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Tropical Medicine and Animal Diseases: Onderstepoort and the Development of Veterinary Science in South Africa 1908–1950*

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Abstract

This article traces the development of agricultural science at the Onderstepoort Veterinary Institute, near Pretoria, from its founding in 1908 until the 1950s, by which time many enzootic and epizootic diseases had either been eradicated, or were largely controllable through various forms of prophylaxis. The Institute demonstrated the political and economic significance attributed to the pastoral industry in South Africa and the conviction that scientific discoveries could increase output. During this period, researchers explicated the aetiology and provenance of hitherto mysterious diseases such as lamsiekte, geeldikkop and African horsesickness. They developed vaccines, some of which were adopted internationally. The nature of their investigations showed that veterinary science increasingly entailed more than just progress in biomedical procedures. Ecological factors, in particular the nutritional state of the veld, became a priority from the 1920s onwards as veterinarians saw their function as promoting animal health as well as eliminating disease. Dealing with contagious infections also incorporated less welcome, and at times controversial, approaches to disease control. The imposition of pastoral regulations illustrated the expanding powers of the South African state, founded on presumptions of scientific legitimacy. The article also explores the contribution made by African communities and settler farmers to the institutionalisation of veterinary knowledge, as well as the role South African researchers played in the evolution of a colonial, as well as an increasingly international, scientific culture.

In January 1944, Petrus Johann du Toit, the South African Director of Veterinary Services, rejected a request from R. Parker of the United States Department of Health for strains of the heartwater *rickettsia* for which the Americans were hoping to devise and manufacture a vaccine. Du Toit refused on the grounds that 'Heartwater is an exclusively African disease and I am of opinion that the task of solving the many problems connected with this disease should in the first place devolve on African scientists'. Du Toit described how a small group of dedicated researchers at Onderstepoort were working flat out to find a preventive and a cure for this tick-borne disease that affected sheep and calves, despite the fact that South Africa did not have the economic resources to compete on equal terms with the United States. Defending the efforts of his team, du Toit bluntly stated:

I realize of course that a scientific problem can never be any one person's preserve; that competition and even duplication of work may sometimes be very desirable; and yet I feel that in this instance I ought to protect the men who have struggled against the odds and are beginning to see daylight in a very complicated problem, which is of immense economic importance to South Africa.¹

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Du Toit's letter is important because it says a great deal about internal perceptions of South African veterinary science in the mid-1940s. Du Toit was Director of Veterinary Services from 1927 until 1948, having succeeded the Swiss bacteriologist Arnold Theiler, who had played a key role in the founding of the Onderstepoort Veterinary Institute in 1908. Under the direction of both Theiler and du Toit, Onderstepoort Veterinary Institute contributed considerably to the growing international body of veterinary knowledge. Significant discoveries included the aetiology of the cattle disease *lamsiekte* in the 1920s as well as the invention of an effective vaccine against African horsesickness in the 1930s. By the late 1940s, South Africa was well on the way to eradicating two major scourges of the African continent: East Coast fever, transmitted to cattle primarily by the brown tick, and nagana, conveyed to cattle and other domestic animals by the tsetse fly. In Africa as a whole, Onderstepoort also led the way in toxicological research into poisonous plants. During the Second World War, South African virologists provided horsesickness vaccines for the British army fighting in Egypt and the Middle East and were instrumental in promoting the anti-rinderpest inoculation campaign in Tanganyika, successfully preventing the southward spread of this cattle epizootic. Du Toit was indeed proud of South Africa's contribution to veterinary science and its relative success in controlling a number of dangerous animal diseases. In his view, South Africa could and should solve its own epidemiological problems.²

Du Toit epitomised a new sense of national self-assurance that pervaded the scientific fraternity more generally. Saul Dubow has discussed this in relation to the changing attitudes amongst members of the South African Association for the Advancement of Science from the time of its founding in 1903 to the visit of their British counterparts in 1929. By the latter date South African scientists no longer saw their work as inferior or dependent upon an agenda or methodology set by the European metropole.³ South Africans had their own intellectual networks, peer-reviewed journals of international standing, of which the *Onderstepoort Journal* was one, as well as their own professional organisations.

