levels ie agriculture, forestry and fisheries, water affairs and sanitation, environmental affairs, Statistics South Africa (StatsSA), South African National Space Agency (SANSA) and municipalities. Many geographers and environmental scientists are self-employed in areas such as environmental planning, analysis, risk and impact assessment, environmental auditing, marketing, development, tourism, cartography and geographic information systems (GIS) and remote sensing. A master's or PhD is essential to pursue an academic career.

Geoinformatics

Geoinformatics or Geoinformation Science integrates elements of various disciplines dealing with geographical data such as geography, cartography, computer science, geodesy, mathematics, remote sensing, statistical remote sensing. Geoinformatics can measure and supply information on how your behaviour impacts your immediate environment as well as how the environment influences your wellbeing.

At undergraduate level there are two study options:

BSc (Geoinformatics) focuses on the general GISc profession with geographical thinking and spatial analysis at the core, while BSc IT (Geographical Information Systems) focuses on computer science in GIS applications. (More information can be obtained at www.up.ac.za/ebit). Students gain theoretical knowledge and practical skills to create and apply geographic information system methods and techniques to assist researchers and decision-makers in a variety of fields. Fundamental elements of developing and use of these GIS systems are scientifically approached. Graduates are trained to identify the needs and apply problem solving processes.

Admission towards BScHons (Geoinformatics) requires a BSc (Geoinformatics) or an applicable BSc degree with relevant experience in computer programming, data management, geodesy, remote sensing and spatial analysis. Honours modules include research methods, a research project, professional practice, advanced geospatial data, spatial databases and internet GIS. Appropriate modules from the Faculty of Agricultural and Natural Sciences or from the School of Information Technology can also be selected. A master's or a PhD in Geoinformatics will prepare you for a career in research or academia, at a science council, research institute or tertiary institution.

Careers

After successful completion of the BSc (Geoinformatics) degree, graduates can apply for professional registration as a GISc Technologist with PLATO (South African Geomatics Council). With appropriate work experience (Work Integrated Learning) and PLATO complied exams the candidate can apply for registration as a Candidate GISc Practitioner to become a registered Professional GISc Practitioner.

Graduates with a BSc (Geoinformatics) readily find work at organisations such as Geographic Information System (GIS) vendors (ESRI or Integraph), the Council for Scientific and Industrial Research (CSIR), GIS consultants (AfriGIS, GeoTerralmage, GISCOE), civil engineering consultants (Aurecon, SSI), the South African National Space Agency (SANSA), South Africa's National Mapping and National Geospatial Information (NGI) or any municipality in the country. Many government departments (eg Environmental Affairs, Science and Technology, Statistics South Africa, Rural Development and Land Reform and Water and Sanitation) also employ GISc professionals.

Meteorology

Weather and climate is fundamental in people's lives since daily activities, such as agriculture, sport, travel and tourism, depend on it. In the long term it may even determine whether humankind survives or not. There is increasing concern that people's activities may irreversibly change weather and climate. Similar concerns exist on air pollution. Meteorologists and atmospheric scientists are interested in understanding how the physics and dynamics of the atmosphere work.

Undergraduate modules include physics and calculus, atmospheric structures and processes, climate and weather of Southern Africa, physical meteorology, remote sensing, geographic data analysis, dynamic meteorology, vector analysis and a weather forecasting module. The practical component is presented by a professional meteorologist using specialised software. Additional electives can be chosen from mathematics and applied mathematics, physics, statistics, chemistry, computer science, geography and geology.

A BScHons (Meteorology) degree is required for registration as professional meteorologist (as prescribed by the World

Physical Sciences/Agricultural and Food Sciences

Meteorology Organisation). A MSc (Meteorology) and a PhD (Meteorology) are essential for an academic career.

