World Association for the History of Veterinary Medicine (WAHVM)

44th INTERNATIONAL CONGRESS

WAHVM 2020

SOUTH AFRICA

27-29 FEBRUARY

World-Association for the History of Veterinary Medicine

27-29 February 2020

The Farm Inn Hotel & Conference Centre, Pretoria South Africa

www.wahvm.co.uk

supported by World-Association for the History of Veterinary Medicine

SAVA South African Veterinary Association Suid-Afrikaanse Veterinêre Vereniging

congress organizer SAVETCON EVENT MANAGEMENT

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Who
We Are

The WAHVM encourages, promotes and coordinates research and education in the history of veterinary medicine.

In 1964, German veterinarians and others interested in veterinary history were invited to a symposium on the history of veterinary medicine in Hanover, Germany. The symposium was organized under the auspices of the German Veterinary Medical Association (DVG) by the Institute (Fachgebiet) for the History of Veterinary Medicine, which was established in 1963 within the Veterinary College of Hanover.

From 1969 onwards the symposia were announced as “International Symposia” as delegates were attending from outside Germany. In the same year, the World Association for the History of Veterinary Medicine (WAHVM) was founded. The Association received observer status of the World Veterinary Association in 1970 and became an associate member in 1976.

The main activity of WAHVM is the organization of a biennial international congress.

During the 26th congress in 1993, it was decided to revise the Constitution of the WAHVM and to transform the association into a federation of national societies concerned with the promotion and study of veterinary history. The new Constitution was adopted in 1994. At the General Assembly Meeting of 1997 in Córdoba, it was decided to establish a Liaison Committee instead of the Extended Board, with a representative from each of the member societies, plus one member to represent the personal members. This became effective after the General Assembly Meeting in Munich in September 1998.

WAHVM Officers

President

Prof. Abigail Woods
Department of History
King’s College London
Strand, London, WC2R 2LS
UK
abigail.woods@kcl.ac.uk

Vice President

Prof. Joaquin Sanchez de Lollano Prieto
Historia de la Veterinaria
Facultad de Veterinaria
Universidad Complutense de Madrid
jsdelollano@vet.ucm.es

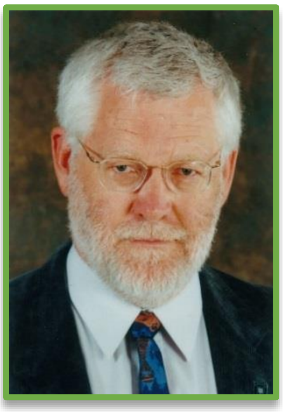
Secretary

Andrew Gardiner
The Royal (Dick) School of Veterinary Studies and The Roslin Institute
Easter Bush Campus,
Midlothian, EH25 9RG
Andrew.Gardiner@ed.ac.uk

Treasurer

Dr. Tijmen van de Vuurst
Dutch Association for the History of Veterinary Medicine
Netherlands
vandevuurst@wxs.nl

Words of Welcome
Congress Chair



Dumelang, Sanibona, Goeie dag!

On behalf of the South African Veterinary Association, the Veterinary History Society of South Africa and our sponsors, I am honoured and delighted to express our warmest South African welcome and gratitude to all who have come to join us in our Rainbow Nation.

2020 is a special year in the history of veterinary Science in South Africa: it marks the centenary celebrations of both veterinary education at the Faculty of Veterinary Science, and a century of service to the profession nationally by the South African Veterinary Association.

The history of the South African Veterinary Association starts with the inauguration of the Transvaal Veterinary Medical Association (TVMA) on 16 February 1903 in Johannesburg, and then at a TVMA meeting on 23 June 1910, following Union, There was general agreement that a South African Veterinary Association should be formed of the TVMA, the Cape Veterinary Veterinary Medical Society and the Natal Veterinary Medical Association. However, it was only on 1 April 1920 that the South African Veterinary Association (SAVA) was officially inaugurated.

The SAVA Veterinary History Committee was formed in 1995, and became the Veterinary History Society of South Africa in 2019.

South Africa is home to eight World Heritage sites, and we hope our visitors will be able to experience some of these places of 'outstanding value to humanity'. With 11 (soon to be 12) official languages, a wealth of unique cultural experiences and magnificent scenic beauty, our country is open for exploration and waiting to accompany you all on the journey of a lifetime. Whether it is getting in touch with nature and our wonderful wildlife on a safari, viewing rainbows of intricate craftsmanship of handmade African art and jewellery, or getting lost in an unparalleled palate pleasure trip whilst trying our local cuisine, there need never be a colourless moment in your time with us.

May this be a very successful and enjoyable congress and may your stay with us be enthralled with Mzansi* magic. *(*Mzansi is a colloquial name for South Africa and is derived from the Xhosa word umzantsi meaning "south".)*

Ke a leboga, Ngiyabonga, Baie dankie, Thank you.

Gareth Bath
Congress Chair

Words of Welcome
President, WAHVM

Welcome to the 44th Congress of the World Association for the History of Veterinary Medicine (WAHVM).

It is now 56 years since veterinary historians gathered in Germany for a meeting that eventually led to the founding of the WAHVM in 1969. Since then the WAHVM has held regular international meetings, each hosted by one of its membership of national societies. This year, we are delighted to be meeting in South Africa, at the invitation of the South African Veterinary Association (SAVA) and the Veterinary History Society (VHS) of South Africa.

The congress offers an excellent an opportunity to reconnect with existing colleagues, to meet new people, and to engage with exciting scholarship in the field of veterinary history. One of the key strengths of the WAHVM lies in its global reach, which enables delegates from across the world to develop an understanding of how the veterinary field has evolved in different times and places. The WAHVM is also unique in bringing together veterinarians who are interested in history with historians who work on veterinary-related topics. While these communities may adopt different perspectives on, and approaches to the subject, each has much to learn from the other. Thank you all for attending what promises to be a socially stimulating and intellectually invigorating event at the Farm Inn, Pretoria.

The WAHVM would like to express its gratitude to the organising committee for all of their hard work and advanced planning. We are indebted to each person who has worked tirelessly to create this opportunity for all of us, and especially to Prof. Gareth Bath for his leadership. We are also grateful towards the sponsors of this event: thank you for your generosity and participation.

Best wishes,

Abigail Woods MA MSc VetMB PhD MRCVS
WAHVM President

THE ZOETIS STORY

zoetis

WHO WE ARE

We are a global animal health company dedicated to supporting veterinarians and animal producers and their businesses in ever better ways. Building on more than 65 years of experience, we are the world leader in the discovery and delivery of quality veterinary vaccines, medicines and diagnostic products, complemented by genetic tests, biodevices and a range of services.

300 PRODUCT LINES

6 PRODUCT CATEGORIES

8 ANIMAL SPECIES SUPPORTED

10,000 EMPLOYEES WORLDWIDE

APPROXIMATELY 1,100 VETERINARY R&D SCIENTISTS AND SPECIALISTS

FINANCIAL STRENGTH
PROVEN & SUSTAINABLE FUNDAMENTALS

CUSTOMER-OBSESSED CULTURE

100 COUNTRIES WHERE PRODUCTS SOLD
45 COUNTRIES WITH DIRECT PRESENCE

25 MANUFACTURING SITES IN 12 COUNTRIES

WHY WE DO WHAT WE DO

In advancing animal health, we believe we are making a vital contribution to public health and well-being. After all, a safe, abundant and sustainable supply of meat, poultry, fish, milk and eggs begins with healthy animals. And by helping maintain the health of our pets a growing source of companionship and emotional support we are enriching the lives of people all over the world.

INCREASED URBANIZATION/ REDUCED FARMLAND =
Increased pressure to raise farm animals efficiently with limited natural resources

POPULATION GROWTH + PER CAPITA INCOME GROWTH =
Increased demand for animal protein/ companionship/pet wellness

HOW WE OPERATE

As the global leader in animal health, we are fully dedicated to serving the real-world needs of producers and veterinarians as they raise and care for their animals. In doing so, we are guided by Our Core Beliefs and a successful business model based on three interconnected capabilities.

CORE CAPABILITIES

- Direct customer relationships
- High quality manufacturing
- Continuous innovation

GUIDED BY OUR CORE BELIEFS

COMMITTED TO 6 AREAS OF SOCIALRESPONSIBILITY

WHERE WERE GOING

Our vision is to have our products, services and people be the most valued by animal health customers around the world. Thanks to a clear strategy and a simplified way of working, we are leading the industry in helping address growing marketplace needs around pet health and improved livestock productivity.

LEVERAGE OUR CAPABILITIES

Leverage our local presence and customer relationships
Invest in innovation to extend our product portfolio
Provide high-quality products and improve margins

EXTEND OUR REACH

Further penetrate emerging markets
Remain the partner of choice for external development
Expand complementary businesses

Welcome to the
City of Tshwane

Welcome to South Africa's capital, Tshwane.
We hope this progressive, cosmopolitan city will charm our guests with its harmonious blend of African and European cultures and traditions.

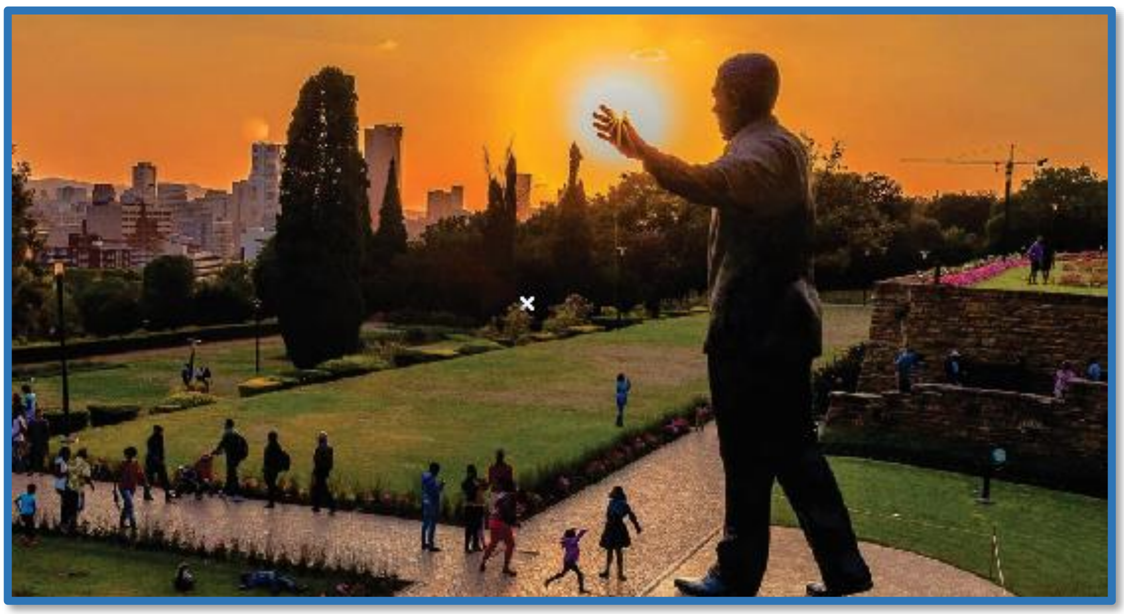
The city is considered one of South Africa's top domestic holiday destinations and whether it is business, adventure or relaxation that you seek, Tshwane can make for unforgettable experiences. Our city is a hub of science, technology and research and is at the forefront of our knowledge economy. Tshwane has a track record of hosting numerous national and international business and academic events.

Tshwane is also the proud host of the country's national government and houses the ministry and head offices of all national government departments.

The city is thus at the heart of policy development, which continues to change the face of South Africa. The Union Buildings are a monument to past generations of policy makers and are now the offices of new ones. They were the scene of the inauguration of former president Nelson Mandela, and of the 1956 Women's March to protest against the notorious pass laws used during the Apartheid regime in South Africa. There can be no doubt of their status when one sees the majesty of the sandstone Union Buildings as they watch over our city.

In Tshwane we hope you will experience an African city of excellence – one that blends a depth of local culture and character with world class technology and infrastructure – all set against a backdrop of natural splendour and architectural diversity. Sport, arts and culture, research and development, industry, learning and the business of running the nation are all captured in the daily lives of the city's 2.5 million residents who make up this city. It is a city with a welcome as warm as its climate and for very good reason was named the best host city for the 2010 FIFA World Cup™.

Let the destination be your beginning:
Welcome to the City of Tshwane!



The Venue: The Farm Inn Country Hotel and Wildlife Sanctuary

The Farm Inn is a privately-owned Country Hotel and Meeting Centre on the eastern outskirts of Pretoria, just 20 minutes' drive from Central Pretoria (Tshwane), 45 minutes from OR Tambo International Airport and 50 minutes from Johannesburg. The Farm Inn is a great getaway, an ideal meeting venue and the perfect setting for a wedding. The Farm Inn has that special something extra - a wildlife estate within the city boundaries.

Settled on a rocky outcrop under the African sun, the Farm Inn Country Hotel's unmatched hospitality and the warmth of thatch, stone and natural materials make it a luxury 'home away from home' for guests. Amidst the serenity of park-like grounds, guests can enjoy the magic of a wildlife estate with 23 indigenous species including lion, leopard and cheetah.

The Hotel is owned by a 4th generation hotelier and guests at the Farm Inn are assured of the same extra-special attention every time they visit. From memorable getaways to meetings, weddings and parties, dedicated attention and care is given to each and every visitor.

Since 1982 the Farm Inn has grown exponentially but hasn't lost its personal touch. The hotel offers 83 bedrooms, 17 function venues, 2 chapels and 3 bomas - one of which provides an intimate venue amongst the roars of the lion enclosures. If you prefer something more formal, the hotel's Tugela à la Carte Restaurant is open 7 days a week.

WAHVM 2020 Congress Committees

Local Organising Committee
Prof. Gareth Bath (Congress Chairperson)

Scientific Programme Committee

- Prof. Ken Pettey (Programme Chairperson)
- Prof. Gareth Bath
- Dr Rudolph Bigalke
- Dr Andrew Gardiner
- Dr Maryke Henton
- Ms Heloise Heyne
- Prof. Peter Koolmees
- Mrs Susan Marsh
- Prof. Abigail Woods

WAHVM Early Career
Scholar Award

The World Association for the History of Veterinary Medicine holds a biennial competition for early career scholars. This is for the best original essay or research paper on any aspect of the history of animal health and healing, broadly construed.

First Prize: 500 Euro plus budgeted expenses to present the paper at the WAHVM Biennial Congress
Second Prize: 200 Euro
Third Prize: 100 Euro

Terms and Conditions
The competition is open to current students of all educational backgrounds, and to those within 5 years of the award of their PhD or equivalent professional degree (e.g. DVM, VetMB etc).

2020 Winners

Nicole Welk-Joerger

1st prize: **Nicole Welk-Joerger (USA):** *'Regulating Rumensin: Defining Antibiotic Feeds in the U.S. in the Wake of Resistance'.*

2nd prize: **Sandi Howie (UK)**: *'From Caledonia to the Cape – the first veterinary surgeons of the Cape Colony'.*

3rd prize: **Gabriel Lopes and Luísa Reis-Castro (Brazil)**: *'A History of Aedes aegypti as Mosquitoes that Transmit Diseases in Brazil'.*

Congress
Participant Information

Registration Information
Each participant at WAHVM 2020 must register in person at the Registration Desk to collect a Congress kit and badge before attending any of the sessions or events.

Registration Times
Wednesday 26 February:	16h30 - 18h00
Thursday 27 February:	07h30 - 16h30
Friday 28 February:	07h30 - 16h30
Saturday 29 February:	07h30 - 12h00

Badges
Identification badges are required for admission to all sessions, official functions and social events of the Congress. Participants who lose their badges must report to the Registration Desk, presenting proof of identity.

Presenters, Chairs & Facilitators
All speakers are required to report to the Speaker Registration Area at least two hours before their presentations.

Please Note: failure to report to the Speaker Registration Area within the two hours preceding the scheduled presentation time may necessitate last minute speaker and oral presenter replacements.

Poster Presentations
Posters will be available for viewing at the back of the Congress Room for the duration of the Congress.

Speaker Contact
Mrs Corné Engelbrecht | +27 (0) 82 925 9241

On-site
Congress Support

Code of Conduct
WAHVM acknowledges the freedom of expression of speakers and meeting attendees. It does, however, subscribe to the widely held principles associated with exercising such freedom of expression, i.e. that such expression may not lead to any harm or prejudice to any person or damage to any property, including disruption of the meeting or any activities associated with it. South African Law will apply in the event of failure to adhere to these principles.

Emergency Medical assistance and Paramedic Services
For assistance with any medical emergencies, please visit the Registration area. Medical procedures and medicine will be for the meeting attendee's own account. For any medical emergencies, please contact +27 (0) 82 925 9241 during congress hours.

General Information Desk
The main Information Desk is operated by Farm Inn Staff and is situated in the foyer.

Guide to logging onto the Farm Inn wireless network

The wireless network feature must be enabled on the laptop/desktop that you are using. The on-site support staff are not permitted to make any changes on an attendee's computer. However, support staff are able to assist should you experience difficulties connecting to the wireless network.

Step 1: Make sure you are connected to the wireless network called Farm Inn Guest
Step 2: No Password is required

Liability

Neither the Congress Secretariat nor any of its contracted service providers will be responsible for the safety of articles of any kind brought into the Congress facilities by attendees, whether registered or not, their agents, contractors, visitors and/or any other person/s whatsoever. The Congress attendee shall indemnify and not hold the organisers and associates of the organisers and their subcontractors liable in respect of any cost, claims, demands and expenses as a result of any damage, loss or injury to any person howsoever caused as a result of any act or default of the Congress Secretariat or a person representing the Congress Secretariat, its contractors or guests. In addition, the Congress attendee shall take all necessary precautions to prevent any loss or damage to his/her property with special regard to mobile phones, carry or handbags and computing equipment.

Meals and Snacks

Meals and beverages will be provided to attendees for the duration of the Congress. All additional meals will be for the Congress attendees' own account.

Safety and Security

In the interest of personal safety and security, attendees should only display their identity tags on the Farm Inn premises and within the restricted Congress areas.

Lost property can be handed in at the Registration Desk. Any losses should be reported to the Congress Secretariat. Although every effort will be made to retrieve lost personal belongings, the responsibility for securing his/her personal belongings remains that of each person attending the Congress.

Accommodation and Transport

IMPORTANT: All accommodation and transport arrangements will be for your own account.

Flights

Should you require any assistance with flights, please approach Corné Engelbrecht at the Registration Desk area.

Accommodation

The official hotel for the Congress meeting is the Farm Inn Country Hotel and Wildlife Sanctuary

Please indicate that you are attending the **WAHVM # 44 Congress** when making your accommodation booking.

Reservations / Enquiries

Tel: +27 12 809 0266-77
Fax: +27 12 809 0688
E-mail: farminn@farminn.co.za / functions@farminn.co.za

Transfers

Airport transfers can be arranged through Kwathlano by contacting them on reservations@kwathlano.co.za or telephone +27 (0) 861 428 836. Airport transfers are R520-R550pp one way (OR Tambo International Airport – Farm Inn Hotel, Pretoria)

Transfers can also be arranged through Shuttle Direct. Costs are:
R500 pp one way (OR Tambo International Airport – Farm Inn Hotel, Pretoria)

For airport transport/shuttle/transfer bookings, please book and pay online at www.shuttledirect.co.za with credit card or send an email to admin@shuttledirect.co.za and pay via EFT (POP to be sent through to confirm booking).

Pre / Post-Meeting Tours

If you would like to experience the best that Tshwane has to offer, please speak to our Congress organiser, Corné Engelbrecht at the Registration Area.

Foreign Delegate Information

Climate in Tshwane

Tshwane has a moderately dry subtropical climate with long, hot and rainy summers from November to March. Autumn follows from April to May, when temperatures are cooler. Winter is short, cool and dry, from June to August, and is followed by a very hot spring from September to October. The average annual temperature is 18,7 °C (65,7 °F). This is rather high considering Tshwane's relatively high altitude of about 1 350m and is due mainly to the city's sheltered valley position which acts as a heat trap and cuts it off from cool southerly and south-easterly air masses for much of the year. Rain is chiefly concentrated in the summer months, with drought conditions prevailing over the winter months, when frosts may be sharp. Snowfall is an extremely rare event – snowflakes were spotted in 1959, 1968, and 2012 in the city, but the city has never experienced an accumulation of snow in its history.

Credit Cards

Most major credit cards are accepted at shopping centres, as well as traveller's cheques in major currencies.

Currency

With a favourable exchange rate for many international currencies, you'll find South Africa an inexpensive destination and an easy one – our financial institutions are world-class, with no shortage of banks, bureaux de change and automatic tellers. South Africa's unit of currency is the Rand, which is divided into 100 cents. Notes come in denominations of R10, R20, R50, R100 and R200; coins come in denominations of 5c, 10c, 20c, 50c, R1, R2 and R5. There are two R5 coins in circulation, both of which are legal currency. All transactions are rounded down to the nearest 5c.

Exchange Rates in February 2020 (these can fluctuate)

US$1 (one American Dollar) = ± R14.45
£1 (one British Pound) = ± R18.75
€1 (one Euro) = ± R16.00

Drinking Water

Tap water at hotels, inns, lodges and in other public places is purified and safe to drink.

Language

There are 11 official languages in South Africa: English, Afrikaans, isiZulu, isiXhosa, isiNdebele, Sepedi, Sesotho, siSwati, Xitsonga, Setswana and Tshivenda. English is widely spoken throughout South Africa, and English-speaking visitors will have no problems communicating while travelling in South Africa. All signposting is in English.

Metric System

South Africa uses the metric system: weather forecasts are given in degrees Celsius (C); petrol, milk, and wine are sold by the litre; grocery items are sold in grams and kilograms; road speeds are posted in kilometres per hour.

VAT

Value Added Tax (VAT), currently at 15%, is levied on the quoted prices of most goods offered for sale and on hospitality services. Refunds of VAT paid for goods (not services) may be claimed by foreign visitors at their port of departure, provided that the total claim (money spent) exceeds R250.00 and that goods are being taken with them out of South Africa (in which case, tax invoices and the actual goods must be presented as proof).

While in Tshwane

Safety

Like many major cities, Tshwane has both good and bad areas. It is advisable when walking in Tshwane, particularly at night, that you should be aware of people around you and that ideally you should not walk alone but in a group. Highly visible displays of wealth should be avoided, and it is not advisable to look like a 'typical tourist' with cameras and binoculars strung around your neck. Never leave any valuables unattended.

In General

- Do not carry a camera openly in the city. Please take care when using your camera, as this will identify you as a tourist and could draw unnecessary attention.
- Avoid wearing jewellery and expensive watches.
- If you are accosted, remain calm and be cooperative.
- Be extra vigilant when drawing money from a bank machine (ATM) and never accept assistance when transacting at an ATM.

When on Foot

- Carry your handbag across your body.
- Do not carry large amounts of cash on you.
- Do not leave valuables exposed (e.g. on a seat or the floor or ground) while having a meal or drink.
- Do not let strangers get too close to you, especially people in groups.

On the Road

- Lock your car doors.
- Never leave anything worth stealing in view when driving or when your car is unattended.
- Preferably use the air-conditioning or cooling system in the car to avoid opening your windows.
- Be vigilant when stopped at a traffic light or Stop street.