In the veterinary context, the confidence of the 1940s can be contrasted with the deference to metropolitan knowledge demonstrated in 1902 when East Coast fever broke out in Southern Rhodesia and the Transvaal. This disease was new to the region and on this occasion the various southern African authorities asked the eminent German virologist, Robert Koch, to investigate. Paul Cranefield has discussed this encounter between established metropolitan scientists and those working in the colonies. Initially Koch mistakenly assumed that East Coast fever was a virulent form of another cattle disease, redwater, and like redwater was transmitted by the blue tick (*Boophilus decoloratus*). Cranefield argued that these assumptions undermined the convictions of several colonial veterinarians, who doubted Koch's conclusions, yet were hesitant about contesting his theories.⁴

However,, in many respects East Coast fever was the turning-point for South African veterinary science, both in terms of the confidence it ultimately imparted to its scientists and in the credibility it gave them in the eyes of the public and the state. At Elands River Valley and Daspoort in the Transvaal, as well as at the Rosebank laboratories near Cape Town, Arnold Theiler and the Cape's American entomologist, Charles Lounsbury, came to different conclusions to Koch, and published their findings in 1903–04. Theiler discovered East Coast fever was not redwater but a disease caused by a different protozoan (single cell organism) that came to be known as *Theileria parva*. Lounsbury meanwhile proved that the brown tick (*Rhipicephalus appendiculatus*) was the primary vector, not the blue tick. Lounsbury's findings received international attention, being published in his home country by the American Association of Economic Entomologists, whilst the classification *Theileria parva*, granted by the metropolitan establishment, reflects the pre-eminence given to Theiler

as the recognised identifier of the offending organism.⁵ Advances in the understanding, if not the immediate eradication of East Coast fever, affirmed the importance of veterinary science as an economic pillar of the South African state and provided a justifiable basis for funding the construction of the Onderstepoort laboratories. With Union in 1910, Onderstepoort became the centre for South African veterinary research.

By 1910 South Africa had already obtained some recognition for its research in other parts of the continent. Invited as an adviser to British as well as German East Africa in 1909, Theiler described how the veterinary authorities in both colonies had adopted the South African practice of trying to tackle East Coast fever by clearing the veld of all cattle for at least a year, thereby denying the ticks their blood feed. Although scientists later revised this advice, the idea of clean veld, which resonated with the Victorian sanitationist approach towards improving human health, constituted the latest in veterinary thinking, based as it was on entomological investigations into the life-cycle of the brown tick. Theiler's visit suggests that scientists working in other African colonies no longer automatically looked to Europe for its expertise. South Africa had become an important centre in what Roy MacLeod has described as the 'moving metropolis' of knowledge generation. Western scientific methodologies could ultimately be developed and adapted as much at the colonial periphery as at the metropole, and the colonies themselves played a significant role in the expansion of an imperial, and indeed an increasingly global, scientific culture.⁶

The rest of this article explores several key themes that relate to the agricultural history of South Africa, as well as to debates in the history of science and medicine. It argues that veterinary science played an important role in the development of the livestock economy in South Africa. Second only to gold mining, rural products generated the largest amount of export revenue, with wool constituting the prime pastoral commodity throughout the first half of the twentieth century. The expansion of mining compounds, together with the rapid urbanisation that accompanied the manufacturing boom from the 1930s onwards, generated a growing demand for cheap meat and dairy products. The article also traces the development of veterinary research and analyses the scientific and economic reasons behind specific shifts in investigative priorities. It shows that, despite the growing understanding of the role played by germs in causing epizootics, the environment in terms of climate, the veld and its broader ecology, were key components of South Africa's disease landscape. Given that insects and ticks were responsible for transmitting a large number of diseases, scientifically South Africa fell under the generalised remit of 'tropical' medicine. The article also highlights the importance of the local disease environment in contributing to the expansion of an international body of veterinary and ecological knowledge. Work on indigenous plants, such as *Vangueria pygmaea*, a species apparently unique to South Africa and the cause of *gousiekte* toxicosis, demonstrates a very specific focus that contrasts with studies into continent-wide diseases such as horsesickness or global problems such as botulism (*lamsiekte*). The security of South Africa's livestock industry also depended upon effective veterinary controls in neighbouring states to contain diseases such as rinderpest and nagana. The paper concludes by arguing that Onderstepoort made an important contribution to veterinary research with a relevance that extended far beyond the Limpopo.