Careers

Meteorologists are employed by institutions involved in the study, interpretation and prediction of weather and phenomena relating to the climate. The South African Weather Service (SAWS), the Council for Scientific and Industrial Research (CSIR), some universities, agricultural institutions, municipalities and industries employ meteorologists who mainly practise as specialists in the following areas:

- **Researchers:** All aspects of weather and climate are researched in order to improve understanding of atmospheric phenomena. Atmospheric modellers use supercomputers to simplify and solve complex flow dynamic equations of the atmosphere. Constant monitoring of air quality and air pollution on society is done and the impact of climate change receives increasing attention.
- **Weather forecasters** analyse data and predict the weather by using models running on supercomputers. Weather forecasts are issued on different time scales from very short-range forecasting to forecasts valid for months ahead as well as seasonal forecasts. Some private weather forecasting positions such as presenting the weather on television are available.
- **Climatologists** manage important data sets that contain large volumes of information gathered by the SAWS and other organisations.
- **Meteorologists** work as consultants in the private sector and at universities to provide specialised research services.
- **Academic positions** are available at some South African universities after obtaining a master's or PhD in Meteorology. They ensure that training of meteorologists meets international standards.

Physics

Physics is the study of the laws of nature. Its principles form the basis of all the basic sciences, such as astronomy, biology, chemistry and geology. Physics also forms the basis of applied science and engineering, which led to major technological developments, from the horse-drawn cart to the supersonic jet, from the candle to the laser, from smoke signals to satellite transmission. When studying physics, students will develop their creativity, inventiveness and problem-solving abilities, which will enable them to advance successfully to management positions at all levels of industry.

The Department of Physics at the University of Pretoria is staffed with excellent physicists in a wide range of physics sub-disciplines, such as astronomy, biophysics, theoretical physics, material science and physics education. Materials are studied for nuclear applications and their properties investigated during irradiation. Materials for solar cells and optoelectronics equipment, as well as carbon-based magnetic systems, are also investigated. Furthermore, there are active studies in biophysics, astronomy, mathematical physics, high energy theory, quantum theory (resonances and information theory), solid state physics, incorporating computational physics, as well as the effect of symmetries. The Department has a high international standing, with many international collaborators.

There is a growing number of master's and doctoral students drawn from all parts of South Africa, and increasingly now from the African continent. A postgraduate student committee oversees the interests of the postgraduate students, which includes organising social functions. This helps create an inviting and supportive environment for students to pursue their research degrees.

Students learn useful and transferable skills in experimental, theoretical and computational physics that enable them to become competent physicists, and they are also able to use their skills in a variety of career choices outside academia, for example in commerce and industry.

Careers

University academics, whose duties include lecturing, research and the supervision of postgraduate students; researchers in national laboratories such as the Nuclear Energy Corporation of South Africa (NECSA), the South African Astronomical Observatory or iThemba LABS (Laboratory for Accelerator-based Sciences); researchers in industry such as at the CSIR or Element Six; science advisors for non-governmental organisations, industry or government; radiation scientists, medical and biophysicists; atmospheric scientists and climatologists; developers of renewable energy sources; geophysicists; innovators and entrepreneurs; computational scientists, etc. For more information, please visit the Physics Department website www.up.ac.za/physics.

Agricultural and Food Sciences

Agricultural Economics, Extension and Rural Development

Agricultural and food industries all over the world are facing the growing demands of an ever-increasing global population. At the same time, natural resources such as soil and water, as well as human resources, are becoming scarcer and production costs are soaring. The immense challenge facing agricultural economists is the need to find solutions that will enable farmers to farm more effectively reducing costs to ensure the financial sustainability of farms and companies operating in the field of agriculture. Agricultural Economics can broadly be defined as the study of how limited resources can be utilised to feed an ever-increasing world population. Agricultural economists are therefore concerned with the economic and financial issues related to farming, agricultural food chains and the price of food on the shelf. The subdisciplines of this study field include marketing, financial management, economics, business management, policy formulation and accounting.

The Department offers two undergraduate courses:

- a four-year BScAgric (Agricultural Economics) course intended for students who are more interested in agriculture; and
- a BCom degree in Agribusiness Management with the focus on agribusiness, management and marketing.

