



CORONAVIRUS | COVID-19

Elanco



Faculty Day

20 November 2020



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of
Veterinary Science

Fakulteit Veeartsenykunde
Lefapha la Disaense tša Bongakadiriwa

Brief history of Faculty Day

Faculty Day of the amalgamated Faculty of Veterinary Science reflects a proud tradition, which had been nurtured by the original faculties of Veterinary Science of both the Medical University of South Africa (Medunsa) and the University of Pretoria, of showcasing the research activities of staff and students on a special, dedicated occasion.

Since the inception of the Faculty of Veterinary Science at Medunsa in the early 1980s, the staff, and later students, were involved in the activities of the "Academic Day", which was aimed at highlighting the research activities of the University, as well as exposing young researchers to a conference environment.

The Faculty of Veterinary Science of the University of Pretoria at Onderstepoort followed this trend shortly thereafter and the first "Faculty Day", which focused on the research activities of the Faculty, was held on 5 September 1984, sponsored by the then Dean, Prof JMW le Roux. The combined research skills of the two original institutions are today reflected in the proceedings of the Faculty Day held each year at the Onderstepoort Campus.



Virtual Faculty Day



Faculty of Veterinary Science University of Pretoria

20 November 2020



Contents/programme

Master of Ceremonies: Prof Tshepo Matjila

10:30 – 10:35 Start of Proceedings and Housekeeping Rules
Prof Tshepo Matjila

10:35 – 11:00 **Welcoming address:**
Prof Vinny Naidoo, Dean of the Faculty of Veterinary Science
Session Chair: Prof Tshepo Matjila

11:00 – 12:00 **Session 1: Research Theme Leaders**
Session Chair: Prof Tshepo Matjila

1. African Wildlife Health and Management Faculty research theme highlights
Prof Leith Meyer
2. Translational Medicine Faculty research theme highlights
Prof Lyndy McGaw
3. Pathobiology of Disease Faculty research theme highlights
Prof Johan Schoeman

12:00 – 12:20 **Session 2: Rising stars**
Session Chair: Prof Dietmar Holm

1. Background and purpose of the Veterinary Research Report (VRE) module
Prof Dietmar Holm
2. “It’s getting hot in here” – the effect of relative humidity on the thermoregulating ability of the dog during exercise – a systematic review
Ms Magdalena Jannasch
3. A scoping review of viral diseases in free-ranging African felids
Ms Antjie Menne
4. A body condition index for adult African penguins *Spheniscus demersus*
Mr Roelof Berg

12:20 – 12:40 **Session 3: Postgraduate student research speed session**

Session Chair: Prof Tshepo Matjila

12:40 – 13:10 **Virtual lunch break**

13:10 – 14:00 **Session 4: Future research leaders**

Session Chair: Prof Tshepo Matjila

1. **Inappropriate regenerative response in dogs naturally infected with *Babesia rossi***
Dr Chandini Seejaram
2. **The investigation of highly pathogenic avian influenza outbreaks in key ostrich-producing areas of South Africa**
Dr Miriam Marimwe
3. **Exposure to anthrax in Kruger and Etosha national parks and the effect of haemoparasite co-infections**
Dr Sunday Ochai
4. **Histology of the southern ground hornbill (*Bucorvus leadbeateri*) gastro-intestinal tract**
Ms Anel Naude
5. **Using novel scientific techniques to evaluate physiological responses in the thick-tailed greater galago, *Otolemur crassicaudatus***
Ms Channen Long

14:00 – 14:45 **Keynote address: Coronavirus: Unveiling the viral entry pathways into the host cell**

Dr Javier Jaimes, Cornell University, Ithaca, New York, USA

Session Chair: Dr Darshana Morar-Leather

14:45 – 15:00 **Annual Faculty Research Prizegiving**

Prof Marinda Oosthuizen

15:00 Closing remarks
Prof Vinny Naidoo

Speed session presenters

1. Retrospective study of bacterial and fungal causes of abortion in domestic ruminants in northern regions of South Africa (2006–2016)
A Jonker
2. Towards the development of a low-cost molecular test for the identification of selected *Rhipicephalus* tick species in South Africa
B Bezuidenhout
3. Markers of inflammation and cytokine concentrations during experimental *Babesia rossi* infection of beagle dogs
B Atkinson
4. Reference intervals for haematology and clinical chemistry for the African elephant (*Loxodonta africana*)
C Steyrer
5. Efficacy of *Leonotis leonurus* against phytopathogens and nematodes infecting tomatoes
F Makhubu
6. Challenges in the diagnostic performance of parasitological and molecular tests in the detection of African trypanosomiasis in cattle in Mambwe district in eastern Zambia
G Mulenga
7. Predictors of carnivore detection at the domestic wildlife interface within Mpumalanga, South Africa
JM Wentzel
8. Comparison of etorphine-azaperone and etorphine-midazolam for African buffalo (*Syncerus caffer*) immobilisation
JF Grace
9. Investigation of spore survival in the *Bacillus anthracis* Sterne (34F₂) strain in soil from Kruger National Park
K Govender
10. Evaluation of endometrial glandular changes in aged captive cheetahs (*Acinonyx jubatus*) in southern Africa
A Avenant
11. Apoptosis of germ cells in the normal testis of the Japanese quail (*Coturnix coturnix japonica*)
M Zakariah
12. The effect of different automatic cluster removal switch-point settings on milking and overmilking duration and on total, peak and overmilking claw vacuum
P Vermaak
13. Anti-inflammatory effects of *Psilocybe natalensis* magic mushroom extracts on LPS-induced nitric oxide, prostaglandin-E₂, and cytokine production on RAW 264.7 macrophages
SM Nkadimeng

Message from the Dean

The year 2020 marks the first centenary of our Faculty and undoubtedly a proud moment in the history of any veterinary faculty. This remarkable achievement was set in action when Prof Sir Arnold Theiler stood up during the smallpox epidemic of the time to produce a local smallpox vaccine, and later pioneered one of the earliest rinderpest vaccines.



Prof Vinny Naidoo
Dean: Faculty of Veterinary Science

However, while we should be celebrating this momentous occasion with a good meal and drink as was done at Faculty Day for numerous years in the past, you are here today behind a firewall following a digital presentation because of an unpredicted event in our recent history – COVID-19. How ironic, as in my 2019 Faculty Day message, I referred to a world where technology was advancing exponentially as a major positive disruptor in our lives, and how we needed to reassess how we interact with and adapt to technology in order to cope with its disruptive effect.

What has transpired during this challenging and trying year is that we were basically forced to quickly adapt to the circumstances surrounding the COVID-19 pandemic. It also meant that we had to make changes to our ways of thinking, and our ways of interacting with each other and with technology in order to absorb potential further disruptions to our lives and working environment. This equally applies to the way we conduct our teaching and learning, our research and our day-to-day operations. Our world, as we know it, has, in actual fact, been reframed and almost redefined this year and will be defining how we train and undertake research for many years to come.

What we accomplished during this unusual period as a Faculty within the framework of guidelines provided by the University is to face our own challenges head-on. Notwithstanding certain glitches, we were able to successfully negotiate most of them and have taken advantage of the opportunities that presented themselves. In fact, making use of existing technology led to creative thinking and the foundation was laid for continued future innovation with regard to online teaching and learning.

However, our well-known ability to teach has to be complemented by our ability to specifically generate knowledge through our research initiatives, thereby contributing directly to the intellectual debate by teaching our own ideas. Knowledge generated in this way serves as the cornerstone to sustainable development in our country's economy and is a way to a globalised society, especially one built on trade policies.

The Faculty's ongoing strategic aim is to improve the quality and impact of our research to further our international recognition and be acknowledged as such. It is thus a positive feature that, so far during 2020, no less than 27 research articles from our

faculty were published in the top 10% of the world's journals/magazines, measured by the number of citations they receive. It bodes well for the future, a future that will undoubtedly be based on continuous new advancements during the Fourth Industrial Revolution (4IR), also in the veterinary field.

One such relevant example is our Department of Anatomy and Physiology's possible future collaboration with the Laboratory of Artificial and Natural Evolution in the Department of Genetics and Evolution of the Faculty of Sciences of the University of Geneva. Its cooperation with this lab entails an international team analysing the African elephant's trunk, and its exceptional agility and versatility, to create a robot guided by touch, capable of operating in unstable environments, adapting quickly to unexpected situations and performing a multitude of concrete tasks. The project could revolutionise automation in the manufacturing and food industry, as well as in robotic assistance systems for the elderly or disabled.

The Faculty's quest remains to be perceived as a highly productive, world-class veterinary seat of excellence. It is imperative that we accept the challenges of animal health, poverty and food security in southern Africa, making an impact internationally with innovative research, and continuing to seek high-level collaboration and networking.