The Founding of Onderstepoort: South African Veterinary Science in Historical Context

We are building a laboratory sufficiently large, not only for the requirements of this Colony, but also for the study of these great problems of South Africa, not only for the present time, but also with a view to the requirements of the future.⁷

Arnold Theiler believed it was the responsibility of the state to provide veterinary services and carry out research into livestock diseases that undermined the Transvaal and later the South African economy.⁸ His ideas found favour with the British government, which had taken over the former South African Republic, as well as the Orange Free State, during the South African War (1899–1902). The governor, Alfred Milner, who oversaw the early years of reconstruction, was determined to make the Transvaal a prosperous colony by promoting gold mining on the Witwatersrand, as well as increasing agricultural production, primarily by white, and preferably British, settler farmers. Milner believed in the imperial ideal that the Empire should pay for itself. Like Joseph Chamberlain, he was committed to the notion of ‘constructive imperialism’ by which modern science, as well as professional bureaucracies, should promote economic growth. In 1903, Milner established the Transvaal’s first Department of Agriculture with the support of progressive commercial farmers and leading Afrikaner politicians such as Louis Botha and Jan Smuts. Improving the livestock economy in order to provide cheap food for the Rand as well as the cities was integral to this policy. These events mirrored the scientific and administrative approach to rural development, which had already started in the Cape with the appointment of the Colony’s first state veterinarian in 1876 and the establishment of a Department of Agriculture eleven years later.⁹

After 1910, the quest for nutritional self-sufficiency, as well as an increase in export revenues from primary products, remained a strong political ideal. Self-consciously progressive white commercial farmers were politically influential and, through organisations such as the Agricultural Union, they collectively put pressure on the state to finance research that would overcome environmental barriers to improved production.¹⁰ The Department of Agriculture sponsored a variety of research programmes that looked into such issues as the development of dryland farming, the cultivation of better varieties of seeds and grasses, as well as the elimination of injurious crop pests. Nonetheless, the Veterinary Department received the largest share of state grants, which reflected not only the economic importance attributed to the livestock industry but also the high cost involved in developing this branch of science. Many animal diseases in South Africa were unknown in Europe and, given the lack of research facilities available elsewhere in Africa at the turn of the twentieth century, South Africa-based scientists often had to investigate mysterious infections from scratch. The large distances between many farms, as well as the poverty of many farmers, militated against the emergence of a private veterinary service until the 1940s. Nor were there any pharmaceutical companies in South Africa with the capital or will to invest in inoculation and drug research. Thus, in a bid to increase pastoral yields, the state bore the cost of discovering remedies and prophylaxis, as well as enforcing regulations aimed at preventing the spread of contagious diseases.

Leading veterinarians justified this public spending by pointing to their contribution to the national economy. In 1928, for instance, Petrus du Toit argued that the €90,000 spent each year on research facilities and staffing at Onderstepoort, as well as the €300,000 needed for veterinary regulation and fieldwork, had been of immense value to the country, having saved millions of pounds worth of livestock.¹¹ Between 1904 and 1929 the cattle population increased from a low of 3,500,000, in the wake of rinderpest, to 10,500,000 head, whilst the number of sheep rose from around 16,000,000 to 45,000,000 over the same period. Wool exports grew from 165,000,000 lb in 1915 to 287,000,000 lb by 1929.¹² Du Toit also claimed that because South Africa had a harsh environment and a hot climate, diseases were much harder to tackle than in the temperate north, thereby providing an ecological dimension in his defence of veterinary spending.¹³