The curriculum is designed to expose students to the abovementioned subdisciplines, but also includes a strong focus on agriculture and food. To ensure that economic and financial issues in the agricultural milieu make more sense, students also have to register for courses in the agricultural sciences (eg Soil Science, Plant Production and Animal Science). This develops business acumen in agricultural economics and graduates' understanding of the financial and technical aspects of food production and value chains.

Postgraduate studies

An undergraduate course in Agricultural Economics provides a strong basis for further study. Postgraduate courses specialise in various fields that fall in the scope of Agricultural Economics, namely Agribusiness Management, Environmental and Resource Economics, Rural Development and Policy Analysis. The majority of companies that employ agricultural economists require a postgraduate qualification as this prepares a student

Agricultural and Food Sciences

more effectively for a career as an agricultural economist. A postgraduate qualification therefore offers better career opportunities and prospects.

Career opportunities

The term 'farm to fork' refers to the process that takes food products from where they are produced to the consumer's plate. Agricultural economists play a role in every step of the process. Owing to the diverse nature of potential careers in this discipline it would be difficult to compile a complete list of all the possible occupations. Depending on their areas of specialisation, agricultural economists are employed in the following fields/companies:

- input companies such as Omnia or Syngenta (general manager, sales rep, marketer, market analyst)
- large farming enterprises (general or financial manager)
- agricultural enterprises (market analyst, logistics manager, commodity trader)
- commercial banks and insurance companies (agri-specialist in insurance and financing)
- public sector (several positions, usually with a strong focus on policy and market analysis)

Animal and Wildlife Sciences

The Department of Animal and Wildlife Sciences at the University of Pretoria has all the resources to give you an education that will provide you with a sought-after qualification in the field of animal and wildlife sciences.

The Department has a commitment to provide outstanding and relevant academic programmes and appropriate practical training in animal and wildlife sciences. The Department is proud of its rich tradition spanning more than 100 years, its excellent academic staff, experimental farms and a legacy of service to its students, alumni and the agricultural industry.

Animal and wildlife sciences include the sciences and practices whereby domesticated animals and wildlife are used for the benefit of mankind. Our dependence on nature makes us responsible for conserving the environment as part of our natural heritage. The work environment of animal and wildlife scientists spans a continuum from primary farming or wildlife production to the marketing of animals and the processing of animal products. Every link in this long chain offers a career opportunity according to one's own field of interest, needs and personality. The programmes presented by the Department of Animal and Wildlife Sciences at the University of Pretoria are acknowledged as professional qualifications by the South African Council for Natural Scientific Professions (SACNASP) in terms of Act 106 of 1993, and are recognised internationally.

BScAgric (Animal Science) and BScAgric (Animal Science and Pasture Science)

Production physiology, animal nutrition and animal genetics and breeding are important subjects and find application in subjects such as meat science, large-stock and small-stock sciences, poultry (including ostriches), and wildlife management. These programmes can lead to an MScAgric, a BScHons (Wildlife Management), and or an MPhil (Wildlife Management) (web-based). Duration: Eight semesters of full-time study.

Postgraduate education and specialisation

Postgraduate qualifications include MScAgric and PhD degrees. Four main research focus areas have been identified in which the

majority of postgraduate students are accommodated, namely animal physiology (growth, reproduction, adaptation, meat science), animal breeding (quantitative and molecular), animal nutrition (monogastric and ruminant nutrition) and production management (different species and production systems). A PhD is offered in Animal Science. The duration of the MScAgric and PhD is a minimum of four semesters. The Centre for Wildlife Management functions through the Department of Animal and Wildlife Sciences, and it offers the postgraduate degrees BScHons, MPhil (web-based), MSc and PhD in Wildlife Management. Duration: Varies, depending on the degree programme.

