

# Faculty Day

21 October 2021



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of  
Veterinary Science

Fakulteit Veeartsenykunde  
Lefapha la Disaense tša Bongakadiruiwa





# 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.

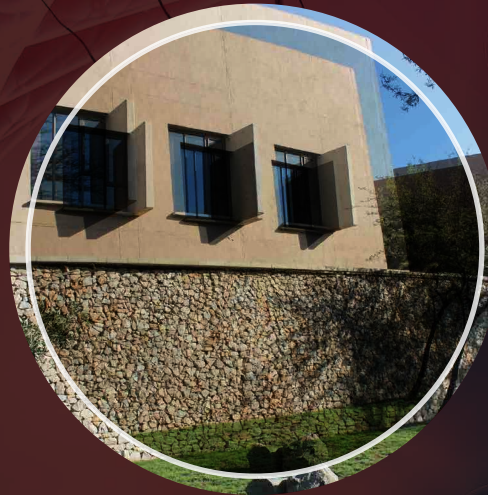


# Virtual Faculty Day

## Faculty of Veterinary Science

### University of Pretoria

21 October 2021



## Contents/programme

Master of Ceremonies: Prof Banie Penzhorn

08:00–08:15 Online platform opens – For the expanded scientific programme, go to <https://opvetfacultyday.co.za/>

08:20–08:30 Start of proceedings and housekeeping rules

08:30–08:55 Welcoming address: Prof Vinny Naidoo, Dean of the Faculty of Veterinary Science  
Session Chair: Prof Banie Penzhorn

08:55–09:55 Session 1: Postgraduate research  
Session Chair: Prof Mary-Cathrine Madekurozwa

08:55–09:05 1. Histomorphometry of seminiferous tubules in four reproductive cycles of Japanese quails (*Coturnix coturnix japonica*)  
*M Zakariah*

09:05–09:15 2. Establishment of temporally specific adrenocorticotrophic hormone reference intervals for horses in South Africa  
*D Fisher*

09:15–09:25 3. Construction of three foot-and-mouth disease virus peptide phage display libraries for the identification of epitopes  
*NPB Sekgobela*

09:25–09:35 4. Effect of maximum daily temperature and relative humidity on milk urea nitrogen concentration of Holstein cows  
*T Tshuma*

09:35–09:45 5. Antibiofilm, antioxidant and anti-inflammatory activity of selected indigenous South African plants used in the treatment of diarrhoea  
*RO Adeyemo*

09:45–09:55 Question and answer session

09:55–10:05 Virtual tea/coffee break

- 10:05–10:35 **Session 2: Undergraduate research (VRE 600)**  
**Session Chair:** *Ms Nina Burger*
- 10:05–10:13 1. Comparison of the different PRP systems and the results of the treatment of suspensory ligament desmitis in clinically affected horses  
*C Randlehoff*
- 10:13–10:21 2. An analysis of experiential learning in a community engagement setting in third-year veterinary science students  
*G Naidoo*
- 10:21–10:29 3. Animal welfare organisations in South Africa: A preliminary exploration of distribution and activities  
*T Hlaka*
- 10:29–10:35 Question and answer session
- 10:35–11:00 **Session 3: Postgraduate research speed session 1**  
**Session Chair:** *Dr Zulfiyah M Moosa*
- 11:00–11:30 **Virtual tea/coffee break**
- 11:30–12:30 **Session 4: Postgraduate research**  
**Session Chair:** *Dr Ned Snelling*
- 11:30–11:40 1. Reliability of pulse oximetry, at four different attachment sites, in immobilised white rhinoceros *Ceratotherium simum*  
*TK Mtetwa*
- 11:40–11:50 2. Influence of high-protein and high-carbohydrate diets on serum lipid and fructosamine concentrations in healthy cats  
*CF Berman*
- 11:50–12:00 3. Prevalence, risk factors for exposure and socio-economic impact of peste des petits ruminants in Karenga district, Karamoja region, Uganda  
*CJ Akwongo*

- 12:00–12:10 4. The circulation of *Toxoplasma gondii* in a human-livestock-wildlife interface area in Mpumalanga, South Africa  
*RP Bokaba*
- 12:10–12:20 5. Comparison of medetomidine-ketamine vs medetomidine-zoletil anaesthetic on cardiovascular parameters in chimpanzees (*Pan troglodytes*)  
*C Greyling*
- 12:20–12:30 Question and answer session
- 12:30–12:40 **Virtual tea/coffee break**
- 12:40–13:05 **Session 5: Postgraduate research speed session 2**  
**Session Chair:** *Mrs Danelle Venter*
- 13:05–14:00 **Virtual lunch break**
- 14:00–14:25 **Keynote address: Prof Tawana Kupe, Vice-Chancellor and Principal of the University of Pretoria**  
*Science needs to be celebrated – but is that enough?*  
**Introduction and Session Chair:** *Prof Vinny Naidoo*
- 14:25–14:35 **Launch of Centenary Book and Commemorative Centenary Stamp**  
*Prof Vinny Naidoo*
- 14:35–15:20 **Arnold Theiler Memorial Lecture: Prof Peter Sutovsky, University of Missouri, USA,**  
*Male infertility and semen evaluation: Andrology in the age of precision medicine and agriculture*  
**Introduction and Session Chair:** *Prof Joseph Chamunorwa*
- 15:20–15:25 **Virtual tea/coffee break**
- 15:25–15:40 **Annual Faculty Research Prize-giving**  
*Prof Marinda Oosthuizen*
- 15:40 **Closing remarks**  
*Prof Vinny Naidoo*

## Speed session presenters

1. **Evaluation of the effects of probiotic and ascorbic acid on the adverse effects of heat stress in broiler chickens**  
*VO Sumanu, V Naidoo, MC Oosthuizen, JP Chamunorwa*
2. **Comparative antimicrobial efficacy of four surgical hand preparation procedures prior to application of an alcohol-based hand rub in veterinary students**  
*H Viljoen, JP Schoeman, GT Fosgate, C Boucher*
3. **Short-term clinical outcomes of 220 dogs with thoraco-lumbar disc disease treated by mini-hemilaminectomy**  
*RC Elliott, CF Berman, C Moon, G Zeiler, RG Lobetti*
4. **Feeding patterns of *Culicoides* at Onderstepoort**  
*L Penzhorn, AJ Guthrie, JE Crafford, GJ Venter*
5. **Extension of sylvatic circulation of African swine fever virus in extralimital warthogs in South Africa**  
*AF Craig, ML Schade-Weskott, HJ Harris, L Heath, D Kriel, L de Klerk-Lorist, L van Schalkwyk, P Buss, JD Trujillo, JE Crafford, JA Richt, R Swanepoel*
6. **The effect of Garlium GEM HC™ as a tick repellent agent in beef cattle**  
*FM Hagg, LJ Erasmus, D Cromarty, WH Stoltsz*
7. **Spatio-temporal patterns and risk factors of foot-and-mouth disease in Malawi between 1957 and 2019**  
*ET Chimera, GT Fosgate, EMC Etter, RM Hassan, G Kamwendo, P Njoka*
8. **Semen parameters of roan and sable antelope (*Hippotragus equinus* and *H. niger*) in a semi-intensive setting in Kimberley, South Africa**  
*S de Bruyn, MP Smuts, DE Holm, EC Webb, D Gerber, KN Koepfel*
9. **Dose-related morphological changes in the epididymal region of sexually active adult male Japanese quail treated with di-n-butyl phthalate (DBP) commencing during the pre-pubertal stage**  
*MIA Ibrahim, J Williams, CJ Botha*
10. **The cytotoxic effect of ionophores on cardiac and skeletal muscle cells *in vitro***  
*D Henn, GCH Ferreira, EA Venter, CJ Botha*
11. **Bioassay guided fractionation of *Senna singueana* and its potential for development of poultry phyto-genic feed additives**  
*P Jambwa, FN Makhubu, SM Nkadimeng, G Matope, G Fouche, LJ McGaw*
12. **Temporal changes of endocrine variables in beagle dogs experimentally infected with *Babesia rossi***  
*E van Zyl, AL Leisewitz, BK Atkinson, A Goddard, Y Rautenbach, P Thompson, JP Schoeman*

- 13. Development of a serological-based vaccine matching technique for SAT 2 foot-and-mouth disease (FMD) viruses**  
*T Malesa, P Opperman, L Heath*
- 14. Temporal dynamics of *Anaplasma marginale* infection in calves at the wildlife-livestock interface in the Mnisi communal area, Mpumalanga, South Africa**  
*SM Makgabo, L Biggs, KA Brayton, MC Oosthuizen, NE Collins*
- 15. Serum neutralisation profiles of straw-coloured fruit bats (*Eidolon helvum*) against four lineages of Lagos bat lyssavirus**  
*VO Ameh, G Wu, H Goharriz, AR Fooks, CT Sabeta, L Mcelhinney*
- 16. Spatio-temporal analysis of bovine theileriosis (*Theileria parva*) in Zimbabwe from 1995 to 2018**  
*M Manyenyeka, C Marufu, WM Tagwireyi, RM Spargo, E Etter*
- 17. Low-dose thiafentanil in combination with medetomidine and azaperone for the immobilisation of African buffalo (*Syncerus caffer*)**  
*VE Faber, R Burroughs, LCR Meyer, KN Koepfel*
- 18. Semen collection and cryopreservation in black (*Diceros bicornis*) and white rhinoceroses (*Ceratotherium simum*) – field-friendly protocols**  
*J Meuffels, H Bertschinger, I Luther-Binoir, I Lueders*
- 19. Antibacterial interactions, anti-inflammatory, cytotoxic and anti-biofilm effects of medicinal plant species used for cutaneous wound infections on animals**  
*JK Madisha, LJ McGaw*
- 20. Evaluating the effect of bambarmycin on *mcr-1*-associated colistin resistance in *E. coli***  
*IZ Hassan, N Mbelle, DN Qekwana, V Naidoo*
- 21. Anti-inflammatory and antioxidant activity of selected medicinal and invasive plants of South Africa with potential for developing mastitis medication**  
*EC Ogbuadike, SM Nkadimeng, CC Igwe, IM Petzer, LJ McGaw*
- 22. Some Menispermaceae plant species have dual effects against *Mycobacterium* spp. and *Caenorhabditis elegans***  
*RT Akande, IM Famuyide, LJ McGaw*





# 100 YEARS

OF VETERINARY EDUCATION

1920 - 2020

FOUNDED BY SIR A THEILER





**Prof Vinny Naidoo**  
Dean: Faculty of Veterinary Science

# Message from the Dean

*COVID-19 has been a major disruptive factor in our lives for the past 18 months. It affected almost all aspects of our lives and our working environment. It also brought sorrow and sadness to many, including some of our colleagues and students who lost loved ones to COVID-19.*

During this unpredictable and trying time, we had to quickly adapt to circumstances surrounding the pandemic. Similarly, we were forced to adopt new thought processes about the way we are interacting with each other and with technology to absorb potential further disruptions to our lives and working environment. This equally applies to the way we conduct our research, teaching and learning. Thankfully, making use of existing technology has led to creative thinking, which has now become the foundation for future innovation in our teaching and research activities.

Another major change has been the introduction of numerous very effective vaccines. Of course, the history of the remarkable invention of the vaccination process goes back to 1796 when people were vaccinated with cowpox to serve as vaccine against smallpox, based on observations by Edward Jenner linking cowpox exposure to protection against smallpox. Unfortunately, despite the proof of the protection that vaccines, in general, have offered over the last 200 years, the science of vaccines is still being questioned today, either through conspiracy theories or odd fake news stories. We need to trust the science that is allowing our society to progress.



It is then also quite relevant that our Faculty's humble beginnings derived from admitting its first eight students to study at the Onderstepoort Bacteriology Laboratory, which was the key veterinary vaccine developing facility for the control of smallpox and Rinderpest at the time. Thus, when the decision makers in 1918 decided to support Arnold Theiler's proposal to establish a faculty of veterinary science at Onderstepoort, the foundation was laid of something very special that would change the animal welfare, food production, disease prevention and veterinary public health landscape in South Africa forever.

This brings us to where we are today. From our humble beginnings, the Faculty has grown from sharing one building with the researchers of the Bacteriology Laboratory to acquiring its own campus, which hosts an extensive range of laboratories, clinical facilities and an on-site training farm. The Faculty's ongoing strategic aim is to improve the quality and impact of our research and to further our international recognition and be acknowledged for its research excellence. First and foremost, the impact of any academic institution is best measured by the impact of its alumni on society. In the 100 years of our Faculty's existence, the Faculty graduated 5 139 veterinarians and 1 170 veterinary nurses, as well as 308 Master of Veterinary Medicine, 509 Master of Science, 66 Doctor of Veterinary Science and 208 Doctor of Philosophy candidates.

There is no doubt that our graduates have proceeded to change not only South Africa, but have also made a significant impact in many other countries. From just a financial view, our graduates in practice today support the survival of an animal agricultural industry worth over R200 billion, especially when the entire value chain is taken into consideration. These outputs are furthermore evident in the research statistics of this last year which, despite the restrictions imposed by COVID-19 and the nationwide lockdown, were at a record high of 113 publication units, which translates to 251 manuscripts in our centenary year.

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. No doubt, as we move forward with technological advances, the Faculty needs to change focus on how we teach, in our research activities and

how we undertake our diagnostics. As a result, there will be a need for new ways of disease diagnostics, which will include smart devices using the internet of things, smart intensive care units (ICUs), external sensor monitoring of herds and telemetric medicine.

However, as part of the Faculty's mission, it remains locally preeminent and relevant to the needs of the country and its population. The challenge to improve production for local consumption and for exportation will always remain, with vets striving to attain these goals. Also, while much has been done in disease research thus far, it is perhaps time for us to unify these research activities by creating a new Centre for Biosecurity and Disease Risk Assessment, which will be a first in Africa. This centre would be the focus of all disease research at the Faculty and would also focus on further improving animal-based agriculture in the country and Africa to allow farms in South Africa to develop for the international trade.

Faculty Day, as an event, was held on 5 September 1984 for the first time to showcase research undertaken at the Faculty. Today's Faculty Day not only provides us with an opportunity for our students to showcase their research projects, it also allows us to formally celebrate our centenary. Another feature that has become part of Faculty Day since its inception is the Arnold Theiler Memorial Lecture, which was first hosted by the Faculty in 1962, with the aim of allowing international speakers to contribute to the knowledge of the veterinary profession in our country. Therefore, we are extending a warm welcome to Prof Peter Sutovsky from the University of Missouri, who will be presenting this year's Arnold Theiler Memorial Lecture.

We are also privileged to have our Vice-Chancellor and Principal, Prof Tawana Kupe, addressing us today to mark this very special occasion, being the official celebration of the Faculty's centenary this past year, which we had to delay due to COVID-19 restrictions. Last, but certainly not least, we welcome all our staff members, students and visitors to this special event. A special word of gratitude to everyone who has made this event possible.

**Prof Vinny Naidoo, Dean**



# Past deans of the Faculty of Veterinary Science, University of Pretoria

1<sup>st</sup>



**Dean:**

Sir Arnold Theiler  
1920 – 1927

2<sup>nd</sup>



**Dean:**

P J du Toit  
1928 – 1948

3<sup>rd</sup>



**Dean:**

G vd W de Kock  
1948 – 1950

4<sup>th</sup>



**Dean:**

J I Quin  
1950 – 1951

5<sup>th</sup>



**Dean:**

P J J Fourie  
1951 – 1955

6<sup>th</sup>



**Dean:**

H Graf  
1956 – 1960

7<sup>th</sup>



**Dean:**

R M du Toit  
1960 – 1963

8<sup>th</sup>



**Dean:**

B C Jansen  
1963 – 1969

9<sup>th</sup>



**Dean:**

C F B Hofmeyr  
1969 – 1981



**Dean:** Medunsa

N Owen  
1980 – 1994

10<sup>th</sup>



**Dean:**  
JMW le Roux  
1982 – 1986

11<sup>th</sup>



**Dean:**  
RI Coubrough  
1987 – 1999



**Dean:** Medunsa  
HM Terblanche  
1994 – 1999

12<sup>th</sup>



**Dean:**  
NPJ Kriek  
2000 – 2005

13<sup>th</sup>



**Dean:**  
GE Swan  
2006 – 2014

14<sup>th</sup>



**Dean:**  
DA Abernethy  
2014 – 2018

15<sup>th</sup>



**Dean:**  
V Naidoo  
2018 to present

**SOURCES:**  
*Onderstepoort 1908–2008, by courtesy of the Veterinary History Society of South Africa*

*Universiteit van Pretoria. Ad Destinatium 1910–1960: Gedenkboek van die Universiteit van Pretoria. Johannesburg: Voortrekkerpers Beperk, 1960.*



**Professor Tawana Kupe**  
Vice-Chancellor and Principal of the University of Pretoria

# Professor Tawana Kupe

*Professor Tawana Kupe has been the Vice-Chancellor and Principal of the University of Pretoria since 2019. He holds a DPhil in Media Studies from the University of Oslo, Norway. An Honorary Doctorate in Humanities was bestowed on him by Michigan State University in December 2019.*

Prof Kupe has a notable publication record, having authored journal articles, books and book chapters in his main discipline, Media Studies and Journalism. He is an active member of several civil society organisations, including the AmaBhungane Centre for Investigative Journalism, and is Chairman of the Board of Media Monitoring Africa.

He has been a judge and convenor of multiple major journalism awards in South Africa and is a member of the Council of the International Association of Media and Communication Research.

He is the Co-chair of the Australia-Africa Universities Network (AAUN), and is a member of the Association of Commonwealth Universities (ACU) Council, the National Advisory Council on Innovation (NACI) in South Africa, and a board member of the Association of African Universities (AAU) and the Advisory Committee of the South African Sustainable Development Goals Policy Support Initiative, among others.



# Keynote address: Science needs to be celebrated – but is that enough?

*There are numerous examples of how scientists, research and scientific discoveries changed the course of history in some or other way. The work and discoveries of scientists such as Sir Arnold Theiler, Alexander Graham Bell and Louis Pasteur irreversibly altered the world we are living in and influenced our future thought processes.*

The essence of how the dynamic nature of science and technology contributes to society is the creation of new knowledge, and utilising that knowledge to ultimately boost the prosperity of human lives.

Furthermore, science is valued because the application of scientific knowledge helps to satisfy many basic human needs, improve living standards and solve various problems facing society.

There are thus explicit reasons why we can and need to celebrate progress and change in science over many decades and centuries. But would it suffice to just celebrate and appreciate new scientific discoveries that will benefit humanity? Do we not need to do much more to ensure and emphasise the application of science in education?