Emergency Contacts

Prof. Gareth Bath	+27(0)82 802 2526
Corné Engelbrecht	+27(0)82 925 9241

Police and Flying Squad:	10111
Metro Police:	+27 (0) 12 358 7095/6
Ambulance:	10177
Netcare Medical Response:	082 911
EMRS Medical Response:	10177

Programme
at a glance

Wednesday, 26 February 2020
10h00 - Arrival at The Farm Inn
13h00 - WAHVM Board Member's Luncheon in the main restaurant (own account)
15h00 - WAHVM Board Meeting
16h30 - Registration Opens
18h00 - Free Time / Dinner at Hotel (own account)

Day 1 - Thursday, 27 February 2020
07h30 - Participant registration
08h30 - Session 1
10h10 - Group photo / Morning refreshments
10h40 - Session 2
12h40 - Lunch
13h30 - Session 3
15h30 - Mid-afternoon refreshments
15h45 - Session 4
17h55 - Close of Day 1
18h30 - Welcome Reception (for participants who have booked)

Day 2 - Friday, 28 February 2020
07h30 - Participant registration
08h30 - Session 5
10h10 - Morning refreshments
10h40 - Session 6
12h40 - Lunch
13h30 - Session 7
15h30 - Mid-afternoon refreshments
16h00 - AGM
17h00 - Close of Congress
18h30 - Congress Dinner (for participants who have booked)

Day 3 - Saturday, 29 February 2020
09h00 - Game Drive at the Farm Inn (for participants who have booked)
11h00 - Tour to Onderstepoort (Grab-n-Go lunch packs) (for participants who have booked)
18h00 - Dinner at Hotel (own account)

Programme Schedule by Day

WEDNESDAY, 26 FEBRUARY 2020 (PRE-CONGRESS DAY)

10h00	Arrival at the Farm Inn
13h00 – 15h00	WAHVM Board Members' Luncheon in the Tugela Restaurant (own account)
15h00 – 16h30	WAHVM Board Meeting (Mopani Venue)
16h30 – 18h30	Participant Registration opens
18h00	Free Time & Dinner at the Hotel (own account)

THURSDAY, 27 FEBRUARY 2020

07h30 – 16h30	Registration	
08h30 – 10h10 ***Pongola Room***	**Opening Session** *Session Chairs: **Prof. Abigail Woods**, President of WAHVM & **Prof. Gareth Bath**, Chairperson of WAHVM Congress 2020*	
	Opening & Welcome	SAVA / VHS / WAHVM President
	Keynote: Bloodlines and Bloodlies – The Equine Experiment in Africa	**Prof. Sandra Swart** *University of Stellenbosch, South Africa*
	MEDUNSA: The rise and demise of South Africa's second veterinary faculty	**Dr Neville Owen** *Former Dean of Medunsa, South Africa*
10h10 – 10h40	Group Photo / Morning refreshments and Poster viewing	
10h40 – 12h40	**Session 2 – Free Topics** *Session Chair**: Dr Peter Koolmees**, Utrecht University, Netherlands*	
	Jenner's Zoological Perspective	**Prof. Abigail Woods** *King's College London, United Kingdom*
	Animal disease in iron-age and early medieval Western Europe: Knowledge, understanding and management	**Mr Patrick O'Reilly** *Retired Veterinary Surgeon, Ireland*
	Puzriš-Dagan: Organization of an animal concentration centre during UR III period	**Silvia Nicolas Alonso** *Biblical and Oriental Institute of León, Spain*
	Request to cancel an appointment for the Civil Veterinary Service in the Dutch East Indies in 1890	**Dr Jons Straatman** *VHG, Netherlands*
12h40 – 13h30	Lunch	
13h30 – 15h30	**Session 3 – Free Topics** *Session Chair: **Dr Susan Jones**, University of Minnesota, United States of America*	
	Felled by the Wolves of Finland: Tracking down the Foot-and-Mouth Disease Virus	**Dr Dylan Proctor**
	Eradicating Foot and Mouth Disease in North America, 1946-1954	**Dr Rebecca Kaplan** *Science History Institute, United States of America*
13h30 – 15h30	**Session 3 – Free Topics**	

Session Chair: ***Dr Susan Jones****, University of Minnesota, United States of America*

	Reduction of antibiotic use in farm animal and aquaculture production in Norway over the last 30 years	**Dr Halvor Hektoen** *Head of R&D Department, Åkerblå AS (Fish health service)*
	Regulating Rumensin: Defining Antibiotic Feeds in the U.S. in the Wake of Resistance	**Ms Nicole Welk-Joerger** *University of Pennsylvania, United States of America*
15h30 – 15h45	Afternoon refreshments and Poster viewing	
15h45 – 17h55	**Session 4 – Vet Histories of International Cooperation** *Session Chair:* ***Dr Rudolph Bigalke,*** *Retired Veterinary Surgeon, South Africa*	
	Keynote: A brief historical overview of the World Organisation for Animal Health (OIE) and its historical relationship with countries in southern Africa	**Dr Gideon Brückner** *Retired Veterinary Surgeon, South Africa*
	Collaboration between the veterinary schools of Utrecht and Onderstepoort - A political history	**Dr Peter Koolmees** *Utrecht University, Netherlands*
	The Swiss Connection - A. Theiler and colleagues as an example of successful international veterinary cooperation	**Prof. Andreas Pospischil** *Retired Veterinary Surgeon, Switzerland*
	'No one over here has had the pluck to do [this]': International intercommunity collaboration and the investigation of canine inherited disease	**Ms Alison Skipper** *King's College London, United Kingdom*
17h30 – 19h00	Welcome Reception sponsored by UNISA (for participants who booked) – The Pavilion	

FRIDAY, 28 FEBRUARY 2020

07h30 – 16h30	Registration	
08h30 – 10h10	**Session 5 – Tropical Diseases** *Session Chair:* ***Prof. Gareth Bath****, Veterinary History Society, South Africa*	
	Keynote: Historic highlights of South African Veterinary R&D in tropical diseases	**Dr Rudolph Bigalke** *Retired Veterinary Surgeon, South Africa*
	Making Plague a Tropical Disease	**Dr Susan Jones** *University of Minnesota, United States of America*
	Eminent South African Veterinary Virologists	**Dr Daan Verwoerd** *Retired Veterinary Surgeon, South Africa*
10h10 – 10h40	Morning refreshments and Poster viewing	
10h40 – 12h40	**Session 6 – Tropical Diseases** *Session Chair:* ***Dr Gideon Brückner,*** *Retired Veterinary Surgeon, South Africa*	
	The history of East Coast fever in southern Africa	**Dr Ben Mans** *Agricultural Research Centre, South Africa*
	Heartwater: a simple disease with a peculiar distribution that has exasperated farmers and scientists for eons	**Prof. Ken Pettey** *University of Pretoria, South Africa*
	South African Veterinary Bacteriologists	**Dr Maryke Henton** *IDEXX, South Africa*
	A study of the ecology of anthrax in the Kruger National Park, South Africa	**Dr Valerius de Vos** *South Africa*
12h40 – 13h30	Lunch	

13h30 – 15h00	**Session 7 – Tropical Diseases & Free Topics** *Session Chair: **Prof. Ken Pettey,** University of Pretoria, South Africa*	
	Jaundice in sheep in South Africa – confusion and resolution	**Prof. Gareth Bath** *Veterinary History Society, South Africa*
	Notable veterinary parasitologists of South Africa	**Ms Heloise Heyne** *Retired Technologist, South Africa*
	The historical collections of the faculty of veterinary medicine in Munich: lost and hidden treasures	**Dr Veronika Goebel** *Ludwig-Maximilians-Universität München, Germany*
	Preserving South Africa's veterinary history: a collaborative approach	**Mr David Swanepoel** *Agricultural Research Centre, South Africa*
15h00 – 15h20	Afternoon refreshments and Poster viewing	
16h00 – 17h00	AGM – All WAHVM Members	
18h30 – 21h00	Congress Dinner (for participants who booked) – Meerkat Manor	

POSTER

Preliminary study of rabies prevalence in animals in Madrid during the Spanish Civil War (1936-1939)	**Dr Joaquín Sánchez de Lollano Prieto** *Complutense University Madrid, Spain*

SATURDAY, 29 FEBRUARY 2020

07h30 – 08h00	Arrival refreshments and Poster Viewing	
09h00 – 10h30	Game Drive at the Farm Inn	
11h00 – 17h00	Buses depart for Onderstepoort Tour (for participants who booked)	
12h00	Arrive at Onderstepoort, historic buildings described and pointed out	Heloise Heyne
12h15	Lunch on veranda	Livio Heath
12h45	Two group tours, to museum and main building area	Heloise Heyne & Rudolph Bigalke
15h00	Return to bus, travel to Faculty	All
15h15	Tour of skills laboratories	Liani Kitshoff
15h45	View lecture halls	All
16h00	Depart from Farm Inn for OR Tambo International Airport (for all flights departing from 19h00)	Corné Engelbrecht
16h00	Bus tour of campus with descriptions	Gareth Bath
16h30	Return to Farm Inn	All

List of Abstracts in Alphabetical Order

Keynote Presentations

Thursday, 27 February 2020

Bloodlines and Bloodlies – The Equine Experiment in Africa

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Biography: Prof. Sandra Scott Swart received her PhD in Modern History from Oxford University in 2001, while simultaneously obtaining an MSc in Environmental Change and Management, which she received with distinction. She is currently an Associate Professor in the Department of History at Stellenbosch University. Prof. Scott Swart's current research is into themes of social and environmental history. She has done most of her research in archives, in South Africa and abroad, but her favourite research was conducting oral history interviews on horseback in the mountains of Lesotho.

This lecture focuses on the responsibilities – indeed, duties – of an historian today. It asks about the value - asks how do we write about them now? In this time of global crisis, with a world on fire in many senses of the word, what can historians do in and about the Anthropocene? A key approach – so evident from all of us gathered here at this conference – is writing "more than human history". Because one way to render the past edifyingly unfamiliar in these strange times is to reconstruct histories of the ultimate others – to tell a multi-species story. What I want to do today is reconsider horsepower in reconsidering the great equine experiment in history of Africa – an experiment almost 400 years old in southern Africa. I want us to see how we can write it: because as fires burn around literally and figuratively, we do have a duty as historians to respond with the stories we choose to tell. It is impossible to ignore the changing animal body's relationship with the changing body politic. Animal bodies are sites where human histories are contested and fancies and fantasies are enacted. Horse bodies changed and were changed by their move to Africa and the great equine experiment on the continent. The first hardy, rugged ponies developed through anthropogenic selection coupled to a harsh and rapid process of survival of the fittest to survive a new and hostile environment. They became a key technology of conquest used in multiple arenas - in exploration, in transport, in farming and in war – but from the early nineteenth century they were replaced by a new kind of creature who could do only one thing well: run. Once racing was entrenched under the British occupation, there was a concomitant recalibration of what 'good horseflesh' meant. The common herd of horses was leavened by the importation of pedigreed Thoroughbred horses. In so doing, breeders tapped a social vein. They fed the public's growing thirst for blue-blooded horses as desirable commodities to white settlers who were beginning to consider their own sanguinary consequence. A key point is that discourses of breeding were not hermetically sealed away from political discourses. Breeding debates, in both state and popular milieu, drew on ideas about race, class and gender. The blood-based idiom spread and changed as the ideas of animal breeders and their buying public became a synthesis of folk belief and fresh scientific advances. This combination, epitomised by faith in the pedigree beasts 'of pure race', drew on and sustained the popular vocabulary of race theory that was strongly evident in the colony. Although the Thoroughbreds may have been granted some relief from the menial burdens carried by the other horses of the colony, perhaps they carried a heavier load still: the egos and self-identity of the elite. Horses were, however, more than just signifiers of elite status, they could contribute towards creating elite status. Once the public was persuaded that pedigree and purity actually mattered, there was serious money to be made as a thoroughbred breeder. Ironically, the elitist insistence on the primacy of blood and populist fears about polluted and tainted blood, actually contributed to the 'breed's' downfall. Buyers infatuated by Thoroughbred bloodlines snubbed the qualities of the other horses, the hybrid pool homogenous enough to be branded a breed – the so-called Cape Horse, which thus lost robustness and utility – and even its ability to survive in Africa. Human obsession with mixing – perceived variously as mongrelisation, miscegenation, and bastardising in the animal world – works through transference, to explain, rationalize and patrol the human socio-political hierarchy. The vocabulary of breed and breeding wordlessly encrypts human fears, fantasies and fictions in racial rhetoric and sexual stratification. The world of animal breeders has sustained, until late into the twentieth century some of the most antiquated ideas like telegony (sustained by and, arguably, sustaining socio-political ideas codified into apartheid) where foals and calves and puppies (and human babies) were considered forever stained by their mother's original sin of carnal categorical crossing. So, 'blood did tell', but it exposed far more about the humans consumed by it, than it did about the horses in whose changing bodies it flowed.

A brief historical overview of the World Organisation for Animal Health (OIE) and its historical relationship with countries in southern Africa

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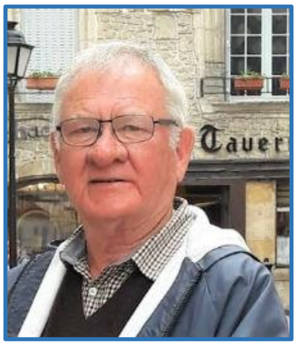
[2] *Former Information Specialist, OIE*



Biography: Dr Gideon Brückner qualified as a veterinarian at the University of Pretoria (Onderstepoort) in 1972 and also obtained post-graduate degrees in Public and International Administration in 1981 and 1986. He started his career as a state veterinarian in Vryheid, KwaZulu-Natal in 1972. He was transferred to Louis Trichardt in the Northern Province in 1973 where he was state veterinarian for 12 years before he moved to the head office of the Department of Agriculture in Pretoria in 1981. He progressed upwards in the ranks as Director of Veterinary Public Health, Director of Animal Health and Director of Veterinary Services of the National Department of Agriculture in 1999. In 2001 he was promoted to Chief Director Veterinary Services of the Western Cape.

In 2006 he accepted an offer from the World Organisation for Animal Health (OIE) to become Deputy Director General and Head of the Scientific and Technical Department of the OIE in Paris, France.

Dr Brückner has spent his entire career of 47 years as a veterinarian within provincial, national and international veterinary services. He was responsible for the management of several major animal disease outbreaks in South Africa such as foot and mouth disease, rabies, avian influenza, tuberculosis, brucellosis, swine fever and Corridor disease. He has represented South Africa on numerous missions abroad and was the leader of several delegations to negotiate the allocation or the re-instatement of freedom from animal diseases for South Africa such as foot and mouth disease, Newcastle disease and Crimean Congo Fever.

He has been very active in an expert advisory capacity to international organisations such as the OIE, FAO, World Health Organisation (WHO) and the World Trade Organisation (WTO). He was also the first South African veterinarian to serve as a nominated expert on legal dispute panels for animal health of the WTO. He has chaired numerous ad hoc expert Groups of the OIE and was elected as a member of the Scientific Commission for Animal Diseases of the OIE in 2002. He retired as Deputy Director General of the OIE in 2009 and was subsequently elected by the OIE World Assembly as President of the OIE Scientific Commission for Animal Diseases – a position he held until his final retirement in 2018. He has been an invited speaker on major national and international conferences and has published 58 scientific articles of which 45 as senior author. In 2005 he was the recipient of the Presidents' award of the South African Veterinary Association. He was also invited to deliver the Theiler Memorial lecture at the centenary celebrations of the Faculty of Veterinary Science of the University of Pretoria in 2008. He still serves as an accredited mission expert of the OIE to assess animal disease control in member countries of the OIE and has in this capacity, visited more than 74 countries on behalf and on request of the OIE.

The devastating effects of rinderpest in Europe in the 18th century resulted in a call from Professor John Gamgee, of the New Veterinary College of Edinburgh, to the Deans of Veterinary Faculties in Europe for an International Veterinary Congress in Hamburg on 24 March 1863 to 'define the rules of prevention of contagious and epizootic diseases' and to elaborate on establishing standardised sanitary legislation. However, in spite of the good intentions of the call from Prof Gamgee, this vision of harmonised intergovernmental control over the spread of animal diseases only materialised 60 years later, when rinderpest was re-introduced into Europe together with ongoing epizootics of tuberculosis, dourine and rabies as an aftermath of World War I. This resulted in a letter dated 1 October 1920, by Mr Ricard (French Minister of Agriculture) to the Ministry of Foreign Affairs of France, to convene an international conference to be held in Paris on 21 May 1921 to examine the animal health situation in particular with regard to rinderpest, foot and mouth disease and dourine. The conference also aimed to encourage the exchange of animal health information between countries and to harmonise export health measures. In addition, it was stated by the Ministry that surveillance and control of epizootics are also of interest to public health because of the transmissibility of certain diseases of animals to man. Forty-two States, mainly from Europe, heeded the call that an International Office of Epizootics for the control of infectious animal diseases be created and set up in Paris. It is interesting to note that the participants at the conference initially pleaded strongly that the proposed Organisation should be part of the Office International d'Hygiène

Publique (International Office of Public Hygiene), which was founded in Paris in 1907 as the precursor of the present World Health Organisation (WHO).

However, in less than three years, on 25 January 1924, twenty-eight states signed an International Agreement to establish the OIE as an autonomous intergovernmental international organisation with its finances and activities governed by its own constitutional texts. The OIE is today one of the oldest intergovernmental organisations together with the United Nations (established in 1945), the WHO (1948), FAO (1946) and WTO (1994). The first General Session of the OIE was convened on 8 March 1927 where Professor Emmanuel Leclainche of France was elected as first Director General of the OIE and General Henri De Roo from Belgium as the first President.

During the period 1927 to 1939, the membership of the OIE consisted mainly of countries within Europe (44 member countries) and the activities were mainly focused on trade facilitation for animals and animal products, zoonosis and public health in Europe. It was also during this period that the headquarters of the OIE in the Hôtel de Prony was occupied and it has remained the headquarters of the OIE ever since.

The Economic Committee of the League of Nations convened two expert veterinary committees in 1931 and 1934 with the task of developing draft veterinary conventions relating to the control of epizootics during transit and exportation and importation of animal products. However, unanimity could not be reached on the text and this was subsequently submitted to the Office International des Epizooties which, since then, has been responsible for developing international standards on matters related to animal health.

During World War II, the activities of the OIE slowed down but after the war, the activities expanded as more countries joined the organisation. There was also notable assistance to member countries by experts designated by the OIE to assist with disease control activities such as vaccination against CBPP (contagious bovine pleuropneumonia) in Togo in 1955 and tick control in Kenya in the same year.

Specialist Commissions were set up such as the Foot and mouth disease Commission (1946), the Standards Commission (1949), the Fish Diseases Commission and Code Commission (1960). Meanwhile, the United Nations, which replaced the League of Nations in 1945, established two specialist Agencies: The World Health Organization (WHO) in 1945 and the Food and Agriculture Organization of the United Nations (FAO) in 1946. Their aims partially covered those of the OIE. The presence of these two Agencies called the existence of the OIE into question and the possibility of simply dissolving the organisation was envisaged in 1946, and again in 1951. Thanks to the opposition of numerous OIE Member Countries and Delegates, the functions of the OIE were kept alive.

Since 1952, official agreements were signed between the OIE and more than 72 other international and regional organisations of which the most notable were the agreements with the FAO (1952), WHO (1960), WTO (1998) and WVA (2002 and again in 2015). The new agreement with the WVA signed on 26 May 2015 agreed on three common objectives namely collaboration on the One Health concept (with emphasis on antimicrobial resistance), the promotion of Good Veterinary Governance and the harmonisation of standards for Veterinary Education.

Today the OIE, with its 182 member countries, is recognised as the only reference organisation by the World Trade Organization (WTO) for international animal health standards.

Initially, member countries of the OIE were from Europe, the far East and the Americas. Countries in Africa, which were almost all colonies at that stage, were represented at the OIE General Session meetings by their ‘parent’ countries and only became full members of the OIE after decolonisation. Mozambique for example became a member in 1949; Zimbabwe in 1961; Botswana in 1968; Swaziland in 1970; Lesotho in 1984 and Namibia in 1990. The only exceptions are Tunisia, which was one of the founder members of the OIE, and the then Union of South Africa, which became a member country of the OIE in 1936 and has retained its membership through the years in spite of its internal policies preceding the establishment of a full democratic society in 1994.

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Friday, 28 February 2020

Historic highlights of South African veterinary R&D in tropical diseases

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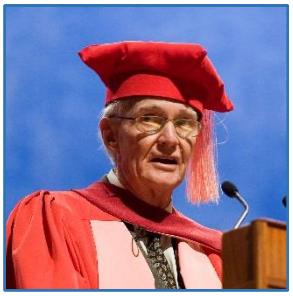

Biography: After qualifying as a veterinarian in 1953, Dr Bigalke was appointed in the Section Protozoology of the Onderstepoort Veterinary Institute (OVI) where he made his mark as researcher before moving through the ranks to become the 9th Director of the Institute in 1980. In 1988 he was promoted to Chief Director for Animal Production in the Department of Agriculture and in 1996 ended his career as Deputy Director General of the department.

For the purposes of this address, tropical diseases are broadly defined as animal diseases and toxicoses that were unknown to European settlers and European-trained veterinarians when they came to South Africa. However, there is good evidence that indigenous pastoralist Khoi-Khoi and Nguni people recognised and sought to manage some of these diseases and exploit identified poisons long before the arrival of European colonists.

The involvement of Sir Arnold Theiler, founder of Onderstepoort, in research and development in tropical diseases is so manifold that only the absolute highlights will be dealt with. It kicked off with co-developing the first safe and effective vaccine for rinderpest in 1896. Then followed the elucidation of the aetiology (*Theileria parva*) and epidemiology of East Coast fever. The next triumph was the discovery of the taxonomically unusual, erythrocytic parasite *Anaplasm*a and the development of an effective blood vaccine. Although best known for his lamsiekte (botulism) research, Theiler's involvement was somewhat controversial, as will be elucidated in the address.

Theiler's realisation of two major career objectives: a state-of-the-art research institute (in 1908), and a South African veterinary faculty (in 1920) will receive considerable attention. Crucial for his educational objective were textbooks dealing with local tropical diseases, especially Henning's (infectious diseases), Mönnig's (ecto- and endo-parasites) and DG Steyn's (toxicology) pioneering publications and their impressive successors.

R du Toit's major contributions were masterminding the complete eradication of the tsetse fly *Glossina pallidipes* population from KwaZulu-Natal with organic insecticides and determining that African horse sickness (AHS) and bluetongue of sheep were transmitted biologically by *Culicoides* midges.

The discovery that 'uitpeuloog' of cattle was due to infestation of an aberrant host with the minute larvae of an oestrid fly, *Gedoelstia*, actually a parasite of blue wildebeest, by Basson was a masterpiece in pathological observation.

WO Neitz was particularly renowned for his studies on tick-borne protozoan and some other tick-associated diseases. Neitz recognised the massive mortality of cattle in Zululand as being caused by a variant form of ECF which he called Corridor or buffalo disease because it was buffalo-associated rather than cattle-associated, like ECF. He also discovered that sweating sickness of calves was caused by the tick *Hyalomma truncatum*, ostensibly due to a toxin produced by engorging females. His pioneering studies on the chemotherapy of heartwater of ruminants and the development of a live blood vaccine against the disease were major contributions to economic farming with livestock in endemic areas. Bezuidenhout *et al.* made a major breakthrough when they succeeded in cultivating *Ehrlichia ruminantium* in an endothelial cell culture. This led to confirmation of earlier suspicions of immunological and pathogenic variability of strains as well as comprehensive genomic studies on the organism.

Onderstepoort is also internationally known for its virological research. In the 1800s and early 1900s AHS was a great killer of horses in the southern African crucial transport industries as well as in warfare. Theiler succeeded in producing a crude but fairly effective vaccine against the disease. Variability of strains, however, bedevilled his efforts and it was left to Alexander to identify immunologically different strains, attenuate them and produce a highly effective polyvalent vaccine. Erasmus revolutionised AHS vaccine production by exploiting a large plaque selection technique on 8 suitable strains obtained from field isolates.

Demonstration of the plurality of bluetongue virus (BTV) strains by cross-protection studies by Neitz and serial passage in embryonated eggs by others led to their attenuation and the development of an effective live cell culture vaccine consisting of 15 serotypes. Alexander and Weiss were respectively responsible for the isolation and attenuation of the lumpy skin disease virus for vaccine production.

A high containment laboratory provided facilities for research on the epidemiology of local FMD. Using genome-sequencing studies on the three SAT strains, Thomson *et al*. proved that buffaloes in the Kruger National Park serve as healthy carriers of the disease and that the calves experience epidemics of subclinical infections with overt lesions, thus serving as a source of infection for, inter alia, cattle.

Research on bovine besnoitiosis by Bigalke provided information on the epidemiology of this now emerging disease. Cultivation of *B. besnoiti* in cell culture inter alia enabled studies on the production of a live vaccine against the disease utilising a less pathogenic strain isolated from blue wildebeest. This followed the detection of infected animals in the KNP by McCully and Basson.

The genetic resistance of indigenous livestock, such as cattle, to some tropical diseases and indigenous parasites was recognised by animal scientists like Jan Bonsma, and their easy-care advantages exploited in the development of several pure breeds that are economically productive under African environmental conditions.

Timely anticipation of the revolutionising influence that the newly developed molecular techniques would have on all biological research by Verwoerd provided for a very productive Molecular Biology Laboratory at Onderstepoort. The genomic structure of economically important viruses like AHVS and BTV were determined, genome libraries of these constructed and genes identified for the diagnosis of a variety of important viral, protozoal and rickettsial diseases. Isolation of the retrovirus causing 'jaagsiekte' finally elucidated the aetiology of the disease.

The period 1960 to 2014 was a golden era for veterinary wildlife research in South Africa, especially on the many local tropical diseases, such as theileriosis, FMD, ASF, MCF, AHS and besnoitiosis. The blossoming local wildlife industry resulted in the development of impressive clinical veterinary expertise based mainly on chemical immobilisation technology, essential for not only efficient translocation of wild animals but also to allow the clinical manipulation required to satisfy official biosecurity measures aimed at control and surveillance of the diseases they may be carrying.

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- Turfgrass manager
- Crop production manager

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- Laboratory technician
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- Agricultural extension officer
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- Officer in the Department of Agriculture
- Officer at the State Veterinary Office

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Applicants who have a final major mark of 50% to 59% or who completed the diploma more than 5 years previously, may be considered by the department.

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Session 1 – Free Topics

Medunsa: The rise and demise of South Africa's second veterinary faculty

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The faculty of veterinary science of the Medical University of the Southern Africa (MEDUNSA) was a child of the 'apartheid' policies of the National Party governments which governed South Africa from 1948 to 1994. The cornerstone of these policies was the demographic separation of people by 'race' and educational separation accordingly. Black university education, including medical training, thus received early government attention.

The University of Natal medical school was pivotal in establishing Medunsa and its veterinary faculty. The medical school, approved by the pre-1948 government, was established to train black doctors. The 'apartheid' government limited state funding to black African medical students, thereby encouraging segregated education of black doctors at the university[1].

The government appointed an 'interdepartmental' committee in 1955 (the Van der Walt Committee) to investigate separate medical education for 'non-whites'. This committee recommended that government take over the 'non-white medical school' pending the creation of a faculty for the 'Bantu population'[2]. Government backed down temporarily from this approach in the face of widespread opposition[1]. In seeking to entrench segregated education facilities, an interdepartmental committee noted in 1963 a need to establish training facilities for black veterinarians and other professions[3]. A proposal to integrate veterinary and agricultural training at the University of Fort Hare was rejected in favour a course at Onderstepoort[3].

The dean (Dr BC Jansen) of the Onderstepoort veterinary faculty visited veterinary colleges in the USA and concluded in January 1968 that large classes were not necessarily detrimental to veterinary education. He concurred with the recommendation of the faculty subcommittee to double the annual student intake, from 45 to 90, rather than to create a faculty elsewhere. Jansen noted that the need to train black veterinarians would be decided by "higher authority"[5].

In April 1968, government appointed its scientific advisor Dr HO Mönnig, to investigate and advise on veterinary education[4]. His terms of reference were to: (a) establish whether there was a need to train more veterinarians in South Africa, and if so, whether to increase the intake of students, or to establish a second faculty elsewhere; (b) the need to train non-white ("Nie-Blanke") veterinarians and related matters[9]. The Mönnig investigation received inputs from several sources: the Onderstepoort faculty dean; state veterinary services; the veterinary association (SAVMA); agricultural unions and several universities. Jansen recommended doubling the student intake at Onderstepoort, and that a veterinary "school" for blacks be placed close to the faculty at Onderstepoort, but in an adjacent Bantustan, to enable the sharing of staff and all facilities[5].

The director of veterinary services (MC Lambrecht) supported the need to train more white veterinarians, calling for both an increased intake and a second white veterinary faculty elsewhere. He supported the need to train black veterinarians[6]. The South African Agricultural Union called for a second white veterinary faculty elsewhere and recognised the need to train black veterinarians[7]. The chairman of the SAVMA (HP Steyn) reported that whilst the association recognised the need to train black veterinarians, the creation of a second faculty for whites remained paramount[8]. Mönnig's report in March 1969 incorporated the Jansen and Lambrecht recommendations almost verbatim and concluded that the existing white faculty should be expanded rather than establishing a second faculty elsewhere, and that a facility to train black veterinarians should be provided[9].

Government appointed two further committees: one (the Van Zyl Committee[10]) to advise on the establishment of a black medical faculty and another (the Jansen Committee[11]) to similarly advise on the establishment of a black veterinary facility respectively[2].

The Jansen committee was required to evaluate the need for black veterinarians and assistants, and to make recommendations as to the implementation and the siting thereof[11]. The committee suggested that the veterinary school be combined administratively with the proposed medical school to be built at Ga-Rankuwa[13]. Where black people owned approximately 38% of all livestock, the committee estimated a need for 22 veterinarians. Additional veterinarians would be required in the fields of hygiene, animal welfare and private practice. The committee concluded that at least 5 veterinarians should be trained annually[11]. The University of Pretoria undertook to provide the new faculty with teaching assistance but stipulated that the students (black) would not be registrable with the university. The committee recommended *inter alia* that a faculty be established in a 'homeland' near to the existing 'white' faculty and that a dean be appointed to manage the process. The faculty was to have 9 academic departments, each with a lecturer and a technical assistant. Lecturers were to be supported by staff from the 'parent' faculty on a part-time basis. This surrogate arrangement would apparently negate the aspirations of other universities wishing to house the new veterinary faculty[11]. The committee recommended that the new faculty be located on a state farm called Zoutpan near Bophuthatswana and approximately 30 km north of Onderstepoort[11].