Although this year's historic first virtual Faculty Day differs in format and our attendees are all online, it is a proud tradition and provides the opportunity for our undergraduate and postgraduate students to present the results of their studies and share them with their peers. This year, our research theme leaders will also present highlights pertaining to the Faculty's research themes. A particularly warm welcome is extended to Dr Javier Jaimes of the Department of Microbiology and Immunology in the College of Veterinary Medicine, Cornell University, who is our keynote speaker. Last, but certainly not least, welcome to all our staff members, students and visitors to this special event, which also serves as a reminder and inspiration to our postgraduate students to pursue the Faculty's primary research goals through sharing new knowledge, innovative concepts and scientific results.

Prof Vinny Naidoo
Dean

Message from the Deputy Dean: Research and Postgraduate Studies

Many researchers agree that the goals of scientific research are embodied in description, prediction and explanation or understanding.



Prof Marinda Oosthuizen
Deputy Dean: Research and Postgraduate Studies

Emphasised on more than one occasion by our Dean, our ability to specifically generate knowledge through our research initiatives also contributes directly to the intellectual debate by teaching our own ideas. Knowledge generated in this way serves as the cornerstone to sustainable development in our country's economy and a way to a globalised society.

In planning and prioritising our Faculty's research objectives, it must not only be statements, but steps that will define measurable outcomes in order to be relevant to sustainable development in our country's economy and, at the same time, be aligned to the United Nations' Sustainable Development Goals (SDGs).

As early as 2017, the Faculty identified the need to change its research themes into four more focused areas:

- African Wildlife Health and Management
- Sustainable Livelihoods and Wellbeing
- Translational Medicine
- Pathobiology of Disease

The aim of the research themes was to establish collaborative research across the Faculty, as well as to put the Faculty in a favourable position to compete for large international grants. The foundation for focused and collaborative research in the Faculty has always been our effective and relevant postgraduate programmes.

However, increased international cooperation and collaboration is an important part of the Faculty's strategic focus in delivering high-quality postgraduate training and research and we will continue to strengthen our existing partnerships and seek to establish new ones.

The Faculty has seen a major improvement in its research standings since 2009 in all the major indicators: Contract income increased from R28.3 million to R65.8 million; National Research Foundation (NRF)-rated researchers increased from 17 to 39; publication units increased from 82 to 113.58 in 2019; and from nine PhDs awarded in 2009 to 18 awarded in 2019.

Aligned with the increase in research output, the Faculty's goal of being a top research facility was achieved when the Faculty was placed 30th in the Shanghai Ranking's Global Ranking of Academic Subjects in 2017. The Faculty was also ranked 43rd in the QS Ranking of Veterinary Schools in 2019.

In 2019 the Faculty had 107 international students, 109 PhD candidates, 160 master's students, 16 postdoctoral fellows and 23 postgraduate diploma students. Our researchers and postgraduate students continue to excel in various ways. Although there were too many highlights to mention over the last few years, a few examples are in order.

The article of one of our postgraduate students, Dr Petronillah Sichewo, who obtained her PhD in April this year, entitled "Prevalence of *Mycobacterium bovis* infection in traditionally managed cattle at the wildlife-livestock interface in South Africa in the absence of control measures", was one of the top three highly cited articles in *Veterinary Research Communications* since 2019.

Two papers on African swine fever by Dr Mary-Lou Penrith, an extraordinary lecturer in the Faculty, were among the top 10% of papers downloaded and of the most read in *Transboundary and Emerging Diseases* (2018–2019).

Dr Sunday Ochai recently participated in a global competition of the International Business School Americas (IBS Americas) with team members from Asia. They emerged as the top 10 winners in the Digital Transformation Case Study contest in the postgraduate category from thousands of entries.

Our research continues to make inroads and an impact. Worth mentioning are the development of an avian influenza vaccine deriving from tobacco and the development of a new African Horse Sickness (AHS) diagnostic test.

Various research projects under the One Health umbrella are underway to find the best possible approach to address and solve complex health problems in collaboration with specialists in the human health sector, environmental sciences and other relevant role players.

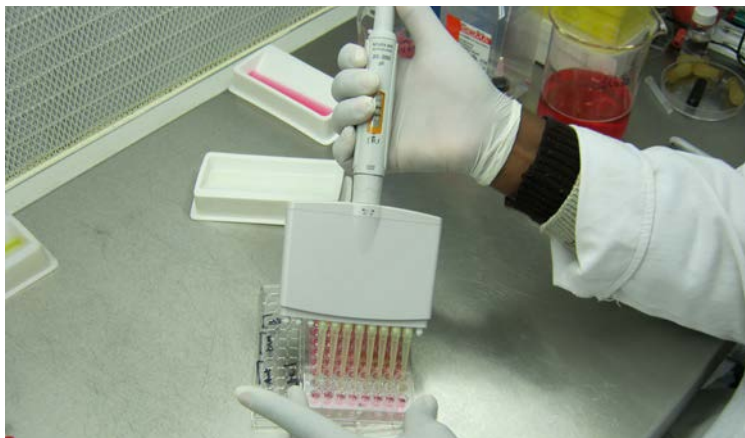
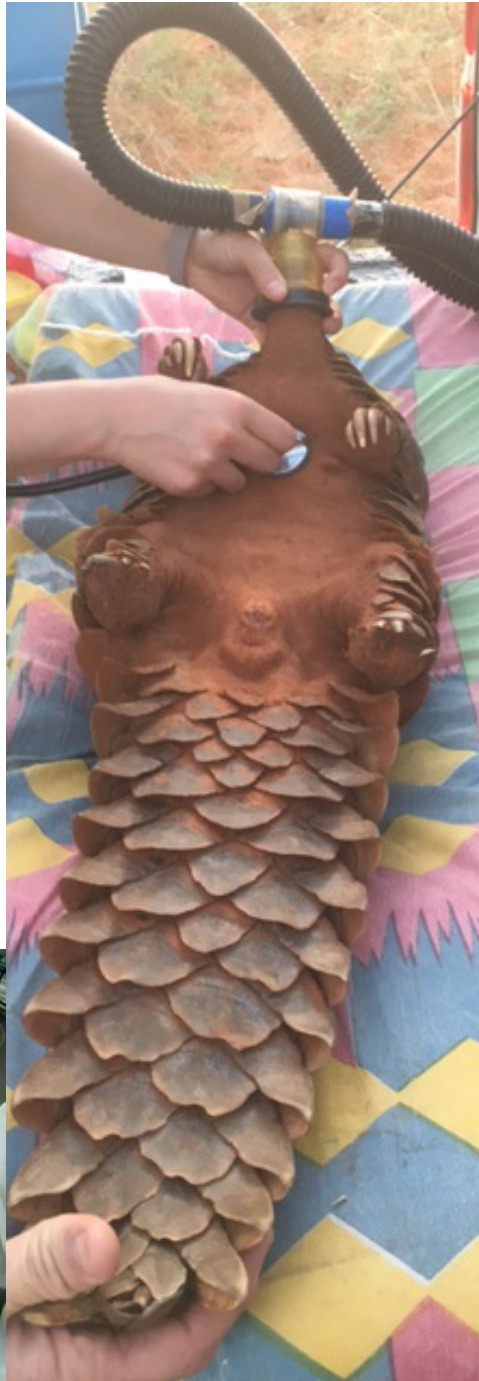
An exciting development relating to this is that the Department of Veterinary Tropical Diseases (DVTG) is in the process of converting its MSc (Tropical Animal Health) degree programme, in collaboration with the Institute of Tropical Medicine (ITM) in Belgium, to a formal joint MSc degree in Global One Health.

An efficient research programme must remain relevant to the needs of South Africa, but also to a constantly changing international environment. Therefore, a strong research platform is explicitly pursued to continue the growth and development of the Faculty. We will continue to stimulate our vision to create strong internationally recognised research groups to escalate the research status of the Faculty, to be an excellent international veterinary seat of excellence, and to be the best postgraduate and research facility on the continent.

I would like to thank Elanco Animal Health for their commitment to sponsoring the Researcher of the Year Award, our small committee for their hard work to make this event and programme booklet possible, and Corné Engelbrecht from SAVETCON for the webinar platform hosting and online event management.

Welcome to our first ever virtual Faculty Day!