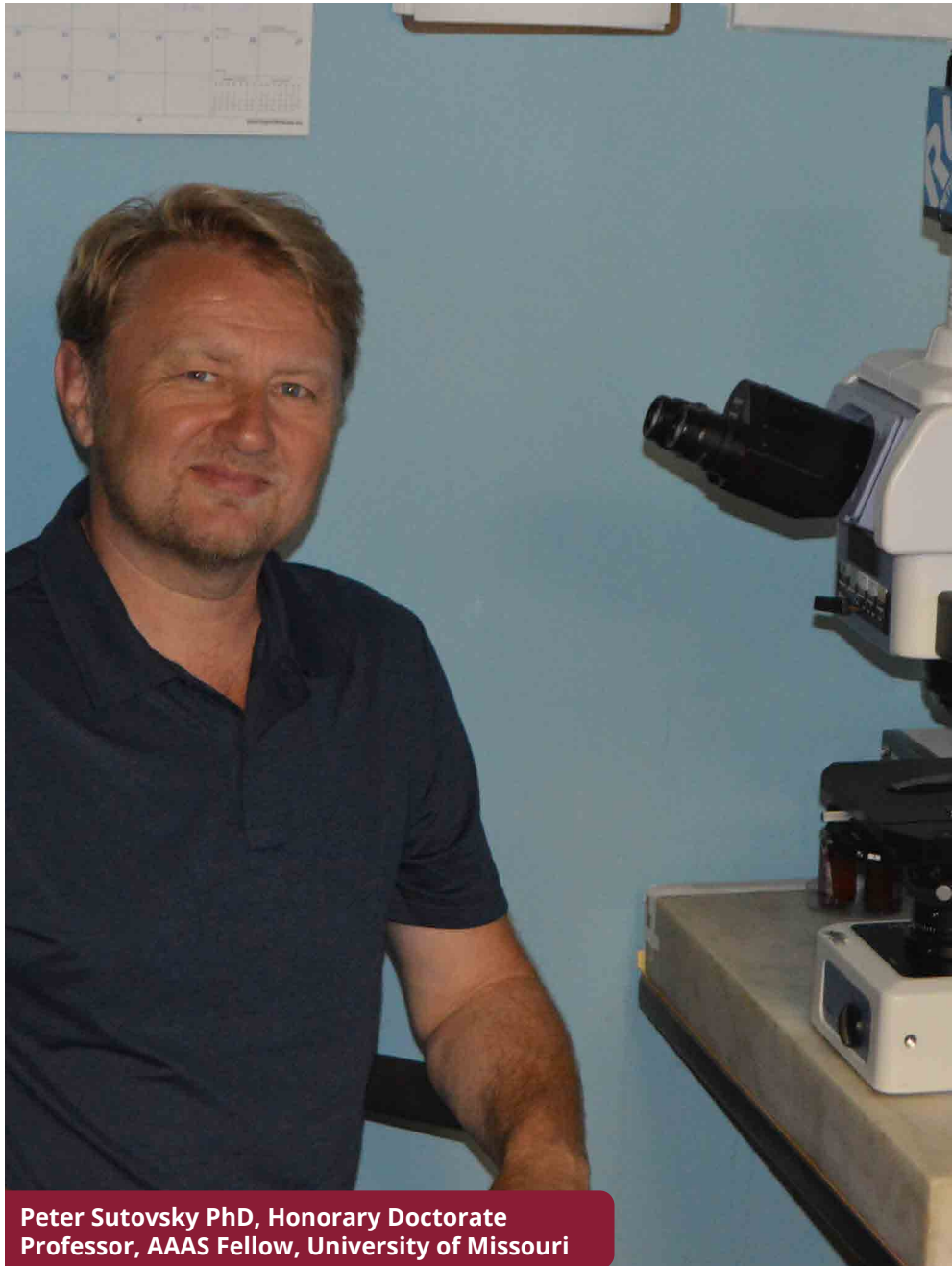
It is the premise that the deliberate and consistent addition of new scientific knowledge to enhance education might seem an obvious application of science, but it is often ignored (Rull, 2014). If scientific knowledge and research was more proficiently diffused to the general public to create awareness on all levels of society, it has enormous potential to address the challenges facing humanity in present day education.

A more informed and enlightened society would further assist in addressing problems such as the misuse of, and misinformation about scientific discoveries.

Lastly, history has shown that science and change are intrinsically linked. The magnitude and pace of change, also in the veterinary health care environment, demand that a Faculty such as this one will change.

While we need to embrace and celebrate change, we must – at the same time – be exquisitely attuned to what is really important to ensure future institutional ascendancy and quality.





**Peter Sutovsky PhD, Honorary Doctorate  
Professor, AAAS Fellow, University of Missouri**

# Curriculum Vitae: Peter Sutovsky

*Prof Peter Sutovsky is Professor of Animal Science and Obstetrics, Gynaecology and Women's Health at the University of Missouri. He is recognised worldwide for his studies of mammalian gametogenesis, fertilization, and embryo development with emphasis on the gamete and zygotic ubiquitin-proteasome system (UPS).*

Among other discoveries, he was the first to describe the role of UPS in the regulation of mitochondrial inheritance, and introduced the concept of extracellular UPS and its role in sperm maturation and fertilization.

In his career, Prof Sutovsky published over 200 peer-reviewed articles and monograph chapters, was cited 7 350 times in SCOPUS (h-index 45) and 10 300 times in Google Scholar (h-index 56; i10 index 152), and featured on over 50 journal and book covers.

Recent work focuses on biomarker-based flow cytometric semen analysis, semen nanopurification, sperm genome-to-phenotype research and sperm capacitation studies aimed at improving conception rates in the artificial insemination of livestock.

## **Professor**

Reproductive Physiology • University of Missouri • Division of Animal Sciences and Departments of Obstetrics, Gynaecology and Women's Health

Prof Peter Sutovsky is Professor of Animal Science in the College of Agriculture, Food and Natural Resources, University of Missouri, also appointed as Professor of Obstetrics, Gynaecology and Women's Health at the School of Medicine, University of Missouri Health System.

Since the early 1990s, Prof Sutovsky has studied mammalian gametogenesis, fertilization and pre-implantation embryonic development with special emphasis on the gamete and zygotic ubiquitin-proteasome system. He was the first to describe the role of UPS in the regulation of mitochondrial inheritance and introduced a novel concept of extracellular UPS, which has been validated in reproduction and outside the reproductive biology field.

In particular, Prof Sutovsky demonstrated the importance of sperm-borne proteasomes for mammalian fertilization and the role of UPS in epididymal sperm quality control, a mechanism relevant to male fertility evaluation in livestock, and the diagnosis and treatment of human male fertility.

His collaborative research on the biogenesis and post-fertilization processing of sperm head perinuclear theca influenced the optimisation and safeguarding of assisted reproductive technologies or therapies, such as *in vitro* fertilization (IVF) and intracytoplasmic sperm injection (ICSI).

Other notable collaborations include the development of the transgenic pig model for the study of 26S proteasome and work on the rodent model of human endometriosis. Recent work focuses on biomarker-based flow cytometric semen analysis, semen nanopurification, sperm genome-to-phenotype research and sperm capacitation studies aimed at improving conception rates in the artificial insemination of livestock.

As of June 2021, Prof Sutovsky published 212 peer-reviewed articles and monograph chapters, of which 196 were cited 7 350 times in SCOPUS (h-index), 10 300 times in Google Scholar (h-index 56; i10 index 152), and featured on over 50 journal, book or trade publication covers. He has edited three books and three

special journal issues. Beside other editorial board memberships, he has served on the Board of Reviewing Editors of *Biology of Reproduction*, and is currently the Section Editor for Reproductive Biology of *Cell and Tissue Research*, Associate Editor of *Systems Biology in Reproductive Medicine*, Editor-in-Chief of *Advances in Anatomy, Embryology and Cell Biology*, and editorial board member of *Scientific Reports (Nature)*. He holds 18 US and foreign patents, reflecting his involvement in technology development and commercialisation.

He has been recognised as the inaugural recipient of the USDA-NRI Discovery Award, Big 12 Rising Star Award, and the Distinguished Researcher Award and Faculty Entrepreneur of The Year Award by the University of Missouri. He was elected a Fellow of the American Association for the Advancement of Science (AAAS) in 2020. Reflecting his international efforts, Prof Sutovsky received an honorary doctoral degree, *Doctor Honoris Causa*, from the Czech Life Sciences University in Prague, an Honorary Professorship from the Universidad Nacional Mayor de San Marcos in Lima, Peru, the oldest university in all the Americas, and was elected honorary Visiting Professor, *Professoreme Hospitem*, of the Charles University in Prague.

His work on fertilization and infertility has been funded by the United States Department of Agriculture, the National Institutes of Health (NIH), the National Institute of Justice, the Missouri Life Sciences Trust Fund and various other public and private entities. He is a frequent plenary speaker in the USA and around the world, frequent NIH panel member and a senior editor in several leading journals in his field.

The Sutovsky laboratory maintains active collaborations with scientists and industry partners in Argentina, Australia, Brazil, Canada, Chile, the Czech Republic, Denmark, France, India, Japan, Peru, Slovakia, South Africa, South Korea, Spain, the United Kingdom and the USA.

S141 Animal Science Research Center  
Division of Animal Sciences  
Columbia, MO 65211



## Male infertility and semen evaluation: Andrology in the age of precision medicine and agriculture



<sup>1,2</sup>Peter Sutovsky, <sup>1</sup>Dalen Zuidema, <sup>1,3</sup>Karl Kerns, <sup>1</sup>Michal Zigo, <sup>1</sup>Lauren E. Hamilton, and Miriam Sutovsky<sup>1</sup>

<sup>1</sup>Division of Animal Sciences, and <sup>2</sup>Department of Obstetrics, Gynecology and Women's Health, University of Missouri, Columbia, MO 65211-5300; <sup>3</sup>Department of Animal Science, Iowa State University, Ames, IA 50011-3150

Infertility has been considered a chronic disease for millennia, and remedies have been sought, both holistic/spiritual and medicinal. Infertility testing is not a modern concept either, with the first test method on record being described over 900 years ago, attributed to female physician Trota of Salerno (1050-1097). This, by today's standard amusing testing "protocol" predated the first observation of human spermatozoon by van Leeuwenhoek and Hamm by nearly 500 years, though it was hardly a forerunner of contemporary andrology, which emerged in the late 19<sup>th</sup> and early 20<sup>th</sup> century. In those times, the sperm count and appearance/morphology were the gold standards. Ironically, despite recent advances in precision andrology and fundamental spermatology research, sperm count, concentration, morphology, and often but not always, sperm motility, remain the guiding parameters of semen analysis in humans and livestock animals.

Male fertility is of paramount importance in animal health, veterinary medicine and reproductive management. Artificial insemination (AI) of livestock has been a staple technology for producers across various species worldwide for over sixty years. This technology allows for greater overall livestock production through enhanced livestock genetic selection while also experiencing an increase in efficiency over the past decades. Though much work has been done to improve the efficiency of AI, there are still many areas in need of advancement including semen analysis protocols, sperm selection techniques, semen sexing technologies, and semen storage methods. These improvements are driven by new technologies and fueled by a deeper understanding of reproductive physiology.

Our laboratory has been at the forefront of sperm quality biomarker discovery, validating proteins involved in protein turnover by the ubiquitin-proteasome system, ligands and receptors involved in fertilization, and sperm redox system enzymes defending spermatozoa from damage inflicted by reactive oxygen species within the male and female reproductive tract. We have contributed to these areas of

improvement in several ways including increasing the capabilities of semen analysis using image-based flow cytometry (IBFC) in combination with new biomarker probes, such as those that reflect spermatozoas' zinc ion content and localization. Furthermore, we have explored the role of zinc ions in sperm function and their impact on sperm capacitation and sperm storage. We have also investigated sperm mitochondrial sheath length and its association with boar and bull AI fertility, which may provide a new flow cytometry-based semen analysis method coupled with machine learning to ultimately develop an automated, label-free sperm phenotyping pipeline. As a proof of concept, we have used IBFC to phenotype the sperm quality of commercially available beef and dairy bulls carrying rare, detrimental single nucleotide polymorphism (SNP) mutations within the sperm quality/output influencing genes that contribute to reduced AI fertility. Our laboratory was able to link these fertility issues to identifiable sperm phenotypes and is conducting similar studies on bulls with compromised fertility. Regarding new sperm selection technologies, our laboratory was among the first to explore the use of nanopurification. Peanut agglutinin lectin (PNA) probe coated nanoparticles have been used to cleanse semen samples of damaged/abnormal spermatozoa and tested in field AI trials with favorable results. Our lab also heavily investigates post-fertilization sperm mitophagy and its roles in fertilization, which is becoming ever more important as the recent reports of human heteroplasmy continue to be published. As such, the possibility of naturally occurring and somatic cell nuclear transfer -related livestock heteroplasmy continues to increase. The use of basic research to shift the understanding of paradigms within reproductive physiology, such as is outlined above, will continue to impact the field of andrology, lead to the development of new technologies and increase the efficiency of assisted reproductive technologies such as AI.

*Work in Sutovsky laboratory is currently supported by grants from USDA-NIFA, NIH-NICHD, and seed funding from the College of Agriculture, Food and Natural Resources, University of Missouri.*

# 2020 Research Summary

*The year 2020 marked the first centenary of our Faculty and undoubtedly a proud moment in the history of any veterinary Faculty. As such, the Faculty is, and will continue to be, an important contributor to attain optimal health for people, animals and our environment. We continue to aim towards expanding our local relevance and increasing our international visibility. The delivery 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, the Faculty furthermore strives to increase its research outputs and the impact thereof through effective postgraduate programmes.*

The world is currently facing an unprecedented global health crisis; COVID-19 is aggravating human suffering, destabilising the global economy, deepening global inequity in health, and upending the lives of billions of people around the globe. On the level of postgraduate education and research, 2020 was indeed also a difficult year for the Faculty with a number of challenges and some serious delays experienced due to the COVID-19 pandemic. Some of the biggest challenges faced by our researchers and postgraduate students included time delays, experimental and field work that could not continue, limited availability of space in the residences for postgraduate students, financial constraints, emotional pressures and international students who could not return to South Africa due to the travel restrictions. Despite these challenges, the Faculty continued to perform well.



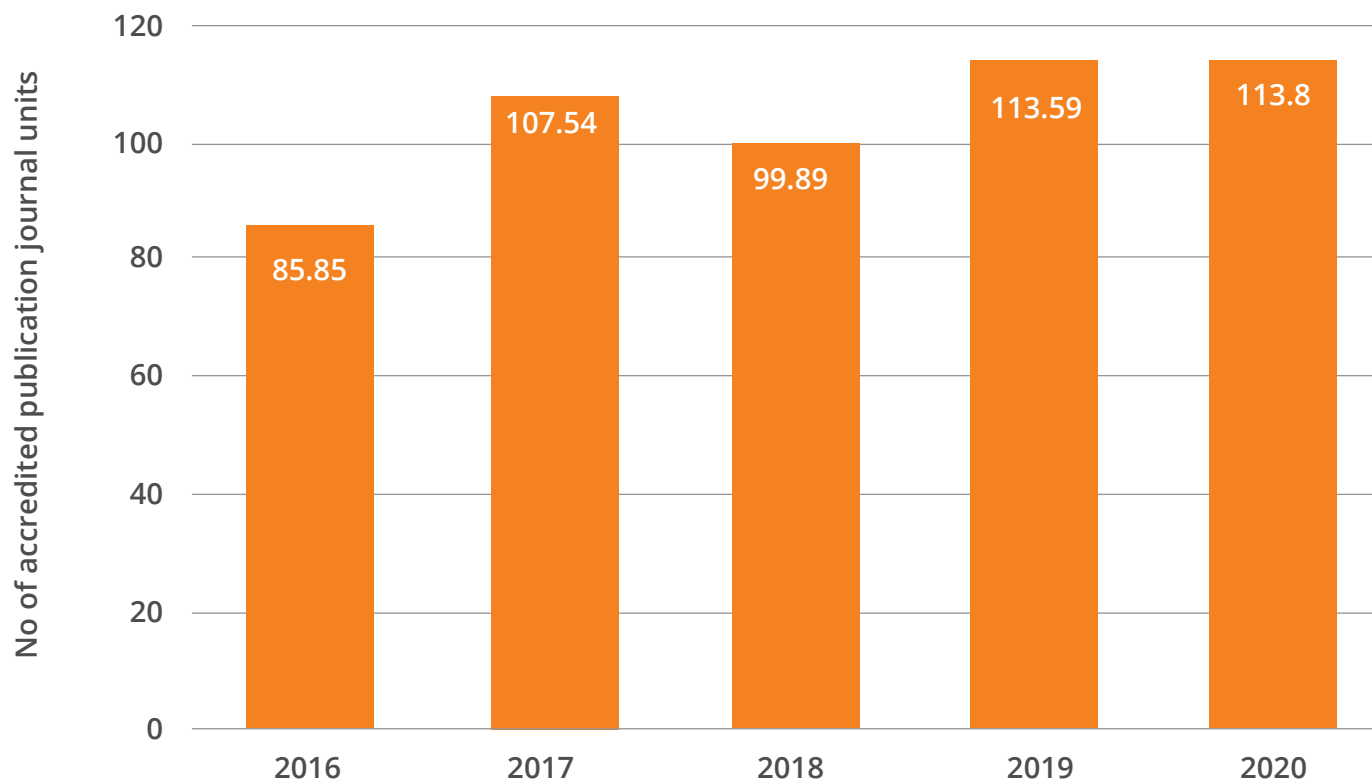
**Prof Marinda Oosthuizen**  
Deputy Dean: Research and Postgraduate Studies

## 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 National Research Foundation (NRF) rating. 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 43% permanent staff members with a doctoral degree as their highest qualification. The number of NRF-rated researchers in the Faculty's staff complement has shown a steady growth, reaching 40 by the end of 2020. The Faculty now has 10 B-rated, 27 C-rated and three Y-rated staff members.