Building of the 1500 bed regional human hospital on the outskirts of Ga-Rankuwa in 1975 became an important consideration in the siting of the new medical faculty. Government decided to convert this hospital into a teaching hospital by expanding the number of patient beds and providing advanced teaching and treatment facilities. By adding dentistry and veterinary science, an 'inter-ethnic' autonomous health science university was approved for establishment adjacent to the Ga-Rankuwa hospital. This was formalized by the passing of enabling legislation (Act 78 of 1976) by parliament. A dean for each of the respective faculties was to be appointed with plans to admit students as soon as possible[14].

Medunsa became the first health sciences university in South Africa on 21 August 1976. A University Council was constituted consisting of a chairman, "homeland" representatives, representatives from corresponding faculties at the universities of Pretoria and of the Witwatersrand, the historically black universities, the senate and government. Building of the university complex began in earnest in 1977 together with extensive upgrading of the Ga-Rankuwa hospital[15]. The academic complex started with the building of a student residence, a basic medical sciences block and the first phase of the clinical pathology block, completed in 1979. A library building, central kitchen, further residences and the second phase of the clinical pathology building were completed in the following year[15].

Planning of the veterinary faculty started with the appointment of a dean on 1 July 1980. The BVMCh degree curriculum was approved by the SA Veterinary Council, thus enabling the first intake of veterinary students in 1982. Academic departments and the respective heads of department for each of these were approved. Two departments (physiology and pharmacology) were shared on an inter-faculty basis. Posts were duly advertised, and the faculty was fortunate to appoint leading academics to head the respective departments[17].

The faculty embarked on a recruitment campaign to bring the profession to the notice of black society. This elicited huge interest at schools, but few of these offered the science and mathematics subjects required for admission. Prospective BVMCh degree course candidates were required to complete the first year of a science degree course at another university. Selection was based purely on the results achieved. Only five black applicants qualified for admission to the programme in 1982[17].

The "Club House" building of the golf course - which became the university campus - was modified to house anatomy instruction and a separate temporary animal hospital. The small yet comprehensive hospital, which comprised both small and large animal medical, surgical and hospitalization facilities, was commissioned in May 1983[17]. A farm animal production unit, commissioned on campus in 1986, provided animal handling, demonstration and research facilities. Economic demonstration units exposed students to production systems and husbandry practices[17].

The faculty expanded progressively during the first 5 years after its establishment, with student numbers increasing towards full capacity[16]. This coincided with the period of government reform initiatives from 1979 to 1986. However, widespread unrest thereafter initiated severe repressive measures by government from mid-1986 to February 1990[18].

Introspection by the governing elite saw rejection of apartheid in favour of universal franchise subject to entrenched "group" rights and autonomy[20]. This change required historically black universities to be funded in terms of the post-secondary education formula (SAPSE 110) applicable to the predominantly white universities. Since Medunsa consisted of only expensive health science faculties with limited student numbers, inadequate funding became inevitable. Most students also had difficulty raising tuition fees given their impoverished backgrounds. Unlike the older universities, Medunsa had accumulated almost no financial reserves to fall back on. Drastically curtailed funding in 1987/8 precipitating a financial crisis necessitating institutional austerity[19]. Nevertheless, the faculty continued to grow and had graduated 60 veterinarians, seven specialists and one doctorate by 1992[16].

The unfortunate siting of the Medunsa veterinary faculty and the university's financial difficulties made it a prime candidate for rationalization. The logic of not duplicating expensive facilities approximately 20 km apart could obviously not be faulted. Consequently, in June 1990, Medunsa was advised to seek an agreement with Pretoria University for the joint use of its new ultra-modern hospital facilities. In November 1990, the SA Veterinary Council agreed to the proposed amalgamation of the two veterinary faculties into a single entity[21]. Besides the council, the amalgamation proposal was duly accepted by virtually all the role players. These included the majority of the Medunsa faculty staff, members of the Medunsa Council, the university administration, presumably the Onderstepoort faculty staff and the profession at large.

Consultants were engaged by the Overseas Development Administration under British Aid arrangements to assist the Land and Agriculture Policy Centre of the African National Congress in November 1993. Their report submitted in February 1994 recommended "that the faculties of veterinary science at Medunsa and Onderstepoort be amalgamated at the University of Pretoria"[22].

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Session 2 – Free Topics

Edward Jenner's zoological perspective

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Edward Jenner is widely celebrated as the discoverer of the world's first successful vaccine. His demonstration that inoculation with cowpox could protect against smallpox is viewed as the starting point for the development and worldwide dissemination of vaccination, and the eventual eradication of smallpox. However, despite efforts to situate Jenner in his historical context, and to claim him as an early practitioner of 'One Health', commentators have generally failed to grasp the nature of his work on cowpox, and the roles that animals played in it.

Drawing on a close reading of his publications, this paper will argue that initially, Jenner was less concerned with protecting human health than understanding the natural history of cowpox – where it had come from, how it spread, its effects on the body, and the character of the 'virus' that caused it. These questions were prompted, and the answers shaped, by the ways in which he and the inhabitants of his rural district lived and worked with animals. They gave rise to a holistic, locally embedded concept of cowpox as a disease originating in horses, spread by humans, and transformed by cows into a condition that offered protection against smallpox.

This concept did not travel well. Metropolitan doctors, who had a less direct relationship with animals and were primarily concerned with advancing human health, questioned Jenner's natural historical findings and worked to develop vaccination as a human-centred medical procedure. Initially, Jenner fought back by re-embedding cow pox in its local context. Subsequently, country-wide reports of the disease, its propagation outside of bovine bodies, and the threat that others would claim credit for vaccination, led him to focus his writings on its applications to human health. In practice, however, he retained his zoological perspective, exploring the effects of cowpox in other species, and sourcing material for human vaccination from horses.

These findings not only demonstrate how history changes when animals are taken seriously as active participants; they also align social history with historical epidemiology – which indicates that the vaccinia virus used to protect against cowpox probably originated in horsepox.

Animal disease in iron-age and early medieval Western Europe: Knowledge, understanding and management

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Dían Cécht is the semi-divine god of healing in the ancient Irish mythological cycle. He was the son of *Dagda*, the father of the gods who like *Thor,* carried a great hammer. Dian Cécht was grandfather to the almost universal Celtic deity *Lugh*. (*Lúnasa, Lugudunum, Lyon, Lleu, Lugoues, Lucubo etc.,etc.*)

Dian Cécht tended *Nuada* after he lost his arm at the Battle of Moytura and made him a silver prosthesis. In time, *Dian Cécht's* son *Miach* was also a great healer, apparently more into physic than surgery. He healed *Nuada* completely by physic. In a prolonged fit of jealous rage *Dian Cécht* killed *Miach*. 365 healing herbs grew from his grave which were gathered and catalogued by *Airmed, Dian Céchts* daughter and *Miach's* sister. Dian Cécht threw the herbs to the wind which scattered them and that is why the knowledge of healing was so hit and miss.

The myth of *Dían Cécht* provides an allegory explaining the shortcomings in the medicine of the times. Recognising these shortcomings and the importance of animal disease, the jurists of the time, the Brehons, devised laws and rules to ensure the orderly and equitable resolution of problems and disputes involving animals and animal-diseases.

Irish Gaelic is the oldest vernacular Northern European literature and dates to the coming of Christianity to Ireland and the advent of monasticism in the fifth and sixth centuries A.D. Besides copying (and translating) the great classical authors, the scriptures and philosophers of the time the monks transcribed the *"seanchas mór"*. This was the first written draught of the previously orally transmitted laws of Ireland. The literature includes hagiographies of the saints as well as annals which refer to animal disease. One text of mysticism or prophecy (of many) contains references to animal disease.

The hagiographies are of little interest to anyone of scientific bent, being intent on promulgating a Christian explanatory model, involving miracles, shape changing and other supernatural interventions.

The annals do describe a number of Rinderpest epizootics.

The purpose of the prophetic or wisdom text *"Imacallam idir dhá thuraid"* is unknown. It consists of questions and answers in the form of riddles in a contest of knowledge between two sages (druids?). Its significance here is the inclusion of a list of cattle diseases with no apparent veterinary or farming context. Interest in this list for me has been limited to guessing what these diseases might have been.

The written draught of the laws, the *"seanchas mór"*, was reputedly commissioned by St Patrick himself. A significant amount of this legal code is available to modern scholars in a number of translations, most recently as the *Corpus Iuris Hibernici,* the Body of Irish Laws.

In veterinary terms these laws, known generally as the Brehon Laws, legislated for orderly commerce in ancient and early medieval Ireland's most valuable currency-livestock. The laws did so in a number of ways. They specified the nature of disease in general, categorising contagious or infectious disease as well as fundamental defects in animals. They specified the duties of sellers and the rights of purchasers. Importantly they specified the duration of those rights and responsibilities, a time limit was placed on the period after purchase in which these laws could be invoked.

In addition to laws on purchase, the Brehon Laws had legislated for a huge variety of situations, from animal attack to cattle trespass, from theft to "driving". They cover distraint, unauthorised use, accidents, and importantly in those times, bewitching. There are lists of diseases at different points but in only a single case is there any context to the circumstances of the promulgation of that law.

Between A.D. 770 and 778 the annals record an outbreak of Rinderpest. Considering the likely population of cattle on the island at that time it is likely that the disease became endemic in the cattle population for a considerable time. In A.D. 810 the *Cáin Dár Í* forbade cattle raiding, the national sport before Gaelic football and hurling.

Because Ireland was never a part of the Roman Empire, the Irish converted directly from Druidism to Christianity. They abandoned the taboo of writing handed down by the Druids, adapted the Roman alphabet to their language and started writing. The laws were written in such a way as to make them acceptable to the Church, either by churchmen with an eye to the lay jurists, the Brehons, or by the Brehons with an eye to the ever-increasing power of the church.

The Druids wrote nothing down themselves. We are dependent largely on Greek and Roman writers for our knowledge of their functions. According to these writers they served as philosophers, poets, bards, priests, jurists, historians and prophets. It is not stretching things to suggest the Irish brehons, the *filí* and the *seanchaíthe* were orders derived from the druids.

Any reading of modern thinking on the Celts will leave you in little doubt that this group were represented by a culture rather than by ethnicity. They are defined more by language, social structure and religious belief than by ethnicity or genetics.

The Celtic languages of pre-Roman Europe are theoretically derived from a proto-Celtic language. Irish broke off first and went its separate way, followed by Celt-Iberian, Brythonic, Gaulish, Lepontic and the rest. Peripheral societies are notoriously conservative in their resistance to change. I suggest that what the Irish monks wrote down from the sixth century onwards was reflective of a much more ancient canon of laws, one that may have had its origins in pre-Roman Northern Europe.

In ancient Ireland, healing was in the hands of certain families of hereditary 'leeches'. Their books were handed down through the generations, and their libraries were far from primitive for the times. They were especially well known for their knowledge of herbalism. The animal doctor, where he is specifically mentioned, is referred to by the same word, *"liaigh"*. I infer from this that One Health was practiced in ancient and early medieval Ireland.

Despite major deficiencies in medicines and other knowledge, the Gaelic people of Ireland and their Celtic cousins throughout northern Europe would seem to have had much more than a rudimentary knowledge of animal disease, as well as a sophisticated method of dealing with, if not it's causes, it's effects.

Puzriš-Dagan: Organization of an animal concentration centre during UR III period

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Chronological and geopolitical context

At the end of the 21st century B.C., after the Akkadian Empire collapsed, the political situation in Southern Mesopotamia was tense under the constant pressure of the kingdom of Elam and the destructive incursions of the *guti* nomads[1]. With the expulsion of the latter, Sumer began a period of relative prosperity and important administrative changes were made to consolidate the country[2]. The monarchs started a centralization and territorial integration process that would reach its climax with the establishment of Ur as the new capital of the Kingdom. One of the most significant advances in this regard was constructed by Šulgi, second monarch of the III Dynasty of Ur, and consisted of a large animal concentration and distribution settlement in Puzriš-Dagan (present-day Drehem). Its main scope was tax collection delivered in the form of animals from peripheral provinces and the payment of a tribute forced on neighbouring territories. Its management, therefore, became a matter of state.

Administrative system

The cuneiform writing conceived by the Sumerians allowed the development of a very complex administrative system[3]. Thanks to the economic-administrative texts preserved in clay tablets, we know the nature of this place strategically located about 8 km south of Nippur, the religious capital of the country[4]. Although the temple was a fundamental part of the administrative machinery scheme, it depended on the Royal House that imposed strict regulations to avoid fraud. The complex, lacking domestic architecture, had three public buildings: the ziggurat, a possible storehouse and an administrative building. From an administrative point of view, it presented a very pronounced hierarchical structure, with a central office controlling several subordinates, each one dedicated to a specific work area[5]. Normally, every office had a chief-officer and several subordinates, positions that were often inherited. Usually, the animals were received in the central office in charge of their classification and direct dispatch to destination or to the subordinate offices from where they were re-dispatched to their final destination. An approximate diagram of this operation can be seen in figure 1. Inverse movements were rare, and it seems that only high-ranking officials could authorize them[6].

With every movement, a type of tablet was generated, in a similar way to modern forms. In addition to these records, other elements guaranteed the transactions: the cylinder-seals (**kišib**) to authenticate the identity of the officers in documents[7], and the small clay labels or *bullae*[8] to mark objects or people of special relevance. Thousands of animals were received annually, small ruminants particularly, although bovines, equines, pigs and poultry such as geese, ducks and pigeons, were also handled[9]. Wild species were rare, including bears, deer, onagers and gazelles, as well as mouflons, Bezoar goats and their hybrids with domesticated individuals[10]. All were meticulously counted, inspected and classified by the numerous officers of the Puzriš-Dagan organization, however production control began long before their arrival at the complex.

[1] We appreciate the support provided by the Biblical and Oriental Institute of León (IBO) that has allowed us the access to its specialized bibliographic fund.
[2] This period is known as the Sumerian Renaissance.
[3] Postgate, J. N., 1999.
[4] All tablets come from illegal digs during early 20th century.
[5] Liu, Ch., 2017.
[6] Liu, Ch., 2017, p. 359.
[7] Tsouparopoulou, C., 2015.
[8] Do not confuse with the bullae used as envelopes containing the calculi in the primitive commercial exchanges.
[9] Sigrist, M., 1992, p. 33.
10 In this early period, backcrosses were still necessary. Sumerians used them intuitively to mitigate the effects of consanguinity and increase the vigour of the lineages in the domestication process.

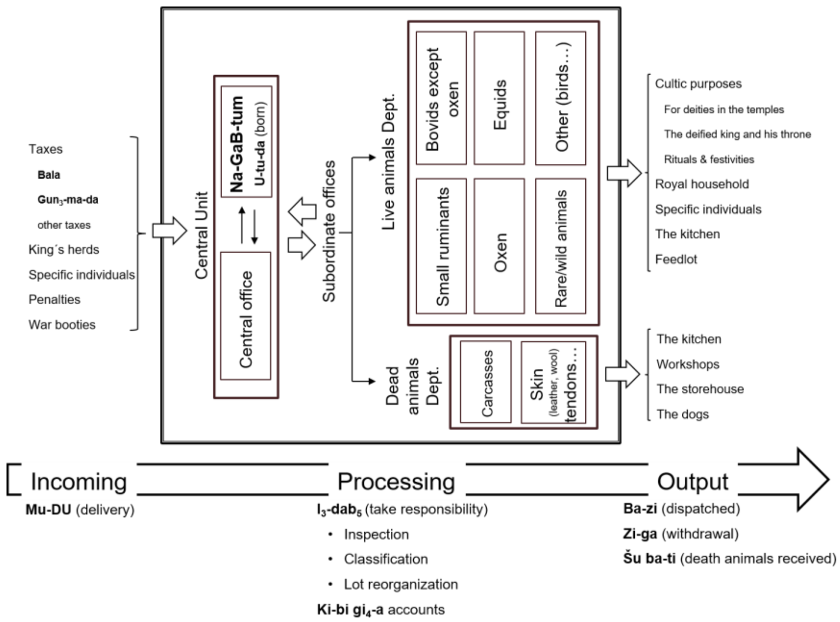

Figure 1: Approximative diagram to the administrative organization and functioning of the Puzriš-Dagan complex during UR III period (ca. 2112-2004 B.C.).

a) Herd management: importance of the shepherd
The numerous shepherds distributed all over the country played a decisive role in this animal management, as they were responsible for the daily control of the herds. Besides, they regularly performed counts or census at fixed periods, such as the spring shearing. They carefully respected the location of the herds within their allocated grazing or work area, since harsh penalties were applied both for cattle theft and for allowing them to graze in forbidden areas[11].

It is not clear how Sumerians indicated animals ownership. One way to mark them consisted of the use of *bullae* as pendants. It seems unlikely that collective identification systems (such as tattoos, dyes or ear cuts) were used, and it is more likely that only the most valuable animals were identified individually. These choice animals could not have any physical defects, so this type of marking can be discarded[12]. The crown usually took possession of the most appreciated animals, such as white sheep[13].

b) Receipt / delivery: mu-DU
In the offices, arrivals and departures of the lots were registered. From that moment the officials acted as intermediaries between the shepherds and the centre "taking responsibility" (i$_3$-dab$_5$) for the animals from that moment. These came, mostly, from tax collection and were received from the fields or from the feedlots existing in each large city[14].

Special mention must be made of the so-called na-GaB-tum, a multifunctional institution[15] whose role has not yet been fully understood. Described by some authors as a subordinate office[16], we propose its ascription to the central office as a team unit. It supported this office in the management of the animals, including the supply of individuals in cases of deficit. It also served as a farmyard for the king´s animals, feedlot and birthing pen. The accounting of newborn individuals was recorded on the u-tu-da tablets[17], similar to modern birth certificates.

c) Processing/taking responsibility: i$_3$-dab$_5$
Wild and domestic species were classified according to different criteria. Determinatives or primary names automatically classified the animals into a group with similar characteristics. Then, the secondary names referred to a series of characteristics that, in the case of wild animals, were related to both morphological and ethological distinctive characters. In the case of domestic animals, due to their value and the economic interest of their products, a more meticulous classification was necessary. In this case, determinatives indicated the species directly (Figure 2a) while the secondary

11 Van Driel, G., 1993, p. 223.
12 Van Driel, G., 1993, p. 238.
13 Ryder, M. I., 1993, p. 13.
14 Sigrist, M., p. 21.
15 Not only dealing with animals but with agricultural products. Brunke, H., 2008, p. 112.
16 Liu, Ch., 2017.
17 Sigrist, M., 1992, p. 71.

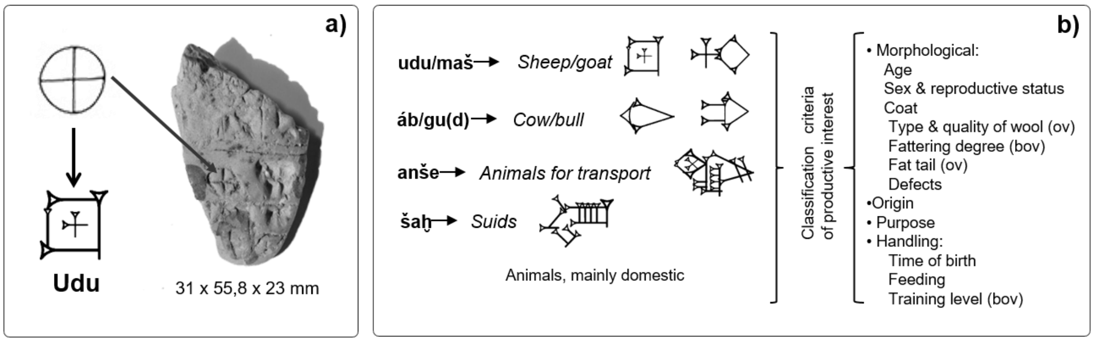

Figure 2: Management in zootechnical interest species. a) Sheep count in a tablet fragment. The pictogram for sheep (**udu**) is clearly visible. IV millennium B.C., kindly provided by the Biblical and Oriental Institute of León. b) Domestic animals' classification. The most relevant determinatives are included. Adapted from Nicolás, S., 2017.

names referred to productive interest traits[18] (Figure 2b). Once the number of animals per category was annotated, the lots were dispatched. Animals were generally dispensed alive for slaughtering and preparation in or outside the complex.

Once a month, a detailed account of all movements was made (**ki-bi gi$_4$-a**)[19]. These documents were filed in baskets labelled as **pisan dub-ba** (tablet container), similar to the current counts that are used for statistical studies.

d) Expenditure: **ba-zi/šu-ba-ti**

The animals spent, generally, little time in the complex and they could be dispatched or processed on the same day, thus freeing up space for next shipments. A distinction was made between alive or dead animal shipments. Most of the alive individuals for consumption were sent (**ba-zi**) as offerings for worship of the numerous gods of the Sumerian pantheon. In the temples, the sacrifice was carried out following a religious ritual[20], and then the carcass was cut up and distributed for consumption by the priests of the temple itself or the citizens during religious festivities. Other animals were destined for the kitchens (**e$_2$-muḫaldim**), where they were sacrificed and roasted for immediate consumption. An interesting aspect, from a veterinary point of view, is that these lots were marked as **šu-gid$_2$**, that is, they had undergone a previous quality control[21].

There was an office responsible specifically for dead animals[22]. The records did not distinguish between those slaughtered (**ba-ug$_7$**) in Puzriš-Dagan (the majority) and those that died by other causes, such as diseases. From this, it can be deduced that the unhealthy individuals were discarded before arriving at the complex, an act that would be performed by the shepherds. For the deaths, they had to present the animals skin and indicate their sex and age in order to reflect these data in the herd balance. Around 10% natural deaths were admitted[23]. The meat was cooked for consumption *in situ* or it was preserved by desiccation[24] and stored in the **e$_2$ kišib-ba** (storehouse) until consumption. A part of the dead animals was dedicated to feeding the dogs which were used in the army[25] and for guarding and defence of the herds against intruders and steppe predators. It is interesting to note that, in this case, they could also be marked as **šu-gid$_2$**. As for derivatives not intended for human consumption, tendons, hooves, tails and horns were used[26]. They were sent to different workshops for processing[27].

Conclusions

Despite the limited availability of texts, we can appreciate the great management capacity of livestock resources the Sumerian civilization developed. To this expert management, we can add a well-integrated administrative system which was organized in an official hierarchy which presented important parallels with the current official control systems. These included a type of quality control with possible implications in Animal Health. Although the lack of individual identification prevents exhaustive traceability, it exists in some lots due to political and/or economic interests. This type of study contributes to the knowledge of a foundational culture, still largely unknown, as well as to a better understanding of the Sumerian people's relationship with animal species and their exploitation.

18 Steinkeller, P., 1995.
19 Liu, Ch., 2017, p. 163.
20 The procedure of the ritual depended on the god to whom the animal was offered and should include bloodshed, which was ensured by cutting the throat of the victim. Scurlock, J. & College, E., 2006.
21 The term šu-gid2 ("hand" + "to reach out") is translated as "to accept" or as "to observe/inspect the animal offering" regarding extispicy.
22 Tsouparopoulou, C., 2013, p. 151.
23 Van Driel, G., 1993, p. 223.
24 By salting or smoking. They also knew the curing process. Nemet-Nejat R., K., 1998, p. 160.
25 Tsouparopoulou, C., 2012
26 Tsouparopoulou, C., 2013, p. 154.
27 Tendons were used for the shoe making facility existing in Puzriš-Dagan. They were also used, probably boiled, to feed the dogs.

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Cuneiform signs in figure 2 have been obtained from url: http://psd.museum.upenn.edu/epsd1/index.html.

Request to cancel a veterinary appointment for the Dutch East Indies in 1890

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In 1890, all of a sudden the small veterinary world in Java was startled by the appointment of a gepatenteerd veearts, a 'patented' veterinarian. The Board of Association for the Advancement of Veterinary Science in the Dutch Indies, founded in 1884, sprang into action and wrote a request to the governor-general.[28] This twelve page letter was published in the Veterinary Pages for the Dutch Indies and was striking in its directness of argumentation as to why the board of this association thought this man was unacceptable.[29]

What was the matter, what did 'patented' veterinarian mean and why was the veterinary community so upset by this man? What kind of tasks did veterinarians have over there that they felt this appointment was undesirable?

In the nineteenth century the Dutch Indies predominantly meant Java. As a typical exploitation colony it was meant to balance the Dutch state finances with her surplus production. In this tropical world far from the motherland, veterinarians had their own role and expertise necessary for a densely populated country which needed a large and safe production of animals for traction and meat.[30] Their task was far from easy amidst numerous contagious diseases like anthrax, rabies, glanders, surra, septicaemia haemorrhragica, foot and mouth disease and above all rinderpest. Since low salaries gave the job little attraction, the Civil Veterinary Service was continuously understaffed. This became obvious during a major outbreak of rinderpest in 1879 when there were only two veterinarians within the Civil Veterinary Service available on Java.[31] In order to get this disease under control the government

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[28] J.J. Postma and D. Driessen, 'Rekwest der Veeartsenijkundige Vereeniging, naar aanleiding der ter beschikking stelling van den heer W. Eefting, gepatenteerd veearts, ten einde benoemd te worden tot Gouvernements veearts', *Veeartsenijkundige Bladen voor Nederlandsch-Indië*, 3 (1889) 459-470.
[29] *Veeartsenijkundige Bladen voor Nederlandsch-Indië* and *Vereeniging tot bevordering der veeartsenijkunde in Nederlandsch-Indië*. *Nederlandsch-Indië = The Dutch Indies = nowadays Indonesia.* **In this article Indonesia is called Indië**.
[30] Martine Barwegen, *Gouden Hoorns. De geschiedenis van de veehouderij op Java, 1850-2000* (Wageningen 2005), 15, Graph 1.2. (Around 1890 Java had about 22 million inhabitants)
[31] The Civil Veterinary Service: de *Burgerlijke Veeartsenijkundige Dienst* (BVD) founded in 1853 (Barwegen, *Gouden Hoorns*, 68)

succeeded in procuring an expert and a group of young veterinarians from the Netherlands by offering them an exceptional high salary for a period of five years. This outbreak was a major disaster causing 220 000 animals to succumb. To get the situation under control a cull of 22 500 animals was rigorously executed and a double fence was erected along some rivers from north to south, from coast to coast, with a cattle free zone on both sides and guarded by the army, to prevent the disease from spreading.[32]

Clearly the prevention of major outbreaks of contagious diseases in this large and densely populated tropical country required a minimum number of professionals. They needed the knowledge and experience to recognize such diseases and the ability to take the right measures. In 1890 the Civil Veterinary Service had a total of thirteen veterinarians at its disposal: nine for the monitoring of several large districts and four who manned the pathological and bacteriological laboratory in Batavia or did veterinary work in governmental institutions.[33] They were serious about their tasks as shown by the outstanding articles about a plethora of endemic diseases in their journal that started in 1886. The core of veterinarians in 'The East' must have been committed, reliable and in possession of a scientific mentality, qualities needed for their huge task. In this continuous need for more assistance the appointment of Mr. W. Eekhof, a 'patented' veterinarian, was announced which led to great indignation among Java's veterinarians.