At times du Toit and some of his colleagues, in particular Philip Viljoen (who was Secretary for Agriculture 1931–45), tried to boost their case by giving some support for political

positions that advocated racial differentiation in the allocation of land and veterinary resources. Although there is no direct evidence to suggest that the Veterinary Department actively endorsed the 1913 Land Act and the dispossession of Africans that this entailed, du Toit did express the belief that science could open up new lands to white settlement as exemplified in the expansion of a 'beef frontier' in the Western Transvaal as well as in the land grants to ex-soldiers in tsetse-stricken Zululand after the First World War. Du Toit was confident that veterinary science would ultimately eliminate disease, whilst the construction of boreholes and veld reclamation schemes could generate more productive pastures.¹⁴ Philip Viljoen meanwhile took on board the political issue of Afrikaner 'poor whiteism' and specifically linked scientific advances with the alleviation of poverty.¹⁵ Viljoen played an important role in drawing up the 1937 Marketing Act, intended to secure retail outlets and improve prices for settler farmers.¹⁶

In defending the €90,000 spent on the Onderstepoort Veterinary Institute by the late 1920s du Toit was also reflecting upon the expanding nature of veterinary research, which was to continue throughout the first half of the twentieth century. In 1906 the Transvaal Government had bought the land at Onderstepoort, north of Pretoria, for €1,500. Theiler chose this location because of its proximity to the capital, its large acreage and its good rail networks. Environment played a role too: Onderstepoort lay in the heart of the Transvaal bushveld where horsesickness was rife and poisonous plants plentiful. The Institute's designers constructed three specialised laboratories for bacteriology, pathology and zoology, all equipped with the latest technical apparatus. Over the years they added new buildings, revealing a growing diversity in veterinary research. In this respect the increasing specialisation of individual scientists is very striking. In the early years, practitioners such as Theiler and Herbert Curson explored a variety of veterinary problems, such as vaccine manufacture as well as the bionomics of ticks and tsetse flies, veld deficiencies and poisonous plants. By the 1930s, however, each researcher focused much more on a particular area of expertise. Toxicology, biochemistry, parasitology and sex physiology emerged as sub-departments, and 'germ research' was divided into virology, bacteriology and protozoology. By 1958 only 38 out of the 66 researchers at Onderstepoort had had veterinary training. Although infectious diseases continued to receive the most attention, biochemistry was the largest single department, analysing the nutritional value of grasses and mineral supplements.¹⁷

These developments illustrated more than just growing scientific complexities. The timing of particular specialisations was also linked to changing patterns of disease incidence as well as to new technological opportunities. At the turn of the twentieth century and before the founding of Onderstepoort, veterinarians prioritised two highly fatal bovine epizootics, rinderpest and East Coast fever. By 1905, rinderpest had been practically eliminated through vaccination and strict quarantines.¹⁸ East Coast fever was still a problem and illegal stock movements brought the disease into the Transkei in 1910. Gradually, however, the situation stabilised. The disease remained confined to the Transvaal, Natal and the Transkei as regulations on stock movements and regular cattle dipping contained the infection to some degree and prevented the recurrence of widespread mass outbreaks. By 1910, vaccines were available for a number of enzootic diseases such as lungsickness and redwater in cattle, as well as bluetongue in sheep, all of which had caused considerable losses in the past. In comparative terms the second decade of the twentieth century was quiet on the disease front. There were no major epizootics to contend with, enabling researchers to investigate diseases that were not necessarily fatal but rather undermined the economic potential of the livestock industry. From around 1912 to 1930 there was a marked shift from an emphasis on germs and immunological research, executed in the laboratory, to an emphasis on the veld as the site of infection and malnutrition.

This shift to the field indicated a more environmental approach to understanding sickness as researchers sought not only pathogenic ‘germs’, but also analysed the wider world in which they functioned. The distribution of game and insect vectors, as well as the composition of the veld, were identified as significant contributors to the spread and development of a number of diseases. One example of this intellectual shift can be clearly seen in relation to *lamsiekte*, which Theiler began to investigate in 1912 in response to pressure from farmers in the potentially productive cattle-rearing district of Griqualand West. The condition was characterised by varying degrees of paralysis, often followed by sudden death. Field experiments at Armoedsvlakte Farm, near Vryburg, dominated research in the 1910s and revealed that *lamsiekte* was a form of botulism, acquired by gnawing carrion scattered around the veld. Cattle chewed the bones because of a condition known as pica, caused by a phosphorous deficiency in the soil and hence in the vegetation.¹⁹