## Research publication output

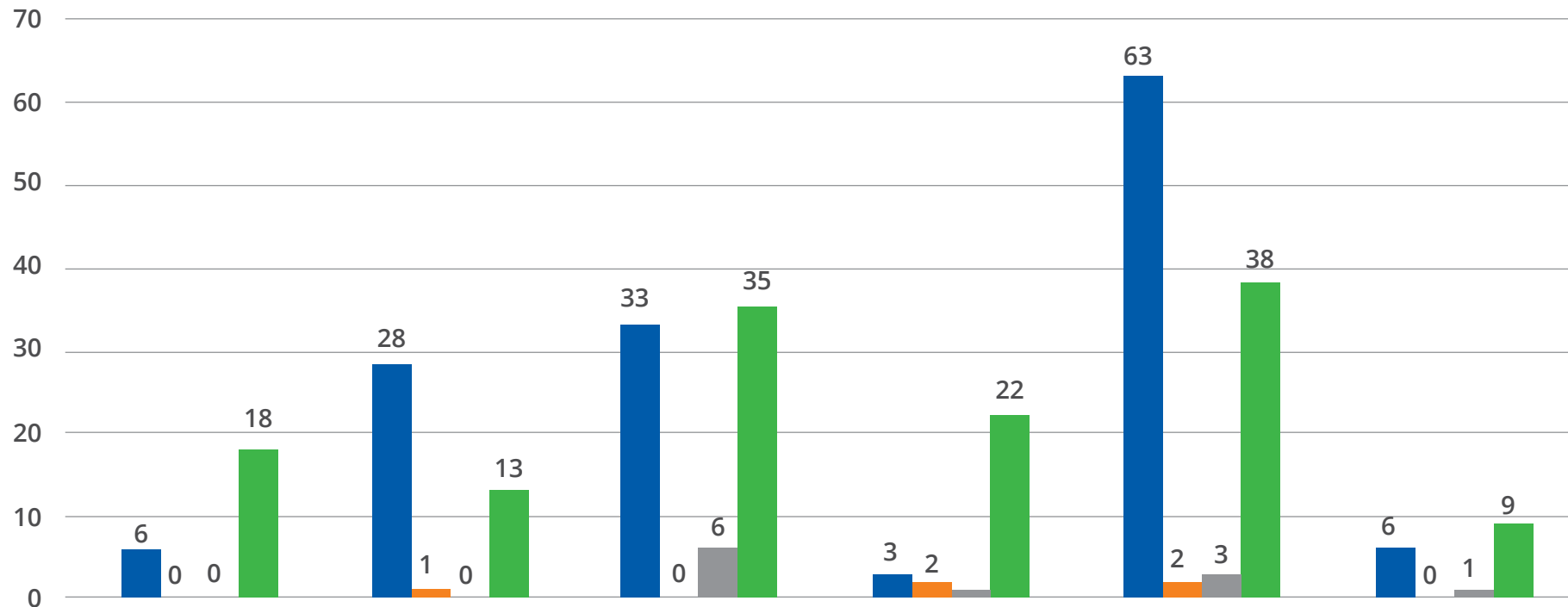


- The Faculty's research publication output increased to 113.80 units in 2020 (251 papers), with 1.15 accredited publication journal units per headcount of academic staff.
- The number of publications in the top 10% of most cited publications worldwide for 2016 to 2020 was 179 (10.8%).
- The number of publications in the top 10% of journals worldwide for 2016 to 2020 was 506 (31.5%).
- A total of 60.8% publications (2016–2020) involved international collaboration, with the top three collaborating institutes (co-authorship) being Utrecht University, James Cook University and Imperial College London.



## Postgraduate numbers

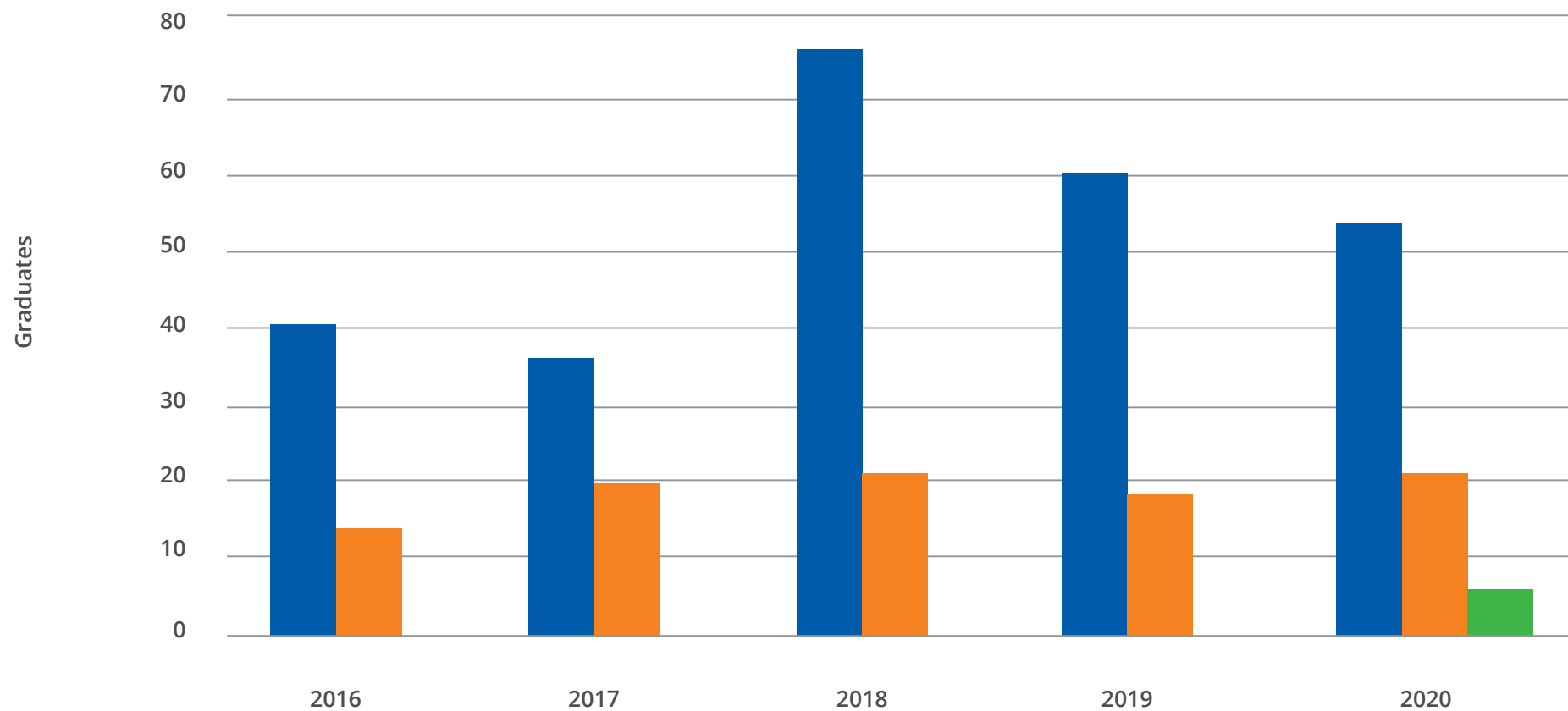
- For the 2020 registration year, postgraduate students contributed 25% of the total student body. Students from designated groups made up 55% of the total number of postgraduate students, with the group being 58% female and 70% South African. The number of postgraduate students and postdoctoral fellows in the Faculty in 2020 totalled 290.



	Postgraduate Diploma	Coursework MSc	Research MSc	MMedVet	PhD	Postdoctoral Fellows
<b>African</b>	6	28	33	3	63	6
<b>Coloured</b>	0	1	0	2	2	0
<b>Indian</b>	0	0	6	1	3	1
<b>White</b>	18	13	35	22	38	9

## Graduates

- In 2020, the Faculty awarded a total of 21 PhDs and 54 master's degrees at the University's Autumn and Spring graduation ceremonies. The first cohort of six Postgraduate Diploma students also graduated at the Spring graduation ceremony.



	2016	2017	2018	2019	2020
MSc	41	36	77	61	54
PhD	14	20	21	18	21
Postgraduate Diploma	0	0	0	0	6



## Research focus areas

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, and contributing to at least 14 of the 17 Sustainable Development Goals (SDGs). Nonetheless, an efficient research programme must remain relevant to the needs of South Africa, but also to a constantly changing international environment.

Fundamental to these visionary requirements, the Faculty has, for the past three years, placed much emphasis on the specific research themes that were chosen to establish, achieve and project an African uniqueness and complement expertise and technology, with the ultimate aim being to increase the visibility of the Faculty and produce more focused, high-impact research, enabling the Faculty to attract more international students, as well as attract competitive and sustainable research funding. This has proved to be very successful as can be seen by some of the highlights listed below.

### Translational Medicine

The aim of the Translational Medicine Research Theme is to translate laboratory research into generating or repurposing useful products that can assist with overcoming common problems such as antimicrobial and antiparasitic resistance.

Thus far, six overarching projects have been supported, involving 12 postgraduate students

and postdoctoral fellows. A pilot-scale *in vivo* study of phytogenic feed additives with potential for development as alternatives to antibiotic feed additives to support growth and decrease the persistence of *Campylobacter jejuni* in broiler chickens is currently close to completion.

This project has drawn together expertise from the departments of Paraclinical Science, Veterinary Tropical Diseases and Production Animal Studies. Excellent results have also been obtained with a project comprising a number of students and staff investigating the topical application of plant-based formulations to reduce the incidence of mastitis-causing bacteria in dairy cattle. A planned *in vivo* study is set to take place at the University of Pretoria's Experimental Farm in the near future.

### African Wildlife Health and Management

The African Wildlife Health and Management Research Theme has aimed to support cross-cutting collaborative research projects within the Faculty. Projects supported needed to have a strong conservation focus by either improving the health, welfare and management of threatened or endangered African species, or enhancing biodiversity and conservation efforts by improving veterinary management procedures.

The theme has supported ten projects, involving six PhD and five MSc students. One PhD and two MSc students have already graduated, and five papers have been published from this work so far. Some of the

key findings include that transport poses significant welfare challenges to rhinos during translocation events. These challenges not only result from a lack of food and dehydration, but also from muscle fatigue and stress-induced responses that challenge an animal's immune and metabolic systems.

An additional highlight is that reference intervals for haematology and clinical chemistry have now been established and published for African elephants, which will help ensure their proper treatment and health. Many of the projects were delayed in 2020 due to COVID-19 restrictions, but all the remaining projects are now underway. Most of them are expected to be completed and the findings published within the next year.

### 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.

Over the past years, the theme has supported approximately 20 research projects involving master's and PhD students. The most notable project was one



on experimental babesiosis in which more than seven researchers from different departments and sections worked together on the genomic, inflammatory and endocrine responses to this severe protozoal infection. One paper has already been published and two others have been submitted from this project.

As the Faculty enters into its second century, we shall continue to improve the Faculty and the impact of our research, in a manner similar to which Arnold Theiler and his team had an impact on the country in the 1920s. To achieve this, the Faculty will be introducing new research focus areas.

### **New research focus areas and harnessing the Fourth Industrial Revolution**

The Faculty is increasingly focusing on various aspects of veterinary infectious and zoonotic diseases across a number of departments. These include disciplines such as clinical medicine, epidemiology, risk assessment, public health, chemical food safety and vaccine development. Therefore, the Faculty believes the time is right to consolidate research activities under a new African Centre for Biosecurity and Disease Risk Assessment, which will be a first in Africa.

It will focus on the entire value chain in animal production with specific emphasis on the sanitary control of veterinary disease. Part of its vision is the discovery of novel approaches for disease intervention and the delivery of preventive health care for animals and humans. Through our training programmes, research and transdisciplinary initiatives,

we will ultimately improve the quality of life of animals and humans.

Furthermore, it is evident that new technologies are revolutionising our ability to prevent, diagnose and treat many diseases. Examples of these are genome editing, synthetic biology and digital health technologies such as Artificial Intelligence (AI), all of which can solve many problems. These technologies have provided impetus to the Faculty's decision to embark upon several new research themes, such as Regenerative and Molecular Medicine and Smart Diagnostics.

One of the newest fields in medicine is the use of somatic stem cells to treat injuries, specifically in working animals such as sports horses. Through a Memorandum of Understanding signed with Utrecht University, which hosts an advanced programme in regenerative veterinary medicine, the Faculty will start focusing on this research field, which has been limited so far to autogenous platelet treatment. The Faculty will also look to incorporating regenerative medicine into surgical procedures to allow surgery to become less invasive, which will enable faster healing and minimise post-operative complications.

The Faculty is also investigating how smart technology could be introduced into current veterinary diagnostics. The Faculty has already entered this field with projects with small animals, wildlife and large animals, but would like to become a major player across the board. Areas of interest include remote blood collection for easier disease surveillance, smart watch technology for dog monitoring, drone

technology for farm animal monitoring, smart ICUs, AI-assisted radiography and livestock identification.

Lastly, in recognition of increasing global pressure on food resources, food insecurity and economic inequality, aquaculture is positioned as one of the fastest-growing food production sectors. However, the overwhelming challenges and need for aquatic veterinary and health support in our country and on our continent have not been addressed. Therefore, the establishment of an Aquatic Health Unit will ensure improved aquaculture production by optimising fish health and welfare, capacity development in aquatic health and aquaculture, and address local, continental and global challenges affecting the aquatic industry.

The **UP-NRF Community of Practice in Sanitary and Phytosanitary Risk Assessment** (the COP) funded eight active projects during 2020, with research topics including risk assessment focusing on:

- Controlled animal diseases such as foot and mouth disease, African swine fever, Rift Valley fever and highly pathogenic avian influenza
- Public health issues particularly anti-microbial resistance (AMR) in the milk and poultry value chains
- The water-food-plant interface related to the molecular epidemiology of pathogenic bacteria

## Increased visibility by media coverage

Various research and related topics deriving from the work of our researchers have featured extensively in the media and on the websites of both the University and the Faculty over the last 12 months, contributing to an increased visibility of the Faculty. Examples of these included articles and research studies on the following:

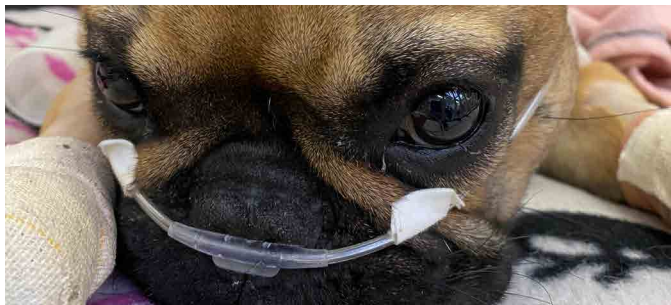
- Bovine tuberculosis and Brucellosis diagnostic services go live
- Onderstepoort Veterinary Academic Hospital obtains first high-field MRI scanner, the first of its kind in Africa
- Training and local and international research at the Hans Hoheisen Wildlife Research Station
- Research in the Kruger National Park to investigate novel immobilising drug combinations to facilitate the capture of free-ranging lions for conservation management, monitoring and research
- A first dynamic neuroprosthesis performed on a horse in South Africa
- The Faculty's successful Onderstepoort Feedlot Challenge
- Southern Africa needs a new science-based approach to control foot and mouth disease
- New research aimed at improving the practical skills of our BVSc graduates
- Webinar about the risks, benefits and the law with regard to ivermectin for COVID-19 treatment
- Veterinary pathology and post-mortems are key to problem solving
- Expert article on Lily flower species that are highly toxic to cats
- Faculty vets' partial knee replacement surgery on a cat a first for South Africa
- New study: Welfare and survival of Africa's arid mammals under threat of climate change
- Faculty vets use ground-breaking heart surgery technique to save lives of two dogs
- Skills Lab: Enhancing the hands-on and cognitive skills of veterinary students
- Artificial Intelligence could change animal farming as we know it
- Expert opinion piece: The South African debate on the veterinary drug ivermectin

In 2020, the **DST-NRF SARCHI in Poultry Health and Production** supported the postgraduate studies of the MSc students, three PhD students and two postdoctoral fellows. Projects ranged from epidemiological investigations into highly pathogenic avian influenza and other important poultry diseases to the development of diagnostic assays or vaccines. One peer-reviewed paper and 22 technical reports were produced. Ten grant applications were written, of which four were successful, including the NRF competitive call for rated researchers for the production of plant-based vaccines for poultry and other avian species (R2.3 million) and the NRF National Equipment Programme for a new scanning transmission electron microscope (TEM) for the Faculty of Veterinary Science (R9.2 million). The SARCHI and collaborator, Dr M O'Kennedy, were runners up in the 2020 Innovation Hub's Gauteng Accelerator Programme for Biosciences.

- Article: Veterinarians are experienced in dealing with animal pandemics – use our knowledge to fight COVID-19
- Expert opinion piece: Higher levels of rabies awareness needed
- The Gauteng IDC Nguni Cattle Development Project
- 2020 L'Oréal-UNESCO Women in Science Award
- Total hip replacement on a dog using a biological fixation system
- Global Animal Welfare Award of the World Veterinary Association
- Article on malicious poisoning in dogs
- Run4Rhinos webinar series
- Veterinary and medical experts join forces to save Makokou the gorilla
- Collaborative study proves that South Africa's springhare has a bigger bounce than Australia's kangaroos
- Expert article: Canine parvovirus or cat flu

Despite the unprecedented challenges we faced in 2020 due to the COVID-19 pandemic, some of which are still impeding our research activities, we are grateful for the continued progress we are making and the successes we are enjoying. It is thus quite appropriate to thank all of you – researchers, postgraduate students and support staff alike – who are making it possible for us to continue to operate in an abnormal environment and who are indeed contributing towards the Faculty and the University's goal of being a research-intensive entity.