What was a 'patented' veterinarian and what was wrong with his qualifications?

The historical background of this originated in 1821 when the veterinary school was founded in Utrecht. Until then horses and cattle had been treated by farriers or farmers with traditional empirical knowledge and skills. Often, they were experienced obstetricians who knew how to castrate a horse or a bull and could provide their clients with some 'secret' medicine. Since the veterinary school was not able to educate masses of veterinarians this situation did not change much in the first decades after 1821. These early veterinarians had a hard time competing because artisans were cheaper and on top of that veterinarians were impeded by lack of practical education in obstetrics and surgery.[34] In 1874 a law was implemented about the authorisation of competent empiricists as veterinarians. All empiricists got a 'patent', a licence, to practice as veterinarian, but with the exclusion of those who had less than ten years of experience. The less experienced would have to pass an exam before the first of January 1877 to acquire this patent. The intention of this legislation was to ensure that no empiricist after 1877 could acquire a licence to practice anymore, in the expectation that this profession would die out in due course.

Empiricists had to pass a less stringent examination. Important questions on this exam were about contagious diseases and diseases that could endanger man and animals.[35] The appointed Mr. Eefting had failed this exam, but just succeeded at a second attempt.[36] Compared with the education at the veterinary school this examination was considered a farce and the profession looked upon these 'equalized' veterinarians as being not fully competent.[37] Since such an empiricist could not function in an environment that needed professional competence, the Veterinary Association for the Dutch Indies requested the governor-general to either cancel the appointment or, if not possible, to ensure that this would never happen again. In their request it was reasoned that this veterinarian had not taken part in any training concerning the recognition of contagious diseases. Therefore, being responsible for the monitoring of these diseases in isolated districts, he predictably would make mistakes which could not be corrected, resulting in disaster not only for the population but also for the exchequer.[38]

This request was made on the 18th of February 1890. The answer on behalf of the governor-general came on May the 16th and informed that the request of the Association had been accepted and brought to the attention of the Minister of Colonies in the Hague.[39] On the 5th of July the law of 1874 was amended, meaning that from that date a 'patented' veterinarian was excluded from the civil veterinary service.[40]

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[32] J. Wester, *Geschiedenis der veeartsenijkunde* (Utrecht: Hoonte 1939), 477-478;
F.C. Kraneveld, *Bestrijding van dierziekten in de tropen*, Inaugural lecture (Utrecht: Kemink en Zoon 1949), 9-10.
[33] Veeartsen in Nederlandsch-Indië, *Tijdschrift voor Veeartsenijkunde en Veeteelt* 17 (1890) 262;
Naamlijst van de Vereeniging tot Bevordering van Veeartsenijkunde in Nederlandsch-Indië op 1 Juli 1890, *Veeartsenijkundige Bladen voor Nederlandsch-Indië* V (1891) Deel V, 2-4.
[34] Wester, *Geschiedenis der Veeartsenijkunde*, 458-462.
[35] Ibidem, 463-469;
Nowadays about fifteen licenced obstetricians and castrators are still active in The Netherlands. This profession is dying out because the education stopped in 1990 (Peter Koolmees, *Tussen mens, dier en samenleving* (Utrecht 2012) 145-148.).
C. Offringa, *Van Gildestein tot Uithof* (Utrecht: Rijksuniversiteit Utrecht en Faculteit der Diergeneeskunde 1971) Vol. I, 122-123.
[36] Wester, *Geschiedenis der Veeartsenijkunde*, 479;
Veterinaire Bladen voor Nederlandsch-Indië 4 (1890) 463-464.
[37] Ibidem, 465-466.
[38] Ibidem, 467-470
[39] *Veterinaire Bladen voor Nederlandsch-Indië* (1891) Deel V, 46.
[40] Ibidem, 185.

In September the following message was published in the Veterinary Pages:[41]

> **Civil Veterinary Service**
> *Dismissal:*
> Due to physical unfitness for service as government-veterinarian is dismissed with honour, the officer of the civil veterinary service W. Eefting.

With unprecedented speed, a fault was admitted, a law amended, a mistake corrected an a precedent prevented. This could only mean that the professionalism of veterinarians in the Dutch East Indies was fully recognized by the government in Batavia and The Hague, but for Mr. Eefting this must have been a dramatic episode in his life.

[41] Ibidem, 187.

Felled by the Wolves of Finland: Tracking down the Foot-and-Mouth Disease Virus

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The foot-and-mouth disease virus holds several distinctions. It was the first animal virus discovered in a modern laboratory. It is considered one of the worst economic threats to modern industrial agriculture. It belongs to one of the oldest and most diverse viral families, counting poliovirus, hepatitis A virus, and even the common cold, human rhinovirus A, as distant relations. Despite its infamy, foot-and-mouth disease receives remarkably little attention in historical literature. Tracing the origins and spread of the foot-and-mouth disease virus has so far been the purview of evolutionary biologists, geneticists, and veterinarians. A few historians have traced key pathways in the dissemination of foot-and-mouth. To date, their efforts have focused exclusively on the role of the virus within the United Kingdom and/or connections between the United States, Argentina, and Mexico.

This presentation summarizes the landscape epidemiology of FMDV between the sixteenth and twentieth centuries. It focuses in particular on outbreaks within and connections between continental Europe and Africa. Some outbreaks will be put into question—such as a dramatic tale in Uppsala, Finland, where FMD rendered domestic herds of reindeer lame enough to be felled by ravenous packs of wolves—namely, the 'earliest known outbreak' in sixteenth century northern Italy, which continues to influence the calibration of molecular clocks in phylogenetic studies of FMDV. It will conclude with suggestions for the future as to what role the historian of animal disease can play in the debates about the origins and spread of this notorious transboundary disease.

Eradicating Foot and Mouth Disease in North America, 1946-1954

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During the early twentieth century, Canada, Mexico, and the United States governments coordinated to prevent foot and mouth disease from entering their borders. These policies facilitated the trade of livestock and related products across the Mexico-United States and Canada-United States borders, in particular cattle and hay. Outbreaks of the disease in Mexico and Canada in the 1940s and 1950s threatened the free movement of people, animals, and goods as the United States implemented border closures and importation bans. In each country, veterinarians, livestock owners, politicians, and government officials debated how to prevent foot-and-mouth disease from spreading and restore the normal movement of non-human animals between the nations. These discussions raised larger questions about the technical and financial plans to eradicate foot-and-mouth disease, different modes of intergovernmental cooperation, sovereignty, and the borders.

In November 1946, rumours of animals with blisters in Veracruz started to circulate and in mid-December veterinarians arrived on the scene to diagnosis if it was vesicular stomatitis or foot and mouth disease. Mexican agriculture officials requested that American veterinarians assist in the diagnosis process and, on December 26, 1946, they announced that the animals had FMD. These were the first cases of the disease in North America since the 1920s and the United States immediately took action by closing the border to cloven-hoofed animals and their products. The Mexican government formed the National Commission to Combat Aftosa to begin an eradication campaign aimed at reopening livestock trading across the border.

Reports by Mexican and American agriculture officials in January 1947 indicated that the disease had already spread across central Mexico to eight states and the federal district. Members of the Mexican government were concerned that they could not handle the scope of the problem and requested that the United States assist them in eradicating the outbreak. According to U.S. Department of Agriculture officials and veterinarians, the only way to ensure the safety of agriculture in the United States was to cooperate with the Mexican government to end the disease in Mexico. Congress moved quickly to authorize a cooperative program that provided money, manpower, and machinery to the eradication effort in order to increase the pace of quarantine, slaughter, and disinfection. For the American government, it was worth investing in an eradication program for Mexico because it was a disease prevention strategy for the United States.

The eradication policy quickly became politically nonviable in Mexico due to the number of animals slaughtered. Too many people lost their livestock to the “sanitary rifle” and commission members faced angry farmers and violence in the field due to this policy. Officials from the Mexican side of the program believed that slaughtering more animals would lead to more violence and unrest, so they proposed a new eradication program that focused on vaccination with limited slaughter. Some on the American side were hesitant because the vaccine had never been used for eradication. However, the options were to agree to the new Mexican plan or to abandon the Joint Commission. While the Mexican and American Commission staff were considered equal, the Americans were guests of the Mexican government. The United States government either could accept the changes to the eradication operations or it could withdraw from Mexico, ending the cooperative agreement that had kept the United States foot and mouth disease free. Cattlemen, politicians, and veterinarians argued that abandoning Mexico would inevitably lead to foot and mouth disease spreading to the United States. Instead, they encouraged the U.S. government to accept vaccination, seeing continued cooperation as the only way to prevent the disease from crossing the border.

The switch from slaughter policy to vaccination policy happened in late 1947 and, at first, nothing seemed to change. The virus continued to spread in early 1948 but then increased vaccination, more feet on the ground, tighter quarantines, and a better information campaign started to turn the tide against foot and mouth disease. September 1, 1952, a year after the last infected animals were destroyed, Mexico was declared foot and mouth disease free, the Joint Commission was transformed into a prevention program, and the U.S. embargo on cloven-hoofed livestock and their products was lifted.

As the Joint Commission eradication campaign was continuing observation and vaccination in February 1952, cases of FMD were reported in Saskatchewan, Canada. Just as it did with the Mexico outbreak, the United States government suspended importation of cloven-hoofed animals and related products. It also provided veterinary technical support and training as it did in Mexico. However, the Canadian government did not propose a joint eradication program with the United States like the Mexican government did. The Canadian outbreak was much smaller in scale and federal authorities and veterinarians decided they could complete eradication on their own.

While the Canadians did not have a formal joint program with the Unites States during their foot and mouth disease outbreak, government veterinarians cooperated to share information, techniques, and new research. Canadian officials also lobbied to swiftly lift the quarantine and prevent industries such as recreational hunting from being impacted by the border policy. The United States government did not change their importation restrictions, but it did provide technical assistance to quickly end the outbreak through eradication only.

Regulating Rumensin: Defining Antibiotic Feeds in the U.S. in the Wake of Resistance

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This paper emphasizes the need to tell more histories about the specific cultural and chemical properties of antibiotic livestock feed to better understand its adoption and use in the past and today. The existing literature about U.S. antibiotics in food production provides important but generalized takes of agriculture’s “antibiotic era.” The history of on-the-farm antibiotics demonstrates how historical alliances between producers and scientists formed, how shifting definitions of abundance and purity impacted antibiotic adoption, and how science has been used to “manufacture uncertainty” about the impact of these technologies. Despite these contributions, few address the differences that exist between antibiotics, or how these differences affect their development, adoption, regulation, and use.

To stress the particularities of antibiotics, this paper tells the story of Eli Lilly’s Rumensin from the lab to the trough. The history of Rumensin details why it is difficult to regulate some agricultural antibiotics in the United States. Since its inception in 1975, Rumensin has largely been seen by scientists, policy makers, and producers as the “successor” or “replacement” feed technology to prior problematic ones: namely sulfaquinoxaline, which became inefficient for treating coccidiosis, and diethylstilbestrol, which proved carcinogenic. Rumensin was also one of the first feed additives developed for exclusive use in agricultural animals. Rumensin’s chemical compound, called monensin, had not been used in human medicine prior to its adoption and use in livestock farming, like most other antibiotics had been. This strict definition as a medication for non-human animals continues to contribute to Rumensin’s exemption from a Food and Drug Administration defined Veterinary Feed Directive (VFD) drug status.
Further, a focus on the use of Rumensin in cattle shows how decades-long debates about it has hinged on how scientists, farmers, policy makers, and the public understand what monensin does in cattle bodies. When Eli Lilly first marketed Rumensin in the U.S., they emphasized its role in the rumen as a feed-to-food converter rather than as an antibiotic coccidiostat. Their advertisements

focused on the role of the rumen, which Lilly illustrated with a glowing white orb placed on the stomach on a steer. To cattle farmers in the late 1970s, Rumensin's status as a "feed efficiency tool" seemed inferior to DES's status as a growth promotant. However, over time, policy makers argued that Rumensin was the ideal DES successor as an alternative growth promotant.

The way monensin worked at the cellular level led to an entirely different scientific classification of antimicrobial – the ionophore – which popularized as a term in agricultural communities that hoped to avoid publicly-charged hormone and antibiotic feeding. However, the term "ionophore" had little significance outside agricultural and regulatory infrastructures, which has caused confusion and tension across later debates about agricultural antibiotics through today. Future use of monensin for beef and milk production will depend on how experts distinguish ionophores from other antibiotics, the role of monensin as a methane inhibitor in the wake of the climate crisis, as well as its potential use for human medicine, including as a cancer treatment.

Session 4 - Vet Histories of International Cooperation

Collaboration between the veterinary schools of Utrecht and Onderstepoort - A political history

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Until late in the 19th century, Utrecht University played a very important role in providing academic training for South African students. Professors at Utrecht stressed the Dutch roots of the Boers and supported their cause. The board of the veterinary faculty encouraged collaboration with colleagues from the veterinary school at Onderstepoort. Not only would this broaden the scientific horizon, but also create jobs for Dutch vets in South Africa, in addition to employment in the Dutch East Indies. Hence, the connection with Onderstepoort was framed in the context of colonial veterinary medicine. The collaboration became concrete. In 1931 Phillipus Fourie, deputy director of Veterinary Services at Onderstepoort, became the first foreigner to receive a PhD in veterinary medicine at Utrecht University. Otto Nieschulz from Utrecht was a guest lecturer at Onderstepoort in 1931 and 1933. Sir Arnold Theiler received an honorary doctorate from Utrecht University in 1936.

Theiler's successor, Petrus du Toit, was awarded the title 'Doctor honoris causa' in Utrecht in 1948, the same year in which apartheid was officially adopted in South Africa. In the 1960s and 1970s ethical debates on the colonial heritage were held within Dutch politics. The post-colonial era witnessed a shift from colonial exploitation to development collaboration. While attention was mainly focused on new collaboration with Indonesia, the relation with South Africa became more and more uneasy. The dubious role Dutchmen had played in this former colony, ultimately resulting in apartheid, was heavily criticized. In addition to the international boycott after 1960, the Netherlands imposed a cultural and academic boycott against South Africa in 1986.

After the abolition of apartheid in 1990, rapprochement between Utrecht University and South African universities took place. This was part of a broader development collaboration between Utrecht University and universities in Zimbabwe and Mozambique. The new contact with the old partner led to chairs established in both cities. Frans Jongejan from Utrecht was appointed as extraordinary professor in tropical veterinary medicine at Onderstepoort, while Koos Coetzer from Pretoria became part-time professor in tropical animal health at the veterinary faulty in Utrecht in 2001. Since then, research projects are being carried out while postgraduate courses are taught with mutual participation.

The Swiss Connection - A. Theiler and colleagues as an example of successful international veterinary cooperation

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The start of the Swiss veterinary connection with the Transvaal

The start of this connection dates back to the late 19th century when a shortage of veterinarians in Transvaal motivated M. Constançon, the Swiss ambassador to the ZAR in 1890, to inform his home country. The message reached Erwin Zschokke (1855-1929) of the Zurich Veterinary School and Wilhelm Kolle (1868-1935) of the Medical Faculty, University of Bern.

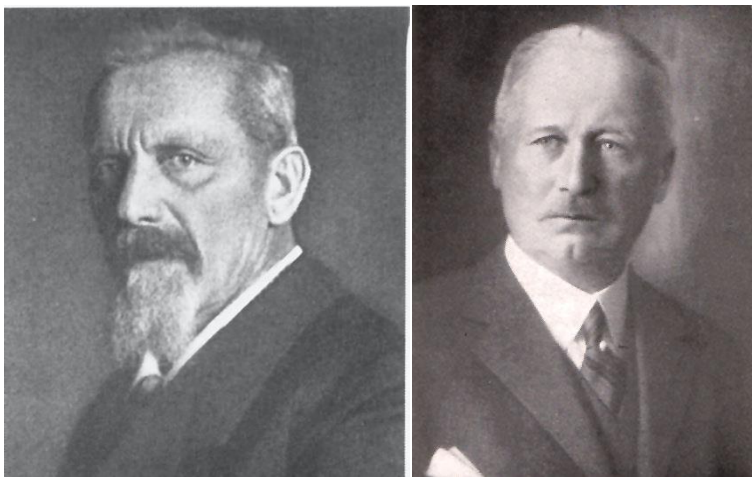

Figure 1: Left: Erwin Zschokke; right: Wilhelm Kolle

Since veterinary practice in Switzerland was not profitable, graduates were interested in alternatives abroad. The Zurich graduates Arnold Theiler (1867-1936), Peter Lys (Lis) (1865-1913), and Emil Tüller (1870-1905) discussed emigration. Tüller wanted to stay, Theiler and Lys (Lis) decided to emigrate. Lys finally decided to stay in Switzerland. Theiler went by himself. His veterinary equipment was lost on the trip but he nevertheless started a veterinary practice in Pretoria. However, the Swiss curriculum did not include “tropical diseases” and it is no wonder that his practice was unsuccessful. To gain experience he decided to work as a farm hand for A. H. Nellmapius (1847-1893). Theiler learned how to deal with tropical diseases and, following the advice of Zschokkes, he performed as many post-mortems as possible. During an accident at the farm he lost his left hand in a chaff cutter and had to use an artificial hand, a fact that he tried to hide for the rest of his life (Fig. 2). In 1892 Theiler reopened a successful veterinary practice in Pretoria.

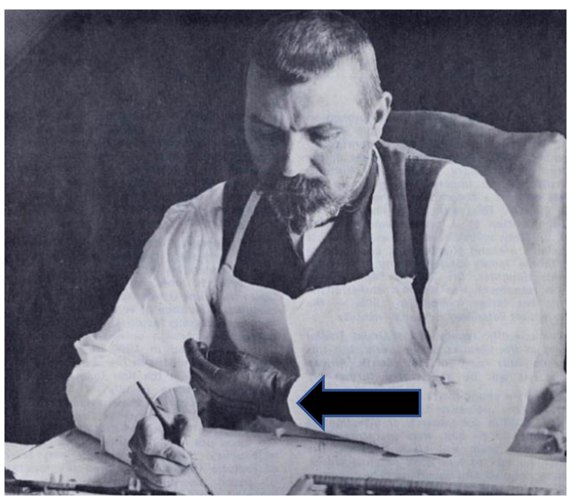

Figure 2: Theiler`s artificial left hand (arrow). Even working at his desk, he used a white apron, a habit he copied from his mentor Erwin Zschokke.

Swiss citizens working for A. Theiler

Prior to the establishment of the “Veterinary Bacteriological Laboratories of the Transvaal” in 1908, Theiler continuously followed his research interests which gave him a chance when in 1893 a smallpox epidemic broke out. He proposed to the Government to provide smallpox vaccine and contacted his Swiss mentors to supply him with the latest information on the vaccine production. To produce the vaccine, (Fig. 3) he hired Swiss helpers like A. Brenzikofer, Alfred von Bergen, Charles Favre and D. Schroeder (table 1). Charles Favre (Fig. 4).

Figure 3: Production of smallpox vaccine (lymph) from inoculated calves

Table 1: Swiss citizens working with Arnold Theiler prior to 1908.

name	function	year
Brenzikofer, A.	production of smallpox vaccine	1898
von Bergen, Alfred		1898
Favre, Charles		1898, 1904
Schroeder, D.G.I.G.		?
von Berlacher, ??	assistant at Daspoort	1904

Figure 4: Theiler, Favre and other unidentified persons

Theiler's next challenge came in 1896 when rinderpest threatened the ZAR. President Kruger appointed him as State Veterinarian, and he started to develop the first safe vaccine for rinderpest. The Government of the Cape Colony invited Robert Koch (1843-1910; fig. 5) to fight against Rinderpest. Another team from the Institute Pasteur in Paris, Jules Bordet (1870-1961; fig. 5) and Jan Danysz (1860-1928; fig. 5) were sent to help in 1897. In collaboration with Theiler they used serum or defibrinated blood from infected animals (Danysz and Bordet, 1898). Koch, however, used bile from infected animals for a vaccine (Koch, 1897; Theiler, 1898). Theiler moved his laboratory to Daspoort where Charles Favre and von Berlacher helped him.

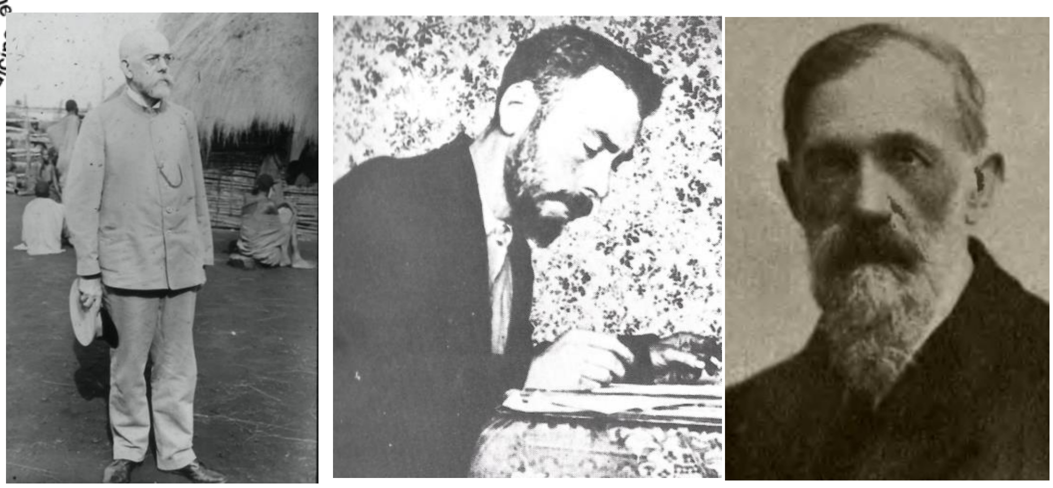

Figure 5: Left: Robert Koch in Africa; centre: Jules Bordet; right: Jan Danysz

In 1899 the Transvaal Government nominated him as delegate to the 7th International Veterinary Congress at Baden-Baden. On the trip he met with his family, Zschokke and Koch.

Meanwhile the Second Boer War began, and Theiler returned to be conscripted as the only veterinarian. Returning to his laboratory after the war he worked on equine ‘malaria’ or biliary fever and could prove that this disease was not horse sickness but due to a piroplasm, later named *Babesia equi* (later *Theileria equi*). He submitted the results as a thesis to obtain a Dr. med vet. degree from the recently established Veterinary Faculty in Bern.

Following the establishment of the “Veterinary Bacteriological Laboratories of the Transvaal” in 1908

On his trip to the 8th International Veterinary Congress at Budapest he met with Zschokke and Kolle and was particularly looking for Swiss veterinarians to join him. Bernhard Kobler (1878-1964) describes Theiler`s meeting with Zschokke (Kobler, 1963): “Theiler gave Zschokke several jars containing tissue samples from South African infectious animal diseases. After Theiler left Zschokke told Kobler to discard the jars and commented: “We already have enough animal plagues in Switzerland and who knows what happens if one of these plagues escapes through an open window and settles in Switzerland.”
Theiler tried to convince Kobler to work for him. Kobler, however did not accept.

Walter Frei (1882-1872)

Zschokke recommended Frei (Fig. 6) and he became assistant government veterinary bacteriologist 1906. After a prior training with Jules Bordet at the Pasteur Institute in Brussels, Frei and James Walker (1868-1952) were working on horse sickness, piroplasmosis and lamsiekte at the new laboratories at Onderstepoort.

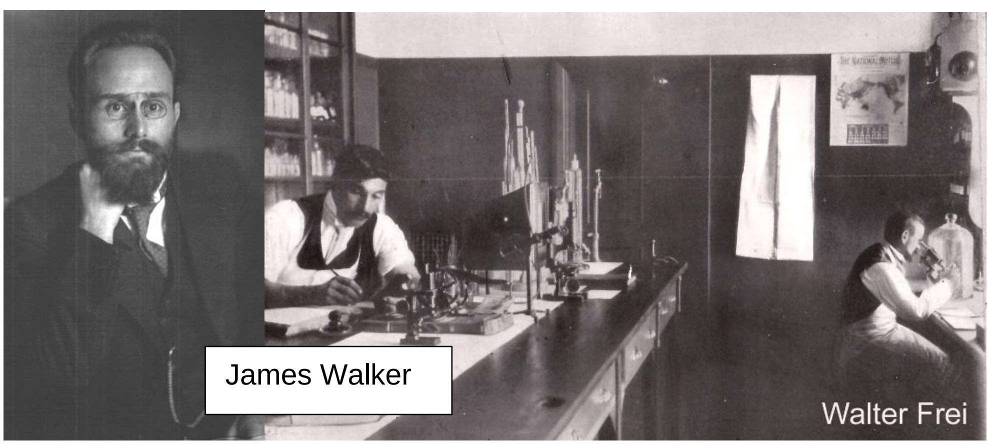

Figure 6: Left: Walter Frei; right Frei and Walker in the bacteriological laboratory

Despite a good publication record (Frei, 1908; 1909; 1910, a, b) Frei's work was not highly regarded and he returned to Switzerland in 1910. Gutsche (1979), however, reports: “He (Frei) expressed himself disloyally to the staff and worse had occurred in the case of Karl. F. Meyer, who had pursued his assignment, not in accordance with Theiler`s direction but in conformity with his own ideas.”

In 1911 Frei was appointed Director of the Veterinary Pathology Institute in Zurich, a post he retained until his retirement in 1952.

Karl Friedrich Meyer (KF, 1884-1974)

Theiler hired Karl Friedrich Meyer (Fig. 7) who had studied veterinary medicine and received a Dr. med. vet. in 1908. After arriving in Pretoria in 1908 he took over the pathology laboratory (Fig. 7) and published continuously (Meyer, 1908, a, b, c; 1911). Like other colleagues working there, KF had problems with Theiler`s personality and described it: Theiler "was a typical Lucerne square-head (although he was actually not from Lucerne), and a Lucerne square-head cannot get along very well with a Basel square-head." When, in 1908 KF published results from his research against Theiler`s wishes, they did not speak to each other again. Meyer left in 1910 and went to the US.

Figure 7: Left: Karl Friedrich Meyer at the lab bench and in the lab (right).

Figure 8: Staff at The Veterinary Bacteriological Laboratories of the Transvaal (1908), 1: Arnold Theiler; 2: Walter Frei; 3: K.F. Meyer; 4: James Walker.

In 1909/1910, on the way to the 9th International Veterinary Congress, Theiler again met with Zschokke in order to unsuccessfully try to recruit veterinarians.