Prof Marinda Oosthuizen
Deputy Dean: Research and Postgraduate Studies



Past Deans of the Faculty of Veterinary Science, University of Pretoria



1st Dean:
Sir Arnold Theiler ~1920-1927



2nd Dean:
P J du Toit ~1928-1948



3rd Dean:
G vd W de Kock ~1948-1950



4th Dean:
J I Quin ~1950-1951



5th Dean:
P J J Fourie ~1951-1955



6th Dean:
H Graf ~1956-1960



7th Dean:
R M du Toit ~1960-1963



8th Dean:
B C Jansen ~1963-1969



9th Dean:
C F B Hofmeyr ~1969-1981



10th Dean:
N Owen ~
1980 - 1994 (Medunsa)



10th Dean:
J M W le Roux ~1982-1986



11th Dean:
R I Coubrough ~1987-1999



HM Terblanche ~
1994 - 1999 (Medunsa)

SOURCES:

Onderstepoort 1908-2008, by courtesy of the Veterinary History Society of South Africa.

Universiteit van Pretoria. Ad Destinatum 1910-1960: Gedenkboek van die Universiteit van Pretoria. Johannesburg: Voortrekkerpers Beperk, 1960.



**12th Dean:
N P J Kriek ~2000-2005**



**13th Dean:
G E Swan ~2006-2014**



**14th Dean:
D A Abernethy ~2014-2018**



**15th Dean:
V Naidoo ~2018-Present**

Curriculum Vitae: Javier Andres Jaimes

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Javier A. Jaimes

Education

- Doctor of Veterinary Medicine (DVM) – *National University of Colombia*
- Master of Science – Virology (MS) – *National University of Colombia*
- Master of Business Administration (MBA – *University of La Salle*
- Doctor of Philosophy – Microbiology (PhD) – *Cornell University*

Position

Postdoctoral Associate

Affiliation

Department of Microbiology and Immunology, Cornell University

Research areas

Viral pathogenesis, viral evolution, vaccine development

Distinctions

Dr Jaimes holds the “Ambassador for Colombians Abroad Medal”, conferred by the Colombian Congress as a recognition for his research work in coronavirus

Profile

Dr Jaimes is a veterinarian and virologist working in research and education. His professional career has focused on the study of viruses; principally those infecting humans and domestic animals. He has more than 15 years’ experience (including six years as faculty) investigating virus-host interactions, viral pathogenesis, viral evolution and vaccine development.

His research focuses on understanding the mechanisms used by coronaviruses to enter the host cells, principally studying the molecular and biochemical events that allow the virus to start the cellular infection. He is currently a Postdoctoral Associate in the Department of Microbiology and Immunology at Cornell University, where he studies the mechanisms of infection of SARS-CoV-2, the virus that causes COVID-19.

Coronavirus: Unveiling the viral entry pathways into the host cell

Javier A. Jaimes¹

¹ Department of Microbiology and Immunology, College of Veterinary Medicine, Cornell University, USA

Email: jaj246@cornell.edu

Coronaviruses (CoVs) are a group of infectious agents known for causing disease in humans and animals. They are frequently involved in spill-over events where viruses jump to new species, occasionally causing epidemics. The CoV replication cycle starts with viral binding to a susceptible cell, which triggers a series of molecular events, leading to the fusion between the viral and the cell membranes, and the subsequent release of the viral genetic material into the cytoplasm. The mechanisms used by CoVs to facilitate viral entry are usually studied as targets for drug discovery and antiviral therapy. However, these mechanisms are complex and vary between CoVs, hindering the development of universal therapies to treat infections. Among CoV's proteins, the spike is the major viral regulator for entry processes. This protein is divided into two subunits: S1 and S2, the former harbouring the receptor-binding domain, which interacts with the cellular receptor for viral binding, and the latter enclosing the fusion domain, which drives the viral-cell membrane fusion. During the past 18 years, our laboratory, lead by Dr Gary Whittaker, has studied the CoV molecular pathways for viral entry, especially those related to the viral-cell membrane fusion in several CoVs, including FCoV, SARS-CoV, MERS-CoV, and recently, SARS-CoV-2. We have studied the structure and function of the CoV spike and the role of cellular proteases, as well as positively charged ions, in the activation and stabilisation of the CoV fusion machinery. We are currently studying the effect of protease inhibitors and ion channel blockers in interfering with SARS-CoV-2 infection. Our studies have contributed to understanding the molecular pathways of CoV entry into the host cell and we aim to understand how to interfere with these processes in order to prevent and treat CoV diseases.

Research summary: 2019–2020

The enhancement of innovative and relevant research, as well as high-quality postgraduate training, remains an integral part of the Faculty's strategic plan. In support of the University's goal of being a top research-intensive institution, it requires increased research outputs through effective postgraduate programmes, and making research a primary thrust. International cooperation and collaboration is also an important part of the Faculty's strategic focus in delivering high-quality postgraduate training and research.

The upward trend and sustained growth in research outputs, the quality of ongoing research and facilities, and the engagement of many staff members with the UP vision, suggest that the Faculty is well placed to contribute significantly to the strategic goals of the University. The Faculty's research publication output increased from 55.3 units in 2006 to 113.58 units in 2019 in 109 ISI-accredited journals (214 articles in total), and the higher number of subsidy units earned by the Faculty at 1 unit per academic staff member. In terms of postgraduate students, the Faculty currently has 144 master's, 106 PhD, 16 postdoctoral and 24 postgraduate diploma students.

The number of postgraduate graduations continues to increase compared to previous years. Challenges to sustaining these increases include the clinical nature of academics' work in some departments, the percentage of academics with doctoral degrees or NRF ratings and the percentage supervising postgraduate students. Plans are underway to try and further increase these percentages over the next five years and to recruit additional postdoctoral researchers and research fellows. In 2019, the Faculty awarded 18 PhDs and 61 master's degrees at the University's Autumn and Spring graduation ceremonies.

The Faculty is training professionals who will be able to promote animal health, which directly impacts on human health, thereby stimulating economic growth and food security which are part of the United Nations' Sustainable Development Goals (SDGs). An efficient research programme must remain relevant to the needs of South Africa, but also to a constantly changing international environment. Therefore, a strong research platform is explicitly pursued to continue the growth and development of the Faculty. Our vision is to create strong internationally recognised research groups in wildlife health, infectious diseases, primary animal health, food production, One Health and risk assessment, which are already focus areas of the Faculty. At the same time, the Faculty must have the potential to generate high-impact publications, attract more postgraduate students nationally and internationally, and escalate the Faculty's research status. Fundamental to these visionary requirements, the Faculty has also changed focus through the introduction of four new research themes:

Translational Medicine

This theme will focus on the treatment of human and animal disease. For the former, this will involve the use of natural disease in animals as a model for human disease or the use of animal models of disease to study new treatment(s). For veterinary application, it will either entail the treatment of disease in the target animals in order to optimise veterinary treatment protocols or use animal models of veterinary disease to develop new treatment modalities for the veterinary patient.

African Wildlife Health and Management

This theme focuses on Africa's unique animals and their management. Research within this theme will be cross-cutting from the basic sciences, diagnostics medicine to clinical medicine/surgery. In this theme, research will focus on physiology, farming, management, disease management, food safety and disease transmission.

Pathobiology of Disease

This research theme is dedicated to the study of diseases in animals, including disease epidemiology. Areas of study include changes in the normal physiology of animals brought about by disease and disease processes. An integral component of this theme includes disease diagnostics from clinical changes observed in the patient, diagnostic imaging, clinical pathological changes, pathological changes, the molecular study of disease processes, including descriptions of new pathological agents and/or toxins, and the epidemiology of animal disease.

Sustainable Livelihoods and Wellbeing

This theme looks at the implications of animal diseases on human health and wellbeing, emphasising the country's wildlife interface areas. It focuses on diseases that are uniquely African and not under investigation in other countries. The theme also largely revolves around the One Health concept. Research in this theme includes aspects such as bacterial resistance transmission, environmental toxicity, zoonotic diseases and sustainable food production, all in an attempt to improve the livelihood of Africa's people.

Research summary: 2019–2020

Research output and growth

Measures to increase the Faculty's research output could, inter alia, be achieved by establishing a research ethos, increasing the number of postgraduate students and encouraging teaching staff to submit themselves to the National Research Foundation (NRF) rating process. The Faculty's growth and progress in support of the University's strategic direction could be measured when compared to research publication outputs, growth in the number of master's and postdoctoral students over preceding years, and the number of NRF-rated researchers in the Faculty.

Currently, the Faculty has 98 permanent academic staff members, of whom 47 have doctorate degrees as their highest qualification. Since 2014, there has been a dramatic upsurge in the combined number of master's and doctoral students, and the Faculty has more than doubled its postgraduate output and number of postdoctoral students. The Faculty has improved on the number of PhDs awarded, with 2018 being higher than the previous years, and 2019 slightly lower. The number of NRF-rated researchers in the Faculty's staff complement has shown a steady growth, reaching 29 in 2017 and 38 by the end of 2019.