**Prof Marinda Oosthuizen**  
**Deputy Dean: Research and Postgraduate Studies**







*In 2020  
the Faculty  
opened a  
dedicated  
wildlife  
clinic, the  
first of its  
kind in  
Africa*

### **Faculty Day 2020 and research awards**

Due to the COVID-19 pandemic, 2020 also marked the first virtual Faculty Day to be held on 20 November 2020. With more than 160 people in the virtual audience and joining from all over the world, it provided an excellent opportunity for our researchers to showcase their research activities. The keynote address was on a very relevant topic titled “Coronavirus: Unveiling the viral entry pathways into the host cell” and was delivered by Dr Javier Jaimes from Cornell University, Ithaca, New York, USA. 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 Vinny Naidoo

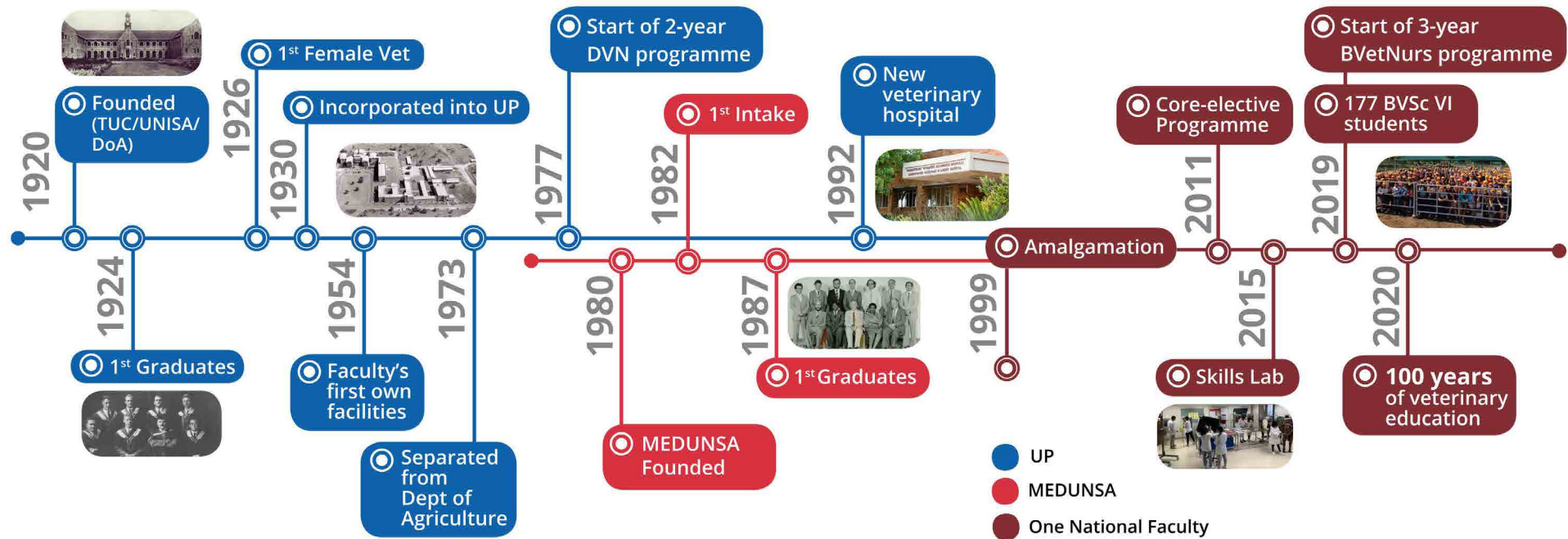
Nine top researchers in the Faculty

2. Prof Lyndy McGaw
3. Prof Geoff Fosgate
4. Prof Anita Michel
5. Prof Leith Meyer
6. Prof Peter Thompson
7. Prof Christo Botha
8. Prof Marinda Oosthuizen
9. Prof Martin Schulman
10. Prof Johan Nöthling

### **Young Researcher of the Year**

No nominations received

# 100 YEARS OF VETERINARY EDUCATION IN SOUTH AFRICA



*In 2020, the Faculty of Veterinary Science celebrated a centenary of veterinary education in South Africa. This timeline represents some of the most important developments and highlights in the 100-year history of the Faculty.*





# Session 1: Postgraduate research



## Histomorphometry of seminiferous tubules in four reproductive cycles of Japanese quails (*Coturnix coturnix japonica*)

Information on histomorphometry of seminiferous tubules in avian species is scanty, compared to mammalian species. The present study aimed to evaluate some parameters of the seminiferous tubules of Japanese quails (*Coturnix coturnix japonica*) as a model avian species. A total of 28 birds were used for the study, comprising 7 birds each of the 4 reproductive cycles, namely pre-pubertal (4 weeks old), pubertal (6 weeks old), adult (12 weeks old) and aged (52 weeks old). The mean and standard error of the body and testicular weights showed a significant difference ( $P < 0.001$ ) between the age groups sequentially from the pre-pubertal to the aged birds. For the seminiferous tubule diameter, the aged group had the highest mean diameter ( $305.974 \pm 26.24$ ) even though there was no significant difference between the age groups ( $P > 0.05$ ). However, a significant difference ( $P < 0.005$ ) for the aged groups was observed for both the seminiferous tubule lumen diameter ( $116,273 \pm 14.47$ ) and the mean epithelium height ( $121.017 \pm 8.89$ ) than the pre-pubertal, pubertal and adult age groups. The cross-sections of the seminiferous tubules of the pre-pubertal, pubertal, adult and aged birds were similar in appearance. There were no obvious morphological differences observed between the age groups. The present study showed that spermatogenesis gradually declines in aged birds by the lower epithelial height, that could be due a higher rate of germ cell apoptosis and a fall in androgen levels, which are common indicators of aging as seen in both avian and mammalian species.

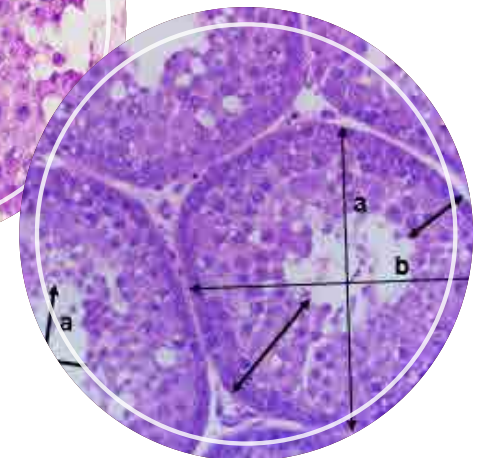
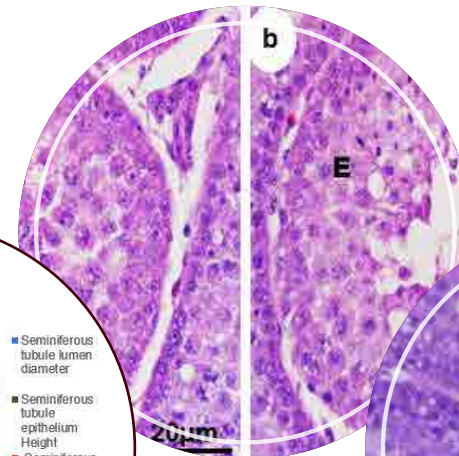
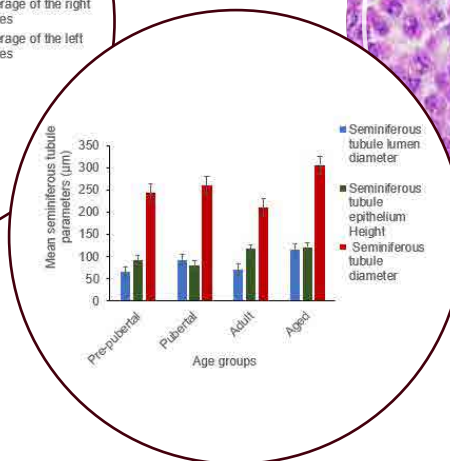
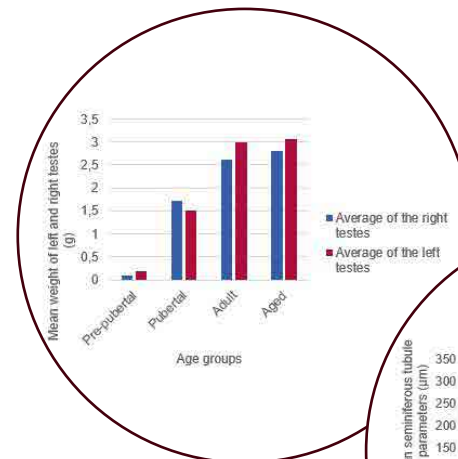


M Zakariah

M Zakariah<sup>1,4</sup>, MIA Ibrahim<sup>1,5</sup>,  
RA Molele<sup>1</sup>, SO Ochai<sup>3</sup>, LJ McGaw<sup>2</sup>

- 1 Department of Anatomy and Physiology, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, Pretoria 0110, South Africa.
- 2 Phytomedicine Programme, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 Pretoria, South Africa.
- 3 Department of Veterinary Tropical Diseases, Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, 0110 Pretoria, South Africa.
- 4 Department of Veterinary Anatomy, Faculty of Veterinary Medicine, PMB 1069 University of Maiduguri, Maiduguri, Nigeria.
- 5 Department of Basic Science, University of West Kordofan, West Kordofan State, Sudan.

email: [mzakariah@unimaid.edu.ng](mailto:mzakariah@unimaid.edu.ng)



## Establishment of temporally specific adrenocorticotrophic hormone reference intervals for horses in South Africa

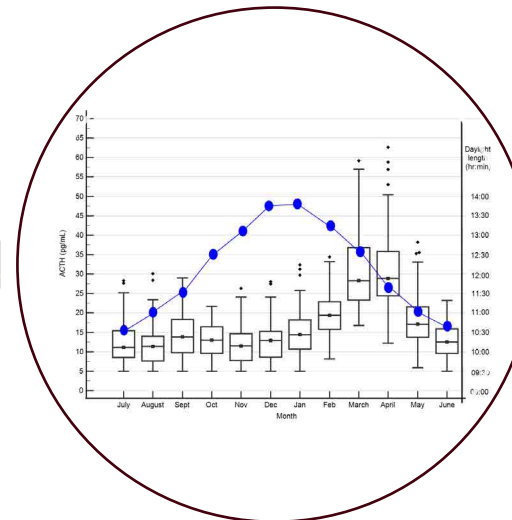
An endogenous adrenocorticotrophic hormone (ACTH) concentration above the reference interval (RI) is commonly used as means for diagnosing equine pituitary pars intermedia dysfunction (PPID). Basal ACTH concentrations are highly dependent on photoperiod and RIs should be month- and location-specific. To date no ACTH RIs have been specifically established for South Africa. A longitudinal prospective study was conducted over twelve months to determine ACTH RIs for a representative population of healthy South African horses in the Gauteng province. Eighty clinically healthy horses under 12 years of age were recruited for monthly venous blood sample collection, from July 2019 to June 2020. Monthly reference individual group size varied from 59 - 79 horses. ACTH was measured using a chemiluminescent assay. Reference intervals were constructed for each month of the year. This South African population showed temporal changes in ACTH concentrations similar to those previously observed in other locations. Upper reference limits were at their lowest in early summer (21.4 pg/mL, 90% CI 20.8–21.7) with a pronounced increase in autumn (60.6 pg/mL, 90% CI 53.1–62.7), and tapered off in winter (22.3 pg/mL, 90% CI 19.9–23.2). The RIs established in this report are the first for a healthy South African equine population. The significant increase in ACTH concentrations coincided with the decreasing daylight length at the beginning of autumn. The circannual variations in the RI and increased variability in ACTH levels around the autumnal peak are consistent with seasonal autumnal variations previously reported in Australia and the Northern Hemisphere. The month-specific ACTH RIs generated in this study will improve the accuracy of diagnosis and monitoring of PPID in the local equine population. These results highlighted the previously recommended need for seasonal and location-specific RIs.

D Fisher

*D Fisher<sup>1</sup>, EC Schlievert<sup>1</sup>,  
EH Hooijberg<sup>1</sup>*

<sup>1</sup> Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

email: dfishervet@gmail.com





**NPB  
Sekgobela**

*NPB Sekgobela*<sup>1,2</sup>, *J Fehrsen*<sup>1,2</sup>,  
*FF Maree*<sup>1,3</sup>, *PA Opperman*<sup>1,4</sup>,  
*M Chitray*<sup>1,2</sup>

1 Agricultural Research Council, Onderstepoort Veterinary Research, Vaccines and Diagnostic Development, Private Bag X05, Onderstepoort, Pretoria 0110, South Africa.

2 University of Pretoria, Faculty of Veterinary Science, Department of Veterinary Tropical Diseases, Pretoria, South Africa.

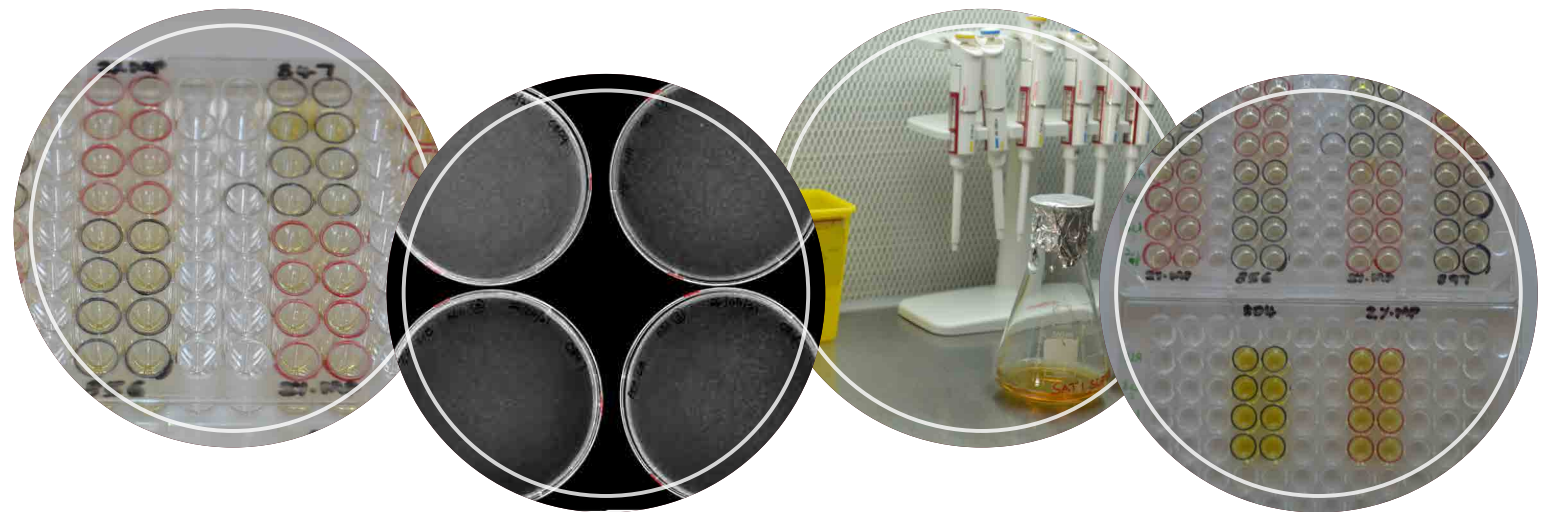
3 University of Pretoria, Faculty of Natural and Agricultural Sciences, Department of Microbiology and Plant Pathology, Pretoria 0002, South Africa.

4 University of Pretoria, Faculty of Veterinary Science, Department of Animal Production Studies, Pretoria, South Africa.

email: sekgobelanaledi@gmail.com

## Construction of three foot-and-mouth disease virus peptide phage display libraries for the identification of epitopes

Foot and mouth disease (FMD) is a transboundary animal disease that severely affects the production of livestock with significant economic impact. The OIE ranks FMD as an economically important infectious animal disease. There are seven serologically distinct serotypes i.e. A, O, C (last outbreak in 2004), Asia1 and the Southern African Territories (SAT): SAT1, SAT2 and SAT3. Five of the serotypes exist in sub-Saharan Africa and considering that the virus maintenance host is the African buffalo, eradication is near impossible in South Africa. Thus, emphasis is placed on control in the form of vaccination. Vaccination against one serotype does not confer protection against another due to high antigenic variation. Knowledge of FMD virus antigenic sites can be useful to produce recombinant FMD vaccines with broad immunological coverage. To address the scarcity of knowledge regarding SAT antigenic sites, the three FMDV peptide phage display libraries were constructed, using the fragmented P1 regions of FMDV SAT1, SAT2 and SAT3 and biopanning with IgGs. RT-PCR of P1 regions followed by shearing using the Covaris Adaptive Focused Acoustics® technology to fragment DNA. This DNA was cloned into an appropriate digested vector and transformed using *E. coli* TG1 competent cells. The resultant libraries underwent phage rescue and were utilised for the identification of FMDV epitopes through biopanning with purified IgGs from FMDV-infected/vaccinated bovine sera. Antigenic regions were identified through DNA sequencing. The advantage of utilising immune sera and biopanning against virus-specific peptide libraries is that affinity maturation has already occurred in immunized animals and the recognized epitope regions are identifiable. This study has added value towards knowledge of FMDV antigenic sites and significantly contributes to the future development of improved vaccines. Through recombinant, reverse genetics technology, identified epitopes can be incorporated into the FMDV genome and use recombinant viruses for vaccine production, thus producing vaccines with broad immunogenic response and protection.







T Tshuma

## Effect of maximum daily temperature and relative humidity on milk urea nitrogen concentration of Holstein cows

This observational study investigated the effects of maximum ambient temperature and relative humidity on milk urea nitrogen (MUN) concentration in Holstein cows. Composite milk samples were tested for MUN concentrations and somatic cell counts (SCC) once every five weeks over six years, as part of routine milk testing. Meteorological data corresponding to the dates of milk sampling were collected. A linear mixed-effects model including a random effect term for cow identification was used to assess whether the ambient temperature and relative humidity were predictive of MUN concentration. Age, days in milk, heat stress level, diet, milk conductivity, milk production, parity, and SCC were also evaluated as main effects in the model. A general linear model including all variables as random effects was used to assess the contribution of each variable towards the variability in MUN concentrations. Maximum daily temperature and humidity on the sampling day were both positively associated with MUN concentration, but the interaction term between these variables was negative, indicating that the effects of these two variables were not independent and simply additive. Heat stress and milk yield were positively associated with MUN concentration, while SCC was negatively associated. As expected, diet was also a significant predictor of MUN concentrations. Variables that contributed the most to the variation in MUN concentrations in this study were the diet (18%), temperature (14%), humidity (13%) and other unmeasured factors (24%). Temperature and relative humidity had a significant influence on measured urea nitrogen concentration, and are therefore important in the interpretation of urea nitrogen concentration data, in relation to dietary and management factors of cows. This is also important when identifying cows that might be at risk of poor reproductive performance.

*T Tshuma*<sup>1</sup>, *GT Fosgate*<sup>1</sup>,  
*EC Webb*<sup>2</sup>, *CF Swanepoel*<sup>3</sup>,  
*DE Holm*<sup>1</sup>

<sup>1</sup> Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Private Bag X 04, Onderstepoort, South Africa, 0110.