Careers

There are career opportunities for animal and wildlife scientists in research, commercial farming, the public sector and for professionals in the animal science industry. Animal scientists can contribute on different levels in these sectors, ranging from researchers, animal nutrition or breeding consultants, technical representatives, game managers and policy-makers. The BScAgric (Animal Science) degree is acknowledged as a professional qualification by the South African Council for Natural Scientists in terms of Act 106 of 1993, and is recognised internationally.

Consumer Science

Consumer Science offers students the opportunity to specialise in various fields of interest, namely clothing retail management, food retail management, hospitality studies or food management. The Department has a strong postgraduate and research culture and attracts students from all over the country and the rest of Africa.

All the undergraduate programmes are structured over four years of full-time study. UP is at present the only South African university that offers consumer science degrees with a focus on the economic and management aspects of the specific specialisation fields. Students are therefore sought after, especially in the retail sector. Every programme revolves around a specific product category in terms of its properties, consumers' purchasing and consumption behaviour, product management, as well as the development of new products and services. Consumer science aims to encourage strategies to enhance informed, responsible buying and consumption behaviour as well as consumer satisfaction, and to address the needs of individuals and groups in small businesses and the retail sector. A BSc (Food Management) degree that focuses on the consumer aspects of food and nutrition is also offered.

Students who have completed a four-year degree in Consumer Science can apply for the master's degree that involves two years of full-time study or three years of part-time study. Four areas of specialisation are offered: clothing management, food management (that allows for a focus in the hospitality or nutrition domains), interior merchandise management, and general (which is recommended for students who do not have a marketing background and who have not specialised in the previously listed areas during their undergraduate studies). After completion of a master's degree in Consumer Science, a student may register for a PhD.

Careers

Career opportunities are diverse and a graduate's eventual career path is mostly determined by the individual's personality and interest. Students are therefore provided with the opportunity to investigate different possibilities through compulsory experiential

Agricultural and Food Sciences

training during their studies. During their fourth year of study, students also have to complete a research paper that offers them the opportunity of participating in a formal research project and to consider the possibility of postgraduate studies. The Department has acquired valuable contacts over the years, and students who perform well during their experiential training are often assured of appointments before the completion of their final exams.

Graduates with a degree in clothing retail management are employed as brand/production managers, clothing buyers/planners, textile technologists, fashion designers and coordinators, fashion marketers, fashion product developers, quality controllers and assurance managers, store managers, image consultants, stylists, textile conservationists, visual merchandisers, pattern technologists, entrepreneurs, etc.

Graduates with a degree in food retail management are employed as brand/sales/store managers, food and beverage buyers and planners, food stylists, journalists, researchers, marketers, visual merchandisers, consumer consultants, etc.

Graduates with a degree in hospitality management are employed as food and beverage managers, catering/food service managers, culinary specialists, event coordinators, entrepreneurs, product and menu developers, food journalists. Graduates interested in teaching may consider teaching hospitality studies or training and consultation in the hospitality industry, etc.

Graduates with a BSc (Food Management) degree are employed as culinary scientists, culinologists, consumer consultants, sensory analysts, researchers, product developers, food service managers, etc.

Food Science

The Department of Food Science is the centre of excellence in integrated Food Science and Nutrition research focussing on the health and wellbeing needs of the people of Africa. It provides relevant, world-class, education and training of future leaders in Food Science and Nutrition. The programmes are academically and practically based and prepare students for economically satisfying careers. Students also undertake research projects. The nutrition discipline deals with the human requirements for food and the effects food have on well-being of individuals and communities in South Africa and elsewhere. The four-year Nutrition degree is presented jointly by the Department of Food Science (Faculty of Natural and Agricultural Sciences) and the Department of Human Nutrition (Faculty of Health Sciences).

The Department boasts an internationally recognised postgraduate research record driven by top rated scientists. Participation in national and international research programmes attracts the cream of students from within and outside South Africa. Research activities focus on food product safety, nutritious and health-promoting African foods and beverages, plant biopolymer and bioplastic microstructures and nanomaterials; and sensory science research.