Faculty Day 2019 and research awards

The annual Faculty Day on 22 August 2019 provided an opportunity for our researchers to showcase the research activities in the Faculty to colleagues and peers, and was well attended by staff members, visitors and sponsor companies alike. The Arnold Theiler memorial lecture, titled "Large mammals facing climate change", was delivered by Prof Duncan Mitchell, Emeritus Professor of Physiology at the University of the Witwatersrand, Johannesburg, and Honorary Professorial Research Fellow in its Brain Function Research Group. Excellence in research performance was recognised at the event with the identification of the Faculty's Top 10 researchers and the allocation of the following research awards:

Researcher of the Year:

Prof Geoff Fosgate

Nine top researchers in the Faculty

2. Prof Lyndy McGaw
3. Prof Vinny Naidoo
4. Prof Estelle Venter
5. Prof Anita Michel
6. Prof Leith Meyer
7. Prof Johan Schoeman
8. Prof Marinda Oosthuizen
9. Prof Christo Botha
10. Prof Peter Thompson

Young Researcher of the Year

Dr Roxanne Buck

Research theme leaders

The Faculty's vision is to have strong internationally recognised research groups in wildlife, infectious diseases, One Health, epidemiology and veterinary public health in support of UP's 2025 Vision and current research clusters. At the same time, it must have the potential to generate high-impact publications, attract more postgraduate students nationally and internationally, and escalate the Faculty's research status. Fundamental to these visionary requirements, the Faculty has also changed its focus through the introduction of four new research themes. The research niche areas and themes serve as the driving force behind all research and postgraduate programmes and were chosen to establish, achieve and project an African uniqueness and to complement external expertise and technology.



Prof Leith Meyer

African Wildlife Health and Management

This theme focuses on the unique animals of Africa and their management. Research within this theme is cross-cutting from the basic sciences, diagnostics medicine to clinical medicine/surgery. In this theme, research focuses on physiology, farming, management, disease management, food safety and disease transmission.



Prof Lyndy McGaw

Translational Medicine

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Prof Johan Schoeman

Pathobiology of Disease

This research theme is dedicated to the study of diseases in animals, including disease epidemiology. Areas of study include changes in the normal physiology of animals brought about by disease and disease processes. Integral components of this theme include disease diagnostics from clinical changes observed in the patient, diagnostic imaging, clinical pathological changes, pathological changes, the molecular study of disease processes, including descriptions of new pathological agents and/or toxins, and the epidemiology of animal disease.

Rising stars

Introduction by the Deputy Dean: Teaching and Learning

Veterinary Research Report
(VRE) module



Prof Dietmar Holm
Deputy Dean: Teaching and
Learning

Background and purpose of the Veterinary Research Report (VRE) module

Prof Dietmar Holm

The BVSc programme of the University of Pretoria has a research thread that starts with Academic Information Management (AIM 121) and Biometry (BME 120), and follows through to a number of assignments in the form of short scientific reports. The new module, Veterinary Research Report (VRE 600), was established in the BVSc curriculum to complete this research thread and to comply with accreditation requirements. Other aims were to strengthen the Faculty's research focus and instill a critical evidence-based mindset in future South African veterinarians. Students choose research topics within their elective career choice, which can be an experimental study, a case study or a literature review.

Rising stars



Magdalena Jannasch

“It’s getting hot in here” – the effect of relative humidity on the thermoregulating ability of the dog during exercise – a systematic review

Magdalena Jannasch and Joe Hanekom

Dogs are often required to exercise in hot ambient conditions making them susceptible to heat injury. Often, when heat injury gets discussed in literature, references are made to ambient conditions (especially temperature and humidity) that affect the thermoregulating ability of dogs during exercise. These references are not always based on scientifically validated evidence but on other reviews or expert opinions.

This systematic review aims to investigate the true effects that relative humidity has on the ability of the working dog to regulate its core temperature during and after exercise and to critically compare that to the current concepts accepted within the field.

A wide electronic search was performed on several electronic databases and by scanning reference lists of potentially relevant articles. Studies were included based on predefined inclusion criteria (working or sporting canines, exertional heat stress, relative humidity included as an environmental factor, and written in/translated to English).

From the above database searches, 93 resources were initially identified as potentially relevant based on titles and abstracts. From those, only 4 met the inclusion criteria and were included in the final review. The data was then extracted by a single author and summarized in table form.

A qualitative comparison was made between study results. None of the included studies found any significant correlation between relative humidity and core temperature responses during exercise. An accurate conclusion regarding the true effect of relative humidity on body temperature regulation in dogs cannot not be drawn with confidence based on data currently available.

Further in-depth research is required to explore the exact relationship between relative humidity and body temperature regulation of canines. Future studies should consider relative humidity independent of other environmental parameters to fully understand the mechanisms behind temperature regulation in the canine in humid environments.

Rising stars

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Antje Christine Menne

A scoping review of viral diseases in free-ranging African felids

Antje Christine Menne and Melvyn Quan

Lion, cheetah and leopard populations are labelled as “vulnerable” by the International Union for Conservation of Nature: the lion population has decreased to 30 000 animals (in 2009), which is less than half of what it was 20 years ago. As populations of African wild felids continue to decline, an increasing number of viral disease cases are being diagnosed in African wild felids, posing a threat to their existence. Possible viral threats to African felids must be identified to mitigate their impact on the wild felid populations.

In this scoping review, the focus was placed on viral diseases in African wild felids. The main aim of this research project was to identify viral diseases (caused by natural infections) that have a significant impact on African felids and to determine where future research should be conducted, indicated by a gap in the literature. For the purposes of this review, viruses that caused clinical disease in free-ranging African felids were identified, a list of resources about viral diseases diagnosed in semi-captive/captive African felids was provided and emerging viral diseases identified.

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement was used as a guide for writing the scoping review. The “Web of Science”, “Wildlife and Ecology Worldwide” and “Scopus” scientific databases were searched during 12-25 August 2019 for information related to the topic of this review. Information sources were searched for English language, peer-reviewed journal articles of all years that contained information about viral diseases in African felids. Review or repeated data were excluded, as well as articles describing iatrogenic infections of African felids. Information was screened and checked for eligibility. Data were extracted for specific variables, using MicroSoft Access 2016.

The journal articles used for this review were published between 1970 and 2019, with a peak number of publications in 2015. Publications about viral diseases in African felids have decreased slightly in the last few years. Most publications were case/outbreak reports and surveillance reports. The viral diseases that were reported most frequently in journal articles were Feline immunodeficiency virus (26/132 times), followed by *Alpha coronavirus 1* (22/132 times) and *Felid alpha herpes virus 1*, with 20/132 reports. Lions were diagnosed with 17/20 viral infections reported in wild African felids, with 26 references about FIV. In the cheetah population 13/20 viral diseases reported in wild African felids were reported with *Alpha coronavirus 1* referenced in 10 articles. Only 6/20 viral diseases reported in African wild felids were reported in leopard, with Feline immunodeficiency virus and Canine morbilli virus the most mentioned (three references each). The caracal was diagnosed with 5/20 viral infections, with two references for *Carnivore protoparvo virus 1*. Very few references have been published on diseases in the African wild cat, the black-footed cat and serval. No references were available on viral infections in the African golden cat.

Publications on viral diseases in African felids reported mainly on research conducted in South Africa, Namibia and Botswana. These results show that many viral diseases impact African felids, with Feline immunodeficiency virus, *Alphacoronavirus 1*, *Felid alphaherpesvirus 1* and *Carnivore protoparvovirus 1* reported the most frequently. The impact of these viral diseases on the wild felid population is still unclear and more research needs to be conducted to identify possible threats to less researched African felids, like the black-footed cat, African wild cat and the African golden cat. Newly emerged viral diseases and zoonosis have been identified and need further investigation.

Rising stars

A body condition index for adult African penguins *Spheniscus demersus*

Roelof Berg and Richard Burroughs

Body condition indices have been widely applied in conservation biology for several different species, and have several applications in the conservation and rehabilitation of wildlife species. The linear relationship between different morphometric measurements of growth and body weight for adult African penguins (*Spheniscus demersus*) were investigated in this study, together with the different statistical methodologies available to develop a body condition index. Quantile regression models for body weight as described by head length at admission and outcome were applied to develop a body condition index for adult African penguins admitted to the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB). Head length and body weight measurements were collected at admission, release and death. Data validation was performed with subjective post-mortem results of body condition of 75 adult African penguins, as well as for differences between the two sexes. Recommended release weights based on head length measurements were made, and based on the data collected for this study, recommendations were made in terms of the practicality of using a body condition index at a wildlife rehabilitation centre such as SANCCOB.