<sup>2</sup> Department of Animal Science, Faculty of Natural & Agricultural Sciences, University of Pretoria, Private Bag X 20, Hatfield, 0028

<sup>3</sup> Hatfield Experimental Farm, University of Pretoria, Private Bag X 20, Hatfield, 0028

email: takula.tshuma@up.ac.za





RO  
Adeyemo

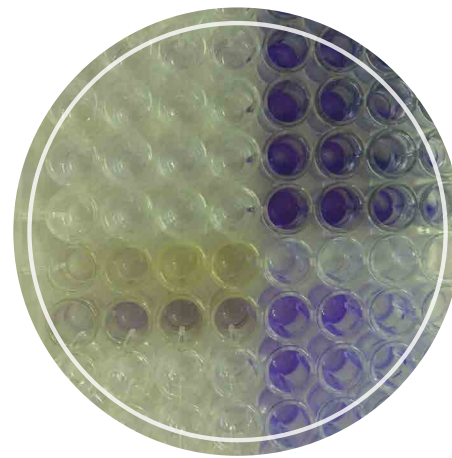
*RO Adeyemo*<sup>1</sup>, *IM Famuyide*<sup>1</sup>,  
*LJ McGaw*<sup>1</sup>

<sup>1</sup> Phytomedicine Programme, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa.

email: u17399328@tuks.co.za

## Antibiofilm, antioxidant and anti-inflammatory activity of selected indigenous South African plants used in the treatment of diarrhoea

Biofilms are complex structures formed when bacterial colonies group together within an extracellular matrix, providing protection and aiding antimicrobial resistance. Antioxidants protect cells against free radicals, which play a significant role in various pathological conditions. Inflammation is a biological response mechanism to harmful stimuli. Macrophages contribute to initiation and resolution of inflammation by the production of cytokines. Medicinal plants have proven to be a good source of antioxidant, anti-inflammatory and antibiofilm compounds. This study was designed to determine the ability of the selected plants to inhibit biofilm formation or to eliminate pre-formed biofilms, and also to determine their antioxidant and anti-inflammatory activities. A modified crystal violet method was deployed to establish the antibiofilm activity against *E coli* (ATCC 25922 and clinical strains). *In vitro* assay of 2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) and 2, 2-diphenyl-1-picrylhydrazyl (DPPH) were used to determine the antioxidant activity of the plants. Inhibition of nitric oxide (NO) production in lipopolysaccharide (LPS)-activated RAW 264.7 macrophages was used to estimate the anti-inflammatory activity. The percentage biofilm development inhibition of all the tested plants were above 50, with 69-100 % and 54-100% for the clinical and ATCC strains, respectively. *Bauhinia bowkeri* had the best antibiofilm activity. However, the plants were not effective against pre-formed biofilms. The antioxidant values ranged from 0.74 to 36.45 µg/ml and 14.313 to 532.86 µg/ml for the ABTS and DPPH assays, respectively. *Searsia batophylla* and *Bauhinia bowkeri* had the best antioxidant activity. All the plant extracts inhibited NO production to varying degrees in a concentration-dependent manner. *Searsia batophylla* had the best NO inhibition of 74.79% with no adverse effects on cell viability at a concentration of 100 µg/ml. The selected plant extracts were therefore found to have good antioxidant and anti-inflammatory activities, in addition to preventing biofilm formation. They were, however, not able to destroy pre-formed biofilm.







# Session 2: Undergraduate research





## Comparison of the different PRP systems and the results of the treatment of suspensory ligament desmitis in clinically affected horses

*C Randlehoff<sup>2</sup>, JA Munoz Moran<sup>1</sup>*

<sup>1</sup> Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

<sup>2</sup> Final year BVSc Student, Onderstepoort Veterinary Faculty, University of Pretoria.

email: cormerandlehoff@gmail.com

Platelet rich plasma (PRP) is a growing field for the treatment of horses suffering from multiple different musculoskeletal injuries. To name a few, these injuries include tendinopathies especially of the superficial digital flexor tendon, suspensory ligament desmitis and osteoarthritis. These injuries are detrimental and career-limiting in sporting horses. It is therefore important to study future treatment options that can aid in the healing process and limit the recovery time following an injury. In the past PRP has been used as a treatment for the aforementioned soft-tissue injuries. The purpose of this literature study was to determine the different concentration of platelets, WBC and RBC found in the final products of PRP following collection, and their effect during treatment. The literature has proven that PRP has a positive effect in the healing process of musculoskeletal injuries. When comparing the different final PRP products in the literature evaluated, large discrepancy between the concentrations of platelet, RBC and WBC were found. This indicates that further research is necessary to determine the ideal platelet concentration that will have a clinical effect, and what effect WBC and RBC have on the final PRP product. A short clinical study was also performed and the results evaluated following the treatment of front limb suspensory branch injuries in horses. Ultrasound evaluation was performed and it was concluded that PRP aids in the healing and prevents the reoccurrence of suspensory branch lesions.

## An analysis of experiential learning in a community engagement setting in third-year veterinary science students

*G Naidoo<sup>1</sup>, Q Sonntag<sup>2</sup>*

1 Final year BVSc Student, Onderstepoort Veterinary Faculty, University of Pretoria.

2 Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

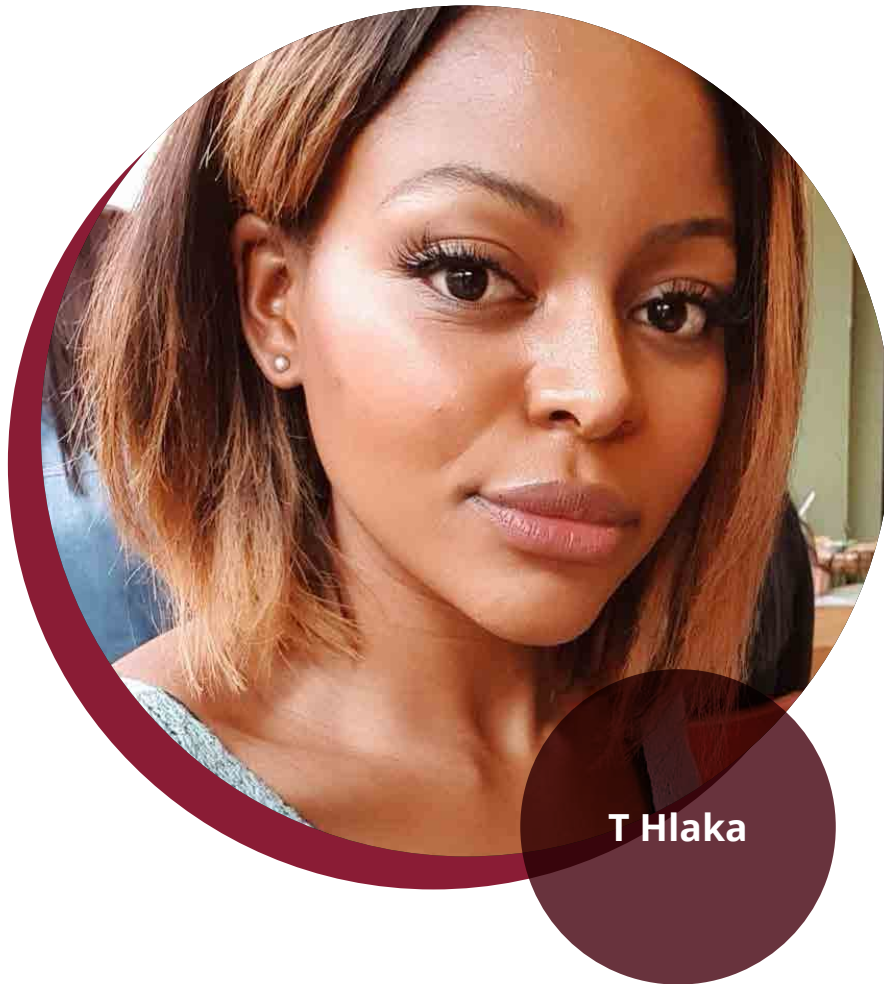
email: gabriella.naidoo.95@gmail.com

We investigate third year veterinary science students' experience of community engagement, which forms part of their BVSc (veterinary science) curriculum. A case study approach was employed in examining this experiential learning opportunity from the students' point of view. The learning opportunity involved planning and executing an educational engagement with school children. Data comprised of written reflections produced by the students. Inductive thematic analysis was utilised to identify themes. The themes that emerged were knowledge, skills and insights gained by the student; perceived benefits for students and community; challenges presented and how they were overcome and the perceived role of a veterinarian in the community. Most students reported improving their communication skills with different age groups, including their peers. This led to improved teamwork abilities. Through this experience students were able to gain insight about community dynamics and cultural differences in South Africa and expanded their understanding of their role as a future veterinarian in a community-based setting. The learning opportunity helped students overcome challenges such as fear of public speaking, group work, language barriers and communicating with children. Most students acknowledged this experience enabled them to broaden their knowledge, skills and insights not only as a future veterinarian, but also as a socially responsible citizen.



**G Naidoo**





## Animal welfare organisations in South Africa: A preliminary exploration of distribution and activities

*T Hlaka<sup>1</sup>, Q Sonntag<sup>2</sup>*

<sup>1</sup> Final year BVSc Student, Onderstepoort Veterinary Faculty, University of Pretoria.

<sup>2</sup> Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: u13111516@tuks.co.za

The World Organization for Animal Health (OIE) defines animal welfare as the physical and mental state of an animal in relation to the conditions in which it lives and dies, with their guiding principles including the five freedoms that were developed in 1965. It is further described to be a multi-faceted subject which has scientific, ethical, economic, cultural, social, religious, and political dimensions. There is very little known of the state of animal welfare organizations in South Africa, their distribution across the country, and the work they do. This is the first such study providing a preliminary window to a complex system of animal welfare service providers. We created a database of animal welfare organizations in South Africa using information obtained from their websites, social media pages and by telephone. Of the 280 welfare organizations recorded in this study the majority are concentrated in provinces with the highest population numbers and the more active economies (Gauteng, Western Cape, and KwaZulu-Natal). SPCA branches contribute the highest proportion of these organizations. Majority of organizations deal with companion animals, some deal with both companion and livestock, whilst a few deal with wildlife. Most are run as shelters, only 9% of them incorporate foster services as part of their function and 17.5% run sterilization campaigns. Organizations are increasingly moving towards the use of foster systems to increase their capacity and reduce costs in order to help more animals. Social media networking is increasingly a medium of marketing and will likely become more relevant in future. It appears that the welfare services available in the country are not aligned to where the need is expected to be the highest.





# Session 3: Postgraduate research speed session 1



## Evaluation of the effects of probiotic and ascorbic acid on the adverse effects of heat stress in broiler chickens

VO Sumanu<sup>1</sup>, V Naidoo<sup>2</sup>, MC Oosthuizen<sup>3</sup>, JP Chamunorwa<sup>1</sup>

1 Department of Anatomy and Physiology, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

2 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

3 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: devicpet@gmail.com

The objectives of this research are to determine the effects of probiotic and ascorbic acid on the adverse effects of heat stress in broiler chickens through evaluation of the following parameters: performance indices, cloacal and body surface temperatures, haematological parameters, oxidative stress biomarkers, heat-stress-associated cytokines and oxidative DNA damage, behavioural parameters and finally, small intestinal morphology. Fifty six COBB500 breed of broiler chickens will serve as the subjects. They will be divided into 4 groups of 14 each as follows: Group 1, control; Group 2, probiotic-administered; Group 3, ascorbic acid-administered and Group 4, probiotic + ascorbic acid administered. They will be given access to feed and water *ad libitum* and the antioxidants will be administered for 35 days via feed. At the time of this presentation, this research will be almost concluded. It is anticipated that the administration of probiotic and/or ascorbic acid to broiler chickens exposed to heat stress mitigates the adverse effects, which will be evident as improved performance indices.

## Comparative antimicrobial efficacy of four surgical hand preparation procedures prior to application of an alcohol-based hand rub in veterinary students

H Viljoen<sup>1</sup>, JP Schoeman<sup>1</sup>, GT Fosgate<sup>2</sup>, C Boucher<sup>1</sup>

1 Department of Companion Animal, Clinical Studies, Faculty of Veterinary, Science, University of Pretoria, Pretoria, South Africa.

2 Epidemiology Section, Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, South Africa.

email: hermien.viljoen@up.ac.za

A prospective clinical study was performed to compare the antimicrobial efficacy of four surgical hand preparation protocols. Veterinary students performing ovariohysterectomies on client-owned dogs were allocated to one of four groups. Three of the four groups performed a pre-wash with different hand soaps (medicated or non-medicated) followed by an alcohol-based hand rub (ABHR). The fourth group did not perform a pre-wash before applying an ABHR in preparation for a surgical procedure. At different time intervals during surgical hand preparation, fingertips were pressed on agar contact plates. The plates were incubated and colony forming units (CFUs) for each sample was determined. The results were compared with respect to the proportion of negative growth plates, CFUs log<sub>10</sub> reduction and total log CFUs. The proportion of negative growth agar plates before and after a pre-wash was significantly higher for the group that performed a pre-wash with scrub containing chlorhexidine bigluconate (CHG) (p=0.031). In addition, the log<sub>10</sub> reduction due to a CHG pre-wash (0.59) was significantly higher than that of a pre-wash with non-medicated, pH neutral soap (-0.39) (p=0.012). Yet, there was no difference in log<sub>10</sub> reduction of CFUs from the baseline to two hours after surgery between the three groups that performed a pre-wash (P=0.012). The total log CFU in the group that did not perform a pre-wash was significantly higher after two hours of surgery (p=0.001). In conclusion, a pre-wash with a medicated scrub prior to applying an ABHR had the best antimicrobial effect before and for the duration of surgery. Consequently, a pre-wash with a medicated scrub should be performed prior to applying an ABHR for surgical hand preparation, despite hands appearing to be clean.

## Short-term clinical outcomes of 220 dogs with thoraco-lumbar disc disease treated by mini-hemilaminectomy

RC Elliott<sup>1,2</sup>, CF Berman<sup>2</sup>, C Moon<sup>2</sup>, G Zeiler<sup>1</sup>, RG Lobetti<sup>2</sup>

1 Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

2 Bryanston Veterinary Hospital, Bryanston, Johannesburg, South Africa.  
email: ross.elliott@up.ac.za

Thoraco-lumbar intervertebral disc extrusion is a common condition seen in veterinary practice. Although there are differing described surgical techniques for decompression, most of these techniques are based on surgeon preference or experience rather than clinical research. Our aim was to determine the clinical outcomes using return to ambulation and micturition as well as complication rates in a large cohort of dogs using a mini-hemilaminectomy. This was a retrospective study performed on dogs presenting for acute thoraco-lumbar intervertebral disc extrusion undergoing surgical decompression. In total there were 252 spinal decompression surgeries performed. The recovery rate for patients graded with a modified Frankel score (MFS) of 5 through to 0 was 100%, 99%, 100%, 96%, 86% and 64%, respectively. The mean days to micturition across all the MFS 5-0 was 1.5 (SD 0.7), 1.8 (SD 1), 4.3 (SD 1.7), 6.4 (SD 2.2), 9.3 (SD 3) and 11.9 (SD 2.2), respectively. The mean days to ambulation across all the groups 5-0 were 2 (SD 0.7), 2.6 (SD 1), 7.6 (SD 4.4), 10.1 (SD 2.5), 16.1 (SD 2.9) and 19.3 (SD 2.6), respectively. Postoperative complications were seen in 32 of the surgeries, giving a complication rate of 13%. Minor complications accounted for 38% of all complications and major complications made up 62% of all complications. In total, 15 dogs died or were euthanized as a direct result of thoraco-lumbar disc extrusion or the surgical procedure, giving a mortality rate of 6% across all groups. A mini-hemilaminectomy provides similar clinical outcomes described in the literature for other methods of spinal cord decompressive surgery.

## Feeding patterns of *Culicoides* at Onderstepoort

L Penzhorn<sup>1</sup>, AJ Guthrie<sup>2</sup>, JE Crafford<sup>3</sup>, GJ Venter<sup>4</sup>

1 Equine Research Centre, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

2 Equine Research Centre, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

3 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

4 Epidemiology, Vectors and Parasites, Agricultural Research Council-Onderstepoort Veterinary Research, Onderstepoort, South Africa

email: lisapenzhorn@gmail.com

*Culicoides* Latreille (Diptera: Ceratopogonidae) biting midges are of veterinary and economic importance worldwide. Numerous studies have been done throughout the world to clarify vector-host relationships by studying *Culicoides* host preferences via blood meal analysis. Studies have concentrated on *Culicoides* as a vector for livestock-associated diseases. Since 1904, African horse sickness virus has been seen in our canine population and until recently it was believed that dogs only become infected by ingesting infected meat and therefore, little emphasis has been placed on determining whether *Culicoides* will feed on dogs. The objectives of this study were to ascertain the species-specific feeding behaviour of *Culicoides*. Onderstepoort light traps and carbon dioxide baited traps were set weekly near different species of animals over the period of a year at the Faculty of Veterinary Science at Onderstepoort. The collected *Culicoides* were sorted, and the blood meals of blood-engorged females were analysed. The *Culicoides* collected were identified to species level and by parity using light microscopy. Blood meal analysis of 310 blood-engorged females was achieved by amplifying a species-specific fragment of the mitochondrial cytochrome *b* gene. This method allowed the accurate detection of multiple species from a single blood meal. Results showed that *Culicoides* show a preference for feeding on horses. It was also shown that they will feed on dogs although to a much lesser extent than livestock species. The majority of blood meals analysed were from *C. imicola* but interestingly, all three *C. leucostictus* which were analysed had fed on dogs. The study concluded that *Culicoides* collected at Onderstepoort feed on multiple domestic species including dogs. *C. leucostictus*, previously described as being ornithophilic, also feed on dogs and this warrants further investigation.



## Extension of sylvatic circulation of African swine fever virus in extralimital warthogs in South Africa

*AF Craig<sup>1</sup>, ML Schade-Weskott<sup>1,2</sup>, HJ Harris<sup>3</sup>, L Heath<sup>1,3</sup>, D Kriel<sup>4</sup>, L de Klerk-Lorist<sup>5</sup>, L van Schalkwyk<sup>5</sup>, P Buss<sup>6</sup>, JD Trujillo<sup>7</sup>, JE Crafford<sup>1</sup>, JA Richt<sup>7</sup>, R Swanepoel<sup>1</sup>*

1 Vectors and Vector-borne Diseases Research Programme, Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Pretoria, South Africa.

2 Present address: The Pirbright Institute, Ash Road, Pirbright, Woking, Surrey, GU24 0NF, UK

3 Agricultural Research Council-Onderstepoort Veterinary Research Transboundary Animal Diseases Laboratory, Onderstepoort, South Africa.

4 Provincial Veterinary Services, Department of Agriculture, Land Reform and Rural Development, Kimberley, South Africa.

5 Office of the State Veterinarian, Department of Agriculture, Land Reform and Rural Development, Kruger National Park, PO Box 12, Skukuza 1350, South Africa.