World War I had a dramatic influence on the staff of Onderstepoort. Eight men enlisted and Hedinger (Table 2) returned to Switzerland. No more Swiss applicants were available.

Swiss veterinarians recruited by Arnold Theiler after World War I

After the establishment of the Veterinary Faculty at Onderstepoort in 1920, Theiler tried unsuccessfully to recruit more Swiss veterinarians (Table 2) for the professorial staff of the new faculty (Table 3). For several years the Swiss connection continued in reverse direction. Several of the appointed professors went to Switzerland for postgraduate training and further degrees (Table 3).

Table 2: Swiss citizens Theiler recruited for Onderstepoort between 1913 and 1920

name	training at	function	year	remarks
Ernst Hedinger, 1873-1924	Human pathology, Bern, 1899	guest scientist	1913 - 1914	1922-1924 Professor pathologische Anatomie, Medizinische Fakultät, Universität Zürich
Werner Steck, 1893-1977	Veterinary medicine Bern 1917 Bern	Research officer, lecturer	1922-1926	1926: Professor internal medicine, pharmacology, equine medicine, Veterinary Faculty Bern
Gerhard G. Kind, 1893-1942	Veterinary medicine, 1918, Zurich, Dr. med. vet. Zurich 1922	Research officer (anthrax laboratory)	1919-1922	1922-1942 private practice in Pretoria and Johannesburg
Zschokke Markus, 1893-1972	Veterinary medicine, 1919, Zurich	Bacteriologists	1919-1922	1926-1953 (1965) State Veterinarian South West Africa (Namibia)
Scheuber Joseph R., 1892-1975	Veterinary Medicine, 1918, Zurich		1919-1952	
Meier Hans (Jakob), 1892-1975	Veterinary Medicine, 1917, Zurich, Dr. med. vet. Bern 1919	Government Veterinary Officer	1919-1921	Return to Switzerland, 1921

Table 3: Professorial staff for the foundation of the Onderstepoort Veterinary Faculty

name	position	further training
A. Theiler (1867-1936)	Faculty Dean, Professor of Pathology, Tropical Medicine.	Dr. med. vet., 1901, Bern
P.J. du Toit (1888-1967)	Infectious Diseases (1920-1948), Faculty Dean (1927-1948)	Dr. phil. (Zoology), 1912, Zurich; Dr. med. vet., 1918, Berlin
H.H. Green (1885-1961)	Biochemistry (1920-1930)	
W.H. Andrews (1887-1953)	Physiology (1921-1924)	
G. van de Wall de Kock (1889-1973)	Anatomy (1923) Pathology (1920-1949)	Dr. med. vet., 1921, Bern
P.R. Viljoen (1889-1964)	Veterinary Science (1920-1933)	Dr. med. vet., 1921, Bern
E.M. Robinson (1891-1982)	Bacteriology (1920-1958)	Dr. med. vet., 1921, Bern
C.P. Neser (1889-1929)	Veterinary Medicine (1920-1929)	
James Walker (1868-1952)	1908 assistant to W. Frei	Dr. med. vet. 1933, Zurich

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Available on request from the author.

'No one over here has had the pluck to do [this]': International intercommunity collaboration and the investigation of canine inherited disease

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In 1920s colonial India, an enthusiastic group of expatriate British officials occupied themselves by breeding Bull Terriers. However, these breeders complained that many of the dogs they imported from 'Home' subsequently proved to be congenitally deaf, or to produce deaf puppies. They claimed that many British breeders were knowingly exhibiting, breeding and exporting deaf dogs, even though such dogs were supposedly banned from the show ring. Although breeders in both countries knew that pure white Bull Terriers, which they generally preferred, were more likely to be deaf, there was no consensus on how to tackle the problem. An impassioned debate between fanciers in Britain and India came to a head in 1921. While some fanciers in India wanted to stop breeding from deaf dogs altogether, others urged instead for scientific research into the cause of the deafness, suggesting that Adair Dighton, a medically qualified Bull Terrier breeder in Britain, would be ideally placed to lead the project.

By 1923, a three-way research partnership was established, involving fanciers and scientists across two continents in the first organised international intercommunity investigation into canine inherited disease. The research was commissioned and funded by the Bull Terrier Club of India. Dighton sourced deaf and hearing Bull Terriers from breeders around Britain and worked with FAE Crew, another doctor, who had founded an experimental animal breeding unit to investigate Mendelian genetics at the University of Edinburgh. Dighton and Crew aimed to investigate the inheritance and pathology of deafness in Bull Terriers, both for the benefit of dogs and their breeders and, through collaboration with other medical researchers working on human diseases, as a model for congenital deafness in people. Although the project did not succeed in its aims and was soon abandoned, for many decades it was remembered within the dog fancy as an exemplar of successful cooperation between communities, inspiring other more successful collaborative health investigations thereafter.

The impetus that fuelled this pioneering initiative stemmed from the synergy that developed between the geographically separated but culturally connected Bull Terrier communities in Britain and India, which, by pooling epistemological, financial, biological and motivational resources drawn from different locations, successfully overcame various barriers to the project. This pattern was repeated in the late twentieth century, when the new technology of the Internet similarly helped global communities to come together, thus catalysing the development of gene tests for various inherited diseases in many different breeds of dog. Drawing together veterinary experts, diseased dogs, breed activists and funding from wherever they could be found, these initiatives accelerated advances in molecular genetics, with real impact on canine health, that would otherwise have been far slower to develop.

Historical accounts of the international construction and circulation of scientific and veterinary knowledge often exclusively focus on professional networks, but the serendipitous links that form through common interest in particular dog breeds or canine diseases readily bridge both geographical and disciplinary boundaries, as these examples show. By drawing attention to these multiple interactions between breeders and researchers, I suggest that international pedigree dog health projects offer particular insight into the co-construction of knowledge within and beyond the academy, through emphasising the pivotal significance of breeder-scientists, such as Adair Dighton in my first example, in driving these complex initiatives. By deploying their technical knowledge and scientific/medical networks to further the investigation of disease in the dogs they bred recreationally, these liminal actors drove (and drive) innovative projects that would otherwise develop more slowly, if at all.

These collaborations demonstrate veterinary care beyond the veterinarian and science beyond the professional scientist. Yet, despite the commitment and knowledge of the human participants in these initiatives, their success ultimately remains constrained by the biological attributes of the very canine bodies that first catalysed their creation. While some of these endeavours have led to major advances in understandings of canine health, those investigating congenital deafness in white dogs have been less fortunate. Even today, deafness in Bull Terriers remains a largely unsolved problem, a century after its first systematic investigation.

Reduction of antibiotic use in farm animal and aquaculture production in Norway over the last 30 years

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Introduction

During the last decades there has been much focus on the use of antibacterial agents in farm animal production. Historically, the focus was based on residues of antibiotics in treated animals that could be harmful to consumers. However, a more serious concern of antibiotic use is the development of antibiotic resistance and multidrug resistant bacteria strains. Resistant bacteria in animals may be passed to humans by different means, leading to infections that cannot be healed by antibiotics. It is also documented that antibiotic resistance is directly correlated to the total amount of antibiotics used in veterinary and human medicine. (Swann Report, 1969). There is also clear evidence that restricting the use of antibiotics in livestock will reduce antibiotic resistance in farm animals and possibly also in humans. (Lancet, November 2017). The WHO has classified antimicrobial resistance as one of the biggest *threats* to *global* health, food security and development today. Antibiotic resistance is also one of the main issues of the "One Health" initiative where WHO, OIE, FAO, UNICEF and the World Bank came together for common responses to global disease outbreaks and underlined the recognition that animal and environmental health has a large impact on human health.

Norway has since the first Veterinary Act in 1948 had strict policy in the use of antibiotics in animal livestock, and compared to most other European countries, the consumption is very low (EMA 2017). There are several plausible explanations for the low consumption, but the most obvious are a good health situation, emphasis on preventive medicine and animal welfare, implementing health criteria in animal breeding schemes and veterinarians gaining no profit in prescribing antibiotics. One success criterium has been a long history of extended cooperation and common goals between veterinarians, farmer organizations and the veterinary and health authorities.

Use of antibiotics in farm animals

Antibacterial agents were used long before people knew that infections were caused by bacteria, and were described in ancient Egypt, Greece and in the Roman empire. However, in modern medicine the ‘antibiotic revolution’ started in 1928 when Sir Alexander Fleming characterized the bactericidal effect of penicillin. With further effort from Ernst B Chain and Sir Howard Flory, mass production started in the early 1940s, and penicillin was then available for widespread commercial use. Fleming, Chain and Flory received the Nobel Prize in 1945. During World War II penicillin was significantly beneficial and saved many lives, and by the end of the war, penicillin was nicknamed “the wonder drug”. However, effectiveness and easy access also led to overuse, and it did not take long before some bacteria developed resistance. To overcome the resistance challenge pharmaceutical companies made large investments to find new types of antibiotics, and for a long time, the industry was able to develop new drugs to compensate for the older ones. This is not the situation now, and we have lost our competitive position against the bacteria.

Penicillin was also soon available for treating infectious diseases in animals. At first antibiotics were used to treat individual sick animals. But soon, herd treatments and preventive treatments were implemented which led to the excessive use of antibiotics. In the mid-1940s we discovered that subtherapeutic doses of antibiotics had a growth promoting effect on production animals, and in many countries the largest amount of antibiotics was used to accelerate growth. Until 2017, about 80% of all antibiotics used in livestock in the USA was as growth promotors. In 2017, U.S. Food and Drug Administration (FDA) made this use illegal. As a result, FDA reported a decrease of 33% from 2016 to 2017 in the domestic sales of antibiotics for use in livestock. At the G 20 Meeting in 2017 the agriculture ministers also made a declaration about the overuse of antibiotics: “We will promote the prudent use of antibiotics in all sectors and strive to restrict their use in veterinary medicine to therapeutic uses alone. Responsible and prudent use of antibiotics in food-producing animals does not include the use for growth promotion in the absence of risk analysis. We underline that treatments should be available through prescription or the veterinary equivalent only.” The European Union banned the use of antibiotics as growth agents in 2006 (Regulation (EC) No1831/2003). Sweden was the first country to ever ban their use as growth promoter as early as 1986, and Denmark started cutting down drastically in 1994, now using 60% less. EU regulations are going even further, and in 2018, they decided to limit prophylactic use and herd treatment.

Use of antibiotic in farm animals in Norway

Norway, Iceland, Sweden and Finland stand out with a much lower consumption of antibiotics used in veterinary medicine compared with other European countries (Figure 1). Several factors may explain this situation. All four countries are relatively isolated geographically and for a long time have had well-regulated agriculture industries which also have an impact on the health situation in livestock.

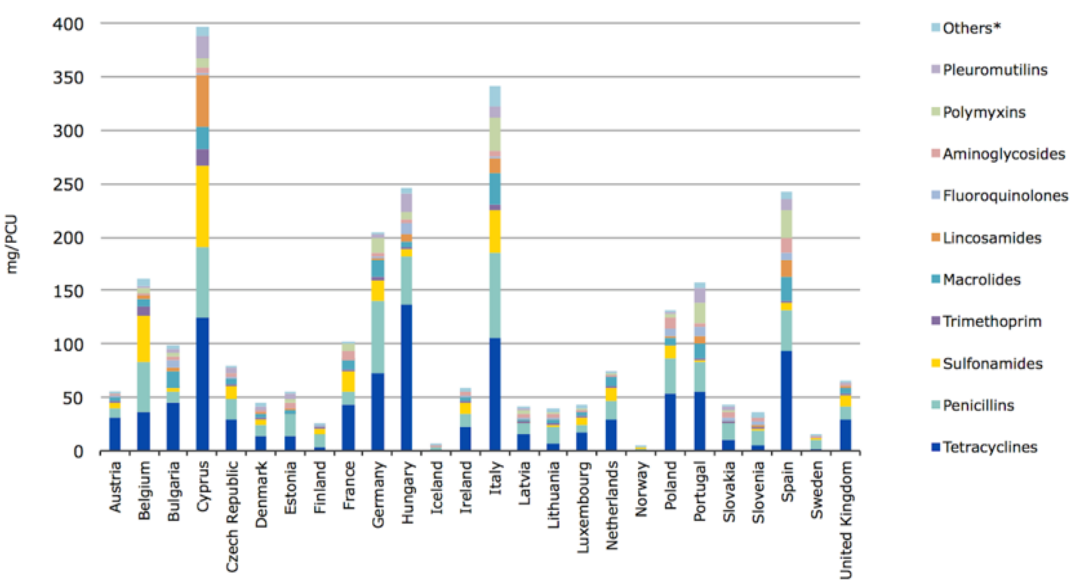

Figure 1. The use of antibiotics in animal production in some European countries. PCU = Population Correction Unit (*EMA, 2017)*

A good animal health situation is a key factor for reducing the use of antibiotics. During the first decades of the last century Norway managed to eradicate most of the severe infectious bacterial and virus diseases such as foot-and-mouth disease, bovine tuberculosis, brucellosis, swine fever and infectious anaemia in horses. Maybe the main reasons for this successful history was the animal disease legislation from 1894 that allowed abrupt measures to combat a disease outbreak: strict import regulations that in practice did not allow any animals to be brought into Norway at all, stamping out as a means of disease control, and giving the farmers full economic compensation for the animals and herd that was euthanased. The compensation prevented farmers from trying to hide sick animals. Norway has recently also started using the same measures to combat antibiotic resistance. Special attention is given to methicillin resistant Staphylococcus aureus (MRSA) which has developed resistance to all types of penicillins and then may cause severe infections that are difficult to treat. When the methicillin resistant strain of the bacteria appears in a swine herd, all the pigs are slaughtered with full economic compensation to the farmer. Up to now the prevalence of antibiotic resistance is at a very low level in the Norwegian animal population.

Having eradicated the more severe animal diseases in the first half of the 19th century, the veterinary authorities and farmers organizations could concentrate more on milder and so called “production animal” diseases such as mastitis, pneumonia, diarrhoea. In 1970 the dairy cattle breeding organization (GENO) together with the Norwegian Veterinary Association implemented a health registration or Health Card, where all treatments were recorded. These health data became a prioritized criterion in the breeding programme. Preventive health schemes for cattle and swine were established in the early 1980s, and in 1995 the farmers organizations, veterinary authorities and the veterinary association came together and set a goal to reduce the use of antibiotics by 25% in five years. The campaign made a huge change in the attitude to preventive medicine and in the use of antibiotics among veterinarians and farmers, and by 2000 the reduction had passed 40%. An important factor in this story is also that Norwegian veterinarians cannot make any profit in selling medicines, which is common in many countries. All prescribed antibiotics have to be dispensed by a pharmacy.

In 2000, the Norwegian Government established an action plan called NORM-Vet for monitoring the use of antibiotics and antibiotic resistance in the food-animal industry including the salmon industry. Since 2014 NORM-Vet has reported to EU’s program for monitoring antimicrobial resistance in zoonotic and commensal bacteria (2013/652/EU). In 2013 a new goal was sat to reduce the use of antibiotics by 15% by 2020, and the industry overreached the goal with a 17% reduction in 2018.

Norwegian salmon farming in the beginning had a bad reputation concerning their use of antibiotics. When the salmon industry took off in the 1970s it was haunted by several bacterial infections like furunculosis and vibriosis. The economic losses were great, and several fish farms even went bankrupt. The only available treatment was massive use of different antibiotics, mostly oxytetracycline and quinolones with a broad antibacterial spectrum, and which should ideally be reserved for human use. Great research and development efforts started out to produce effective vaccines against the most common bacterial diseases. In a few years the diseases were under control and there was a drastic fall in antibiotic consumption (Figure 2). The salmon industry still has major problems with viral diseases, and as much as 15-20% of the fish die before they reach the size to be slaughtered. However, without the effective vaccines, it is doubtful that the salmon production could have grown as it has, being Norway’s second largest export industry after the oil industry.

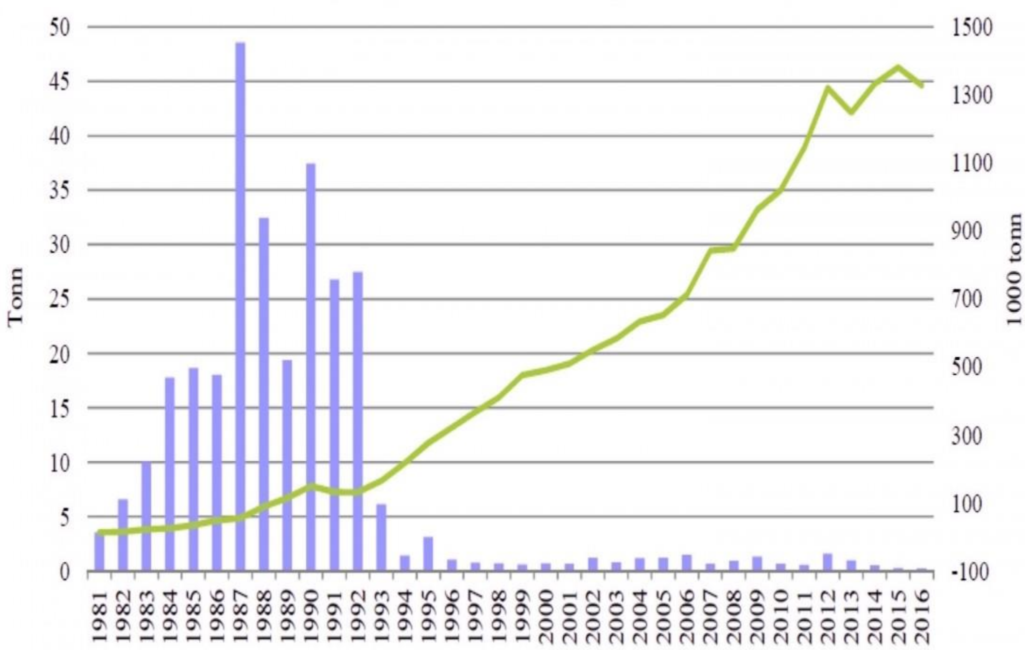

Figure 2. The use of antibacterial agents in salmon production in Norway from 1981 to 2016. (NORM-VET Report, 2017).

Concluding remarks

Even though the use of antibiotics in some countries has shown a slight decrease the last few years, the results from the antibiotic-resistant surveillances in Europe and from other parts of the world are not very optimistic. The situation is most alarming in low income countries in Asia, Africa and South America where there are growing food-animal populations and limited restrictions on the use of antibiotics. (Mega 2019). However, also in Europe and North America the development is considered to be serious. Norway is so far in a more positive situation. In 2018 almost 90% of the bacteria *Escherichia coli* and *Campylobacter jejuni* in samples from poultry were found not resistant to any antibiotic, and no MRSA was found in swine herds. In 2019 there were seven incidents of MRSA in swine herds. It is believed to be unrealistic to eradicate MRSA from the farm animal population, but the goal is to keep the prevalence of antibiotic resistance as low as possible using available biosecurity measures and keeping up the systematic effort in preventive veterinary medicine.

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Session 5 – Tropical Diseases

Making Plague a Tropical Disease

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Although bubonic plague is not one of the major veterinary diseases of South Africa, it played an important role in the scientific history of the Union. In turn, international conceptions of the disease were shaped by scientists from the Veterinary Research Institute at Onderstepoort and the South African Institute for Medical Research, among others. Due to the South African experience, plague became a tropical disease, endemic in a rural landscape south of the equator.[42]

Plague came to South Africa in 1899-1900 through the port cities of Cape Town, Port Elizabeth, and Durban. With the first cases and ensuing panic, public health officials began "sanitizing" these cities (especially poor neighbourhoods inhabited by people of color)[43] by quarantining people, killing rats, disinfecting and even burning whole neighbourhoods.44 By 1910, government health officials congratulated themselves that the disease had been eliminated in South Africa.[45]

Their relief did not last long. As public health officer J.A. Mitchell later remembered, "The year 1914 brought a rude awakening and opened a new chapter in the history of plague in South Africa."[46] In September 1914, several native African workers and the wife of the white owner of "Fairview," a remote farm, fell ill with plague. During the next 7 months, 35 more cases were found in nearby

[42] Plague was later reported to be endemic in some South American areas; it never became endemic in rural India.

[43] MW Swanson, 1977. The sanitation syndrome: bubonic plague and urban native policy in the Cape Colony, 1900-1909. *The Journal of African History* vol 18 no 3, pp. 387-410.

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[46] JA Mitchell, 1927. Introduction in Mitchell, Pirie and Ingram *op cit*. page 95.

rural areas; 19 of these people died.[47] Panicked workers fled; alarmed farm owners appealed for help. Where was the disease coming from? None of the sick people had travelled to port cities; the nearest, East London and Port Elizabeth, were over 100 miles away.

One of the farms had recently obtained some new cattle; could the disease have been brought inland by domesticated animals? The veterinary field investigation, likely slowed by farmers' longstanding mistrust toward government veterinarians,[48] ruled out domesticated animals (although later, cats were found to be susceptible). The native "herdboys" who worked and lived on the veld were most likely to be victims (and also scapegoats, as some were criticized for "stampeding" and carrying the infection to other places).[49] Public health officials in the 1920s established a racialized plague-resistance hierarchy: Europeans were thought to be most resistant, mixed-race "Eurafricans" and native Africans intermediate, with "Asiatics appearing to have the lowest resistance to the disease."[50] Still, tracing the movements of the infected people and their contacts did not explain the pattern of plague outbreaks.

At the South African Institute for Medical Research, J.A. Mitchell and his colleagues read scientific reports about "sylvatic" plague in rural rodents in the United States. These studies described plague spreading from California cities' rats and fleas, to suburban rodents, then to rural wild rodents (such as ground squirrels), where plague became endemic and caused periodic human outbreaks.[51] Mitchell suspected an analogous situation in South Africa, where plague was appearing almost every summer. In 1920, Mitchell decided to collaborate with a zoologist from the Pretoria Museum of Natural History and "an expert tracker and trapper," asking them to survey the local wild rodents. He also engaged the Onderstepoort Veterinary Research Institute's entomologist, GAH Bedford, to study the fleas found on the rodents. Bedford, busy working on the vectors of nagana and horsesickness, nonetheless found time to identify the fleas as species that would bite many hosts—the rodents, other animals and humans—and this was the key to establishing plague as endemic in South Africa. In 1921, bacteriologists found the plague bacillus in rodent colonies. Once established, plague survived from year to year in the animals, their fleas, and their burrows. People working or traveling near the rodent colonies during an epizootic could be infected via flea bite.[52]

Solving the epidemiological puzzle of plague had actually begun much earlier with the work of Arnold Theiler, widely cited as a founding father of veterinary medicine and bacteriology in South Africa. Theiler established his reputation as a bacteriologist by working on human diseases: he produced smallpox vaccine and had participated in plague investigations in 1899.[53] Thus plague was important to the early history of South African bacteriology and veterinary research. Later, at the new Veterinary Institute built at Onderstepoort, Theiler hired two scientists central to the plague investigations: GAH Bedford as the Institute's entomologist (whom we have already met), and veterinarian Karl Friedrich Meyer as pathologist. Meyer, whose strong personality clashed with Theiler's, relocated to the USA and became Director of the Hooper Institute for Medical Research. Drawing on his experience in South Africa, Meyer became the leading American expert on sylvatic plague.[54]

In conclusion, South African investigators reconstituted plague as a tropical disease with unique properties that allowed it to adapt to the veld landscape, the climate, and the peoples of South Africa. In an approach that we would call "One Health" today, these scientists' collaborations revealed the intricate ecology of plague on the veld. By publishing their findings widely in medical and scientific journals, these scientists drew international attention to plague's establishment south of the equator.[55] Proving itself adaptable to new areas in the Southern Hemisphere, plague was likely "to persist in South Africa for a long time," as Dr. Louis Fourie warned in 1938.56 It remains endemic today.

[47] U.S. Department of Health, Education, Welfare, 1915. *Public Health Reports*, Vol. 30 Issue 2 (June 15), pp. 1712-13.

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Eminent South African Veterinary Virologists

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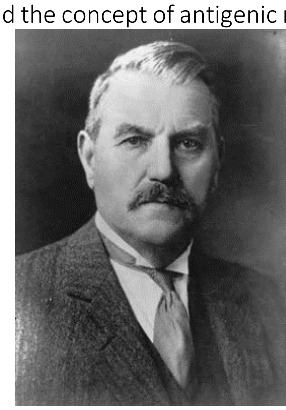
Virology is a relatively young scientific discipline only recognised at the Onderstepoort institute as a separate science in the mid-1950s by the establishment of an independent Section Virology. Before that, research on viruses was mainly carried out in its Section Protozoology and contributions were made by researchers in various other disciplines. For the present review important contributions to our knowledge of viruses and viral diseases will be discussed and only the main contributors identified. Fittingly the first breakthrough was the proof by Arnold Theiler in 1905 that the agent causing bluetongue {BT} in sheep is a virus by means of filterability studies, following in the footsteps of M'Fadyean who similarly proved in 1900 in London that African Horsesickness (AHS) is caused by a virus. Theiler also developed the first vaccines for both diseases consisting of infected blood from donor animals followed by hyper immune serum. He also developed the concept of antigenic multiplicity to explain failures after using the vaccines.



Dr. A.Theiler, founder and first director of the Onderstepoort Veterinary Institute (OVI)

Both Theiler and his successor P.J. du Toit made various efforts to improve the reliability of the vaccines and they were used for many years, until 1946 in the case of BT. The fact that so much effort was spent on their improvement indicates that these two viruses, later called orbiviruses, are of great economic importance for animal husbandry in our country. In the early years of the 20th century horses were of great importance for transport and mobility in agriculture and warfare, and sheep for the flourishing wool industry. In addition, the orbiviruses were at that stage considered unique to southern Africa and little or no research were carried out elsewhere on the two diseases. Consequently, I will concentrate on them as one of the most important research subjects in South African veterinary research and only refer briefly to a few other areas where our results were of international importance.

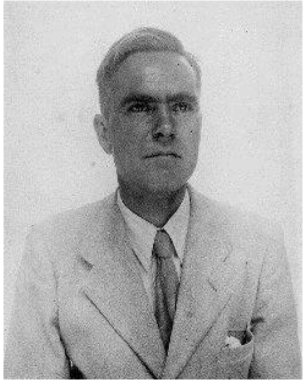
Dr. P.J.du Toit, Theiler's deputy and later successor

A key milestone in orbivirus research was the successful propagation of AHSV in the brains of mice by R.A. Alexander in 1932, using the technique developed by Max Theiler, son of Arnold Theiler, in the US for the propagation of human yellow fever virus for which he received the Nobel Prize. This led to improved diagnostic techniques for AHSV, confirmation of antigenic multiplicity, the isolation of "attenuated" virus strains and the development of the first live AHSV vaccine in 1934, which was used for the following two decades. In parallel studies it was found that bluetongue virus could not be adapted to mouse brains but in 1938 cultivation was achieved by Alexander and co-workers in embryonated eggs and used for the production of a vaccine.