Roelof Berg

Future research leaders



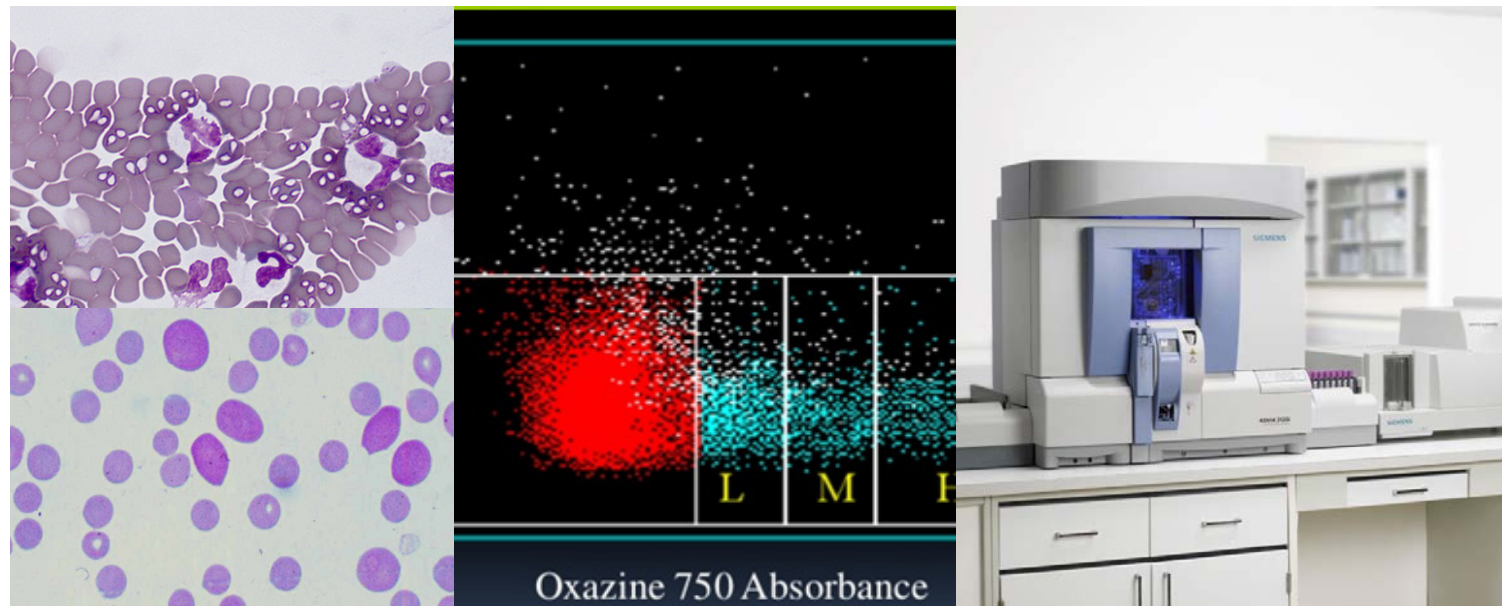
Dr Chandini Seejaram (CACS)

Inappropriate regenerative response in dogs naturally infected with *Babesia rossi*

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Despite haemolytic anaemia being the main consequence of *Babesia rossi* infection in dogs, the bone marrow response has been reported to be mild in the face of severe anaemia. A similar finding has been described in *falciparum* malaria and has been ascribed to either decreased production of erythroid precursors or an inability of erythroid precursors to respond to hormonal stimulus. The objective of this study was to compare the admission absolute reticulocyte count (ARC) in dogs naturally infected with *B. rossi* with dogs suffering from immune-mediated haemolytic anaemia (IMHA), unrelated to babesiosis, as well as healthy control dogs. This was a retrospective observational study looking at the records generated on a haematology analyser, the ADVIA 2120 (Siemens). The haematocrit (HCT) and ARC for 103 dogs naturally infected with *B. rossi* was compared to 16 dogs with IMHA and 14 control dogs. Differences between groups were assessed using the Mann-Whitney U test. The HCT for the *Babesia* (0.16 L/L; 0.12-0.27; $P < 0.001$) and IMHA (0.15 L/L; 0.12-0.17; $P < 0.001$) groups were significantly lower than the control group (0.52 L/L; 0.45-0.57). For the *Babesia* and IMHA groups the HCT did not differ significantly. Compared to the control group ($42.1 \times 10^9/L$; 33.8-62.6), the ARC was significantly higher in the *Babesia* ($82.1 \times 10^9/L$; 48.6-174.9; $P = 0.006$) and IMHA ($256.7 \times 10^9/L$; 79.0 - 436.9; $P = 0.004$) groups. The ARC was significantly lower in the *Babesia* group compared to the IMHA group ($P = 0.011$), despite no significant difference for HCT between groups. This study concludes that the regenerative response in dogs naturally infected with *B. rossi* is inappropriate, despite the severity of anaemia observed, compared to dogs with IMHA. These findings may indicate a direct effect by the organism on the bone marrow, as reported in *falciparum* malaria, or other factors which require further investigation.



Future research leaders



Dr Miriam Marimwe (PAS)

The investigation of highly pathogenic avian influenza outbreaks in key ostrich-producing areas of South Africa

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Highly pathogenic avian influenza (HPAI) has become a major focus for countries due to its zoonotic potential and economic effects resulting from trade restrictions and high mortality rates in poultry. Three H5N2 HPAI outbreaks (2004 and 2011) and one H5N8 HPAI (2017) outbreak have occurred in key ostrich-producing provinces of South Africa. Understanding the epidemiology of HPAI occurrence in ostrich-producing areas is an essential first step in developing effective and efficient control measures. A retrospective descriptive study investigated the spatiotemporal patterns associated with the 2011 H5N2 and 2017 H5N8 HPAI outbreaks in the key ostrich-producing areas of South Africa. Farm-level avian influenza surveillance and disease outbreak data was collected from the Western Cape Department of Agriculture, Veterinary Services. Geographic Information System was used to identify spatiotemporal patterns. Forty-two and 51 farms were affected in the 2011 and 2017 outbreaks, respectively. Both HPAI outbreaks occurred predominantly in areas of high ostrich farm density. However, the temporal occurrence, spatial and directional distribution of the outbreaks were different with two patterns of occurrence evident. The 2011 outbreak occurred earlier in the South African autumn months with a contiguous distribution, whilst the 2017 outbreak onset was during the winter with a more heterogeneous spatial distribution. The outbreaks displayed a stationary and multidirectional distribution of cases, respectively. Results pointed to potential dissimilarities in the risk factors for introduction and mode of spread. The study highlights some important epidemiological features of HPAI outbreaks within ostrich populations, which can be used to inform surveillance and control measures.

Future research leaders



Dr Sunday Ochai (DVTD)

Exposure to anthrax in Kruger and Etosha National Parks and the effect of haemoparasite co-infections

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Anthrax has a global distribution and it is enzootic in Kruger National Park (KNP) in South Africa and Etosha National Park (ENP) in Namibia. These parks share some similarities such as host species and both have endemic and non-endemic areas, but host species differ in their susceptibility between the parks. We measured the presence of anti-PA antibodies in zebra and kudu from both parks using ELISA and also their ability to neutralize anthrax lethal toxin vis-à-vis haemoparasite coinfections detected with reverse line blot probes of *Theileria*, *Babesia*, *Anaplasma* and *Ehrlichia*. It was found that kudus in KNP had higher titres and proportion (95%) of positive animals than ENP (40%). ENP zebras had higher titres and proportions of positive animals (83%) than those of KNP (63%). Animals in anthrax-endemic areas in KNP had higher titres than those in non-endemic areas, but this was not so in ENP. ENP kudus and KNP zebras showed better and higher proportion of neutralization. Animals positive to haemoparasites showed a significant difference between the kudu in KNP (100%) compared to 70% in ENP, while all ENP zebra (100%) tested positive compared to 84.6% KNP zebra. An increase in toxin neutralization was significantly associated with less likelihood of infection with haemoparasites in zebras and kudus. In summary, this study shows that rarity is largely a function of resistance toward anthrax, which could have emanated from both the dose of infection and the interval between exposures and the interplays of other infections in the host.