6 Veterinary Wildlife Services, South African National Parks, Kruger National Park, Skukuza, South Africa.

7 Diagnostic Medicine/Pathobiology, Center of Excellence for Emerging and Zoonotic Animal Diseases (CEEZAD), College of Veterinary Medicine, Kansas State University, Manhattan, KS, United States of America.

email: af.craig83@gmail.com

Sylvatic circulation of African swine fever virus (ASFV) in warthogs and ornithodorid ticks that live in warthog burrows historically occurred in northern South Africa. Outbreaks of the disease in domestic pigs originated in this region. A controlled area was declared in the north in 1935 and regulations implemented to prevent transfer of potentially infected suids or products to the rest of the country. However, over the past six decades warthogs have been widely translocated to the south where the extralimital animals have flourished to become an invasive species. An investigation in 2008-2012 revealed that the presence of ornithodorid ticks and ASFV in warthog burrows extended marginally across the boundary of the controlled area. We were prompted to investigate the occurrence and risk of endemicity further south in the central part of the country, testing sera and tissues acquired opportunistically from extralimital warthogs. Using a blocking ELISA against VP72 of ASFV, a high prevalence of antibody was detected in the sera, some 400 km south of the controlled area in the Northern Cape Province. As this ELISA is not accredited for detection of ASF antibody in warthog sera and to confirm the presumptive evidence for presence of the virus, tissue samples accompanying the sera were tested for ASFV nucleic acid by qPCR. The results obtained confirmed an extension of sylvatic circulation of ASFV in the extralimital warthogs investigated.



## The effect of Garlium GEM HCTM as a tick repellent agent in beef cattle

FM Hagg<sup>1,4</sup>, LJ Erasmus<sup>2</sup>, D Cromarty<sup>3</sup>, WH Stoltsz<sup>1</sup>

1 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, South Africa

2 Department of Animal Science, Faculty of Natural and Agricultural Sciences, University of Pretoria, South Africa

3 Department of Pharmacology, Faculty of Health Sciences, University of Pretoria, South Africa

4 Allied Nutrition (Pty) Ltd, Centurion, South Africa

email: frans@alliednutrition.com

As resistance to chemical acaricides increases amongst tick populations worldwide, the investigation of natural remedies that have an acaricidal or tick-repellent effect, has become essential in the search for alternatives for sustainable tick control. Garlium GEM HC™ (Garlium) is a concentrated garlic product that was fed to eight of 16 Bonsmara steers (average live weight of 215 kg) supplemented at a rate of 2 g per animal per day in their daily feed ration over a period of 43 days. The other eight steers served as controls and were not supplemented with Garlium. All animals were infested with the same number of *Rhipicephalus appendiculatus* adults and *Rhipicephalus microplus* larvae, by placing the ticks in cotton bags attached to the ears and the body of the steers. Engorged female ticks were collected after detachment and kept in a temperature and humidity controlled mini-acaridarium to lay eggs. The number of attached ticks (both male and female) was also determined, as well as the hatchability of the eggs that were laid. Blood samples were collected from the animals intermittently on predetermined days to determine the effect of Garlium on whole blood composition and to detect garlic metabolites in the blood. In general, the results did not show a significant advantage of supplementing Garlium in the Bonsmara steers. Most of the tick parameters were numerically improved, but due to the large standard deviations observed in the results of the different parameters, the results were not statistically significant. When calculating the number of larvae produced by female *R. appendiculatus* ticks per host, a 19.1% reduction ( $p > 0.05$ ) in the number of larvae was observed. Garlium treatment reduced the number of *R. microplus* larvae produced per host by 42.3% ( $p = 0.10$ ). Supplementing Garlium to the cattle had no adverse effect on their haematocrits or haemoglobin concentrations. Thus, there is no evidence that supplementing Garlium at the rate used in this study would cause anaemia. Garlium supplementation, however, significantly ( $p = 0.02$ ) reduced the segmented neutrophil count in the treatment group, suggesting that the immune system was challenged to a lesser degree in the treatment group compared to the control group. There also appeared to be a tendency ( $p = 0.10$ ) for haematocrits and lymphocyte counts to increase with Garlium supplementation. Although the potential repellent effect of Garlium supplementation on tick infestation under field conditions was not investigated in this study, and although there were no statistically significant differences in tick parameters between the treatment and control groups, the effect of reducing the number of larvae produced per host by approximately 20% and 40%, respectively, for the two tick species, may be of economic benefit to commercial cattle farmers.



## Spatio-temporal patterns and risk factors of foot-and-mouth disease in Malawi between 1957 and 2019

*ET Chimera<sup>1</sup>, GT Fosgate<sup>1</sup>, EMC Etter<sup>1,2,3</sup>, RM Hassan<sup>4</sup>, G Kamwendo<sup>5</sup>, P Njoka<sup>5</sup>*

1 Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria

2 CIRAD, UMR Animal, Santé, Territoires, Risque et Ecosystèmes (ASTRE), Petit-Bourg (Guadeloupe), France.

3 ASTRE, Univ Montpellier, CIRAD, INRA, Montpellier, France

4 Department of Agriculture Economics, Extension and Rural Development, Faculty of Natural and Agricultural Sciences, University of Pretoria

5 Epidemiology unit, Department of Animal Health and Livestock Development, P.O Box 2096, Lilongwe, Malawi

e-mail: chimeraelizabeth@gmail.com

Foot-and-mouth disease (FMD) is an important livestock disease causing short-term and long-term production losses and hindering local and international trade. To gain access to foreign markets and also improve local trade, there is a need to employ effective preventive and control strategies. Although FMD has been present in Malawi for over 60 years, very little knowledge is available concerning the dynamics and drivers of FMD in the country. A study based on retrospective data was conducted to establish the spatio-temporal pattern, detect clusters and determine the risk factors associated with FMD in Malawi. A retrospective space-time analysis was performed and a matched case-control study was carried out to investigate risk factors. Two significant spatio-temporal clusters of FMD were identified in the southern region and analysis of index cases only (first detected locations) revealed four significant clusters, two in the southern region and two in the northern region. Higher beef cattle ( $p=0,004$ ) and pig densities ( $p=0,039$ ) increased the risk of reported FMD outbreaks. Increased distances to protected areas ( $p=0,034$ ) and lakes ( $p=0,011$ ) were positively associated with FMD detection while increased distances to international borders ( $p=0,020$ ) and roads ( $p=0,012$ ) reduced the risk of FMD detection. High FMD risk areas were observed in the southern and northern regions but not in the central region during the early years (1957-1981). The recent increase in FMD risk in the central region might be attributed to increases in livestock density within this region. These findings provide insight into the pattern of FMD in Malawi that will promote informed decisions for the progressive control of FMD. Future FMD control efforts should aim to address endemic transmission in areas where cattle and pig densities are highest, along Mozambique, Tanzania and Zambian borders and implement a more targeted surveillance within and around the identified clusters.





## Semen parameters of roan and sable antelope (*Hippotragus equinus* and *H. niger*) in a semi-intensive setting in Kimberley, South Africa

*S de Bruyn*<sup>1</sup>, *MP Smuts*<sup>2</sup>, *DE Holm*<sup>2</sup>, *EC Webb*<sup>1</sup>, *D Gerber*<sup>3</sup>, *KN Koeppel*<sup>2,4</sup>

<sup>1</sup> Department of Animal Science, Faculty of Nature and Agricultural Science, University of Pretoria

<sup>2</sup> Department of Production Animal Studies, Faculty of Veterinary Sciences, University of Pretoria, Onderstepoort, South Africa

<sup>3</sup> V-Tech Ltd, Private Bag X25, Halfway House, South Africa

<sup>4</sup> Centre for Veterinary Wildlife Research, Faculty Veterinary Science, University of Pretoria, Onderstepoort, South Africa

email: sonya.somacas@gmail.com

Breeding roan (*Hippotragus equinus*) and sable (*Hippotragus niger*) antelope for conservation and game hunting industry has led to these antelopes being bred in a similar manner as livestock. As such it is important to establish breeding soundness evaluation (BSE) parameters, to assist with the selection of breeding bulls. Semi-intensively bred roan (n=12) and sable bulls (n=21) from Kimberley in the Northern Cape, South Africa, were used. Bulls were darted during the summer (January) and winter (June) periods. A BSE was conducted using the standard methods applicable for sheep rams. Roan bulls were between 36 and 60 months of age (median 48) and sable bulls between 48 and 60 months (median 48). Semen was collected by making use of electroejaculation: rectal probes 50 cm and 40 cm in diameter were used for roan and sable bulls, respectively. Scrotal circumference (SC) was measured, and semen samples were analyzed macroscopically and microscopically. Mean body weight of the roan and sable bulls were 280.8 kg (SD21.9) and 232.5 kg (SD19.9). Mean SC for roan was 21.4 cm (CI:20.5 -22.2cm) and sable's was 23.6 cm (CI:22.8 -24.3 cm). Roan mean semen volume (SV) was 2.9ml (SD1.0) with a mean concentration of 357 x 10<sup>6</sup>/ml (SD 276.6), mean progressively motile sperm 77.2% (SD 10.9), and mean morphologically normal sperm 55% (SD 31.1). Sable mean SV was 3.3ml (SD2.1), mean concentration 556.6 x 10<sup>6</sup>/ml (SD 387.5), mean progressively motile sperm. 81% (SD 6.5) and mean morphologically normal sperm 71% (SD 12.3). There was no correlation between SV and SC in roan bulls but a weak positive correlation in sable bulls. A weak positive correlation between the semen concentration and the SC was noted in both species. This is the first report of normal parameters of semi-intensively bred roan and sable bulls and these findings can be used as a guideline for BSE in these species.



## Dose-related morphological changes in the epididymal region of sexually active adult male Japanese quail treated with di-n-butyl phthalate (DBP) commencing during the pre-pubertal stage

MIA Ibrahim<sup>1,2</sup>, J Williams<sup>1</sup>, CJ Botha<sup>1</sup>

1 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort, Pretoria, 0110, South Africa.

2 Department of Veterinary Anatomy, University of West Kordofan, West Kordofan State, P.O Box 12942, Gebaish, Sudan.

email: u17372098@tuks.co.za

Di-n-butyl phthalate (DBP) is widely used as a plasticizer in personal care and medical products and is known to induce toxicity in the male reproductive organs in both mammals and birds. In this study, we investigated the effects of DBP on the epithelium of the rete testis, proximal, and distal efferent ductules and epididymal duct of adult Japanese quail (*Coturnix japonica*) following treatment with varying doses during the pre-pubertal and peri-pubertal periods. Pre-pubertal quail ( $n = 25$ ) 4 weeks post-hatching were dosed orally with 10, 50, 200 and 400 mg DBP/kg/d, for 30 days and control birds were administered corn-oil only ( $n = 5$  per group). Histo-metrically, there was lesser ( $P < 0.001$ ) epithelial heights of the rete testis and efferent ductules in all quail DBP-treated groups, but not in the epididymal duct epithelium. There were no morphological change effects as a result of DBP treatments in the rete testis epithelium, while epithelial cytoplasmic vacuoles were detected in the distal efferent ductule and epididymal duct of birds treated with 50, 200 and 400 mg DPB/kg/d. There were several lesions, including degenerative changes, cytoplasmic vacuoles, apoptosis and autophagy in the epithelium of the proximal efferent ductule in quail treated with 200 and 400 mg DBP/kg/d. Overall, the results indicate that treatment with DBP during the pre-pubertal period induced dose-dependent histometric and morphological changes in the epithelium of the epididymal region. It is concluded that the proximal efferent ductule was a highly sensitive component of the epididymal tissues of Japanese quail following treatment with DBP during the pre-pubertal period.

## The cytotoxic effect of ionophores on cardiac and skeletal muscle cells *in vitro*

D Henn<sup>1</sup>, GCH Ferreira<sup>1</sup>, EA Venter<sup>1</sup>, CJ Botha<sup>1</sup>

1 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

email: DanielleHenn@tuks.co.za

Carboxylic ionophores are polyether antibiotics that are extensively used in the livestock industry to control coccidiosis and promote growth and feed efficiency. Unfortunately, due to feed mixing errors and extra-label use, cases of ionophore poisoning in animals occur and primarily affect the cardiac and skeletal muscles. These ionophores form dynamically reversible complexes with cations and facilitate their movement across biological membranes affecting the ion homeostasis of cells, disrupting the normal physiological functions by altering intra-cellular pH, disrupting oxidative phosphorylation, causing calcium overload, and damaging the plasma membrane via lipid peroxidation. The aim of the study was to determine the cytotoxic effect of monensin, salinomycin and lasalocid on cytoskeletal filaments of cardiac (H9c2) and skeletal muscle (L6 & C2C12) cells *in vitro*. The cytotoxicity of each ionophore over 24, 48 and 72h was determined using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) viability assay. Immunocytochemistry was used to investigate the effect of these ionophores on the intermediate filaments, desmin and synemin. Additionally, immunofluorescence was used to visualize the microfilament (F-actin), and microtubules. Monensin induced the highest cytotoxicity of the three ionophores, with  $EC_{50}$ s in the low nanomolar range after 48 and 72h exposure, followed by salinomycin and lasalocid. Cells exposed to the different ionophores had similar morphological changes, with cytoplasmic vesicles filling the entire cell and cells rounding and detaching from their surroundings. Disruption to the intermediate filament network was observed at longer exposure times.



## Bioassay guided fractionation of *Senna singueana* and its potential for development of poultry phytogetic feed additives

*P Jambwa*<sup>1,3</sup>, *FN Makhubu*<sup>1</sup>, *SM Nkadimeng*<sup>1</sup>, *G Matope*<sup>2</sup>, *G Fouche*<sup>4</sup>, *LJ McGaw*<sup>1</sup>

1 Phytomedicine Programme, Department of Paraclinical Sciences, University of Pretoria, Private Bag X04, Onderstepoort, 0110, South Africa.

2 Department of Paraclinical Veterinary Studies, University of Zimbabwe, PO Box MP167, Mt Pleasant, Harare, Zimbabwe.

3 Department of Preclinical Veterinary Studies, University of Zimbabwe, PO Box MP167, Mt Pleasant, Harare, Zimbabwe.

4 Department of Chemistry, University of Pretoria, Private Bag X20, Hatfield, Pretoria, 0028, South Africa.

e-mail: prosperjambwa@yahoo.com

Antimicrobial resistance prompted the European Union and several other countries to ban the use of antibiotic growth promoters in animal feed. Plant-based products have emerged as viable alternatives to in-feed antibiotics. The aim of the study was to evaluate the antibacterial, anti-lipoxygenase, antioxidant and *in vitro* safety of *Senna singueana* fractions and isolated compounds. Solvent-solvent partitioning was carried on the methanol leaf extract of *S. singueana* using *n*-hexane, dichloromethane, ethyl acetate, *n*-butanol and water. Isolation of active compounds was conducted on the ethyl acetate fraction using column chromatography. Antibacterial efficacy of the fractions and isolated compounds were determined against poultry pathogens using a two-fold serial microdilution assay and qualitative bioautography assays. Anti-lipoxygenase activity was evaluated using the ferrous oxidation-xylene orange (FOX) method. Antioxidant activity was assessed using radical scavenging assays. Dichloromethane and ethyl acetate fractions from solvent/solvent partitioning had the best antibacterial activity with MIC values ranging from 156 - 313 µg/ml. Fractions obtained from the column separation had significant to weak antibacterial activity with MIC values ranging from 50 - 938 µg/ml. Bioautography showed clear bands of bacterial inhibition for several of the fractions. The ethyl acetate fraction and all the seven tested column fractions (A3, A4, A5, A6, A7, B1 and B2) had potent anti-lipoxygenase activity with IC<sub>50</sub> values of ≤2.5 µg/ml which were lower than that of quercetin (positive control). The ethyl acetate fraction and fraction A3, A4, A5, A6, A7 and B1 showed powerful antioxidant activity with IC<sub>50</sub> values of ≤5 µg/ml in the ABTS assay. Cytotoxicity values ranged from 68-246 µg/ml. Bioassay-guided isolation led to isolation of the bioactive compound, luteolin. Based on the good antibacterial activity, potent antioxidant and anti-inflammatory activity as well as low cytotoxicity of its fractions, *S. singueana* is a promising candidate for the development of poultry phytogetic feed additives.







# Session 4: Postgraduate research

## Reliability of pulse oximetry, at four different attachment sites, in immobilised white rhinoceros *Ceratotherium simum*

*TK Mtetwa*<sup>1,2</sup>, *GE Zeiler*<sup>3</sup>, *P Buss*<sup>4</sup>, *EP Snelling*<sup>2,5</sup>, *LCR Meyer*<sup>1,2</sup>

1 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

2 Centre for Veterinary Wildlife Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

3 Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

4 Veterinary Wildlife Services, South African National Parks, Kruger National Park, Skukuza, South Africa.

5 Department of Anatomy and Physiology, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: thembeka.mtetwa@up.ac.za

Chemically immobilized white rhinoceros require accurate monitoring of their blood oxygen status to reduce the risk of opioid-induced morbidity and mortality. Pulse oximetry is a common and cost-effective method to continuously monitor peripheral oxygen haemoglobin saturation (SpO<sub>2</sub>) in humans and animals. In this study, we aimed to establish, in immobilized white rhinoceros, the reliability of SpO<sub>2</sub> measured by a pulse oximeter (Nonin PalmSat), at four different attachment sites, compared with arterial oxygen haemoglobin saturation (SaO<sub>2</sub>) measured by a co-oximeter (AVOXimeter 4000). White rhinoceros were immobilized with etorphine + saline, or etorphine + butorphanol. Once immobile, the pinna of the rhinoceros was aseptically prepared for arterial blood collection and four of the pulse oximeters with 2000T transreflectance probes were fixed securely under or on the third eyelid, on the cheek, inside the rectum and under the base of the tail. The SpO<sub>2</sub> values at each of the four attachment sites were statistically compared with simultaneous values of SaO<sub>2</sub> using Bland-Altman and area root mean squares (ARMS) methods. When compared with SaO<sub>2</sub>, SpO<sub>2</sub> measures from the third eyelid were accurate and precise at the manufacturers' claimed performance range of 70% (bias = 1, precision = 3, ARMS = 3). However, pulse oximeter probes placed on the cheek, rectum and tail failed to obtain reliable SpO<sub>2</sub> measures (cheek: bias = 0, precision = 10, ARMS = 10; rectum: bias = -9, precision = 11, ARMS = 14; tail: bias = -14, precision = 8, ARMS = 16). Thus, the Nonin PalmSat pulse oximeter can be used to obtain reliable SpO<sub>2</sub> measures in immobilized white rhinoceros when using a 2000T transreflectance probe inserted into the space between the third eyelid and sclera.