Once Theiler and his team had identified a link between phosphorous deficiency and susceptibility to *lamsiekte*, pedological and dietary investigations became important areas of research and provided a new dimension to the role of the veterinary scientist. For Petrus du Toit his profession went beyond curing or preventing disease:

The chief aim of this Division is to maintain the health of our livestock. We emphasise the word health, because we wish to dispel the idea that the Veterinary Division is concerned only with the diseases of animals. Disease is the negation of health; and our endeavour is to prevent disease and to assist our farmers to maintain their animals in good health and condition.²⁰

Veterinarians had recommended the use of bone-meal in phosphorous deficient areas from the late nineteenth century, but subsequent research showed its properties also helped increase milk yields, promote weight gain and enhance reproductive performance. From the 1920s, biochemists analysed other supplements, including minerals such as salt and sulphur, as well as organic products such as fishmeal.²¹ Further veld research involved liaison with the Botany/Plant Pathology Department, headed by Illyd Pole Evans, and in the 1930s with Heinrich du Toit’s Extension Division. Veld investigations led to the decentralisation of research from Onderstepoort to various field stations, located in different vegetative environments throughout the country. One of the most important was Fauresmith in the Orange Free State. Here the Swiss botanist Marguerite Henrici, one of the few women employed by the state at this time, combined research into the nutritive qualities of Karoo veld with investigations into poisonous plants and animal health.²²

Toxicology came to the fore in the 1930s and combined ecological with chemical disciplines in an attempt to understand the cause of several important non-infectious diseases. In the past, Theiler and others had carried out drenching experiments, in which animals were force-fed plants suspected of being toxic. It was research at a crude level, based on observation of cause and effect, with the Botany Department identifying the noxious plant. Advances in technology and chemical processing meant that by the 1930s researchers could analyse material at the molecular rather than just the microscopic level. Toxicologists managed to isolate the toxic principle of various poisonous plants whilst physiologists looked at the anatomical effects of toxicosis. John Quin and Claude Rimington, for instance, explicated how *Tribulus terrestris* brought on the symptoms of *geeldikkop*. This was a particularly nasty disease involving severe liver damage, photosensitivity and facial disfigurement, and caused the death of thousands of sheep in the Karoo each year.²³ Unfortunately these discoveries did not result in any effective cures due to the prohibitive cost of constant reapplications, the rapidity of death in some cases, as well as limitations in pharmacological knowledge. Identification of toxic plants did however feed into broader policies of weed eradication. William Beinart has discussed the government efforts in the 1930s to eradicate

jointed cactus and the spiky variety of prickly pear (*doornblad*), but the state also invested money in uprooting dangerous plants such as *gifblaar*.²⁴

Starting from the 1920s, fauna as well as flora became a focal point of research as scientists explored the relationship between game and the existence of enzootic diseases, such as nagana in Zululand. The bacteriologist, David Bruce, had proved a link between nagana, game and tsetse flies in the 1890s (discussed below), but a decline in incidence after the rinderpest epizootic (1896–7), which killed many cattle and faunal carriers, stalled further investigations for over twenty years. An increase in cases following the establishment of settlements, such as that at Ntambanana for ex-soldiers after the First World War, generated new enquiries, however. The political construction of nagana was different from that pertaining to some other animal diseases, because it was directly linked to the future viability of white settlement. Veterinarians dealt with contagious and highly fatal infections, such as rinderpest and East Coast fever, as national catastrophes, and the rhetoric and procedures focused on saving the national, as opposed to just the settler, herd. In the case of nagana, however, incidence was due to environmental factors rather than direct contagion, and for the next three decades, the immediate catalyst for particular research initiatives was always the plight of white farmers. In 1925, Petrus du Toit specifically linked the development of Zululand as a ‘white man’s country’ with the ability to deal with the fly.²⁵