Dr R.A. Alexander first head of Virology and later director of the institute

Of major significance was also the discovery by René du Toit (entomologist) in 1944 that orbiviruses are transmitted by *Culicoides* biting midges, explaining many of the environmental issues involved in combating the two diseases. As head of the new Section Virology, which was created in the early fifties, Alexander and Haig was also involved in 1956 in the cultivation of BT virus in lamb kidney cell cultures and Haig received international recognition for the development in 1953 of a safe and very effective vaccine against canine distemper which has been used worldwide for many decades. In the following years many improvements were made in the serotyping of both orbiviruses by Weiss, Erasmus, Howell, Barnard and others. The same researchers were also involved in the development of highly effective vaccines for other tropical animal diseases such as lumpy skin disease, Rift Valley fever, bovine ephemeral fever, African swine fever and others. Peter Howell moved to the Faculty of Veterinary Science as head of the Department of Infectious Diseases, continuing his research as part of his academic responsibilities.

Dr R. du Toit, Entomologist, discovered the transmission of orbiviruses by Culicoides midges

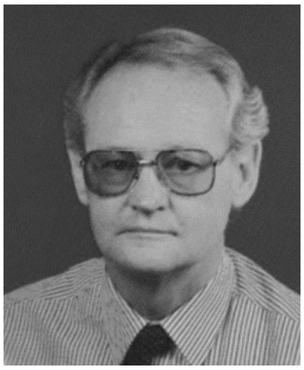


Dr D.A.Haig, virologist responsible for the development of canine distemper vaccine

Dr K.E.Weiss, Successor of Alexander and later Director of the institute

Another key development at the OVI was the establishment of a biosafety level 3 facility for research on foot and mouth disease (FMD) with A. Pini as its first head, later succeeded Gavin Thomson. Their mandate was to develop the necessary infrastructure and experience required for the diagnosis of FMD, including the typing of the virus strains in outbreaks, and assisting Veterinary Services in combating the disease. The virus was found to be carried by the African buffalo and outbreaks could therefore be limited to the wildlife reserves such as the Kruger National Park.

Dr. A. Pini, First director of the FMD institute



Dr G.R.Thomson, Successor of Pini and later director of the OVI

Virus research changed dramatically in 1964 with the founding of a section Molecular Biology by Verwoerd. It was decided to apply the newly developed biotechnology to study the structure and pathogenesis of viruses and BTV was selected as the first model to study. An analysis of the molecular structure of BTV yielded surprising results: a segmented double-stranded RNA genome and a double protein capsid. An important discovery made by Huismans in 1987 was that one of two external capsid antigens provided protection when used as a monovalent vaccine. When Huismans was appointed as head of the Genetics Department of the University of Pretoria he continued his research on orbiviruses. Verwoerd had developed an interest in oncogenic viruses and especially in the proposed virus responsible for jaagsiekte, a lung tumour in sheep first described more than a century ago in South Africa. All previous attempts to isolate and cultivate a putative virus failed, however. Eventually infective material was successfully produced by intratracheal inoculation of new-born lambs. However, no antibodies were produced in the infected lambs suggesting that the original purpose of the study namely to develop serological diagnostic tests and/or a vaccine was not attainable. The reason for this unexpected result became clear when Denis York cloned and sequenced the genomes involved and found that all normal sheep tested contain an endogenous sequence in lung cells identical but smaller than that of the infective virus (1982). The exogenous recombinant virus is therefore not recognized as foreign by the immune system and no antibody is produced. The discovery of a putative 'oncogene' was exiting but unfortunately insufficient manpower and funding prevented further research and the project had to be terminated.

A number of research groups in several countries took note of possibilities and for example used the recombinant or parts of the sequence as vehicle to introduce potential drugs into human lung cells. We may therefore still see some practical application of our results in future.

Conclusion: Virological research at the OVI maintained world standards during the 20th century and often took the lead in the case of tropical animal diseases such as bluetongue and African horsesickness as well as other tropical diseases. In many cases vaccines and diagnostic procedures were developed and made available to countries when confronted by unknown diseases. In the case of jaagsiekte, or ovine pulmonary adenomatosis, the discovery that it is caused by a recombinant virus of endogenous origin excluded such a solution. However, a number of research groups in several countries took note of this discovery and for example used the recombinant or part of its genome sequence as vehicle to introduce potential drugs into human lung cells. We may therefore still see some practical application of these results in future.

Reference: This presentation is an abbreviated version of a chapter in the book *Onderstepoort 1908-2008'* published for the centenary of Onderstepoort. It can be found at the website of the SA Veterinary History Society: www.vethistorysa@co.za

Session 6 – Tropical Diseases

The History of East Coast fever in Southern Africa

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The history of East Coast fever (ECF) spans more than 120 years and it is simply too vast and intricate to do justice to it by trying to give a detailed presentation of all the relevant events, facts and personas associated with this interesting but devastating disease. Comprehensive histories of ECF have been penned that deal with the minutiae of events that comprise its narrative (Lawrence, 1986; Norval et al., 1992). The current study will therefore focus on a question that does touch on ECF history and remains topical: "Was *Theileria parva* present in South Africa prior to ECF introduction, and was it ever eradicated?"

The heavy losses incurred during ECF introduction into South Africa in 1902 suggested a fully naïve and susceptible cattle population. The hypothesis that no ECF or Corridor disease (CD) existed in the country before 1901 was therefore advanced by Andy Norval, John Lawrence, Alan Young, Brian Perry and Tom Dolan, prominent researchers in the theileriosis field (Norval *et al.,* 1991). This hypothesis was upheld in the seminal Epidemiology of Theileriosis in Africa (Norval *et al.,* 1992) and by Lawrence (1986, updated 2016). The argument was advanced that after ECF entered South Africa, the parasite jumped to buffalo, leading to the 1955 CD outbreak, a year after ECF eradication. As such, ECF was never eradicated from South Africa, but remains in a wildlife reservoir. This argument forms the basis of why foreign researchers still believe that ECF exists in South Africa, despite claims by South African researchers that the disease has been eradicated. It has interesting implications, notably that re-adaption to cattle should be relatively easy, increasing the potential risk of ECF in South Africa. It also forms the basis of arguments that vaccines or prophylactics against ECF should be introduced into and used in South Africa, since the disease evidently exists, despite Government claims that an eradicated state has been maintained for 70 years. An answer to the question whether *T. parva* existed in South Africa before ECF is therefore historic and topical. Before we move to the historical narrative, our current understanding and definitions of the biology of *T. parva* will be briefly highlighted to ensure that it informs us retrospectively on our journey.

Theileria parva is part of the Apicomplexa, Hematozoa (parasites of red blood cells) and forms, with the *Babesia,* the Piroplasmida (parasites transmitted as sporozoites by ticks). The *Babesia* infect and replicate solely in red blood cells, while *Theileria* first infects lymphocytes to form schizonts that proliferate, mature and release merozoites that then infect red blood cells to form piroplasms, the stage infective to ticks. *Theileria parva* has two main natural hosts, Cape buffalo and cattle and two main tick vectors, the brown ear ticks, *Rhipicephalus appendiculatus* and *Rhipicephalus zambeziensis*. When transmitted from infected buffalo to cattle, the parasite is referred to as buffalo-adapted/derived *T. parva* and causes a disease known as CD. Corridor disease is characterized by its rapid disease progression, high mortality, low schizont and piroplasm parasitemia and the absence of a persistent carrier state in cattle. When transmitted from infected cattle to other cattle, the parasite is known as cattle-adapted/derived *T. parva* and causes diseases known as ECF and January disease (Zimbabwe theileriosis). East Coast fever is characterized by a slower disease progression, high mortality, high schizont and piroplasm parasitemia, and a persistent carrier state in cattle. January disease is characterized by low mortality, low schizont and piroplasm parasitemia, and a persistent carrier state in cattle.

Setting the historic stage for the discovery of ECF requires some statements on known diseases and the socio-political events of the time. The first tick-borne disease (African babesiosis caused by *Babesia bigemina*) was described by Smith and Killbourne (1893) in Texas. By the early 1900s, African babesiosis was well recognized in South Africa, notably in Natal and Transvaal, with the recognition that in endemic regions animals are generally immune to the disease. Robert Koch (1898) also described the disease in Dar es Salaam, where he differentiated large and small pyriform parasites as different stages of the disease.

The introduction of Rinderpest into Africa in 1896 led to the appointment of Robert Koch by the Cape Government and Arnold Theiler as Government Veterinary Surgeon to the Zuid-Afrikaansche Republiek. Both scientists (Theiler, in collaboration with Watkins-Pitchford) were successful in developing immunization methods that allowed eradication by 1899. The Rinderpest epidemic was followed by the Second Boer War (1899-1902), further decimating the cattle population, necessitating importation of cattle for repatriation and restocking of the national herd.

In 1901 cattle were imported into Rhodesia from German East Africa via Dar Es Salaam and Beira and transported by rail to Umtali and Salisbury. Disease outbreaks in Umtali and Salisbury spread to Bulawayo by 1902. In 1901 cattle were imported into Lourenço Marques (Maputo) from Beira/Madagascar/German East Africa (their exact origin is not known). Military transport cattle were imported into the Transvaal via Komatipoort and the first reports of disease in the Komatipoort area were reported in June 1902. The disease also moved into Swaziland in the same year.

Charles Gray (Chief Veterinary Surgeon, Southern Rhodesia) identified the disease as Texas Redwater. Numerous prominent veterinarians from South Africa supported this conclusion including Alexander Edington (Government Veterinary Bacteriologist, Grahamstown), William Robertson (Bacteriologist from Veterinary Department, Cape Town), Herbert Watkins-Pitchford (Government Veterinary Bacteriologist, Natal), Duncan Hutcheon (Chief Veterinary Surgeon, Cape of Good Hope) and Arnold Theiler (Government Veterinary Bacteriologist for the Transvaal). Theiler visited Bulawayo in September 1902 and concluded that the disease in Rhodesia and the Transvaal was identical and named it Rhodesian redwater, a virulent form of Texas fever.
Gray and Robertson (1902) published a report that stated this conclusion and noted several features that differentiated the disease from Texas Redwater. This included that redwater resistant cattle succumbed, the presence of unique respiratory symptoms, pulmonary and renal lesions not observed in redwater and high piroplasm parasitemia with smaller and morphologically different parasites. Inoculation with blood from recovered animals failed to provide protection, and calves bred and reared on infected pasture failed to develop immunity and died. The inability to recognize that this was a different disease was traced by Neitz (1957) as a misinterpretation of Koch's erroneous description of redwater in Dar es Salaam in 1898.

The inability to halt the disease led to the British South African Railway Company inviting Robert Koch to consult for an impressive sum of £6000 per annum. Based on his own observations (high parasitemia, no destruction of red blood cells or anaemia) and the Gray/Robertson report, he concluded that this was a new disease and published the first report in May 1903. He speculated that this disease was introduced from the Portuguese East African coast, that the disease was endemic along the East African coast and named the disease African Coast fever. Southern Rhodesia adopted this name, but South Africa preferred to call the disease East Coast fever, since the disease was not endemic along the South African coast.

In honour, Stephens and Cristophers (1903) named the parasite for this disease *Piroplasma kochi*. Koch also identified the tick vector as *Rhipicephalus decoloratus*. However, Charles Lounsbury (Government Entomologist for the Cape of Good Hope) definitively showed that *R. appendiculatus* was the vector for the parasite in 1903. Theiler (1904) named the parasite *Piroplasma parvum*. Koch observed the infection of lymphocytes and described the schizont phase that is to date known as Koch's bodies, differentiating it from the *Babesia*. Based on this, Bettencourt, Franca & Borges (1907) raised a new genus and named the parasite *T. parva*. While *T. kochi* is probably the taxonomically correct name, subsequent authors upheld *T. parva*.

Efforts to control the disease by immunization failed. By 1905 ECF spread throughout Transvaal and entered south-eastern Transvaal and northern Natal via Swaziland. By 1910 the disease had entered the Eastern Cape and was essentially established across the geographic distribution of *R. appendiculatus*. By then different control strategies had been explored and the life cycle of the tick was elucidated by Watkins-Pitchford. The short feeding times of larvae and nymphs led to development by of the short-interval dipping method with arsenic-soap every 3-5 days. Quarantine of diseased cattle, removal by detection of fever and movement of the total herd were all measures that were applied. However, they realized that an aggressive approach of constant monitoring for disease, quarantine, dipping and slaughter would be the only long-term solution to eradication. The concerted effort of Veterinary Services across southern Africa finally led to the eradication of the disease in 1954.

A year later, a theileriosis outbreak in the corridor formed between Hlulhluwe and Umfolozi Parks raised concerns that ECF had not been eradicated. However, Wilhelm Neitz realized that the disease did not present the same as ECF but resembled a disease described by Lawrence in Rhodesia in 1934. Neitz (1955) named this disease Corridor Disease, caused by a parasite *Gonderia lawrencei*. Lawrence also described another disease distinct from ECF in 1936. Neitz (1957) named the disease January disease and the parasite *Gonderia bovis*. Subsequently, both names changed to *T. bovis* and *T. lawrencei*. A trinomial system was proposed by Uilenberg (1978) and upheld by Lawrence (1979) to indicate that these are subspecies, namely *T. p. bovis*, *T. p. lawrencei* and *T. p. parva*.

Doubts that these entities were different species arose when Barnett and Brocklesby (1966) claimed transformation of *T. lawrencei* to *T. parva*. Extensive research into transmission biology, epidemiology, serological cross-reactivity and molecular evidence suggested a single species responsible for the different disease syndromes. A workshop on ECF held in 1989 at Lilongwe (Malawi), suggested that a single species, *T. parva* should be instated. Sequencing of the 18S ribosomal RNA gene by Basil Allsopp (1993) supported this with buffalo- and cattle-derived *T. parva* showing 100% identity for this gene. Work done by Hayashida (2013) on whole genome comparison confirmed that all *T. parva* strains show greater than 98% sequence identity and therefore belong to the same species. Importantly, ECF strains show lower genetic diversity (40 000 - 50 000 single nucleotide polymorphisms, SNPs) compared to buffalo-derived strains (100 000-120 000 SNPs), holding the promise of the possibility of differentiating the cattle and buffalo-derived strains.

South African research presents its own conundrums. Researchers such as Neitz and later Fred Potgieter (1988) failed to transform buffalo-derived *T. parva*. Extensive efforts by Abdalla Latif and colleagues have failed to date to find a persisting carrier state in cattle exposed to CD outbreaks. The studies by Kgomotso Sibeko (2010, 2011) on the diversity of single genes such as p67, p104 and PIM also show low diversity for ECF strains, but high diversity in buffalo-derived strains from South Africa. Current research by Boitumelo Maboko on genomic diversity indicate that South African buffalo-derived *T. parva* show much higher SNPs than cattle-derived strains.

From this history we may deduce the following. Adaptation of ECF to cattle and introduction into southern Africa may both be considered bottleneck events that resulted in limited genetic diversity in ECF strains. If ECF jumped to buffalo in South Africa and readapted to these new hosts about 100 years ago, it may be expected that the genetic diversity should be extremely limited and similar to ECF. Such a form would be expected to readily readapt back to cattle, but this transformation failed under laboratory conditions. Molecular data suggests that the genetic diversity found in South African buffalo-derived *T. parva* is much higher than found for cattle-adapted strains. Molecular evidence also suggests that South African buffalo were introduced from East Africa about 50 000 - 80 000 years ago from East African stock. Buffalo diverged around 300 000 ago and were probably infected with *Theileria* since its origins. The tick vectors had also existed for at least one million years. As such, all buffalo within the geographic distribution of the tick vectors for *T. parva* would have been exposed to infection and buffalo migrating to South Africa would certainly have been infected with *T. parva* and maintained, given the southernmost distribution of the tick vector. The integrated evidence therefore suggests that *T. parva* circulated in South African buffalo before the introduction of ECF. While ECF may have jumped to buffalo, it does not represent the major strains circulating in South Africa. The epidemiology of CD, the limited CD outbreaks associated exclusively with buffalo-cattle contact, the limited geographic distribution of CD and the absence of extensive CD outbreaks in a cattle population distributed over 90% of the geographic distribution of the tick vector, all suggest that ECF was indeed eradicated 70 years ago. This makes South Africa the only country within the natural geographic distribution of the brown ear tick, for which ECF is not a major economic tick-borne disease. The conclusions also support the continued measures imposed by the State to control ECF emergence.

Heartwater: a simple disease with a peculiar distribution that has exasperated farmers and scientists for eons

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Heartwater (previously cowdriosis) is a disease caused by a rickettsia, *Ehrlichia ruminantium* (previously *Cowdria ruminantium*). It was first recognised and recorded in South Africa by the Voortrekker Louis Trichardt in 1838. It affects many ruminants and is present in all countries in Africa south of the Sahara, some islands around Africa and in the Caribbean. The disease is transmitted by the *Amblyomma* (bont or patterned) tick and if not treated, usually results in death. Symptoms include high fever, hypersensitivity with other nervous signs, and generalised oedema seen as accumulation of fluid in the lungs, brain, thoracic cavity and pericardial sac. The distribution of the disease corresponds closely to that of its vectors.

At the end of the 19th Century, Dixon and Edington demonstrated that susceptible ruminants could develop heartwater after intravenous injection of blood from infected animals. Lounsbury then demonstrated that the bont tick was the vector of the disease. Cowdry, a visiting scientist from the Rockefeller Institute for Medical Research in New York demonstrated the rickettsia in the tissues of affected animals while on a visit to Onderstepoort.

It was then observed that many wild and some laboratory animals were susceptible to heartwater or that they could act as asymptomatic carriers of the disease. It was also observed that animals infected with heartwater and that recovered were immune. Neitz worked on the immunity and treatment of heartwater. He found that “Uleron”, a sulphonamide drug was effective in treating heartwater. Later, tetracyclines were also found to be effective.

Between 1945 and 1970, there was little progress. During this time, a blood vaccine was developed at Onderstepoort.

After 1970, Du Plessis and Kűmm discovered an isolate very pathogenic for mice which led to a screening and serological test for heartwater.

The USA became interested in heartwater research following the discovery of heartwater on some islands in the Caribbean.

Bezuidenhout successfully cultured the organism in vitro which led to improved diagnostic and serological methods. PCR tests followed that revealed unsuspected genetic diversity in isolates of the organism.

South Africa has endemic heartwater areas, heartwater unstable areas and heartwater free areas. To successfully farm with ruminants and be able to move them from one area to another, heartwater must be managed which can only be achieved if the status of the farm is known. Many farms have a combination of areas. There are also many different strains of heartwater, with varying virulence in the endemic and unstable areas. Global warming has caused the boundaries of these areas to move.

In 1998, Allsopp started work that was aimed at producing an effective, easy to administer vaccine. Recently, scientists at Onderstepoort produced a vaccine that performed well in trials. Onderstepoort Biological Products is presently registering the vaccine for commercial production. Soon, heartwater may be an easily manageable disease.

South African Veterinary Bacteriologists

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Microbial techniques and apparatus had been sufficiently developed by the second half of the 19th century to enable veterinarians to diagnose and study diseases unique to Africa, as well as those diseases carried by imported livestock. The unusual animal diseases encountered in Africa received attention from researchers such as Robert Koch and David Bruce when they worked in South Africa.

When Arnold Theiler arrived in South Africa in 1891 as a young veterinarian, he was disappointed to find that few farmers would employ him, as they were used to treating their own animals. To augment his earnings, he, assisted by his wife, Emma, prepared smallpox vaccine during an outbreak in the mining camp of Johannesburg in 1892.

Theiler’s initial interest in preparing effective vaccines laid the basis for the future of veterinary research in South Africa.

Much of the research effort at Onderstepoort during the next century was aimed at diagnosing disease and developing suitable vaccines for infectious diseases. Many of the vaccines produced by Onderstepoort were for unique African diseases. Onderstepoort vaccines were subsequently in high demand in many African countries as well as in South Africa.

The most successful of these vaccines was the 34F2 anthrax vaccine, which was developed by M P Sterne [1905-1997], is used worldwide, and is still the best of its kind a century later. Science was freely shared in those days, and vaccine strains were not patented. The previous Pasteur anthrax vaccine was unsafe and often gave erratic results. An improved vaccine was developed by P R Viljoen, H H Curson and P J J Fourie in 1928, which gave better results but was still unsafe.

Max Sterne, together with J H Mason, also developed new techniques for clostridial bacterial culture, which resulted in highly concentrated toxins, essential for economical vaccine production. Max Sterne continued his research on clostridial vaccines at the Wellcome Research Laboratory, Kent, UK from 1951 until he retired.

Clostridial diseases, the first being botulism, were of special interest to many veterinarians working during the early 1900s. Early investigations only progressed slowly until Arnold Theiler, working on the farm Armoedsvlakte, made the breakthrough by finding that the disease was due to phosphorus deficiency, which animals self-medicated for by chewing on bones and carcasses. Theiler as well as E M Robinson, P R Viljoen, P J du Toit and others finally identified the toxin of *Clostridium botulinum* as the cause in 1930. J H Mason, H P Steyn and J H R Bisschop [1898-1984] produced an effective vaccine, which was refined by B C Jansen in 1976. Professor Jansen [1921-1987] also worked on other clostridial diseases such as enterotoxaemia, blackquarter and tetanus, which resulted in the development of effective vaccines, still in use today. His leadership talents led to him becoming the director of Onderstepoort at the age of 40, and the chief director of the Department of Agriculture in 1968 and he was at the same time both professor of infectious diseases and Dean of the Faculty of Veterinary Science.

From the 1970s onwards, there was a rapid turnover of bacteriologists researching anaerobic bacteria. Cheryl (CME) McCrindle and B J [Barend] Venter both went on to lecture in bacterial diseases at the faculty. Mike (MW) Odendaal concentrated on the role of *Clostridium perfringens* type A in haemorrhagic enteritis of ruminants, until he left during the 1980s. Odendaal later returned to Onderstepoort to work on improving the vaccines.

E M Robinson [1891-1982] worked on Contagious Abortion and Tuberculosis. He was in charge of Allerton Laboratory in Pietermaritzburg in 1922 when he was appointed as a lecturer and later became professor of infectious diseases at the newly established veterinary faculty. He was a quiet, respected and gentlemanly teacher. He was also in charge of the bacterial vaccine section at Onderstepoort from 1929, held several public offices and was awarded several medals, including the Gold Medal of the SA Veterinary Association. Helmut Kleeberg started working on tuberculosis during the 1950s and collaborated with his medical counterparts to such an extent that when Onderstepoort's unit merged with the Medical Research Unit in 1969, Kleeberg was appointed its first director. His place was taken by HFAK Huchzermeyer [1929-2019] who improved and standardized the tuberculin prepared by the vaccine factory and improved the diagnosis of Mycobacteria. Both Kleeberg and Huchzermeyer collaborated with Ernest Runyon, a researcher into atypical mycobacteria from the USA.

Contagious abortion (Brucella) research was also of special interest of G C van Drimmelen [1911-2003], who improved the live Brucella vaccines, Strain 19 for cattle and Rev 1 for sheep. George Bishop [1943-2001] concentrated on the diagnostics of Contagious Abortion, and his meticulous work at Allerton Laboratory enabled the Natal region to almost eradicate the disease, until a short-sighted retraction of political support made total eradication impossible. Stan Herr [1934-2000], who was as robust in scientific argument as he was in figure, aided by A [Andrew] D Potts did the same at Onderstepoort.

Dr Colin (CM) Cameron worked at Onderstepoort from 1959-1985 on a broad range of bacteria, both diagnostics and vaccines. He managed the bacterial portion of the vaccine factory, gave student and postgraduate lectures, evaluated new drugs for the Registrar of Act 36 of 1947, as well as a heavy administrative load. Dr Cameron was respected and well-loved and had become an adjunct director by the time he left to become a director of the national Department of Health and Population.

E M van Tonder [1938-1989] was interested in the reproduction of sheep and goats in the Karoo. He was the first to study *Actinobacillus seminis*, one of the causes of epididymitis, in detail.

J D W A Coles [1905-1987] was the first veterinarian in South Africa to research poultry diseases. He made many contributions to our understanding of chlamydial and rickettsial diseases.

Dr Marijke (MM) Henton, appointed in 1970, began by researching colibacillosis. Dr Apollon Garifallou, a political refugee from Greece, had been responsible for diagnostic bacteriology during the early 1970s, and when he left in 1976, Dr Henton took over diagnostic bacteriology. She improved the service, was involved in many multidisciplinary investigations and continued the tradition of assisting the vaccine factory in vaccine improvement, until she left in 2002.

Martie (ML) Swanepoel, later van der Walt, initially worked on *Actinobacillus seminis*, then Salmonella, Campylobacter, and later general immunity to bacterial diseases. She left in the late 1990s to join the Medical Research Council's tuberculosis research team.

Pamela Hunter, during the 1980s, concentrated her efforts on improving the vaccines produced by the factory, starting with the E. coli vaccines. She later joined Dr Balthus (BJ) Erasmus, when he succeeded Dr Cameron as the manager of the vaccine factory and used her expertise to improve viral vaccines as well as bacterial ones.

Twelve different veterinarians active in the amalgamated [1985] bacteriology and reproduction sections contributed to establishing an excellent diagnostic service during the last two decades.

Many factors contributed to the constant turnover of researchers from the 1950s onwards, and this trend accelerated later. Wars, government interference, poor career prospects in the scientific field and the fragmented nature of the South African population were major contributors, as well as the attractive new fields of virology and molecular biology, which were more popular choices than bacteriology for young researchers. The Anglo-Boer and first world wars had disrupted research during the war years, but the after-effects of the second world war had a far more persistent influence. Relationships between English and Afrikaans-speaking people had been poor since 1899-1902 and worsened after the National Party won the election in 1948, and this effect was also noticeable at Onderstepoort.

The National Party had a rural base. Politicians put pressure on veterinary personnel to investigate and solve the problems of their constituents. Diagnostics and vaccine production were what the farmers wanted. As all research and diagnostic programmes were government funded, it was more sensible to invest the limited available funds into specific African problems.
Many viral diseases and plant toxins were limited to Africa, but bacterial diseases occurred everywhere, and were being researched by large teams in countries with far more resources than South Africa had. Only diagnostic and vaccine improvements for bacteria were required. This suited researchers who enjoyed those practical aims but drove others to seek other research interests or employment elsewhere.

Theiler had insisted that veterinary education should be based at Onderstepoort in 1920, but there was an administrative separation between the research institute and the faculty of veterinary science in 1973, and Medunsa University [established in 1976]. Dedicated lecturers performed less research because teaching took priority. The split between the vaccine factory and the institute also took its toll on the number of researchers.