TK Mtetwa





## Influence of high-protein and high-carbohydrate diets on serum lipid and fructosamine concentrations in healthy cats

*CF Berman<sup>1</sup>, RG Lobetti<sup>1</sup>, E Zini<sup>3,4,5</sup>, GT Fosgate<sup>6</sup>, JP Schoeman<sup>2</sup>*

<sup>1</sup> Bryanston Veterinary Hospital, Bryanston, Johannesburg, South Africa

<sup>2</sup> Department of Companion Animal Clinical Studies, University of Pretoria, South Africa

<sup>3</sup> Clinic for Small Animal Internal Medicine, Vetsuisse Faculty, University of Zurich, Switzerland

<sup>4</sup> Department of Animal Medicine, Production and Health, University of Padova, Italy

<sup>5</sup> Istituto Veterinario di Novara, Granozzo con Monticello, Italy

<sup>6</sup> Department of Production Animal Studies, University of Pretoria, South Africa

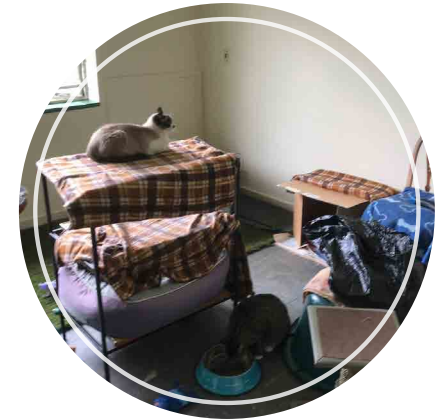
email: u28087543@tuks.co.za

Hypercholesterolaemia in cats with diabetes mellitus has been associated with lower remission rates. The concept that a traditional high-protein and low-carbohydrate diet causes increased cholesterol in healthy cats is relatively new and requires further investigation. The aim of this study was to determine whether high-protein and high-carbohydrate diets exert differential effects on serum cholesterol, triglyceride and fructosamine concentrations in healthy cats. A randomised, crossover diet trial was performed in thirty-five healthy shelter cats. The fat content of the high-protein and washout diet were equal, but nearly double that of the high-carbohydrate diet. The washout diet had the highest fibre content followed by the high-protein and high-carbohydrate diet, respectively. Before enrollment into the study, cats were fed a commercial baseline diet. Following baseline health assessments, cats were randomised into groups receiving either the high-protein or high-carbohydrate diet for four weeks. The cats were then fed a washout diet for four weeks before being transitioned to whichever of

the two studied diets they had not yet been subjected to. Fasting serum cholesterol, triglyceride and fructosamine concentrations were determined at the end of each four-week diet period.

Cats on the high-protein diet had significantly higher serum cholesterol and triglyceride, yet significantly lower serum fructosamine concentrations than cats on the baseline diet ( $P < 0.001$  for all). Within these cats on the high-protein diet, the increases in cholesterol and triglycerides were significantly more pronounced in cats with  $BCS < 5$ . In contrast, cats on the high-carbohydrate diet had significantly lower serum cholesterol concentrations ( $P < 0.001$ ) compared to the baseline diet. In conclusion, diets higher in protein and lower in carbohydrates appear beneficial for short-term glucose control in healthy cats. Indeed, the high-protein diet resulted in significantly elevated cholesterol and triglyceride concentrations amongst healthy cats even though the increase was significantly more pronounced in cats with a  $BCS < 5$ .

CF Berman



## Prevalence, risk factors for exposure and socio-economic impact of peste des petits ruminants in Karenga district, Karamoja region, Uganda

CJ Akwongo<sup>1,2</sup>, M Quan<sup>2</sup>, C Byaruhanga<sup>2</sup>

1 Department of Biomedical Sciences, Institute of Tropical Medicine, Antwerp, Belgium.

2 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: juliemanifest@gmail.com / u20684607@tuks.co.za

Peste des petits ruminants (PPR), a disease caused by the small ruminant morbillivirus (SRM), is a highly contagious disease with high socio-economic impact. In Karamoja region, different foci of SRM occur, attributed to unique and continuously changing epidemiological situations. Karenga is a new district in Karamoja located in the vicinity of Kidepo Valley National Park and bordering South Sudan and Kenya, characterised by free cross-border livestock trade, communal grazing and transhumance. This study was conducted from November through December 2020 to determine the seroprevalence of SRM, the risk factors associated with occurrence and socio-economic impact of PPR in Karenga. A total of 22 *kraals* were randomly selected from all seven administrative units and 684 small ruminants (sheep = 115; goats = 569) were selected for serum collection using systematic random sampling. Exposure to SRM was determined using a competitive enzyme-linked immunosorbent assay. The overall true seroprevalence of SRM antibodies was high, 51.4 (95% confidence interval [CI] 45 - 52.6). A multivariate logistic regression for risk factors showed that seroprevalence ranged from 26.8% to 87.8% by location (odds ratio [OR]  $\leq$  14.5). The odds of exposure to SRM was higher in sheep (73.9%) than in goats (43.8%) (OR = 1.7,  $p$  = 0.08), and seropositivity was higher in animals greater than two years old (65.5%; OR = 11.1,  $p$  < 0.001), or those one to two years old (24.7%; OR=1.6,  $p$ =0.2), compared to small ruminants less than one year old (16.1%). Using participatory epidemiology approaches (pairwise ranking, proportional piling, impact matrix scoring) with 22 focus groups of pastoralists, PPR was the second most important small ruminant disease in Karenga: relative morbidity 14%, relative mortality 9% and case fatality rate 78%, and impacted production in terms of marketability, milk production and reproductive capacity. These findings provide evidence to support implementation of disease surveillance and control strategies, and therefore mitigation of the associated impact of PPR in Karenga district, and Karamoja region in general.



## The circulation of *Toxoplasma gondii* in a human-livestock-wildlife interface area in Mpumalanga, South Africa

RP Bokaba<sup>1</sup>, D Morar-Leather<sup>1</sup>, V Dermauw<sup>2</sup>, P Dorny<sup>2</sup>, L Neves<sup>1</sup>

1 Department of Veterinary Tropical Diseases, Faculty of Veterinary Sciences University of Pretoria, Onderstepoort, South Africa.

2 Department of Biomedical Sciences, Institute of Tropical Medicine, Antwerp, Belgium.

email: philbokaba@gmail.com

The Bushbuckridge Municipality, Mpumalanga, is an interface area comprising wildlife, livestock and human interactions. A cross-sectional study was conducted in the area to determine the seroprevalence of *T. gondii* and investigate its circulation in the different co-habitats. The study area consisted of four villages in the Mnisi Community (Athol, Tlhavekisa, Utah and Gottenburg) including their respective pasturelands and nature reserves in the surrounding areas. Randomly collected blood samples were obtained from humans (n=160), goats (n=358), chickens (n=336), cats (n=9), and rodents (n=376). Serum samples from wild species such as impalas (n=118), kudus (n=51), zebras (n=62), warthogs (n=85) and blue wildebeest (n=36) from the South African National Parks (SANParks) biobank were also included. Rodents in the study were captured for comparison in three habitat types: human dwellings, pasturelands and a conservation area. The seroprevalence of *T. gondii* was determined using a serological commercial latex agglutination kit that detects anti-*Toxoplasma* IgG and IgM antibodies in the various species. Seroprevalence in humans, goats, chickens and cats were 9%, 11%, 5% and 0%, respectively. Seroprevalence in impalas, kudus, zebras, warthogs and wildebeests were 11%, 7%, 9%, 13% and 20%, respectively. In contrast, the rodents had a combined seroprevalence of 18%. The results obtained from the study show a low circulation of *T. gondii* in the domestic cycle and in the wild cycle particularly in the herbivorous population. The results also suggest that the rodents and possibly wild felids play an important role in the parasite transmission between the habitats in the area.



RP Bokaba





## Comparison of medetomidine-ketamine vs medetomidine-zoletil anaesthetic on cardiovascular parameters in chimpanzees (*Pan troglodytes*)

C Greyling<sup>1</sup>, KN Koepfel<sup>1,2</sup>, LL Laubscher<sup>3,4</sup>

1 Department of Production Animal Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort 0110, South Africa.

2 Centre for Veterinary Wildlife Studies, Faculty of Veterinary Sciences, University of Pretoria, Onderstepoort 0110, South Africa

3 Wildlife Pharmaceuticals South Africa (Pty) Ltd., White River 1240, South Africa.

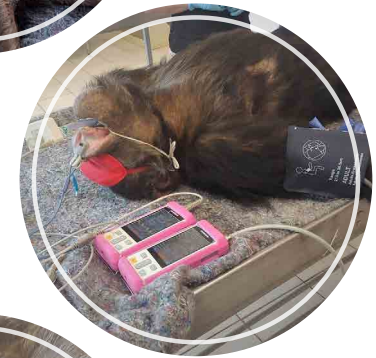
4 Department of Animal Sciences, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa

email: chantellgreyling@gmail.com

Habitat loss, disease and conflict with humans have resulted in an increase in the number of chimpanzees held in captivity. Captive chimpanzees are immobilised for various reasons and improper immobilisation may pose a severe threat to human safety as a result of their physical strength. Therefore, there is a need for effective protocols that ensure the safety of both the animals and their handlers. In this study, anaesthesia was induced in a group of captive chimpanzees using either medetomidine-ketamine (MedKet; 0.03 mg/kg; 1.5 mg/kg) or medetomidine-Zoletil (MedZol; 0.03 mg/kg; 1.5 mg/kg). Chimpanzees were premedicated with midazolam (15 mg) orally and hand-injected with either combination. Additional intravenous ketamine (1.5 mg/kg) was administered between 7.38 and 15.44 minutes after anaesthesia was induced to maintain anaesthetic depth. Induction and recovery times, quality of induction, ease of intubation and degree of muscle relaxation were subjectively scored. Cardiovascular parameters (heart rate, respiratory rate, oxygen saturation, EtCO<sub>2</sub>, and blood pressure) were recorded at five-minute intervals. An arterial blood sample was collected for blood gas analysis between 15- and 40-minutes post anaesthetic administration (median 25

minutes). Data between the protocols were compared using t-tests with significance set at 0.05. Preliminary results show that there is little difference ( $p > 0.05$ ) in heart rate, respiratory rate, EtCO<sub>2</sub> and temperature between the two anaesthetic protocols.

Although oxygen saturation (SpO<sub>2</sub>) remained higher over time with MedKet-induced anaesthesia, a significant difference occurred at 15 minutes of monitoring ( $p=0.0246$ ). Preliminary results also show that there were significant differences ( $p < 0.05$ ) in systolic pressure, diastolic pressure and mean arterial pressure. MedZol anaesthesia produced higher blood pressure measurements over time compared to readings observed when anaesthesia was induced with MedKet. Initial results indicate that both protocols are suitable to be used in chimpanzees for short-term anaesthesia.



C Greyling





## Temporal changes of endocrine variables in beagle dogs experimentally infected with *Babesia rossi*

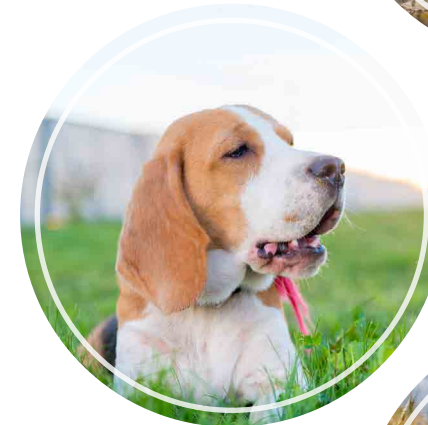
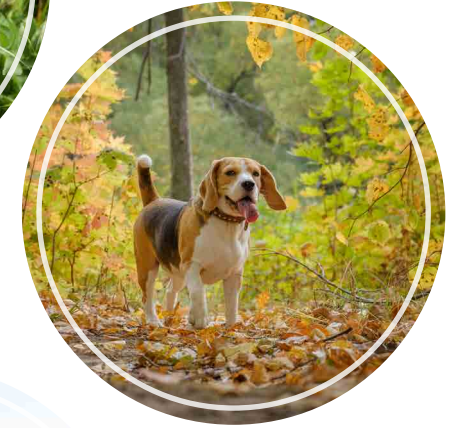
*E van Zyl*<sup>1</sup>, *AL Leisewitz*<sup>1</sup>, *BK Atkinson*<sup>1</sup>, *A Goddard*<sup>1</sup>, *Y Rautenbach*<sup>1</sup>,  
*P Thompson*<sup>2</sup>, *JP Schoeman*<sup>1</sup>

<sup>1</sup> Department of Companion Animal Clinical Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa

<sup>2</sup> Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: estvzyl@gmail.com

The aim of this study was to track endocrine variables longitudinally in an experimental *Babesia rossi* infection in beagle dogs and to assess changes in endocrine variables between dogs infected with a high ( $10^8$  parasites) and a low dose ( $10^4$  parasites) of parasite inoculum. Five purpose-bred castrated male beagle dogs were included in this prospective longitudinal observational study. The infectious inoculum was raised in a splenectomised dog. Two dogs were infected with the low dose of parasite inoculum and three were infected with the high dose. Basal serum cortisol, thyroxine (T4), triiodothyronine (T3), and thyrotropin (TSH) concentrations were measured every second day, until the predetermined end points of infection. Samples were analysed using a solid-phase, competitive chemiluminescent enzyme immunoassay (Immulite® 2000, Siemens). Once the end points were reached, the dogs were drug cured with diminazene aceturate (3.5mg/kg subcutaneously). In both groups, the median cortisol concentration increased and the median T4 and T3 concentrations decreased after infection with a return towards baseline concentration post treatment. The high dose group showed a rapid and more pronounced increase in cortisol concentration, whilst the low dose group demonstrated a slower and milder increase. The high dose group showed a rapid and greater decline in T4 concentration whilst the low dose group showed a more gradual and milder decrease. The T3 concentration also decreased post infection and was significantly lower in the high dose group when compared to the low dose group, at certain time points. The TSH concentration remained within the reference interval throughout the study period. This study illustrated the temporal changes in endocrine parameters during experimental *B. rossi* infection and demonstrated that cortisol rose, whilst T4 and T3 declined proportionate to the severity of disease which is associated with the dosage of the parasite inoculum.





## Development of a serological-based vaccine matching technique for SAT 2 foot-and-mouth disease (FMD) viruses

*T Malesa<sup>1,3</sup>, P Opperman<sup>2,3</sup>, L Heath<sup>3</sup>*

1 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

2 Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

3 Transboundary Animal Diseases, Onderstepoort Veterinary Research, Agricultural Research Council, Onderstepoort, South Africa.

email: MalesaN@arc.agric.za

Foot-and-mouth disease (FMD) is a highly contagious viral disease of artiodactyla animals, an outbreak of which has a great economic impact on affected countries as trade restrictions are imposed. Currently there are seven distinctive FMD serotypes (A, O, C, Asia-1, Southern African Territories [SAT] 1, 2 & 3) with many subtypes due to the high mutation rate of the RNA virus. New variants arise in the field that are different from those included in vaccines resulting in a decrease of vaccine efficacy. The FMD vaccine used in southern Africa has performed inadequately against the SAT type viruses, particularly with the SAT2 serotype strains as evidenced by an increase in recent SAT2 outbreaks. Therefore, it is important to select the correct vaccine strain that will elicit an immune response against a broad spectrum of circulating field viruses. Current vaccine matching tools include the virus neutralization test, which is laborious and time consuming. In this study we aim to develop an ELISA-based vaccine matching technique for the antigenically diverse FMD SAT2 serotype. A Solid Phase Competition ELISA (SPCE) will be developed and optimised to determine the antigenic similarity between 15 prevalent SAT2 FMD virus strains using sera from cattle vaccinated with a pentavalent FMD vaccine developed by the ARC. The antigenic relationship will be determined by calculating the  $r_1$ -value which is the ratio of serum titre against the heterologous virus and homologous virus. The outcome will indicate if the ARC FMD vaccine will confer protection against prevalent SAT2 virus strains. The development of such a SPCE for vaccine matching will enable rapid screening of circulating field isolates to identify the most appropriate vaccine strain to be used in the formulation of FMD vaccines.





## Temporal dynamics of *Anaplasma marginale* infection in calves at the wildlife–livestock interface in the Mnisi communal area, Mpumalanga, South Africa

SM Makgabo<sup>1</sup>, L Biggs<sup>2</sup>, KA Brayton<sup>1,3</sup>, MC Oosthuizen<sup>1</sup>, NE Collins<sup>1</sup>

1 Department of Veterinary Tropical Diseases, Faculty of Veterinary Science, University of Pretoria, South Africa.

2 Hans Hoheisen Wildlife Research Station, Faculty of Veterinary Science, University of Pretoria, South Africa.

3 Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, WA, USA.

email: marcusmakgabo.mm@gmail.com

Bovine anaplasmosis, caused by *Anaplasma marginale*, is one of the most important tick-borne diseases of cattle in South Africa, with an estimated cost due to mortality of R115 million per year and further costs attributable to morbidity and tick control. Through the Health and Demographic Surveillance System in Livestock in the study area of the Mnisi One Health Platform, Mpumalanga, information has been collected on the cattle in the area, indicating the presence of *A. marginale*. This study aimed to investigate the infection dynamics in calves (n=10) in two areas of the Mnisi community during a one-year period, and the diversity of circulating *A. marginale* strains. Blood samples were collected monthly from five calves each in a peri-urban area and at a wildlife-livestock interface. A duplex qPCR assay confirmed the presence of *A. marginale* in all five calves in the peri-urban area but in only two calves at the wildlife-livestock interface; *A. centrale* was not detected. *Anaplasma marginale* strain diversity as determined by *msp1a* genotype analysis revealed more than 50 genotypes (10 from the wildlife-livestock interface and more than 40 in the peri-urban area) circulating in the calves during the one-year study period, with 12 *Msp1a* repeats that have not been previously reported. Our results suggest that calves in the peri-urban area were more likely to be exposed to and infected with *A. marginale* than calves in the wildlife-livestock interface, resulting in endemic stability in the peri-urban area and correlate with the occasional bovine anaplasmosis cases observed at the wildlife-livestock interface. Methods of cattle management, acaride treatment and cattle density, could explain differences in exposure to *A. marginale* in the two areas. Our results indicate that calves in the area are superinfected by distinct *A. marginale* strains within a period of 12 months.