Research into nagana recommenced in 1921 when Herbert Curson and Robert Harris from the Veterinary and Entomology Departments respectively, investigated the extent of trypanosome presence in game.²⁶ Both found the parasites in the blood of various species and their findings came to have political, as well as veterinary, implications. Some entomologists and veterinarians became embroiled in acrimonious debates with conservationists over the existence of the Umfolozi-Hluhluwe and the Mkuzi Game reserves in Zululand and the founding of the Kruger Park in the Transvaal lowveld in 1926. The entomologist, Claude Fuller, who investigated the disappearance of the tsetse species, *Glossina morsitans*, from the lowveld following the 1896–97 rinderpest epizootic, was adamant that the creation of the Kruger Park would create a conduit of disease, enabling the reintroduction of this fly from Southern Rhodesia and Portuguese East Africa where it was still prevalent. Fuller had the support of leading veterinarians including Arnold Theiler and Petrus du Toit.²⁷ Du Toit argued in respect of the Zululand reserves, that game should not be maintained in the proximity of human settlement.²⁸ The survival of all these game reserves, however, revealed political support for the conservationist cause and the belief that fauna should be protected as an economic and cultural asset. It also highlighted contradictions in government policy over land use and illustrated some limits to the political influence of South Africa’s scientific elite even when wildlife threatened the profits of white settlers.

Nagana research continued into the 1930s alongside a revival in immunological investigations, brought about by international developments in vaccine manufacture, rather than the arrival of an unfamiliar and dangerous epizootic. Of particular significance was Raymond Alexander’s invention of an inoculation against horsesickness in 1934. Alexander copied a technique pioneered by Max Theiler (son of Arnold) who had devised a yellow fever vaccine, attenuating the virus by passage through the brains of mice.²⁹ Theiler worked at the Rockefeller Institute in the United States, indicating the importance of personal connections in the creation of scientific networks and the growing influence of American-led biomedical research. Alexander’s neurotropic vaccine was effective and opened up new areas of the country to horse breeding, namely in the Transvaal lowveld and the littoral regions of Natal and the Eastern Cape. Other technical innovations from abroad, in particular the invention of pesticides such as DDT by Swiss scientists during the Second World War, provided new opportunities for disease control. In a bid to intensify cattle

production in Zululand, the veterinary entomologist, René du Toit, worked with the South African air force and perfected methods of disseminating DDT as a gas through the exhausts of planes, thereby eradicating the primary tsetse species, *Glossina pallidipes*, from the region by 1953.³⁰

Technological developments emanating both from within South Africa and outside were therefore important determinants in identifying why certain aspects of research or disease control were adopted at particular points in time. To this can be added pressure from farmers themselves; for example, in relation to the *lamsiekte* investigations. Although South African politics placed economic emphasis on the expansion of settler agriculture, Africans, too, benefited from veterinary developments. Evidently the health of settler livestock depended on disease eradication amongst animals kept by African tenants, as well as in the neighbouring African reserves. Even so, Petrus du Toit also argued that the benefits of veterinary medicine had to be made available and affordable to all, and that Africans, as well as settlers, should have the opportunity to make a viable living from the land.³¹

Nevertheless, at times there was a clear differentiation in the allocation of veterinary services, as the timing of the nagana research demonstrated. But this was not always the case and Africans were not necessarily excluded from access to biomedical advances. In the case of East Coast fever, for instance, the Transkei became a field laboratory in 1912 for testing out a vaccine designed in Onderstepoort, and over 159,000 animals were inoculated during that year. In parts of the Transvaal and Natal, East Coast fever had already resulted in a 95 per cent mortality rate amongst some herds, whilst this inoculation, although badly flawed, could save approximately 35 per cent of bovines exposed to infection.³² On the one hand this showed that veterinary researchers were prepared to take risks with African cattle, which they were less willing to take with settler herds due to potential compensation claims. On the other hand, however, when faced with the reality of the epizootic, many Africans wanted the vaccine in the hope of saving at least some of their animals, as a result of which the Veterinary Department was unable to cope with demand.³³ On this occasion it was Africans who benefited, however imperfectly, from new technology. Farmers in other parts of the country were not provided with this vaccine and, by law at least, were banned from experimenting with inoculations lest this set up new centres of infection.³⁴ The willingness of some Transkei pastoralists to accept this procedure, despite the risks, showed a certain receptiveness towards vaccination, which can be contrasted with the sometimes bitter encounters between cattle owners and stock inspectors, responsible for enforcing veterinary regulations.³⁵