‘I am a third-year BScAgric: Plant Production and Soil Science student. The agricultural sector is a lot more important than you might think. It is not the quaint family-run business that we all picture; it has evolved into a highly specialised science requiring trained experts in precision agriculture.

I chose this field of study because it is important to me to make a difference in the industry that provides us with our most basic needs. As we all know, the world population is increasing rapidly, which means an increased demand to produce more food on limited land. We have to improve our

current systems to increase efficiency in order to achieve this.

I appreciate my course because the lecturers are extremely knowledgeable in their fields and go out of their way to make our studies interesting and to expose us to a wide range of opportunities. Staff of the Department of Plant Production and Soil Science are fun-loving, humorous and helpful. This makes every day a good day with many a fun moment.

I was listed on the Dean’s list of academic achievers and invited to become a member of the Golden Key International Honour Society. There is a wide range of specialisations in Plant Production and Soil Science, which makes it difficult to decide on one. But what I do know is that I want a job where I can contribute to the scientific community and therefore being a head researcher will be the ideal job for me.’

Wentzel Coetzer

Agricultural and Food Sciences/Mathematical Sciences

Ample opportunities are provided to gain career exposure during practical training sessions, visits to food companies, attendance of conferences and events, participation in competitions and mentorship programmes. The Department is actively involved in the South African Association for Food Science and Technology (SAAFoST) and industry associations for meat, dairy and cereals. Students organise education and social activities through a student body, TUKSFoST.

Careers

The food industry is South Africa's largest manufacturing sector. In the modern age, all food is processed to some extent. Food scientists are concerned with the chemical composition, structure and nutritional value of foods. They monitor chemical, physical and biological changes that occur in foods during processing, preservation and storage. Food scientists develop and supply foods that comply with the ever-changing demands of modern consumers. Food scientists also lead the fight against hunger and malnutrition by developing affordable, nutritious foods. Graduates of this Department are employed all over the world as food science researchers, food microbiologists/biotechnologists, food and nutrition analysts, food manufacturing operation managers, food product/process developers, quality and safety assurance specialists, food packaging/shelf-life specialists, academics, sensory scientists, key food category managers, etc.

Our graduates make a difference. All graduates may register as natural scientists with the South African Council for Natural Scientific Professions (SACNASP).

Plant Production and Soil Science

Ever-increasing human populations and increased industrialisation exert great pressure on our natural resources. Some of the greatest challenges both developed and developing countries around the world face are sustainable food production and soil utilisation, as well as the protection and reclamation of soil and groundwater resources. These challenges can be met through a broad understanding of plant and environmental interactions and insight into soil chemical, physical and biological processes. The Department of Plant Production and Soil Science is a multidisciplinary department and consists of five broad disciplines: Agronomy, Horticultural Science, Soil Science, Pasture Science and Forestry Science.

Each discipline has specific focuses, which in many instances involve cross-cutting research projects. We believe that multidisciplinary training, as well as specialisation in Agronomy, Horticultural Science, Pasture Science and Soil Science, will enable graduates and postgraduates from our Department to embark on a diverse range of careers in both the agricultural and environmental fields.

The BScAgric (Applied Plant and Soil Sciences) programme is offered over a period of four years on a full-time basis. Students who have successfully completed their undergraduate programmes have the option to register for a one-year honours degree on a full-time basis.

The Department offers the following postgraduate programmes:

- BScAgric (Hons) (Crop Science)
- BSc (Hons) (Environmental Soil Science)
- MScAgric (Agronomy), MScAgric (Horticulture), MScAgric (Pasture Science), MScAgric (Soil Science)
- MSc (Soil Science), MSc (Biotechnology), MSc (Forest Science), MSc (Forest Management and the Environment)
- PhD (Agronomy), PhD (Horticulture), PhD (Pasture Science), PhD (Soil Science), PhD (Forest Science), PhD (Biotechnology)

Careers

Graduates from the various disciplines of the Department of Plant Production and Soil Science have the following career opportunities:

- **Education and training:** universities, colleges and schools
- **Research and management:** research institutes, government departments, seed, fertiliser and agro-chemical companies, municipalities, mining industry
- **Extension services for technology transfer:** grower associations, national and provincial Department of Agriculture, Forestry and Fisheries, Department of Environmental Affairs and Tourism, Department of Minerals and Energy, Department of Water Affairs and Sanitation
- **Entrepreneurial:** consultant, production

Note: From October 2015 BSc (Plant Science), BScAgric (Plant Pathology) and BScAgric (Applied Plant and Soil Sciences) will resort under one School. The curriculum may change. Stay informed by visiting our website at www.up.ac.za/nas.