Future research leaders



Ms Anel Naude (A&P)

Histology of the southern ground hornbill (*Bucorvus leadbeateri*) gastro-intestinal tract

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The Southern Ground-Hornbill (SGH) is the largest bird species that breeds cooperatively and the only entirely carnivorous hornbill. As the bird is an obligatory carnivore the gastro-intestinal tract (GIT) may display specific adaptations which could be of significance in the husbandry of this endangered species. Seven birds, which succumbed from trauma or natural causes, were studied. On post mortem, the GIT was removed and immersion-fixed in 10% neutral-buffered formalin. Parts of the GIT were sectioned and routinely prepared for light microscopy. The *Lamina epithelialis* of the proventriculus, ventriculus and intestine presented folds lined by simple columnar epithelium, secreting mucins. Additionally, koilin, secreted in horizontal layers, was present in the ventriculus. The *Lamina propria* contains substantial simple, branched tubular glands in the proventriculus and intestine, and long simple tubular glands in the ventriculus. The massive compound tubular proventricular glands contain cuboidal cells that secrete HCl and pepsin. Infiltrations of internodular lymphoid tissue is present in the *Lamina propria* of the proventriculus and intestine. A single inner longitudinal layer of *Lamina muscularis mucosae* is present in the proventriculus and rectum and an additional outer circular layer in the rest of the intestine, and this layer is absent in the ventriculus. The *Tunica muscularis* consists of an inner longitudinal layer and outer circular layer throughout the GIT. The proventricular glands and the thin-walled gizzard support enzymatic digestion and not the grinding of ingesta. The layered secretion of the koilin may assist the koilin layer to be both tough and flexible to allow vast distention to accommodate large prey. The heavy reliance on enzymatic digestion is important in the husbandry of these birds as stress may lead to a breakdown in the gizzard lining leading to ulcers. Additionally, the well-developed muscular layers indicate the importance of maintaining intestinal motility.

Future research leaders

Using novel scientific techniques to evaluate physiological responses in the thick-tailed greater galago, *Otolemur crassicaudatus*

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Primates face difficult challenges obtaining their nutritional and energy requirements and will feed on a variety of different food sources to achieve these needs. The thick-tailed greater galago (*Otolemur crassicaudatus*) is a nocturnal primate situated in a highly seasonal temperate environment in Limpopo, South Africa. This species predominantly feeds on fruit, insects, and gum exudates; however, in the winter period these resources are dramatically depleted and the galagos tend to feed opportunistically on available fruit and gum. Little is known about the physiological responses of this species at a molecular level to changes in its environment. Mammalian metabolism is known to be significantly influenced by complex gut microbial community interactions and the metabolic activities of gut microbes significantly influence host physiology. Therefore, identifying these changes in the gut microbiome and the metabolites that modulate the physiological responses to climatic and dietary changes is key to understanding primate consumer physiology and fitness. To investigate the gut microbiome and determine how these microbial communities and the host physiology respond to the external environment, we identified the faecal bacterial communities and, for the first time, urine and serum metabolomes of a free-ranging population of galagos. Next-generation sequencing was used to profile the faecal gut microbial communities in response to seasonal variations, and ¹H-NMR spectroscopy was used to quantify the complex matrix of chemical compounds and their metabolic pathways. The results revealed significant seasonal changes in metabolite concentration associated with metabolic responses. Seasonal differences were observed in the composition and abundance of bacterial species indicating a change in food resources. From these results, we are able to identify the preliminary microbial and metabolite profiles of this species. The results indicate underlying adaptation and survival of this species to changes in the extrinsic environment.



Ms Channen Long (PCS)

Retrospective study of bacterial and fungal causes of abortion in domestic ruminants in northern regions of South Africa (2006–2016)

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This initial retrospective study presents information on bacterial and fungal causes of abortion in domestic ruminants in South Africa over 10 years (2006-2016). A complete set of data was collected at the Faculty of Veterinary Science by a keyword search of pathology and bacteriology laboratory registers. Additional electronic data were received from an external laboratory. A total of 288 cases were recorded from six provinces. The overall diagnostic rate was 35.1%. In 14.6% of cases histological evidence of an infectious process was found, but no aetiological agent was detected. Several cases did not include aetiological diagnoses as applicable diagnostic techniques were not available or not applied when necessary. Increased submission of placenta as well as additional conventional and molecular diagnostic methods can contribute to improved diagnostic rate. In addition, the study highlights the superior significance of *Brucella abortus* as a major bovine pathogen in South Africa.

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Towards the development of a low-cost molecular test for the identification of selected *Rhipicephalus* tick species in South Africa

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Ticks and tick-borne diseases (TBDs) are major obstacles to livestock farming in Africa and can cause disease in humans. TBDs can be transmitted by immature and adult ticks. While it is possible to identify adult ticks using morphological guides it is often very difficult to identify the larval and nymphal stages. The aim of this study was to sequence DNA markers from selected *Rhipicephalus* tick species and develop a low-cost molecular method to assist in the identification of the immature stages of *Rhipicephalus* ticks in South Africa. Six different species of the *Rhipicephalus* genus were selected and morphologically identified from museum specimens stored at the Department of Veterinary Tropical Diseases. Adult ticks were photographed for use as a reference with the sequence. DNA from ticks was extracted using a Chelex resin insect DNA extraction protocol. Two markers, cytochrome oxidase I (COI) and internal transcribed spacer 2 (ITS2), were amplified by polymerase chain reaction (PCR) and DNA sequences were generated and analyzed. In silico digestions of COI and ITS2 markers were done to identify suitable restriction enzymes for PCR-RFLP analysis. Restriction enzymes AluI and MspI, respectively for COI and ITS2, could differentiate between selected species but not all COI and ITS2 sequences of *Rhipicephalus* species found on Genbank. Notably, the in silico analyses suggested that multiple restriction enzymes could be used for this purpose. However, sequences for all *Rhipicephalus* species are not currently available. Although this method of identification shows some promise, it will only be useful once all *Rhipicephalus* sequences are known.

Markers of inflammation and cytokine concentrations during experimental *Babesia rossi* infection of beagle dogs

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Babesia rossi causes severe morbidity and mortality in dogs in sub-Saharan Africa with complications likely caused by an unfocused and excessive inflammatory response. This experimental study investigated inflammatory markers and cytokine kinetics from inoculation of *B. rossi* throughout the course of disease, and aimed to determine if infectious dose influenced rate and severity of disease progression. Five healthy male beagle dogs were infected with *B. rossi*, three with a high infectious dose (Group 1) and two with a low dose (Group 2). CBC, C-reactive protein, albumin, glucose and lactate were determined daily. Cytokines were quantified on stored plasma, collected daily, using a canine specific cytokine magnetic bead panel (Milliplex®). The experiment was terminated when predetermined endpoints were reached. Parasitaemia occurred on day 1 and 3 in group 1 and 2, respectively. The rate of increase in parasitaemia in group 1 was significantly higher than group 2. Significant differences between the groups were found in interferon gamma (INF γ), keratinocyte chemoattractant (KC), INF γ -induced protein 10 (IP10), interleukin 8 (IL8), IL15, IL18, CRP, albumin and neutrophils, variably, at multiple time points during the course of the infection. Significant differences were noted for glucose, lactate, granulocyte-macrophage colony-stimulating factor (GM-CSF), IFN γ , KC, IP10, IL2, IL6, IL7, IL8, IL10, monocyte chemoattractant protein 1 (MCP1), tumour necrosis factor alpha (TNF α), neutrophils, monocytes, CRP and albumin at multiple time points between group 1 and baseline. Significant differences were noted for glucose, IFN γ , KC, IP10, IL8, segmented neutrophils, CRP and albumin between group 2 and baseline. The variables evaluated were higher in group 1 compared to group 2 and when comparing both groups to the baseline, with the exception of albumin and segmented neutrophils which were lower. These findings suggest that in *Babesia rossi* infection, initiation of inflammation occurs before the onset of clinical disease and infectious dose affects the evolution of inflammation as well as the course and severity of disease.

Reference intervals for haematology and clinical chemistry for the African elephant (*Loxodonta africana*)

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The African elephant (*Loxodonta africana*) is listed as vulnerable, with wild populations threatened by habitat loss and poaching. Clinical pathology is used to monitor disease and injury. However, existing reference interval (RI) studies for this species have been performed with outdated analytical methods, small sample sizes or using only culled or captive animals. The aim of this study was to generate haematology and clinical chemistry RIs for a free-ranging African elephant population. Samples originated from immobilized elephants in the Kruger National Park, South Africa. Haematology was performed on 35 EDTA whole blood samples on the Scil Vet ABC Haematology Analyzer or the Horiba Abx Micros ESV60; PCV was measured from 73 samples; 77 blood smears were examined. Clinical chemistry analysis was performed on 77 stored serum samples using the Abaxis Vetscan VS2. RIs were generated according to American Society for Veterinary Clinical Pathology (ASVCP) guidelines, with rigorous exclusion of outliers. Haematology RIs were: PCV 34-49%, RBC 2.80-3.96 $\times 10^{12}/L$, HGB 116-163 g/L, MCV 112-134 fL, MCH 35.5-45.2 pg, MCHC 314-364 g/L, PLT 182-386 $\times 10^9/L$, WBC 7.5-15.2 $\times 10^9/L$, segmented neutrophils 1.5-4.0 $\times 10^9/L$, band neutrophils 0.0-0.2 $\times 10^9/L$, total monocytes 3.6-7.6 $\times 10^9/L$ ("normal" 74%, bilobed 18%, round 8%), lymphocytes 1.1-5.5 $\times 10^9/L$, eosinophils 0.0-0.9 $\times 10^9/L$, basophils 0.0-0.1 $\times 10^9/L$. Clinical chemistry RIs were: albumin 41-55 g/L, ALP 30-122 U/L, AST 9-34 U/L, calcium 2.56-3.02 mmol/L, CK 85-322 U/L, GGT 7-16 U/L, globulin 29-60 g/L, magnesium 1.15-1.70 mmol/L, phosphorus 1.28-2.31 mmol/L, total protein 77-109 g/L, urea 1.2-4.6 mmol/L. Due to strict adherence to ASVCP guidelines, the RIs were in many cases narrower than those previously published for both elephant species and provide improved diagnostic sensitivity. These RI will be helpful for management of injured or diseased animals in national parks and zoological settings.