Many farmers, both African and settler, disliked regulations and wanted vaccines to tackle all dangerous livestock diseases because they saw them as the least intrusive and most effective form of prophylaxis. In 1908, there were only two bacterial and four viral inoculations on the market. By 1958, Onderstepoort manufactured ten bacterial, seven viral, two rickettsial and one protozoal vaccine. The number of doses issued in 1908 amounted to less than 400,000. In 1958, sales surpassed 55,000,000, suggesting that many farmers were using this treatment on their animals.³⁶ Unfortunately, scientists were unable to design inoculations for many serious tick-borne diseases, as well as nagana, and Onderstepoort had to withdraw the disappointing East Coast fever vaccine. Immunology had therefore failed to provide a universal method of disease control and in the absence of biomedical solutions the state resorted to an array of veterinary directives, including obligatory stock dipping, local quarantines and restrictions on animal movements. The state imposed these measures on African and settler communities alike, and complaints came from all sectors of rural society. Dipping, in particular, was unpopular because it was costly, time consuming and also represented an unwelcome state intervention into the management of livestock. In East Coast fever areas, where dipping was compulsory, veterinarians recommended immersing

stock every three to five days to combat the brown tick. In the Transkei this provoked localised unrest in 1914, and Africans, not only in the Eastern Cape, remained divided over the issue. In 1923, for instance, some magistrates in Zululand reported that many people believed dipping had saved animals in a region subject to both East Coast fever and redwater. Others, however, emphasised African hostility, primarily because the inability to move cattle without cleansing impeded transhumance, stock sales, transport riding and the transfer of *lobola* (bridewealth) payments, all of which exacerbated poverty. Herding cattle to communal dipping tanks was also especially onerous for women whose husbands were absent at the mines.³⁷ The imposition of veterinary regulations, in the wake of extensive male migrancy, therefore also had important social impacts and began to erode the traditional taboos against females handling cattle whilst increasing the labour burden designated to women.

It was not until 1955 that Onderstepoort could declare South Africa free of East Coast fever.³⁸ By this time mortality from many other diseases had also declined and stock numbers had grown. Between 1911 and 1955, cattle numbers doubled from 5,796,949 to 11,689,475, whilst those of sheep rose from 30,656,659 to 37,042,504.³⁹ Yet the benefits of veterinary medicine were not without their contradictions, as scientific advances could potentially reduce rather than enhance the productivity of the livestock industry. Disease control facilitated overstocking and thus overgrazing, thereby giving rise to erosion and the propagation of more resilient, but often less nutritious and potentially more toxic, wild plants. Optimising livestock yields was predicated not just upon biomedicine but also upon a more ecologically conscious approach to veld management. Veterinarians were often critical of overstocking by both African communities and settler farmers.⁴⁰ The toxicologist, Douw Steyn, for instance, advised farmers that overgrazing was the principal reason for the increase in mortality through plant poisoning. With the suppression of epizootics, plant poisoning, together with wireworm infestation, led to more fatalities than any other cause.⁴¹ Along with their colleagues in the Botany and Extension Divisions, veterinarians saw rotational grazing, in conjunction with fodder cultivation and the digging of boreholes to supply fresh as opposed to stagnant water, as vital for the development of a sound pastoral economy. Veterinary science alone could not achieve that end.

The 'South Africanisation' of Veterinary Research

The expansion of veterinary medicine was an important illustration of how applied science and technology could enhance pastoral output. At the same time, it also demonstrated a cultural value attributed to science as a means by which South Africa could promote itself as a modernising state during the first part of the twentieth century. The link between colonial science and national identity has attracted the attention of a number of historians exploring the evolution of scientific institutions, networks and practices beyond the metropole. Jan Todd, for instance, has used the development of the anthrax vaccine to illustrate how local farmers, as well as scientists, have played a key role in adapting European science to suit a colonial, in this case the Australian, disease environment. Others, such as Saul Dubow, have written about the indigenisation of knowledge systems and suggested that the creation of a professional scientific elite was an important component in the construction of a white Anglo-Afrikaner 'South Africanist' identity. These approaches, together with Roy MacLeod's concept of a 'moving metropolis', help inform some aspects of the development of veterinary science in South Africa.⁴² This section of the article explores how Onderstepoort epitomised the transferral and modification of western learning to meet the demands of the South African colonial periphery. It also illustrates the significance of local factors, in particular the voice of farmers and the nature of the environment, in the expansion of South African and, as a corollary, international veterinary knowledge. Some scientists

also attributed a cultural value to South Africa's disease landscape that formed part of a constructed national identity.