Mathematical Sciences

Insurance and Actuarial Science

The Department is extremely proud of its alumni. Former students occupy the highest positions in the insurance and investment world, not only in South Africa, but also abroad. It strives to keep its programme competitive and to afford students the opportunity to leave the University with a number of exemptions from the examinations of the Actuarial Society of South Africa (ASSA). It has highly skilled academics who serve on various committees of the ASSA.

Developments in the modern financial industry have led to a rapidly changing financial world. These changes create a growing need for graduates who are well skilled in the financial models and quantitative techniques that are used in modern actuarial and financial mathematical applications. Students enrolled for a BSc (Actuarial and Financial Mathematics) degree will be able to tailor their coursework in either an actuarial or a financial mathematics option throughout their three years of study. The programme provides students with a broad education that will serve them beyond what is usually expected of a graduate in these fields.

The actuarial option programme is structured in order to provide the aspiring actuary with the opportunity to fulfil the requirements needed for exemption from the ASSA in the minimum time. In order to gain maximum exemptions, a follow-up Honours degree is recommended. Students who elect not to complete the actuarial qualification will be well equipped to enter the financial services industry or a host of other postgraduate degree options.

For aspiring financial analysts or engineers, the programme provides depth and develops the student's ability to design and analyse financial products. The analytical techniques that are essential for the modelling of the stochastic behaviour of financial processes and the analysis of the resulting effects on investment portfolios are studied.

Careers

Many actuaries have careers in the more traditional fields of insurance and retirement funds. However, actuaries are making headway in other fields due to the recognition they are earning for their unique analytical skills. This includes healthcare, financial consulting, risk management and banking. Because of their unique skills, many actuaries are appointed to senior

Mathematical Sciences

management positions after their initial role in solving problems with mathematical and statistical calculations and models.

Financial Engineers can be employed by banks and financial institutions, brokerage firms and investment institutions. They are essential in portfolio management and risk management. Activities include among others: asset management (trading in bonds, futures and derivative instruments such as options), designing new financial products and devising strategies to control credit risk.

Mathematics and Applied Mathematics

Mathematics is the language of science and technology. Mathematics, which originated from arithmetic and geometry, is about pattern and structure. Applied mathematics is concerned more with the modelling and treatment of real-life problems in a variety of fields, such as engineering, finance, statistics, physics and biology. The power of mathematics and applied mathematics lies in their abstract, analytical and computational nature. Nowadays, mathematics is essential for all technological, financial and managerial industries which form the backbone of the South African economy.

Studying mathematics

The Department of Mathematics and Applied Mathematics is not only one of the largest departments on the Hatfield Campus, but also one of the largest mathematics departments in the country, with approximately 20 000 students enrolled for mathematics modules. The Department prides itself on excelling in both its teaching and research activities, and in community-based activities. The Mathematics Building itself has a classical old-time character, surrounding a quad where the bustle of students adds to the vibrancy of the academic environment.

The diverse and competent staff complement has expertise in various fields. Researchers regularly travel abroad to attend conferences and to pay research visits. The Department has 18 NRF-rated researchers in fields ranging from the more traditional

abstract analysis to the contemporary epidemiology field where the modelling of biological phenomena leads to exciting options. The Department regularly hosts illustrious visitors, such as the Fields Medallist, Prof Laurent Lafforgue from France.