A more sinister reason for the loss of bacterial researchers was the establishment of an ultra-secret chemical and biological warfare unit named Project Coast by the military at Roodeplaat in 1982. South Africa did not adhere to its commitment to the Geneva Protocol established at the Biological Weapons Convention of 1972. Roodeplaat Research Laboratories were touted as being a contract research facility, but this was a cover for producing biological weapons such as anthrax and clostridial toxins. Certain veterinary and other scientists were promised interesting research topics and high salaries. Project Coast was so secret that most researchers claimed ignorance about the purpose of Project Coast when the unit was disbanded in 1989. Some of those researchers formed the core of the Bacterial Vaccine Development Unit at Onderstepoort afterwards, using the experience gained at Roodeplaat to improve clostridial and other vaccines.

Long term career prospects for veterinary bacteriologists were poor. Advancement inevitably led to an administrative post. The only alternative for a dedicated researcher was stagnation in the same post without the prospect of promotion. Salaries were also low compared with those for other veterinary posts, other research institutions and other countries. Administrative duties became more and more onerous over the years, with politicians demanding frequent progress reports and complicated financial documents.

The increasing international scientific isolation due to apartheid meant that international research collaboration was limited or non-existent, resulting in slow advancement. There was also a government policy in place where political scientific refugees from communist countries and scientists from the handful of countries still friendly towards the National Party government, such as Paraguay, were to be accommodated within the veterinary field. As the qualifications of these scientists varied widely, they had to be placed where they could be closely supervised. Some of the scientists produced excellent results, but many performed poorly and did not assimilate well into the community.

The heyday of veterinary bacteriology in South Africa was therefore during the first half of the 20th century. The second half was devoted to consolidation and improvements, which are not as illustrious as the early discoveries but are just as necessary for proper disease control in animals.

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A study of the ecology of anthrax in the Kruger National Park, South Africa

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The ecology of anthrax in the Kruger National Park (KNP) in South Africa is described. Endemic anthrax occurs in the northern-most region of the KNP with sporadic cases seen almost annually. In addition, regular periodic epidemic outbreaks occur in the northern half of the KNP with inter-epidemic periods of between 10 and 30 years. These outbreaks were studied over a period of roughly 40 years, providing ideal opportunities to evaluate anthrax in an essentially natural setting with minimal interference by man. Several complex and interrelated patterns of disease occurrence and determinants were identified and described.

Anthrax appears to be unique in the sense that it is the only disease within the KNP, or possibly world-wide, that needs to kill its host in order to propagate. It has however adapted to the KNP ecosystem in being density dependent and self-limiting, leaving in its wake viable young populations of animals. Anthrax should therefore be viewed in terms of its effect on the population and ecosystem rather than on the individual, where the death of individuals may actually be of benefit to the populations and ecosystem.

It was therefore seen as an ideal natural population regulatory mechanism in a natural setting such as the KNP, having also a predilection towards older animals, leaving behind a younger population. However, in a totally fenced-in setting like the KNP, it may be subjected to 'unnatural' outside effects such as fences, fires and unnatural pressure on water, which may place certain marginal and highly vulnerable species such as roan antelope at risk. This has led to a situation of minimal control procedures of anthrax in the KNP.

It is argued that this very complex and interrelated epidemiological web of causation and the evidence of a possible mutually beneficial relationship between the agent, host populations and KNP ecosystem, could only have developed as a result of co-evolution, which indicates that anthrax is indigenous to Africa and endemic to the KNP and southern Africa. Therefore the word 'ecology' is used in preference to 'epidemiology' to describe the effects of *Bacilius antracis* on a near-natural system such as the KNP.

Session 7 – Tropical Diseases & Free Topics

Jaundice in sheep in South Africa – confusion and resolution

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Veterinarians trained in Europe dominated the research fraternity in South Africa up to the Second World War and scientific knowledge and investigations were therefore based on what was known in Europe or other countries with long veterinary traditions.

When faced with the many baffling, unknown diseases of Africa, early investigators trained in Europe floundered. Jaundice in sheep was encountered in many different circumstances and could be accompanied by other signs, notably photosensitisation. Confusion resulted, not helped by the many observations and opinions of farmers, who had given the condition the name of 'geeldikkop' or yellow swelled head. As Theiler noted, farmers were great observers but poor analysts of their observations.

Investigations by Theiler into Geeldikkop in 1918 and by De Kock in 1928 into a disease of sheep from the same geographic area but not involving photosensitivity and dubbed Enzootic Icterus initiated a scientific, methodical approach to describing and defining disease conditions involving icterus in sheep. Quin and co-workers then established for the first time the causative link between icterus and photosensitisation in ruminants. Obstructive icterus resulted in the accumulation of phylloerythrin, a photosensitising biochemical by-product of chlorophyll degradation. Henrici studied for decades the physiology of the plant previously identified by Theiler as the cause of Geeldikkop but her approach was ignored or discounted by later investigators. The attempts subsequent to Theiler's trials failed to repeat his findings and research was thrown into confusion. These trials had all involved the feeding or dosing of dried material of the plant *Tribulus terrestris*, while Theiler had used fresh material, a crucial difference.

Evidence gradually accumulated linking Enzootic Icterus to copper poisoning, but more conflation intervened when Brown and co-workers postulated that Geeldikkop and Enzootic Icterus were manifestations of the same underlying factor, selenosis. Then in the 1970s, Van Tonder and co-workers proved beyond reasonable doubt that the ingestion of *Tribulus terrestris*, as found by Theiler, was the cause of Geeldikkop. The thus-far unidentified toxin was shown to be stable if chilled or frozen, or extracted in alcohol. Only the intake of considerable quantities of wilted plants could reliably cause Geeldikkop. Then, by collecting the existing evidence relating to Enzootic Icterus and further studies, Bath was able to show that it was a form of chronic copper poisoning.

There was a further twist to this tale of false leads and confusion. Encouraged by successes in linking mycotoxicosis to other forms of photosensitisation like lupinosis caused by *Phomopsis leptostromiformis* (now *Diaporthe toxica*) and facial eczema caused by *Pithomyces chartarum*, Kellerman and co-workers postulated that Geeldikkop was due to the simultaneous effects of an unidentified factor in *Tribulus terrestris* and *P. chartarum*. However, after much work it was finally concluded that a labile plant toxin was solely responsible for Tribulosis.

Other diseases involving jaundice further complicated diagnostics; these included Rift Valley Fever, the plant *Lasiospermum bipinnatum*, bacterial icterus, leptospirosis and others. Swollen heads caused by infections or verminosis could be confused with photosensitivity. Ultimately, once the diseases causing icterus in sheep had been identified and their pathology defined, diagnosis became straight-forward and reliable.

A strange by-product of research into Geeldikkop and Enzootic Icterus was that once their causes were properly established and the underlying factor in both cases of poor veld management was identified, measures to ensure good veld management taken after the 1970s reduced the occurrence of both diseases so much that these once feared problems gradually decreased to near-insignificance.

Notable veterinary parasitologists of South Africa

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Introduction

Veterinary parasitologists in South Africa have played a crucial role in elucidating the causes and transmission of many major animal diseases, and in establishing life cycles and control measures that were appropriate to manage these serious conditions in economically effective ways. South Africa had many diseases that baffled early investigators and diligent, persistent investigation was necessary to find the links to a wide variety of internal and external parasites.

Since the establishment of the Veterinary Faculty at Onderstepoort in 1920, parasitology as a subject has been an important part of the curriculum and courses in helminthology, ecto-parasitology and protozoal diseases were featured for a total of 165 hours in 1994. (Verster, 1994).

One of the first documents on a vector-borne disease was an account by a missionary, Father Montclara, in 1569, who wrote about horses that had come from India and had died, the suspicion being that they had been poisoned, but much later Arnold Theiler thought that the symptoms resemble African Horse Sickness. (Vandenbergh, 2010). However, it was more than 300 years before any research was done on parasites.
Sir David Bruce, a Scottish pathologist and microbiologist, while serving as a British Army doctor in South Africa in 1884 discovered that *Trypanosoma brucei* sp. in tsetse flies caused nagana in cattle and sleeping sickness in humans. (Penzhorn & Krecek, 1997).

Gerald Augustus Harold Bedford (1891-1938)

Gerald Bedford, a British entomologist, first worked at the British Museum of Natural History on mosquitos until Arnold Theiler appointed him as entomologist at the Onderstepoort Bacteriological Laboratories in 1912 to investigate horsesickness and other insect-borne diseases of livestock on a three-year contract. Bedford became part of the permanent staff as a research officer in 1920, a position he held up to his untimely death in 1938 at the age of 46, while working on a monograph of South African ticks. (Penzhorn & Krecek, 1997; Plug, 2019a).

Bedford investigated almost all the mosquito species occurring in South Africa trying to discover the vector of horse sickness but never succeeded. He was a leading taxonomist of South African ectoparasites of domestic animals and wild animals. He also studied the life cycle of the sheep scab mite (*Psoroptes communis* [*ovis*]) and specialized in sucking lice (suborder Anoplura), on which he became a leading specialist. (Plug, 2019a).

In 1932 he published the most comprehensive list of ectoparasites found on South African mammals, birds and reptiles, with a supplement in 1936. (Horak, *et al.*, 2018). Between 1912 and 1938 Bedford described four Ixodid tick species, two Argasid species and the enigmatic *Nuttaliellia Namaqua.* (Horak, 2009a; Horak *et al*.; 2018). He was a founding member of the South African Biological Society. (Plug, 2019a).

Charles Pugsley Lounsbury (1872-1955)

Charles Lounsbury, an American-born economic entomologist, arrived in the Cape in 1895 to work on insect pests in the colony. (Giliomee, 2013; Mossop, 1955; Plug, 2019b). This appointment was the first of its kind in Africa and he studied pests of fruit trees, vineyards, crops and insects of veterinary importance, and introduced legislation to regulate plant imports. (Plug, 2019b).
Lounsbury started studying the life cycles ticks in 1898 and in 1900 he proved that the bont ticks (*Amblyomma hebraeum*) was the vector of heartwater and in 1901 that biliary fever (Southern African canine babesiosis) (*Babesia canis* [*rossi*]) is transmitted by the adult stage of the yellow dog tick (*Haemaphysalis leachi* [elliptica]). (Giliomee, 2013; Mossop, 1955; Plug, 2019b).

In 1902 there was an outbreak of what was initially thought to be redwater (bovine babesiosis) in the Transvaal. Arnold Theiler sent specimens of blue ticks (*Boophilus* [*Rhipicephalus*] *decoloratus)*, known to be the usual vectors for redwater (*Babesia bovis*), taken from infected cattle to Lounsbury in Cape Town. This led to the discovery in 1903 that the disease was not African redwater, but a new protozoan parasite, East Coast fever (*Theileria parva*) transmitted by the brown ear tick (*Rhipicephalus appendiculatus*). (Gutsche, 1979; Horak, 2009a; Penzhorn & Krecek, 1997; Plug 2019b).

Lounsbury started dipping animals with sodium arsenite, a chemical he also recommended for the control of locusts and made it possible for him to recommend more effective cattle dipping programmes and dips. (Giliomee, 2013; Plug, 2019b). His tick studies gained him international status as an expert on ticks, and in 1903 he was allotted funds for setting up an entomological laboratory at Rosebank, Cape Town. (Plug, 2019b).

In 1910, with the establishment of the Union of South Africa, Lounsbury was appointed as Chief of the Division of Entomology in the Union Department of Agriculture and he moved to Pretoria. He held this post from 1911 until his retirement in 1927. (Mossop, 1955; Plug 2019b).

He was a founding member of the South African Biological Society and was awarded the South African Gold Medal by the South African Association for the Advancement of Science in 1915. (Plug, 2019b).

René Michel Du Toit (1904-1988)

René du Toit qualified as a veterinarian at the Onderstepoort veterinary faculty of the Transvaal University College in 1927. He was briefly appointed as a research officer at the Allerton Laboratory in KwaZulu-Natal by the Department of Agriculture before being transferred to the Entomology Section of the Onderstepoort Veterinary Research Institute in 1929. From 1930 to 1931 he was stationed at the Experimental Station at Armoedsvlakte near Vryburg where he was responsible for combatting mange in sheep. (Bigalke, 2005; Du Toit, 2008; Verwoerd, 2019a).

He returned to the Entomology Section of the Onderstepoort Veterinary Research Institute in 1936. (Du Toit, 2008; Verwoerd, 2019a). Between 1939 and 1954 he did research into applying insecticides, in particular BHC in aerial form at the breeding sites of the tsetse flies (*Glossina pallidipes*) and later large-scale aerial spraying of DDT at strategic sites in the bushveld region of Zululand to eradicate the tsetse fly. As a result of his research, the economically important cattle disease nagana was finally brought under control after many years. (Anon, 2008; Bigalke, 2005; Du Toit, 2008; Verwoerd, 2019a). In 1953 he was awarded a DVSc degree by the University of Pretoria for his thesis based on his research into the control of tsetse flies. (Bigalke, 2005).

Du Toit was also closely involved in research to identify the role of biting insects in the transfer of bluetongue and African horse sickness, as well as the occurrence of multiple serotypes of the viruses that cause these diseases, and in 1944 he made the ground-breaking discoveries that the African horsesickness virus and bluetongue virus of sheep were transmitted biologically by *Culicoides* spp. (midges), and that cattle possibly served as reservoirs of the bluetongue virus. (Bigalke, 2005; Du Toit, 2008). In 1941 he described *Rhipicephalus glabroscutatum,* a parasite of smaller domestic stock in the Western Fynbos biome and Eastern Cape Thicket and Nama Karoo biomes. (Horak *et al.,* 2018).

Prof du Toit was Assistant Director of the Research Institute from 1959 to 1969 and simultaneously professor in Parasitology at the Faculty of Veterinary Science from 1958 to 1969. He was also Dean of the Faculty of Veterinary Science from in 1960 to 1963. (Du Toit, 2008). He served on various boards and committees. In 1951, he was nominated to the Panel of Experts of the World Health Organization (WHO) on parasitic diseases and was elected President of the South African Biological Association in 1945 and again in 1967. He was also President of the South African Entomological Association. He received various prizes and awards for his research, among others an honorary award from the Agricultural Society of the Witwatersrand. In 2008 the University of Pretoria honoured him posthumously as one of their Leading Minds. (Du Toit, 2008).

Gertrud Theiler (1897-1896)

Gertrud Theiler, the 'first lady' of southern African ticks, was born in Pretoria, the elder daughter of Arnold and Emma Theiler. (Walker, 1987). After matriculating, she studied at the South African College in Cape Town, where she graduated with a BSc degree in 1918. Theiler then left South Africa and spent several years overseas, first at the University of Neuchâtel where she obtained her DSc in 1922, and then at the Schools of Tropical Medicine in Liverpool and London, doing postgraduate work in helminthology. During this period, at the start of her long career working on parasites, she wrote four scientific papers on this research, and even today the article on the strongylids and other nematode parasites of South African equines is highly regarded as one of the standard works on the subject and frequently referred to. (SAHO, 2019; Walker, 1987).

At the end of 1924 Theiler returned to South Africa and taught biology at Jeppe High School for Girls in Johannesburg. In 1926 she obtained a lectureship as Senior Lecturer in Zoology and Physiology at the Huguenot College in Wellington in the Western Cape and in 1935 was promoted to the professorship of the Department, an especially remarkable accomplishment for a young woman at that time. She left Wellington after 3 years and during 1939 she lectured temporarily in Zoology at Rhodes University College. (SAHO, 2019; Walker, 1987).

In 1940 Theiler was offered a research post in the Entomology Section at the Onderstepoort Veterinary Research Institute. Her ensuing studies into African ticks during the next 25 years brought her further fame and she became widely known in her discipline throughout the world. (SAHO, 2019; Walker, 1987).

Her meticulous descriptions of numerous African tick species have in many cases still not been surpassed. (Walker, 1987) Theiler described three new species (one Argasid and two Ixodid species) and provided additional descriptions for 13 tick species which had been described by foreign researchers. (Horak 2009a). She also laid the basis of our knowledge of the zoogeography of numerous southern African tick species. (Walker, 1987).

In 1962 she wrote her opus magnum, '*Ticks of Vertebrates of the Afrotropical Region*' and even though it was never published, it is still in use and quoted by many tick scholars. (Horak 2009a; SAHO, 2019; Walker, 1987).

Theiler always kept close contact with other tick workers, not only in South Africa and other African countries but across the world. Many of these acarologists visited her at Onderstepoort for training or discussions and she could always be depended on to provide assistance and guidance, as well as to supply relevant literature, graphics and reference specimens of ticks. (Walker, 1987).

Theiler officially retired in 1967, but she resumed working on her original subject of helminthology at the Onderstepoort Veterinary Institute as an emeritus faculty member until 1983, when her deafness and failing sight forced her to stop working – a working career of 65 years – a noteworthy record of service. (SAHO, 2019; Walker, 1987).

Theiler received several awards, inter alia the Senior Captain Scott Medal of the Biological Society in 1960 and the Elsdon Dew Medal of the Parasitological Society of Southern Africa in 1975. (SAHO, 2019; Walker, 1987). The argasid tick, *Argas theilerae*, "Theiler's African white-backed vulture argasid" and the ixodid tick, *Rhipicephalus gertrudae,* were named in honour of Gertrud Theiler for her many contributions to tick research. (Horak, 2009a) The Gertrud Theiler Tick Museum, housing the South Africa National Tick Collection, was opened on 23 August 2005 at the Onderstepoort Veterinary Institute and is named after Dr. Theiler in honour of the many years she dedicated to the collection. (Heyne, 2013).

Jane Brotherton Walker (1925 - 2009)

Jane Walker was born in Kenya. She obtained her BSc Honours and MSc degrees at Liverpool University in 1948 and 1959 and was awarded a DSc degree on her published works by the University of the Witwatersrand in Johannesburg in 1983. (Horak, 2009b).

She started her career as Principal Research Officer in the East African Veterinary Research Organization in Muguga, Kenya in 1949 and voluntarily retired as Principal Scientific Officer in 1966. (Horak, 2009b).

In 1966 she was appointed Senior Professional Officer at the Onderstepoort Veterinary Institute where she spent the rest of her professional time as Specialist Scientist until 1990, but she kept on working in an honorary position until 1998. (Horak 2009b).

Dr Walker was one of the foremost tick taxonomists of African ticks, specifically the *Rhipicephalus* species, and her book *The Brown Ticks of the World* was published in 2000. (Horak 2009b; Horak *et al.*, 2018). She was the sole, senior or co-author of 53 scientific publications and five books, illustrating many tick descriptions herself. (Horak 2009b; Horak *et al*., 2018).

Jane Walker was awarded three of the most prestigious awards in the field of biological sciences in South Africa, namely the 1988 Elsdon-Dew Medal of the Parasitological Society of Southern Africa, the Agricultural Science and Technology Woman of the Year Award for 1998, and the Theiler Memorial Trust Award in 1998 for exceptional services rendered to Veterinary Science in Africa. (Horak 2009b). Two tick species were named after her: *Argas walkerae* and *Rhipicephalus walkerae.* (Horak, 2000a; Horak *et al.,* 2013).

Lewis Henry Gough (Dates Unknown)

Lewis Gough qualified as Doctor of Philosophy in Zoology at the University of Basle, Switzerland in 1901. From 1902 to 1903 he worked in the UK on marine biology in the North Sea and adjacent areas. Gough arrived in South Africa in 1906 to take up an appointment as curator of the collection of lower vertebrates and invertebrates (excluding insects) at the Transvaal Museum in Pretoria. (Plug, 2019c).

Shortly after Gough's arrival he was asked to study the intestinal helminths occurring in South Africa and he found 50 species of helminths from his examination of many mammals, birds and reptiles which produced over 50 kinds of worms: Cestoda, Trematoda and Nematoda. (Gough, 1908; Plug, 2019c). He also conducted breeding experiments with bladder worms, a species of tapeworm found in sheep and jackal. Probably as a result of this work he was transferred to the new Veterinary Bacteriological Laboratories at Onderstepoort as a zoologist in July 1908, where he continued his research on internal parasites, particularly tapeworms of sheep and wild antelope. (Plug, 2019c). His description of *Stilesia centripunctata*, a tapeworm of sheep, was published in the commemorative issue of the Onderstepoort Bacteriological Laboratories in1908. (Anon, 1909).

During this period, he also accumulated mosquitoes in connection with experiments to determine the vector of horsesickness and he subsequently published his findings with a description. (Gough, 1909) Around this time, Gough left Onderstepoort and his helminthological work was taken over by Francesco Veglia in 1912. (Plug, 2019c).

Gough was a founding member of the Transvaal Biological Society in 1908. (Plug 2010c). He left South Africa in 1911 for Egypt, where he was appointed head of the Entomological Section of the Agriculture Department and became involved in combatting a serious cotton pest, the pink boll worm, as well as studying locusts and scorpions. He was awarded the Order of the Nile (Third Class) by the King of Egypt in 1923. (Plug, 2019c). Apparently he then returned to South Africa, because in 1937 he was one of the founding members of the Entomological Society of South Africa. (Plug, 2019c).

Francesco Veglia (1881-?)

Veglia, an Italian veterinarian, was the first official helminthologist at Onderstepoort. He worked at the Institute from December 1911 to 1926 as a government veterinary research officer. (Penzhorn & Krecek, 1997; Verwoerd, 2019b). During World War I, Veglia served in the Italian army but returned to Onderstepoort in 1917 to resume his research on economically important endo-parasites of mainly sheep. (Verwoerd, 2019b).

He is best known for his ground-breaking investigations into the anatomy and development of wire worm (*Haemonchus contortus*) in sheep. This work represents probably one of the best studies in veterinary helminthology that has yet been published. He also published papers on nodular worms in sheep and nematode species. (Verwoerd, 2019b). He also developed the first effective anthelmintic against wire worms. This 'Onderstepoort Wireworm Remedy' was used for many years. (Penzhorn & Krecek, 1997; Verwoerd, 2019b).

Veglia was a founding member of the South African Biological Society in 1916. He returned to Italy at the end of May 1927, where he was associated with the University of Turin and bought the Burdizzo Instrument Company in Turin. (Verwoerd, 2019b). He seems to have been still active on his wine farm in Italy around 1960. (Verwoerd, 2019b; Whitcomb, 1962).

Herman Otto Mönnig (1897-1987)

Herman Mönnig was one of the first South African-born parasitologists. He obtained a BA degree in Zoology (Honours) from the University of the Cape of Good Hope (later the University of Stellenbosch) in 1917. (Bigalke & Van der Veen, 2019; Penzhorn & Krecek, 1997). He was awarded a Victoria Bursary which made it possible for him to continue his studies in Europe and he left South Africa in 1919 to study biochemistry in the Netherlands. Unfortunately, the University of Amsterdam did not offer that course at the time and he decided to study zoology and parasitology instead. In 1920 he went to Zürich where he obtained a doctorate in zoology in 1921 for his thesis on the histology of Trematodes. (Bigalke & Van der Veen, 2019; Mönnig, 2008).

Mönnig returned to South Africa in 1922 and was appointed Research Officer in the Parasitology Section of the Onderstepoort Veterinary Institute. In 1926 he obtained his BVSc at the Transvaal University College (University of Pretoria). In 1928, following the departure of the helminthologist Dr F. Veglia, he was appointed head of the Section Parasitology, and in 1929 Professor of Parasitology at the Onderstepoort Faculty of Veterinary Science. (Bigalke & Van der Veen, 2019; Mönnig, 2008). Later he was also appointed Head of the Department of Parasitology at the University of Pretoria. (Mönnig, 2008).

The following 16 years saw him publish many papers on his research in parasitology and chemotherapy for parasitic diseases, also describing some 46 new helminths found in domestic and wild animals and birds. (Bigalke & Van der Veen, 2019). His textbook *Veterinary Helminthology and Entomology*, with illustrations by the author and published in 1934, was used as an international textbook for many years. (Bigalke & Van der Veen, 2019; Mönnig, 2008; Penzhorn & Krecek, 1997).

In 1945 Mönnig resigned from his posts at both the Onderstepoort Institute and Faculty and founded a commercial company, Agricura Laboratory Ltd., to produce pharmaceutical remedies for the control of parasitic infestations and related diseases of livestock and agricultural pests. (Bigalke & Van der Veen, 2019; Mönnig, 2008) The company produced more than 70 remedies for use by farmers and also exported products to several overseas countries. (Mönnig, 2008).

During Mönnig's lifetime, his contribution to research was acknowledged with many honours and distinctions: the Senior Captain Scott Medal of the South African Biological Society (1945); the Havenga Prize (1947) and the M.T. Steyn Prize (1971) of the South African Academy for Science and Arts; DSc (honoris causa) degrees by the University of Pretoria (1953) and the University of the Free State (1970); Fellowship of the American Association for the Advancement of Science, and in 2008 the University of Pretoria honoured him posthumously as one of their Leading Minds. (Bigalke & Van der Veen, 2019; Mönnig, 2008).

Reinhold Johannes Ortlepp (1894-1964)

Reinhold Ortlepp's specialty was taxonomy and the life cycles of Cestoda, Nematoda and Trematoda. (Penzhorn & Krecek, 1997; Verwoerd, 2019c).

He received a BA degree with distinction from the University of the Cape of Good Hope and was awarded a Victoria Bursary, which enabled him to obtain his MSc degree in Zoology at the University of Cape Town in 1917. (Verwoerd, 2019c).

During 1918 and 1919 he lectured in Zoology at the South African School of Mines and Technology (forerunner of the University of the Witwatersrand) and in 1920 he was appointed acting professor of Zoology at Rhodes University College. In 1921 he went to London and was appointed a Researcher at the Institute for Agricultural Parasitology. (Verwoerd, 2019c).

He concentrated on the study of helminths obtained from South African mammals, reptiles and amphibians in the London zoo and he discovered and described nine new species and became Honorary Helminthologist to the Zoological Society of London. He was awarded a PhD in Zoology (Helminthology) by the University of London in 1923 but stayed on in his research post at the Institute for Agricultural Parasitology until the end of 1927. (Verwoerd, 2019c).

Ortlepp returned to South Africa in 1928 and after a short spell of farming in Natal was appointed in 1930 as research officer at the Onderstepoort Veterinary Institute where he succeeded P.L. le Roux as researcher into helminths and where he remained for the rest of his career. He specialised in taxonomy and the life cycles of the Trematoda, Cestoda and Nematoda and during the next 3 decades he discovered and described 100 new helminth species. (Penzhorn & Krecek, 1997; Verwoerd, 2019c). He authored 70 scientific publications during his career.

In 1936 he was awarded a DSc degree by the University of London. After his retirement in 1954, he turned his attention more specifically to the internal parasites of wildlife. (Verwoerd, 2019c).

Ortlepp was a founding member of the Faculty of Science and Technology of the South African Academy for Science and Arts (1942) and in 1948 the Academy awarded him the Havenga Prize for biology. He became a member of the South African Association for the Advancement of Science in 1931 and was president of its Section D in 1943. After joining the South African Biological Society in 1936 he served as its president in 1940 and received its Senior Captain Scott Medal in 1962. He was also a member of the Scientific Advisory Board for National Parks; the Fauna and Flora Advisory Council of the Transvaal; the Bilharzia Research Committee of the

Council for Scientific and Industrial Research (CSIR) and the Scientific Section of the National Advisory Board for Education. He served on the Executive Committee of the Natal Agricultural Union from 1929 to 1931, and as president in 1931. During his career he acquired an extensive library which he bequeathed to the Section of Helminthology at Onderstepoort. (Verwoerd, 2019c).