Efficacy of *Leonotis leonurus* against phytopathogens and nematodes infecting tomatoes

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Leonotis leonurus (L) R. BR. (Lamiaceae), locally known as wild dagga, is used traditionally to treat a variety of conditions including skin rashes, chest infections, digestive tract problems and intestinal worms. In this study, leaves from the plant were selected based on previous good anthelmintic activity against animal parasitic nematodes to test their efficacy against root-knot nematodes and phytopathogens infecting tomatoes. Three extracts: water, acetone, dichloromethane: methanol 1:1 (v/v) and five fractions: *n*-hexane, dichloromethane, ethyl acetate, *n*-butanol and water were tested. Pathogens infecting tomatoes included bacterial *Xanthomonas perforans*, *X. vesicatoria*, *Ralstonia solanacearum*, *R. pseudosolanacearum*, *Clavibacter michiganensis subsp. michiganensis* (Cmm) and the fungus *Fusarium oxysporum* F. sp. *lycopersici*. Nematicidal mortality against *Meloidogyne incognita* second-stage juveniles (J2s) of the crude extracts and fractions was evaluated, as was egg hatch inhibition. A serial microplate dilution method was used to determine the minimal inhibitory concentrations (MIC) of the crude extracts and fractions against bacteria and fungi. Good activity against *M. incognita* J2s was observed only with the water extract with mortality of 78% at 0.7 mg/mL and the dichloromethane fraction with 60% at 0.4 mg/mL after 72 h exposure. Water and dichloromethane: methanol extracts were effective in inhibiting the egg hatching of *M. incognita* at all concentrations except for the acetone extract which had low inhibition. Several fractions were also effective in preventing egg hatching. Against the tested bacterial and fungal pathogens, all extracts and fractions had moderate to weak activity except for the water extract which had good activity against *F. oxysporum* with MIC of 97.5 µg/mL after 24 h incubation. The promising efficacy of *L. leonurus* encouraged further investigation, and preliminary in vivo glasshouse trials using tomato plants confirmed the plant's activity against plant-parasitic *M. incognita*. Nematicidal compounds have also been isolated from the dichloromethane fraction.

Challenges in the diagnostic performance of parasitological and molecular tests in the detection of African trypanosomiasis in cattle in Mambwe district in eastern Zambia

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Trypanosomiasis is a neglected tropical disease with serious health and economic implications. Disease eradication and control programs rely on active case detection through mass population screening. Screening tools and techniques therefore need to be adequately sensitive, practically quick to perform, and affordable. This study compared the field application of the polymerase chain reaction, the loop mediated isothermal amplification technique, and microscopy, in the detection of trypanosomes in cattle blood in Mambwe district in eastern Zambia. Blood samples were collected from 227 cattle into three heparinised micro capillary tubes, and tested for trypanosomiasis infection using microscopy, ITS-PCR and RIME-LAMP. The comparative diagnostic performance of each of the methods was evaluated using the chi-square test, kappa test and receiver operator curves. Microscopy on buffy coat detected 17 cases (n=227), by thin smears detected 26 cases (n=227), and by thick smears detected 28 cases (n=227). In total, microscopy detected 40 cases (n=227). ITS-PCR- on blood spots stored on filter paper detected 47 cases (n=227), ITS-PCR- on blood spots stored on FTA cards detected 83 cases (n=227) and RIME-LAMP-FTA detected 18 cases (n = 131). Using microscopy as gold standard, sensitivity and specificity of ITS-PCR was compared. ITS-PCR-FTA had a better specificity and sensitivity (SE=77.5%; SP=72.2%; k = 0.35) than ITS-PCR-FP (SP = 88%; SE = 60%; kappa = 0.45). Prevalence of *Trypanosoma brucei* s.l. was higher on RIME-LAMP-FTA (18/131) than ITS-PCR-FTA (19/227). Our results are not perfect but are a good illustration of the current diagnostic challenges in rural Africa. Findings showed that none of the diagnostic tests could be taken as having performed better than the others and that each of the tests offered some advantages and limitations. In endemic rural areas of Africa, the use of PCR and LAMP requires specialised staff, laboratory supplies and infrastructure which is often not available. For this reason, microscopy remains the most practical option for field diagnosis of trypanosomes but understanding its limitations is critical particularly when applied for surveillance purposes.

Predictors of carnivore detection at the domestic wildlife interface within Mpumalanga, South Africa

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South African protected areas include national parks and nature reserves. They are managed by either national government, provincial government or private landowners that total 8 % of the land mass according to the World Bank indicators. The conservation of biodiversity in protected areas is managed according to the specific reserve objectives. Two of the most important carnivore management tools are species management and disease management. These two management tools' importance is directly linked to the IUCN red list status and vulnerability index for the carnivore species. In this study a small number of camera traps were used in Andover and Manyeleti Nature Reserves, Mpumalanga both managed by Mpumalanga Tourism and Parks Agency. The camera traps were used to determine possible interaction between different carnivore species. Also to evaluate the possibility for disease transmission at the domestic-wildlife interface between domestic dogs and wild carnivores along with the possible spatial overlap between different carnivore species within the reserves. The camera traps were randomly placed within a grid system on each reserve and the results statistically analysed with SPSS Version 25.0 using univariate, multivariate predictors and Spearman's Rho coefficient tests. ArcGIS version 10.4.1 was also used as a prediction model for the detection of carnivores. Carnivore detection at the domestic wildlife interface was investigated. A fence modification reduced detections per day from 3.8 to less than one with the dominant carnivore species observed being lions, spotted hyenas and domestic dogs originating from adjacent settlements. It was also determined that disease transmission among wild carnivore species is possible due to the spatial overlap either through direct and indirect contact and thus a fenced reserve should incorporate a disease management plan that includes annual testing and vaccination programmes of carnivores.

Comparison of etorphine-azaperone and etorphine-midazolam for African buffalo (*Syncerus caffer*) immobilisation

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African buffaloes (*Syncerus caffer*) are sought after in the South African wildlife industry, and the need for minimal risk of injury and mortality during immobilisation for both animal and personnel is paramount. The aim was to compare the characteristics of etorphine-azaperone (EA) to etorphine-midazolam (EM) immobilisation in boma-habituated buffalo bulls where both combinations were administered once in a blinded randomised crossover design, one week apart. Etorphine (0.015 mg/kg) combined with 0.15 mg/kg of azaperone or midazolam was administered intramuscularly by dart. The times to handling (from darting to handling) and recovery (from administering the antagonist drugs until standing) were measured. Physiological variables were measured at 5-minute intervals from handling until 20 minutes. Arterial blood gases were analysed at handling and 20 minutes. Data were parametric and reported as mean (\pm standard deviation). Paired t-tests (times) and a general linear mixed model (physiological variables) were used to compare variables. The time to handling and recovery were 7.7 ± 6.2 and 1.2 ± 0.5 minutes for EA and were not different from 7.4 ± 6.4 and 1.4 ± 0.7 minutes for EM. Severe hypoxaemia (arterial oxygen tension <50 mm Hg) and mild hypercapnia (arterial carbon dioxide tension >55 mm Hg). Resulted from both combinations and were likely caused by hypoventilation and right-to-left intrapulmonary shunting of blood. Midazolam has minimal cardiovascular effect which did not alter the severe etorphine-induced hypertension [mean arterial blood pressure (MAP) 163 ± 18 mmHg]. Azaperone has $\alpha 1$ -adrenoceptor antagonistic effects which prevents $\alpha 1$ -mediated vasoconstriction which resulted in a lower blood pressure (MAP 102 ± 25 mm Hg) and higher heart rate (113 ± 27 beats per minute) compared to EM (79 ± 22 beats per minute). Both combinations are effective and can be used to immobilise buffaloes; however, oxygen supplementation is recommended.