A degree in Mathematics trains the student to apply, evaluate and adapt existing problem-solving techniques, or to develop new mathematical models and new techniques to solve problems stemming from natural, technological and financial phenomena.

Description of the programmes

- **BSc (Mathematics):** Compulsory subjects are analysis, abstract algebra, geometry (third-year level), calculus, linear algebra, differential equations, discrete structures (second-year level), mathematical modelling, mathematical statistics, numerical analysis and dynamical processes (first-year level).
- **BSc (Applied Mathematics):** Compulsory subjects are analysis, continuum mechanics, numerical analysis, partial differential equations, dynamical systems (third-year level), calculus, linear algebra, discrete structures, differential equations (second-year level), mathematical modelling, mathematical statistics and dynamical processes (first-year level).

Postgraduate studies

Postgraduate studies and research constitute the highest priorities of the Department and are performed in a variety of highly relevant areas.

- **Honours:** A student will have to do a number of modules and write a project under the guidance of a supervisor. The duration of the degree is one year of full-time study and two years of part-time study.
- **Master's:** The duration of the MSc is normally two years. The student does two master's modules, as well as a dissertation that demonstrates that the student has the ability to plan, initiate, carry out and write a report on a scientific investigation.
- **Doctorate:** During study for the PhD degree, students are required to do original research in one of the research areas that is supported by the Department.



‘What I love most about the Faculty of Natural and Agricultural Sciences is the fact that it provided me with a strong mathematical and statistical foundation in my first year. The tutor system has helped me to master difficult concepts. I find the lecturers knowledgeable in their fields of specialisation. They always leave room for you to think and design your own things, which will be a key attribute in the future.

In 2013 and 2014 I received achievement awards from the University, and I have recently been invited to the Golden Key International Honour Society.

I dream of becoming an actuary and to apply all the techniques and skills I acquired at university to contribute to the insurance sector and actuarial science.’

Kupiwa Ngundu

Mathematical Sciences

Careers

Graduates in mathematics and applied mathematics are employed by research institutions, educational bodies (universities and schools), the public sector (government, medical institutions) and the private sector (engineering companies, financial institutions, the computer industry). The training of these graduates in abstract, analytical and computational thinking provides them with the background to easily adjust to changing circumstances in the professional environment and to construct mathematical models of natural, technological and financial phenomena. Mathematicians and applied mathematicians apply, evaluate and adapt existing problem-solving techniques or develop new techniques to solve these problems.

Statistics

Statistics is the art of understanding what value large amounts of data holds. It constitutes a collection of scientific methods which is used to draw reliable conclusions about posed questions. It is also one of the only scientific disciplines without which most other specialties would struggle to survive. It is a catalyst which facilitates progress within interdisciplinary areas to levels previously thought insurmountable.

Since you woke up this morning, you've encountered at least five complex, yet fascinating statistical models – from a traffic light system to the cell phone in your pocket. With almost infinite possibilities of applications, statistics is an extremely challenging yet fun way to see how the world around us unfolds scientifically.

Students in statistics are expected to have a knack for problem solving, with special emphasis on numerical interests and software programming abilities. Verbal and written communication skills are preeminent within the field.

The BSc (Mathematical Statistics) programme is offered over a period of three years on a full-time basis. Students who have successfully completed their undergraduate programme have the option to register for an honours degree in Mathematical Statistics and subsequently, master's and doctoral degrees can be obtained.

Careers

Learning from data is one of the most relevant and vital challenges of the information age we live in, and it presents exciting opportunities for those who work as professional statisticians.

- **Financial institutions:** Statisticians specialising in economic applications of statistics (econometrics) deal with aspects such as national production and expenditure, international economic relations, employment, public finance and related issues. In the insurance business, statisticians are employed in areas such as actuarial work, marketing, share investments and property investments. Market research organisations play an indispensable role in the gathering of information that is used to improve the quality of decision-making in various industries.
- **Industry:** Statisticians are increasingly employed in industries such as mining and production and government corporations, for example, Eskom, Sasol, AECI and the pharmaceutical industry in general. Organised agriculture is another vitally important industry where sophisticated statistical techniques

are used to meet the growing demand for food and services.