Richard Karl Reinecke (1924-1993)

Richard Reinecke completed his BVSc degree at University of Pretoria in 1946 and his DVSc in 1959. In 1978, he obtained his MMedVet (Parasitology) degree at University Pretoria and in 1980 his DSc (Zoology) degree at the Potchefstroom University for Christian Higher Education. (Reinecke, 2008).

In 1947 he started a private veterinary practice and seven years later in 1953 he joined the Onderstepoort Veterinary Institute as a researcher and later headed the Helminthology Section. (Reinecke, 2008).

He was appointed as Senior Lecturer in the Department of Parasitology in the Faculty of Veterinary Science in 1961 and became Head of the Department of Parasitology at the Faculty of Veterinary Science in 1968. He held this position until his retirement in 1986. (Reinecke, 2008).

Reinecke's main research was the occurrence and distribution of internal parasites, especially nematodes, in various areas of South Africa. He also developed methods to diagnose infestations and a variety of anthelmintic tests, including a standardized nonparametric larval anthelmintic test between 1966 and 1972. This test was especially important when a number of new drugs came onto the market during the 1960s and in later years when animals developed a resistance to them. (Penzhorn & Krecek, 1997; Reinecke, 2008).

Throughout his career Prof. Reinecke kept close ties with national and international pharmaceutical companies involved in the development of new drugs and he was often consulted as an expert in his field. (Reinecke, 2008).

Reinecke was author or co-author of more than 90 scientific publications, including the textbook, *Veterinary Helminthology,* published in 1983. (Penzhorn & Krecek, 1997; Reinecke, 2008).

He received several awards for his research, including the Elsdon-Dew medal in 1991 from the Parasitological Association of Southern Africa (PARSA) in recognition of his research contributions. He was also the president of PARSA from 1975 to 1975. In 2008 he was posthumously honoured as one of the One Hundred Researchers by the University of Pretoria. (Reinecke, 2008).

Anna Johanna Maria Verster (1931-1994)

Anna Verster received her BSc (Honours in Zoology) in 1951 and her MSc in Zoology in 1955 at the University of the Orange Free State, and her PhD in Zoology at the University of South Africa (UNISA) in 1964. (Bigalke & Van Wyk, 1994; Verster 1980).

In 1952 she was a research assistant in the Department of Psychology, University of Orange Free State and from 1953 to 1955 she was a research assistant in the Department of Zoology at the same university. (Bigalke & Van Wyk, 1994; Verster 1980).

She accepted a research post in the Helminthology Section of the Onderstepoort Veterinary Institute as an Assistant Professional Officer in 1956; in 1959 she was promoted to Professional Officer, in 1963 she was promoted to Senior Professional Officer and from 1968 to 1980 she held the post of Chief Professional Officer. (Bigalke & Van Wyk, 1994; Verster 1980).

In 1967 she visited Switzerland as a Research Fellow of the Science Foundation of Switzerland and the Veterinary Faculty of Bern, Switzerland; the Veterinary Faculty, Wroclaw and the Polisk Academy of Sciences in Warsaw, Poland; the Zoological Museum in Copenhagen, Denmark; the British Museum of Natural History and London School of Hygiene and Tropical Medicine, London, England; Farbenfabriken Bayer A-G, Wuppertal-Elberfeld, Germany; Rÿksinstituut voor de Volksgezondheit, Utrecht, Netherlands; Museum National d'Histoire Naturelle, Paris, France, and the Veterinary School in Glasgow, Scotland, and she was also a Visiting Professor for post-graduates in Helminthology at the Universidado Federal Rural de Rio de Janeiro, Brazil in 1974 and undertook a study tour to Australia, Tasmania and New Zealand in 1977. (Verster, 1980).

From 1980 to 1984 she served as Deputy Director (on a personal salary scale) at the Onderstepoort Veterinary Institute, and in 1985 she was appointed Senior Lecturer at the Faculty of Veterinary Science of the University of Pretoria, and was soon promoted to full Professor (Parasitology), a post she held until ill health forced her to retire at the end of July 1994; she died on 1 September, barely a month later. (Bigalke & Van Wyk, 1994; Hadfield, 2009).

Prof. Verster's main research interest was Cestoda. She was the author and co-author of about 40 scientific publications and one textbook, *Teaching Veterinary Parasitology*. She also published a review of the *Echinococcus* with descriptions of one new species and one new subspecies in 1965. (Verster, 1965) Her taxonomic revision of the genus *Taenia*, published in 1969, with descriptions of one new species and one new subspecies, is regarded as a classic and is still in use. This study formed the basis of her PhD work at the University of South Africa. In 1976 she published her research on the use of irradiation for the sterilization of *Taenia cysticerci*. (Bigalke & Van Wyk, 1994; Hadfield, 2009; Penzhorn & Krecek, 1997). Her development in 1974 of a method of using the golden hamster as a definitive host for *Taenia solium* and *Taenia saginata* are highly regarded internationally. (Bigalke & Van Wyk, 1994).

Prof. Verster was a respected researcher with worldwide contacts: she was invited to deliver a plenary paper on *Veterinary Education* at the biennial congress of the World Association for the Advancement of Parasitology in Cambridge, UK, in August 1993. (Hadfield, 2009). She was awarded the Senior Captain Scott Medal of the South African Biological Society in the 1980s, and the Elsdon-Dew Medal of Parasitological Society of Southern Africa (PARSA) in 1992. (Bigalke & Van Wyk, 1994; Hadfield, 2009). Bain, Chabaud and Burger (1992) named a new genus of free-living archaic filariid in the abdominal cavities of ostriches after Anna Verster and in 1996 a new nematode species collected from the stomach of a black rhinoceros (*Diceronema versterae)* was named in her honour. (Gibbons, Knapp & Krecek, 1996).

Conclusion

These stalwarts were the mentors of the next generation of parasitologists, who even though retired, are still active in their field: Errol Nevill (Entomology); Banie Penzhorn (Wildlife Parasitology); Ivan Horak (Acarology & Helminthology); Arthur Spickett (Acarology); Jan van Wyk and Joop Boomker (Helminthology). Over the past three decades they have accumulated a wealth of data on the parasites of South African wildlife and domestic stock, their biology and control and in the course of a generation have created an established institution. They in turn have served as experienced and trusted advisers to a succeeding generation of parasitologists: Gert Venter and Karien Labuschagne (Entomology), Kerstin Junker (Helminthology) and Ben Mans and Deon Bakkes (Acarology).

Nowhere is it truer that “prevention is better than cure” than in the case of Parasitic Diseases. Rudolf Leuckar (1886): *The Parasites of Man, and the Diseases which Proceed from Them.*

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Available on request

The historical collections of the faculty of veterinary medicine in Munich: lost and hidden treasures

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Introduction

When the Munich Veterinary School was founded in 1790 by Professor Anton Will (Schäffer 1992, 183 and 196), essential instruments and equipment for training students were not available. Veterinary education lasted three years and included the subjects of animal exterior, botany, anatomy, physiology, surgery, surgery theory, pharmacology, general and special pathology and farriery (Hahn/Viandt 1890, 6). In the early years, the school did not prosper particularly. Therefore, on the 1st of February 1810, King Maximilian Joseph issued the so-called ‘organic edict’ to reorganize what became from then onwards the Central Veterinary School. Its staff was increased to three professors and new teaching subjects were introduced. Not only the theoretical lessons but also practical training was to be improved. Therefore, financial resources were made available each year to install and expand the following attributes: an anatomical theatre, a collection of anatomical and pathological specimens, a small botanical garden, a pharmaceutical lab, a pharmacy, a collection of books and instruments, an animal hospital and a well-equipped forge (Hahn/Viandt 1890, 19-20). In the middle of the 19th century, the curriculum was expanded further, and the teaching attributes were accordingly supplemented, for example by a library and a collection of scientific instruments. From 1852 onwards, students were allowed to visit the city's slaughterhouse regularly for meat inspection lessons. It was also agreed that the pathologically altered organs should be given to the school for teaching pathological anatomy and to prepare specimens for display in the collection (Hahn/Viandt 1890, 82). In 1890 the Munich Veterinary School received the status of a higher educational establishment, then named “Tierärztliche Hochschule”. A quarter of a century later it was integrated in the Ludwig-Maximilians-University as its seventh faculty. In the following presentation, the development of the collections is described based on examples in the context of the teaching and research of faculty personalities. (For a detailed description, see Goebel 2019, 191-237).

The collection of anatomical and pathological specimens: Two examples of lost treasures

Teaching anatomy and pathology was part of veterinary education from the very beginning, but when the Munich school opened, the most important instruments and equipment were missing. The founder and first professor of the veterinary school, Anton Will, was reputed for his anatomical skills and knowledge. From 1803 onwards, Will was supported by Konrad Ludwig Schwab, whose responsibilities included the teaching of anatomy after 1810 and the custody of the collections (Schwab 1831, preface). In the following years, Schwab continuously ordered and supplemented the collections. In the year 1815 the anatomical collection consisted of 45 items and the pathological collection of 150 objects (Jahrs-Bericht 1815, 13-16). Schwab complained that specimens were scarce, basically because the veterinary school suffered from a lack of patients in the early years and correspondingly few dissections were carried out. He owed numerous specimens to donors, some of them former students, but also institutions such as the Zoological Collection of the Royal Academy of Sciences, zoological gardens, civil and military veterinarians, the slaughterhouse, and also the knacker's yard. Thanks to his diligence, Schwab and his successors succeeded in continuously expanding the collections, so that by 1857, the pathological collection contained 1488 specimens (Postl 1857).

In 1863 the institutes of anatomy and pathology moved to a new building, where "the two best halls on the first floor" were determined for the anatomical-physiological collection and a third room for the pathological collection. In view of the move, the arrangement of the collection was presumably less of an issue, since a student from Bern visiting Munich in the autumn of 1868 noted that "the institute's collections [...] were extensive, but not everywhere ordered with a sufficient overview" (Hörning/Fankhauser 1982, 5). Under the direction of Johann Ludwig Franck, who was appointed professor in 1864, the anatomical collection was "systematically built up" (Walter 1963, 9). Among the additions were, for example, the skeletons of various local cattle breeds, a series of dog skulls, and the skeletons of two Arabian horses and an English half-breed from the Royal Court Stables. But also exotic animals including a giraffe, a crocodile, a tapir and a leopard were purchased. In addition, splanchnological, angiological, and histologic-embryological specimens were prepared. Under Franck's direction, microscopic preparations were increasingly produced for teaching histology. To demonstrate the central nervous system, not only the brains of all domestic animals were prepared with zinc chloride, but also microscopic section series of the *medulla oblongata* and wall charts showing these structures were bought (Jahresbericht 1883, 3).

The collection of animal specimens was supplemented by models made of wax and papier mâché. For example, the model of the horse's auditory canal or the five-part model of a horse eye was created under Franck's supervision. In addition, for teaching pathological histology a collection of microscopic slides was made starting in the mid-1870s. From 1874 onwards, a professorship in general pathology and pathological anatomy was established. Under the direction of Professor Theodor Kitt, who was appointed in 1886, the existing collection was reorganized and repaired. In addition, he enriched the collection not only by producing formalin fixed specimens but also coloured wall charts, watercolour paintings and statistical tables. Moreover, the number of specimens sent in had increased considerably within 60 years, so that the collection grew to 3000 objects in 1890 (Hahn/Viandt, 181).

Kitt also lectured in animal epidemiology. Therefore, the institute's holdings also included "a collection of pure cultures of the most important pathogenic and partly non-pathogenic microorganisms", which in 1890 numbered 70 (Hahn/Viandt 1890, 180). From time to time, prepared specimens containing parasites and infectious agents were also sent in from other countries, some of which were far away, illustrating Kitt's international contacts. For example, Dr. Theiler from Transvaal sent smear preparations with malaria pathogens from the horse as well as parts of the abomasum and intestine of cattle that suffered from cattle plague and a piece of horse-lung affected with African horse sickness (Bericht 1902, 39-57). The vivid presentation of transmissible diseases such as tuberculosis, foot-and-mouth disease or glanders seemed particularly important to Kitt. For this reason, he had "a collection of lifelike, colourful pictures, oil sketches and watercolours made for the teaching of pathological anatomy and epidemiology" and, as he underlined, "also made by himself in dilettantish work" (Kitt 1896, preface).

During Kitt's fifty-year term of office, the collection was supplemented with numerous novelties. However, the cramped conditions meant that the magnificent pieces were crowded together in chaos in which even Kitt himself felt no longer familiar. The special value of the collection is also evident from the fact that on several occasions, "particularly beautiful and instructive showpieces of the collection had been borrowed at the request of foreign exhibitions (St. Louis, Dresden hygiene exhibition)" (Kitt 1926, 144).

At the beginning of the 1920s, the economically tense situation of the state caused by the inflation years and the currency reform also became noticeable in the everyday life of the faculty, a situation lasting until the thirties. The budgets of the anatomical and pathological institutes were hardly sufficient for making new or maintaining existing specimens. Therefore, the collections were in a desolate state (UAM, VA, A-II-80, 9).

Shortly before the outbreak of World War II, most professors of the faculty were drafted, and the faculty was closed. Hit by bombs on several occasions, the buildings were largely destroyed, so that the collections built up over a century and a half were mostly lost, except for a few pieces. After the end of World War II, the chairs were occupied again, and the buildings newly constructed before the rebuilding of the collections could start in the sixties and seventies.

The hidden Treasures

In the course of time, many historical pieces were integrated in the Veterinary Medicine History Collections, currently supervised by the Institute of Paleoanatomy, Domestication Research and History of Veterinary Medicine. In addition to the Institute's own collection, which comprises approximately 3,000 objects and is continuously supplemented by donations from institutes and clinics as well as from private persons, there is a stock of approximately 10,000 veterinary instruments and objects dating to the 19th and 20th centuries which was bequeathed as a gift to the Munich Veterinary Faculty in 2011. Since 2007, the Edith Haberland-Wagner-Stiftung GmbH has made its collection of historical veterinary instruments, consisting of approximately 1,500 objects, available to us on temporary loan. Only a small part of latter collection, covering a period from antiquity to modern times, is currently exhibited at the Institute of Anatomy.

A second hidden treasure is a unique collection of plaster cast statuettes of horses, cattle, sheep, goats, pigs and small animals, which has been continuously expanded since the end of the 19th century and preserved until today. It comprises about 300 statuettes, made by different and quite famous German modelers. These objects were previously housed in the rooms of the Institute for Animal Breeding. They are currently being restored and will be put on permanent display once the new buildings of the Munich faculty in Oberschleißheim are completed.

Conclusion

Research into the lost and hidden treasures of the historical collections provides insights into the 230-year history of teaching at the veterinary faculty in Munich. Today, the collections no longer occupy the position in teaching and research they had enjoyed in earlier centuries, as new media and learning techniques have replaced the two- and three-dimensional objects. In the last decade, however, the value and scientific importance of university collections has been recognized, but financial support to maintain and display them is rarely provided. As shown with the historical examples, the establishment and maintenance of the collections included not only an academic but also a social component. Indeed, the collegial exchange by lending specimens or giving away surplus objects within the faculty as well as with external practitioners, international researchers and institutions clearly enriched existing collections, which is illustrated best by the specimens donated by Dr. Theiler. With a view to preserving these collections as a basis of scientific research for future generations of veterinarians, the inventory and digitalization of historical veterinary collections as well as the organization of national and international networks represents key challenges for the coming years.

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Preserving South Africa's veterinary history: a collaborative approach

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Introduction

The history of veterinary science and education in South Africa is embedded within the colonial history of South Africa and is essential to understand and appreciate its contribution to the well-being of the country. Observations on unknown animal diseases that occurred during this historical period in South Africa were documented into written descriptions like journal articles and theses and captured as photos and glass negatives. A vast collection of historical material is available through commercial publications, but it is often grey literature such as archival material, which is difficult to locate, that is crucial to complete the picture.

Development of veterinary science in South Africa

A major event in the history of veterinary science in South Africa was the arrival in 1891 of a Swiss-born veterinarian, Sir Arnold Theiler. The ravaging rinderpest epidemic of 1896 caused Theiler to be appointed the state veterinarian of the South African Republic and he converted a disused hides and skin disinfection station at Daspoort to a research institution and vaccine factory. Another remarkable piece of history is that the first South African to become a qualified veterinarian, was a Xhosa. Jotello Festiri Soga, at the age of 21 graduated at the University of Edinburgh. Upon his return to South Africa, he was involved in pioneering studies on toxic plants and assisted in the endeavour to eliminate rinderpest.

In 1908 Theiler established a new research facility at Onderstepoort which became the Agricultural Research Council's Onderstepoort Veterinary Institute. It was not until 1920 when Sir Arnold Theiler was appointed as Director of Veterinary Education and Research that the possibility of training veterinarians in South Africa became a reality. He was the first dean of veterinary science at "Onderstepoort" under the supervision of the then Transvaal University College. All veterinary degrees were awarded by the University of South Africa for veterinary graduates during this time.

Looking at the history one realised that veterinary historical items, documents and memorabilia were scattered through many institutions, committees and universities named above. Some items were also in private possession.

The start of the preservation journey for veterinary history in South Africa

In 2007 the UP veterinary library realised the importance of safeguarding the veterinary history of South Africa. The library started with a donation received, after the death of a former lecturer Prof Anna Verster, containing photos and other memorabilia of Sir Arnold Theiler. This donation was digitised and uploaded on the institutional repository, UPSpace. UPSpace is a trustworthy place where resources are indexed with metadata and persistent links to assist in preserving the collection for future generations.

As the history of veterinary science in South Africa mainly lies with both the Onderstepoort Veterinary Research campus of the Agricultural Research Council (previously known as the Onderstepoort Veterinary Institute) and the Faculty of Veterinary Science at the University of Pretoria (UP), the libraries of these two institutions realised the importance of closing a Memorandum of Agreement (MOA) to preserve these historical items. With the MOA any material that contributed to the history of veterinary science in South Africa, were to be digitised and preserved in the UPSpace repository as a collection, named the South African National Veterinary Repository (SANVR).

Negotiations with role players in both the Faculty and OVR to create a draft Memorandum of Agreement (MOA) commenced. The Veterinary History Committee, now known as the Veterinary History Society, consisting of members from UP, ARC and the South African Veterinary Association (SAVA), was also identified to contribute valuable material for addition to the SANVR.

The MOA highlighted the aim of the SANVR, the roles and responsibilities of the parties and the commitments and activities expected from each of the co-operatives. It was signed by the parties in 2012.

The start of the SANVR

One of the criteria to build a veterinary historical collection is to carefully select and evaluate the resources to be digitised and uploaded. One of the first resources to be uploaded to the SANVR, was the 6th Pan-African Conference Proceedings of 1929. Not only was this a valuable historical resource, but the chairman of the 1929 Pan-African Veterinary Conference, Petrus Johann du Toit, was an important South African veterinary scientist and the successor of Arnold Theiler as Director of Veterinary Services at Onderstepoort. Forty-three papers were delivered at this conference held in Pretoria, 1-17 August *1929 and some of the research findings were referenced numerously in later years.*

Another major addition to the SANVR in UPSpace was Frank Veglia's landmark article "The anatomy and life-history of Haemonchus contortus (Rud.)". He was an Italian veterinarian who joined the staff at the OVR in 1911 and was the first helminthologist. He was best known for his studies on the anatomy and development of wire worm (Haemonchus contortus) in sheep. The article was published in 1915 as part of the Director's report series mentioned hereafter. Use of this article relies heavily on the study of the artwork contained therein.

Possibly the most important source to be digitised and uploaded onto the SANVR was the Onderstepoort Journal of Veterinary Research and its predecessors, the Reports of the Government Veterinary Bacteriologist of the Transvaal, Reports of the Director of Veterinary Research, Reports of the Director of Veterinary Education and Research and Onderstepoort Journal of Veterinary Science and Animal Industry. This source contains original research information on animal diseases and their cures in South Africa since 1903. Worldwide interest in this research lead to the Jotello F Soga Library making these available in full text.

The Onderstepoort Journal of Veterinary Research, first published by the Transvaal Department of Agriculture as Reports of the Government Veterinary Bacteriologist of the Transvaal, started in 1903. Presently only 1902-3 and 1904-5 of the latter title are not uploaded to UPSpace as the original copies were lost. The 11th and 12th (part1) Reports of the Director of Veterinary Education and Research of 1926 still need to be uploaded. The source of originals used for digitisation was mostly the collection of the Jotello F Soga library. However, the OVR library kept apart from its shelf collection, duplicates throughout its existence that could be cut and mutilated when necessary. This was also of great help to complete the collection. The project took several years to complete and a total of 2403 articles are available in full text.

Another valuable collection in the SANVR is the veterinary biographies compiled by the Veterinary History Society. This project to gather information about veterinarians that played an important role in the veterinary history of South Africa was undertaken by the Veterinary History Society members. These biographies include information about the education and careers, scientific contributions and writings, homages and distinctions of veterinarians in South Africa. The value of these biographies can be measured by the role it plays in linking photos, journal articles and theses to a specific veterinarian's biography. For example the biography of Dr John Isaac Quin (known for his research on immunity against anthrax and geeldikkop and Lantana poisoning) can be linked to his full text thesis "Studies on anthrax immunity" available (with permission from UNISA) in the "Early Veterinary Theses – University of South Africa 1920-1950" collection. A photo of Dr Quin is available in the "Historic Glass Plate Collection" of the OVR while his journal articles can be retrieved in full text from the Onderstepoort Journal of Veterinary Science and Animal Industry in the SANVR collection. All these historical sources of John Isaac Quin are available in the UPSpace repository for easy access.

A valuable glass-plate collection about the early development of veterinary science and education in South Africa is in the possession of the OVR. Glass negatives were in common use between the 1880s and the late 1920s. As concerns were raised about the preservation and safeguarding of these glass-plate negatives it was decided in 2019 to digitise the collection. Currently it is in the process of being assigned metadata and uploaded to UPSpace. The subjects covered in this collection are the early developments at Onderstepoort, students and staff, other research stations like Allerton and Kaalplaas and buildings.

Further possibilities

Apart from the above-mentioned collections, there are still many similar collections available at the OVR that can be digitised.

The OVR has an archive, the most important component being the administrative correspondence and other documents of the OVR and its predecessors, 1919-1962. Sadly, all documents before 1919 were lost due to water and pest damage. After April 1962 all state documents were sent to the National Archives of South Africa. The abovementioned historians and others made good use of this archive and so much value can be added by digitising it.

The Journal of the South African Veterinary Association (JSAVA) was another valuable resource considered to be digitised for the SANVR. SABINET, the national library network who had its own digitisation project in the past, was referred by SAVA to the OVI to hear about the possibility of digitising the JSAVA. The full text archive is therefore available through the SABINET archive. Other journals like the Agricultural Journal of the Cape of Good Hope, also contains the earliest veterinary articles produced on South African soil and will be a good proposition to digitise.

Valuable old books, out of copyright and kept in the OVR library, can also be considered for digitisation.

What is in it for the veterinary librarians and their clients?

Veterinary librarians are frequently faced with requests to supply historical information for various commemorations, presentations and writings. With the centenary celebrations of the Faculty and SAVA this year, material preserved in the SANVR can contribute positively to enriching the timeline of the development of veterinary science and education in South Africa.

Starting in 1920, photos and digitised theses can be harvested from UPSpace about veterinary education at "Onderstepoort" under the supervision of the Transvaal University College. The first eight South African trained veterinarians qualified in 1924. A collection of these theses awarded by the University of South Africa from 1920-1950, is available in full text on UPSpace. The University of South Africa also kindly gave permission to digitise the signature of Sir Arnold Theiler in the UNISA Honorary doctorates graduation book of 1912, 1920 and 1925.

In 2009 a collection, "History of the Faculty of Veterinary Science" containing news articles and newsletters previously published on the Faculty of Veterinary Science web page was created in UPSpace. Important photos and information about the faculty are now preserved for future reference as web publishing does not guarantee a safe preservation environment.

Conclusion

As librarians and archivists with experience in working with software development, data practices and scholarly communication, we have taken up the responsibility of preserving the veterinary history of South Africa. When working in collaboration with other institutions and individuals we can avoid losing our wealth of historical veterinary information.

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Poster Session

Preliminary study of rabies prevalence in animals in Madrid during the Spanish civil war (1936-1939)

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The Spanish Civil War (1936-1939) was a turbulent period that provoked grievous consequences, especially in Madrid, the Spanish capital. Institutions suffered many damages and the Veterinary Profession also suffered this instability. From those years a wooden box containing histological samples, many of them for rabies diagnosis, has been preserved in the Complutense Veterinary Museum.

In this preliminary study we have consulted records from the former Veterinary School of Madrid, kept in the University Complutense Archive, in order to find some references and data related to rabies situation in Spain. Being an endemic disease in Europe, data obtained suggests that the highest prevalence was in canine population.

In Spain, 1938 was the year with the highest number of human victims of rabies. That year 97 people died in this country because of this viral infection. That same year 82 animals (dogs and cats) were analyzed in Madrid and 39 were positive to rabies infection. We have studied in maps the district of origin of these animals and maps of bombed areas and we have found that the less bombed districts reported more animals to the Anti-rabies Municipal Service.

Manzanares River and the belt of vegetation in the west of Madrid acted as natural barriers to the dissemination of stray canine population. Also, bombed districts were so devastated that forced the animals to leave these areas. We suggest that canine and feline populations were fenced in the west but there were three entrances to the city which could have been the north, east and south peripheral expansion districts. In the nearest districts to these areas were reported a high number of animals. In our study we highlight the factors that influence the spread of a zoonosis such as rabies and the difficulty of its veterinary control during a war period.

END

With gratitude to our sponsors

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A CENTURY OF SERVICE

The year 1920 was a special year in the history of veterinary science in South Africa and 2020 marks the 100th anniversary celebrations of both veterinary education through the Faculty of Veterinary Science, and a century of service to the profession nationally through the South African Veterinary Association (SAVA).

The history of the South African Veterinary Association starts with the inauguration of the Transvaal Veterinary Medical Association (TVMA) on 16 February 1903 in Johannesburg. At a TVMA meeting on 23 June 1910, with political Union looming, there was general agreement that a South African Veterinary Association should be formed of the TVMA, the Cape Veterinary Veterinary Medical Society and the Natal Veterinary Medical Association. However, it was only on 1 April 1920 that the South African Veterinary Association (SAVA) was officially inaugurated.

Over the years SAVA membership rose from the 79 in 1920 to 350 in 1953, 900 in 1978, 1400 in 1996 and currently exceeds 1650 members.

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