Investigation of spore survival in the *Bacillus anthracis* Sterne (34F₂) strain in soils from Kruger National Park

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Bacillus anthracis is the aetiological agent of the infamous disease, anthrax, which is a zoonosis that typically affects ungulates. In Kruger National Park (KNP), the disease is unmanaged and has enzootic and non-enzootic regions, namely Pafuri and Skukuza, respectively, where the soils differ in their structure and chemistry. The *B. anthracis* spore can survive in the environment for a long time due to its hardy structure. The avirulent Sterne strain, used for the vaccination of domestic animals, is an attenuated form of the bacterium which lacks the antiphagocytic capsule but is still able to elicit an immune response. The aim of this study was to determine the survival period of the Sterne spores in the anthrax enzootic and non-enzootic soils of KNP in a laboratory experiment. The soil samples were inoculated with 10⁹ spores per gram of soil and incubated in an insulated terra-simulator to reduce the interaction with spores and to mimic the environmental conditions of Pafuri. The soil samples were assessed using classic microbiological techniques to test for the presence of *B. anthracis* colonies and reported as CFU/g. Sterne persisted in the soils for ~3 weeks at very low levels. At day 1, the Sterne counts were 1.93 x 10⁶ CFU/g and 3.67 x 10⁶ CFU/g for Pafuri and Skukuza, respectively. By week 3, these counts drastically decreased and Sterne could only be detected in the Pafuri soil at 6 x 10³ CFU/g. This study highlights that the Sterne strain has poor survivability in the environment due to the absence of the antiphagocytic capsule and competitive inhibition by other bacteria. The findings also show that the Sterne strain poses no threat as an environmental contaminant and most of the spores die within a few days.

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Evaluation of endometrial glandular changes in aged captive cheetahs (*Acinonyx jubatus*) in southern Africa

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The cheetah, *Acinonyx jubatus*, is classified as “vulnerable” on the IUCN red list of threatened species. With declining population numbers in the wild, conservation efforts have focused on captive breeding and investigating the long-term effects of reproduction control strategies. Cheetahs in captivity survive longer than their wild counterparts and are purportedly more predisposed to conditions such as endometrial hyperplasia, cystic endometrial glandular changes, endometritis and pyometra. Uterine samples were collected from 21 captive aged southern African cheetahs (mean and median age of 10 years). Endometrial changes in samples collected a year after laparoscopic salpingectomy were compared with samples collected at ovariectomy and post mortem. Minimal endometrial pathology was observed with only mild glandular ectasia (calculated as gland lumen area %) being observed in most cases. This is in contrast with previous studies in cheetahs, and other domestic and wild felids and canids where severe cystic and/or hyperplastic endometrial glandular changes were reported frequently. Increased gland lumen area % was positively correlated with increased age and endometrial area. There were no differences in endometrial pathology between the post-salpingectomy and other samples. In the 10 cheetahs that were treated with deslorelin contraceptive implants, no significant endometrial pathology was observed. It is possible that the mild endometrial changes that were observed in this study fall within the realm of physiologic normality and therefore do not represent overt pathology. This requires further investigation, as does the discrepancy in severity of endometrial glandular pathology between southern African and North American captive cheetah populations.

Apoptosis of germ cells in the normal testis of the Japanese quail (*Coturnix coturnix japonica*)

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It has been established that excess germ cells in normal and in pathological conditions are removed from testicular tissue by the mechanism of apoptosis. Studies on germ cell apoptosis in avian species are grossly lacking, and there are only a few reports on induced germ cell degenerations in the testis tissue of birds. This study was designed to investigate the process of apoptosis of germ cells in the Japanese quail (*Coturnix coturnix japonica*). Germ cell degenerations were investigated in birds of all age groups, namely pre-pubertal, pubertal, adult, and aged. Apoptosis of germ cells in the quails, as shown by haematoxylin & eosin (H&E), TdT dUTP Nick End Labeling (TUNEL) assay and electron microscopy, was similar to that observed in previous studies of germ cells and somatic cells of mammalian species. The observed morphological features of these apoptotic cells ranged from irregular plasma and nuclear membranes in the early stage of apoptosis to rupture of the nuclear membrane, condensation of nuclear material, as well as fragments of apoptotic bodies, in later stages of apoptosis. In the TUNEL-positive cell counts, there was a significant difference between the mean cell counts for the four age groups ($P < 0.05$). Post hoc analysis revealed a highly significant difference in the aged group relative to the pubertal and adult age groups, while the cell counts of the pre-pubertal group were significantly higher than those of the pubertal group. However, there was no significant difference between cell counts of the pre-pubertal and the adult, and between the pre-pubertal and the aged groups.

The effect of different automatic cluster removal switch-point settings on milking and overmilking duration and on total, peak and overmilking claw vacuum

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The ideal milking machine harvests milk from dairy cows in a fast-effective manner without causing teat or udder damage, cow discomfort or loss in milk quality. The aim of the study was to investigate the influence of three automatic cluster removal (ACR) switch-point settings on machine-on time, overmilking duration and total mean-, peak flow- and overmilking vacuums. In a randomized trial ($n = 65$) performed on one dairy farm, cows were exposed to three ACR switch-point settings (0.504 kg/min, 0.630 kg/min and 0.840 kg/min) for 15 milkings per setting. The parlour was a 10-point, low milk-line, herringbone Waikato machine with the Afimilk system. Pre-milking preparations were observed, while a VaDia apparatus was used to determine machine-on time and vacuums at the claw, mouth piece and pulsator chambers during the whole milking process. Results indicated that machine-on time varied from 290.0, 289.2, 303.3 seconds for 0.840, 0.630 and 0.504 kg/min settings, respectively. Overmilking duration differed significantly ($p < 0.0001$) from 76.5 to 108.2 seconds between the highest and lowest volume settings. The three vacuum level measurements differed significantly ($p < 0.0001$) at each switch-point setting. This study indicated that while machine-on time was decreased by 4.4 %, the overmilking duration was 29.3 % shorter and the vacuum during overmilking was 3.7 kPa lower when an ACR switch-point setting of 0.840 kg/min was used compared to 0.630 kg/min. Overmilking duration was 26.4 % less and overmilking vacuum was 4.3 kPa lower, when an ACR switchpoint setting of 0.840 kg/min was used compared to 0.630 kg/min. The knowledge gained from different switch-point settings can be applied on individual dairy farms with different parlours and milking machines, to optimise settings in order to obtain a balance between milking efficiency, udder health and cow comfort.

Anti-inflammatory effects of *Psilocybe natalensis* magic mushroom extracts on LPS-induced nitric oxide, prostaglandin E₂, and cytokine production in RAW 264.7 macrophages

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The psilocybin-containing mushrooms, commonly known as magic mushrooms, have been used since ancient and recent times for treatment of depression and to improve quality of life. However, their anti-inflammatory properties are not known. Pathological inflammation is a problem in many chronic diseases including major depression. Induced-nitric oxide (NO) accumulation, oxidative stress and lowered antioxidant concentrations play a major role in the genesis and progression of pathological inflammation. The study aimed at investigating for the first time, the antioxidant and anti-inflammatory effects of *Psilocybe natalensis*, one of the well-known psilocybin-containing mushrooms that grow in South Africa, in vitro on lipopolysaccharide (LPS)-induced RAW 264.7 macrophages. *Psilocybe natalensis* mushrooms were grown and extracted with boiling hot water, cold water and 70% ethanol. Radical scavenging activity of the extracts was measured using the 2,2'-azinobis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS) assay. When grown to confluence, RAW 264.7 macrophage cells were stimulated with LPS (1 µg/mL) and treated with different concentrations (10, 25 and 50 µg/mL) of *Psilocybe natalensis* mushroom extracts over 24 hours. Quercetin and N-nitro-L-arginine methyl ester were used as positive controls for induced NO inhibition. The effects of the mushroom extracts on the LPS-induced NO, prostaglandin E₂, and pro-inflammatory cytokine activities were investigated. Phytochemical determination of extracts was performed using gas chromatography-mass spectrometry. The results showed that the three mushroom extracts scavenged the ABTS free radicals effectively and activity was potent with the ethanol extract. The results also demonstrated that the three extracts inhibited LPS-induced NO release as well as prostaglandin E₂, and interleukin 1β cytokine production significantly in a dose-dependent manner similar to that of the positive controls. The study concludes that ethanol and water extracts of the magic mushroom *Psilocybe natalensis* have antioxidant and anti-inflammatory effects. Phytochemical analysis confirmed the presence of known antioxidant and anti-inflammatory compounds in the three *Psilocybe natalensis* mushroom extracts.



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