- **Research councils and educational institutions:** The research councils are well-known large employers of scientists of diverse disciplines and employ statisticians to ensure scientifically founded research outputs. These include the Medical Research Council (MRC), the Council for Scientific and Industrial Research (CSIR), the Agricultural Research Council (ARC) and the Human Sciences Research Council (HSRC). Statisticians are also involved in the training of students at universities.
- **The public sector:** Government employs statistically proficient people in many of its departments, the most prominent being Statistics South Africa.

Community engagement initiatives

Sci-Enza

Sci-Enza (previously known as the Exploratorium) is a science centre where the general public, mostly groups of school children, can discover aspects of science and technology. A variety of interactive exhibits in physics, plant science, zoology, mathematics and engineering are available. Organised groups visiting the centre are given a science show, as well as a guided tour of the botanical garden and a visit to the Camera Obscura on the Hatfield Campus. A reading corner, containing popular scientific books, magazines and video facilities, can be used by visitors. Sci-Enza is open during office hours on weekdays. Individuals may visit free of charge and organised groups attending a science show pay a nominal fee of R10 per person for groups more than 30 and R20 per person for smaller groups (less than 30 people). Please contact +27 (0)12 420 2865/3767 to make an appointment.

UP with Science

The UP with Science enrichment programme was launched in 1998 and is aimed at increasing learners' knowledge of, and interest and skills in science. Approximately 50 candidates are selected from schools in the vicinity of the University to take part in the programme. The programme is offered over a period of three years, from Grade 10 to Grade 12. It includes Saturday classes once a month and a week-long winter school during the July school holidays. Participants who complete the programme will receive study bursaries in the form of university tuition fees if they are admitted to programmes in the University's Faculty of Natural and Agricultural Sciences. Because the UP with Science programme is mainly presented in English, the information is made available in English. However, Afrikaans-speaking candidates are welcome to submit their applications in Afrikaans.

Each school may nominate a maximum of two candidates from which the University will select approximately 50 candidates. Successful applicants will be informed of their selection. The UP with Science group will be constituted in such a way that it reflects the racial and gender diversity of the South African population. The two most important criteria for the selection panel are academic potential and an interest in science. Please contact +27 (0)12 420 2638 for more information.



'If green is indeed the colour of envy, then my faculty (Natural and Agricultural Sciences) ought to be admired and envied. As a second-year student, I love how scientific and theoretical concepts are brought together in my degree. Above all, I have a burning passion for Statistics.

I am humbled by and grateful for this opportunity to obtain a university degree. Being at Tuks has made me realise that I can be the educated and successful professional that I would want to see in the mirror in a few years' time. I want to be an actuarial analyst

with a second qualification in computer science. Both these goals have been put within reach as there are plenty of opportunities to learn and grow at Tuks.

In 2014, I received a bursary from the South African Actuarial Development Programme. I was also the top Academic Achiever in Mopanie Residence and was invited to join the Golden Key International Honour Society.

I dream of becoming a fully qualified actuarial scientist working as the CEO of an internationally acknowledged bank or insurance firm.'

Harry Phirri

General information

General information

Visit www.up.ac.za > 'Study at UP' > 'Undergraduate students' for information on the following:

- Study information
- Calculate your Admission Point Score (APS)
- Closing dates
- Fees and Funding
- Special offer for top academic achievers
- Apply at Tuks
- Change or add a programme
- National Benchmark Test (NBT)
- Application status
- Prepare to study at Tuks
- Registration and start of the academic year

UP Open Day

Date 21 May 2016

Time 08:00–14:00

The following persons should attend the UP Open Day:

- Learners in Grade 12 who already received confirmation that they are provisionally admitted to UP
- Learners in Grade 12 who meet the admission requirements and wish to hand in their application forms
- Learners in Grade 11 who are fairly certain they will apply at UP
- Parents of the above learners