## Serum neutralisation profiles of straw-coloured fruit bats (*Eidolon helvum*) against four lineages of Lagos bat lyssavirus

VO Ameh<sup>1,2</sup>, G Wu<sup>3</sup>, H Goharriz<sup>3</sup>, AR Fooks<sup>3</sup>, CT Sabeta<sup>2,4</sup>, L Mcelhinney<sup>3</sup>

1 Federal University of Agriculture Makurdi, College of Veterinary Medicine, Department of Veterinary Public Health and Preventive Medicine, P.M.B. 2373, Makurdi, Benue State Nigeria

2 University of Pretoria, Faculty of Veterinary Science, Department of Veterinary Tropical Diseases, P Bag X04, Onderstepoort 0110, South Africa

3 Viral Zoonoses Group, Animal and Plant Health Agency (APHA), OIE Rabies Reference Laboratory, Weybridge, Woodham Lane, New Haw, Addlestone, Surrey KT15 3NB, United Kingdom

4 OIE Rabies Reference Laboratory, Agricultural Research Council-Onderstepoort Veterinary Research, Onderstepoort 0110, South Africa  
email: ameh.veronica@uam.edu.ng

Bats are the natural reservoir hosts for many viral zoonotic pathogens including lyssaviruses that can cause the fatal disease rabies. Lagos bat lyssavirus (LBV), a member of phylogroup II lyssaviruses, has been classified into four lineages (A, B, C and D). There is minimal information of LBV lineages circulating in fruit bat populations in Nigeria, despite that the bat lyssavirus (LBV-B) was first isolated in that country in 1956. This study was undertaken to assess the levels of neutralising antibodies against four lineages of LBVs in straw-coloured fruit bats (*Eidolon helvum*) in Makurdi, Nigeria. Serum samples (n=180) were collected during two consecutive seasons between (November 2017 – March 2018 and November 2018 – March 2019) from terminally bled bats captured for human consumption and tested using a modified fluorescent antibody virus neutralisation (mFAVN) assay. The data showed that a high number of bat sera (73%) neutralised at least one lineage of LBV with the reciprocal titre values ranging from 9 – > 420.89. Most sera neutralised LBV-A (63.3%), followed by LBV-D (48.3%), then LBV (C) (46.7%) and LBV-B (23.9%). Many sera (n=107) neutralised more than one lineage of LBV while 24 serum samples neutralised against only one lineage, LBV-A (n=17), LBV-D (n=6), LBV-C (n=1, with a low reciprocal titre of 9). None neutralised against LBV-B virus only, nor displayed a higher titre against LBV-B than other lineages. The high seroprevalence of neutralising antibodies suggests that the exposures to LBVs are common and LBV- A (and possibly C and D) are circulating amongst those bats. The infected bats could potentially pass the deadly virus to their handlers and consumers.







## Spatio-temporal analysis of bovine theileriosis (*Theileria parva*) in Zimbabwe from 1995 to 2018

*M Manyenyeka*<sup>1</sup>, *C Marufu*<sup>1</sup>, *WM Tagwireyi*<sup>2</sup>, *RM Spargo*<sup>3</sup>, *E Etter*<sup>2,4,5</sup>

1 Department of Veterinary Tropical Diseases, University of Pretoria, Private Bag X4, Onderstepoort, South Africa

2 Department of Production Animal Studies, University of Pretoria, Private Bag X4, Onderstepoort, South Africa

3 Division of Veterinary Field Services, Ministry of Agriculture, Mechanisation and Irrigation Development, Harare, Zimbabwe

4 CIRAD, UMR Animal Santé, Risque et Ecosystèmes (ASTRE), Montpellier, France

5 ASTRE, INRA, CIRAD, Univ Montpellier, Montpellier, France

email: musamanyenyeka@gmail.com

Bovine theileriosis is responsible for high cattle mortalities in the smallholder farming sector of Zimbabwe, though knowledge of its spatial and temporal distribution dynamics in the country remain scant and outdated. A retrospective study was done to investigate the spatial and temporal patterns of bovine theileriosis in Zimbabwe in the period 1995 to 2018 to improve understanding of the disease's dynamics. Bovine theileriosis data was obtained from the Department of Livestock and Veterinary Services of Zimbabwe's (DLVSZ) bovine theileriosis database for the period 1995 to 2018. The data was analysed using SatScan® version 9.4.6 so as to detect high-risk areas for bovine theileriosis and Studio R® version 11.0 for evaluation of potential risk factors. A total of 4 540 deaths and 8 728 cases of bovine theileriosis were recorded during the study period. Adult cattle (29%), the hot wet season (42%) and communal areas (72%) had the highest number of cases recorded. One-year and one-month aggregates detected five and four high-risk clusters of bovine theileriosis, respectively, all within the last seven years of the study period (2011 – 2018). All the six tested variables (province, sex, farming system, season, year and age) proved to be associated with bovine theileriosis occurrence ( $P < 0.2$ ) in the univariate model. The spatial and temporal patterns of bovine theileriosis proved to vary over the study period. The results showed bovine theileriosis cases in relation to the identified potential risk factors, risk areas and risk clusters over time and space. Findings support the fact that there is proliferation of bovine theileriosis during the hot wet season, especially in the communal grazing areas. Recommendations revolve around better farmer awareness and improved knowledge about the disease, correct and consistent use of acaricides, cattle movement control and improved disease surveillance.

## Low-dose thiafentanil in combination with medetomidine and azaperone for the immobilisation of African buffalo (*Syncerus caffer*)

VE Faber<sup>1</sup>, R Burroughs<sup>1,2</sup>, LCR Meyer<sup>2,3</sup>, KN Koeppel<sup>1,2</sup>

1 Department of Production Animal Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

2 Centre for Veterinary Wildlife Studies, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

3 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Onderstepoort, South Africa.

email: vfaber87@gmail.com

African buffalo (*Syncerus caffer*) are frequently immobilized for veterinary interventions, disease screening and translocations. Due to the frequency, and associated costs, at which chemical immobilisations occur, as well as for safety reasons and previous difficulties in opioid supply, alternative and less potent immobilisation protocols are needed. This study was to compare the times to recumbency and physiological effects of the thiafentanil-azaperone (TA) combination to the thiafentanil-medetomidine-azaperone (TMA) combination in twelve African buffalo in a randomized cross-over study. Animals received either thiafentanil at 6-7 mg/animal and azaperone at 40 mg/animal, or thiafentanil at 1 mg/animal, medetomidine at 3-4 mg/animal and azaperone at 40 mg/animal. The times to immobilisation and recovery were recorded. Data collection included blood gas analysis, quality of induction and cardio-respiratory variables. The TA combination induced a significantly quicker (mean TA, 5.7 min vs mean TMA, 10.95 min) and a more reliable induction. Arterial blood pressure and respiratory rates were within normal physiological ranges. However, all buffalo were considered hypoxaemic with a mean (SD, range) PaO<sub>2</sub> value of 44 mmHg (± 14, 24 – 77 mmHg) and 51mmHg (± 13, 33 – 80 mmHg) in the TMA and TA combination, respectively. The TMA combination induced immobilization with only 1/7<sup>th</sup> of the higher dose of opioid and at only a quarter of the cost. Hypoxaemia was a concern in both combinations and resulted mainly from decreased pulmonary oxygen diffusion rather than hypoventilation. Importantly, despite respiratory rates and PaCO<sub>2</sub> values being within the normal expected physiological range, hypoxaemia was more severe in the TMA combination. Therefore, supplementary oxygen is considered mandatory during immobilisation with this combination. The enormous reduction in costs with the TMA combination could be beneficial for the wildlife industry. However, the longer induction times, and risks from marked hypoxaemia need to be considered and addressed when this combination is used.

## Semen collection and cryopreservation in black (*Diceros bicornis*) and white rhinoceroses (*Ceratotherium simum*) – field-friendly protocols

*J Meuffels<sup>1,2</sup>, H Bertschinger<sup>2</sup>, I Luther-Binoir<sup>1</sup>, I Lueders<sup>1,3</sup>*

1 Cryovault, Hemmersbach Rhino Force NCP, Tokai 7966, South Africa

2 Department of Production Animal Sciences, Faculty of Veterinary Science, Onderstepoort 0110, University of Pretoria, South Africa

3 GEOLifes, Animal Fertility and Reproductive Research, 22457 Hamburg, Germany

email: Meuffels.janine@gmail.com

With the rapid decimation of wild African rhinoceros populations as result of ongoing poaching, biobanking of genetic material and assisted reproductive technologies (ART) have been suggested as additional conservation tools. Semen collection and cryopreservation for the immediate and future application in artificial inseminations (AI), in vitro fertilisation (IVF) and intra-cytoplasmic sperm injection (ICSI) allow enhancing the genetic diversity of a population. However, species-specific protocols and equipment, based on the reproductive anatomy and physiology of each species, have to be developed. While animals are under general anaesthesia for management and conservation procedures (e.g. dehorning, ear-notching, translocations), semen collection can additionally be performed. Electro-ejaculation is most commonly used, but urethral catheterization was described in one black rhinoceros. Electro-ejaculation was attempted with a specifically designed rectal probe and a portable electro-ejaculator (El Toro 3, electronic Research Group, South Africa) in sixty-nine white and seven black rhinoceroses in South Africa. For management reasons, animals were immobilised for management reasons with a combination of etorphine-medetomidine-midazolam delivered remotely by dart. In eight white and two black rhinoceroses, urethral catheterization was additionally performed. A 10FG 100 cm nasogastric tube (Dynamed, South Africa) was passed retrograde through the urethra (90-100 cm) and semen collected via capillary forces while retracting the catheter. A total of 45 semen samples from white and three from black rhinoceroses were collected via electro-ejaculation and seven and two samples with urethral catheterisation, respectively. Thirty-four and four samples respectively were cryopreserved with liquid nitrogen vapour using different extenders following microscopic evaluation (motility, morphology, concentration).



## Antibacterial interactions, anti-inflammatory, cytotoxic and anti-biofilm effects of medicinal plant species used for cutaneous wound infections on animals

JK Madisha<sup>1</sup>, LJ McGaw<sup>1</sup>

1 Phytomedicine Programme, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa  
email: jacobuskorimadisha@yahoo.com

Increasing drug resistance in a number of microbial pathogens has led to a need for new and efficient antimicrobial agents. Using medicinal plants for natural treatment of diseases caused by bacterial origin is one option under investigation. A serial microdilution assay to determine minimum inhibitory concentration (MIC) was used to investigate the antibacterial efficacy of selected plant extracts on *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella typhimurium*. The acetone extracts of five plant species were assessed independently and in combination for antibacterial activity and the sum of the fractional inhibitory concentration (FIC) was calculated to detect synergistic effects. The ability of *Eucalyptus camaldulensis* and *Elephantorrhiza elephantina* extracts to inhibit the production of reactive oxygen species (ROS) in LPS-induced RAW 264.7 macrophage cells was evaluated using the dichlorodihydrofluorescein diacetate (H2DCF-DA) assay to determine anti-inflammatory potential. Toxicity on African green monkey kidney (Vero) cells was evaluated using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) assay. The antibacterial efficacies of the different combinations of *E. elephantina*, *Aloe marlothii*, *E. camaldulensis*, *Euphorbia tirucali* and *Musa acuminata* plants varied. Synergistic effects were only exhibited against *P. aeruginosa*, while antagonistic effects were observed against *E. coli*. Both *E. elephantina* and *E. camaldulensis* demonstrated antioxidant potential by inhibiting the production of reactive oxygen species in a dose dependent manner. The cytotoxicity of the plants (LC<sub>50</sub> values) ranged from <12.50 to 466.1 µg/mL. *Elephantorrhiza elephantina* extract was the most toxic with the lowest LC<sub>50</sub> value of <12.50 µg/mL. The synergistic interaction observed indicates that combinational therapy may improve biological activity. This report highlights the anti-inflammatory of *E. elephantina* and *E. camaldulensis* which could be exploited in the search for anti-inflammatory agents. In the present study, plant extracts with different compounds showed antibacterial and antibiofilm activity.

## Evaluating the effect of bambamycin on *mcr-1* associated colistin-resistance in *E. coli*

IZ Hassan<sup>1</sup>, N Mbelle<sup>2,3</sup>, DN Qekwana<sup>1</sup>, V Naidoo<sup>1</sup>

1 Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Pretoria, South Africa.

2 Department of Medical Microbiology, Faculty of Health Sciences, University of Pretoria, Pretoria, South Africa.

3 Department of Medical Microbiology, Tshwane Academic Division, National Health Laboratory Services, Pretoria, South Africa.

email: aburo001@gmail.com

Antimicrobial resistance is responsible for about 700,000 human deaths annually, and unquantified losses in animal lives and investments. The horizontal transfer of resistance determinants between micro-organisms is a major contributor to this global health crisis. In line with global efforts targeted at mitigating the spread of this threat, the present study was designed to evaluate the effect of bambamycin on *mcr-1* gene associated colistin resistance. Available (i.e. 20) banked colistin resistant *E. coli* strains were included in the analysis. Following conjugation assay, the plasmid-bound resistance gene was successfully transferred to J53 *E. coli* strain with colistin MIC rising from  $\leq 0.125$  µg/mL to  $> 2$  µg/mL conferring resistance to the former organism. The combination of bambamycin and colistin in a checkerboard assay proved to be synergistic in killing *mcr-1* associated colistin-resistant strains. While bambamycin showed no significant effect on frequency of transfer of *mcr-1* bound plasmid from donors to recipient organisms, the finding does highlight the need for further studies on the drug's mechanism of action as both inhibiting and enhancing effects have been reported.

## Anti-inflammatory and antioxidant activity of selected medicinal and invasive plants of South Africa with potential for developing mastitis medication

EC Ogbuadike<sup>1</sup>, SM Nkadimeng<sup>1</sup>, CC Igwe<sup>2</sup>, IM Petzer<sup>1</sup>, LJ McGaw<sup>1</sup>

1 Department of Paraclinical Sciences, Faculty of Veterinary Sciences, University of Pretoria, Onderstepoort, South Africa.

2 Federal Institute of Industrial Research, Oshodi, (FIRO), Lagos, Nigeria.  
email: ceibekaong@gmail.com

Inflammation is a complex reaction of living tissues to microbial infection or injury. Normally it promotes healing, but when uncontrolled it can result in cell damage or death. In cattle and humans, inflammation is a major feature of mastitis which has significant health and financial challenges. Excess reactive oxygen species accompanying uncontrolled inflammation are also harmful. The anti-inflammatory and antioxidant activities of acetone and ethanol leaf extracts of *Maurocena frangula*, *Maytenus undata*, *Kalanchoe pinnata* and *Bryophyllum pinnatum* were investigated. These plants had good antimicrobial efficacy against mastitis-causing bacteria in previous studies. Anti-inflammatory activity was determined via inhibition of 15-lipoxygenase (15-LOX) and nitric oxide (NO) production using lipopolysaccharide (LPS)-activated RAW 264.7 macrophages. Antioxidant activity was evaluated using radical scavenging 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and electron reducing 2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) assays. *Kalanchoe pinnata* extracts had the best lipoxygenase inhibitory activity with IC<sub>50</sub> values of 1.25 and 2.03 µg/ml for acetone and ethanol extracts respectively and was also more active than the positive control quercetin (IC<sub>50</sub> = 4.93 µg/ml). For NO inhibition, at 50 µg/ml, the *M. undata* acetone extract was active, inhibiting NO production by 94.08% and cell viability was 60.89%. However, at 100 µg/ml, *B. pinnatum* acetone extract had the best activity with NO inhibition of 80.48% and cell viability of 96.75%. The *Kalanchoe pinnata* ethanol extract had the best antioxidant activity of 0.13 µg/ml and 0.06 µg/ml in the DPPH and ABTS assays respectively and was also more active than the positive control ascorbic acid (IC<sub>50</sub> = 0.19 µg/ml and 0.22 µg/ml for DPPH and ABTS assays respectively). These active extracts can be further investigated for the management of inflammatory pathogenic diseases like mastitis as well as inflammatory and oxidative degenerative diseases.

## Some Menispermaceae plant species have dual effects against *Mycobacterium* spp. and *Caenorhabditis elegans*

RT Akande<sup>1,2</sup>, IM Famuyide<sup>1</sup>, LJ McGaw<sup>1</sup>

1 Phytomedicine Programme, Department of Paraclinical Sciences, Faculty of Veterinary Science, University of Pretoria, Pretoria, South Africa.

2 Nigeria Atomic Energy Commission, Abuja, Nigeria.  
email: u18369325@tuks.co.za

In tuberculosis (TB)/helminth coinfection, studies reveal that an indication of helminth infections in experimental conditions and human infection, can lead to increased immune responses (T helper (Th) 2 and T regulatory cells). This in turn impairs Th1 cell development, and results in pathogenesis of TB. Some Menispermaceae plant species are used locally to treat tuberculosis and helminth infections. The antibiofilm and anthelmintic effect of extracts of *Cissampelos owariensis*, *Cissampelos mucronata* and *Tinospora fragosa* was investigated. Based on previous preliminary investigation, the minimum inhibitory concentration, biofilm inhibition and dispersal effects of the acetone extracts of *C. owariensis*, *C. mucronata* and *T. fragosa* and hot water extract of *C. mucronata* against *Mycobacterium smegmatis* mc<sup>2</sup> 155 were evaluated. The minimum inhibitory concentration was evaluated using a two-fold serial dilution method. The antibiofilm effect was evaluated using a modified crystal violet method. The anthelmintic effect was evaluated against *Caenorhabditis elegans* in a mortality assay. The extracts had good to poor antimycobacterial activity with minimum inhibitory concentration between 0.06 – 2.5 mg/ml. The extracts had strong antibiofilm inhibitory effects between 91.45 - 100% and potent dispersal effects between 13.30 - 46.59%. *Cissampelos mucronata* leaf (hot water extracts) exhibited the most potent anthelmintic effect at 1 and 2 mg/ml after 24 and 48 h. This study reveals that Menispermaceae species might be a good source of phytochemicals effective against agents of TB and parasites and potentially against their co-morbidities.



## Faculty Day 2021: Committees

### Organising Committee

Prof Joseph Chamunorwa (Chairperson)  
Prof Vinny Naidoo  
Prof Marinda Oosthuizen  
Dr Paul van Dam  
Prof Martina Crole  
Dr Darshana Morar-Leather  
Dr Christine Steyn  
Ms Metse Mdlongwa  
Ms Fransie Lottering  
Ms Alet Wannenburg  
Ms Marie Watson-Kriek  
Ms Diepe Kgabo  
Mr Chris van Blerk

### Scientific Committee

Prof Martina Crole  
Prof Katja Koepfel  
Prof Andrew Leisewitz  
Prof Adrian Tordiffe  
Dr Aqil Jeenah

### Online platform liaison

Prof Marinda Oosthuizen  
Mr Chris van Blerk

### Online platform management

Vetlink Media Solutions

**Proofreading:** Prof Banie Penzhorn

### Layout and design

Janine Smit Editorial Services

### Editor

Chris van Blerk