The introduction of western biomedicine to South Africa demonstrated the failure of folk or indigenous medicine, often based on herbal concoctions laced with caffeine and Cape *dop*, to eliminate disease and promote sufficient growth in the livestock population, at least in the eyes of the capitalist and progressively minded rural elite. In the Cape and Natal, farmers successfully lobbied the state for the appointment of European-trained veterinarians in the 1870s. For the next 50 years many of South Africa's veterinary scientists came from Europe, in particular Britain, Ireland, Switzerland and Germany. After Union, South Africans such as Petrus du Toit, Philip Viljoen and Douw Steyn went to Europe to study. Berlin was particularly popular for tropical medicine; Vienna for toxicology. Continued links with the metropole ensured the flow of European (as opposed to simply British) science to the southern hemisphere.

Practitioners such as Arnold Theiler, however, were not happy with this state of affairs. Theiler demanded the indigenisation of veterinary education through the founding of a university faculty at Onderstepoort. He clearly revealed his motives for this in remarks made about an anonymous visiting researcher at Onderstepoort in the 1910s, when

I realised once again how much the oversea [sic] veterinarian is out of touch with our problems, and although they may have a thorough grip of veterinary science as applicable to their own country, it sometimes seems to me almost hopeless when I realise how little they know about our own conditions. There is no doubt about it that we have our own veterinary science, and in this respect South Africa is undoubtedly unique.⁴³

In 1920 the government established Africa's first veterinary faculty, affiliated to the University of Pretoria. This once again emphasised the importance of the livestock industry to the South African economy and the influence veterinary scientists could have over state policy. It also resonated with a process that in 1929 Jan Hofmeyr termed the 'South Africanisation' of science. South Africans, as opposed to foreign experts, were now working on local problems with the result that '[s]cience in South Africa. . .has made itself truly South African'.⁴⁴

The first cohort of South African veterinary students arrived at Onderstepoort in 1921. Given that much of the medical literature at the time was written in French and German, students had to be proficient in one or both of those languages, as well as fluent in English and Afrikaans. The course lasted five years and included a wide range of veterinary subjects, as well as topics more specifically suited to South African conditions, such as parasitology, which dealt with worms (helminths) and external parasites such as ticks. Gradually researchers at Onderstepoort began to publish standard textbooks reflecting the localisation of veterinary literature and the declining dependence on publications from overseas. Hermann Mönnig compiled South Africa's first book on helminthology in 1934, whilst Douw Steyn's work on poisonous plants remained the principal point of reference for toxicology until the 1980s.⁴⁵

Reflecting the gendered and racial divisions of labour of the day, most of the people who trained and researched at Onderstepoort were white males. By the late 1940s however, women began to appear, albeit in minuscule numbers. In 1948, three out of the 61 researchers on the Onderstepoort staff list were female.⁴⁶ Africans worked at the laboratories and participated in field experiments as assistants. There was no move to train African veterinarians, although some of the research staff did not appear to have been averse to that idea. In 1926, the Transkei Territories Native Council asked Theiler whether he was

prepared to admit black students. Theiler to some extent avoided the question by stating that that was a political issue but from his personal perspective, he did 'not see how the native can be rightfully prevented from qualifying'.⁴⁷ Several years later, when field staff were questioned about what could be done to improve the service, J.J. Keppel, working in Cape Town, argued that the state had to train African veterinarians and provide them with the opportunity to obtain degrees so that they could practise in the reserves.⁴⁸ Whether Keppel believed African veterinarians should be excluded from treating settler livestock was not made clear, but his comments problematised the racial agenda by indicating that some scientists did not regard their discipline as the preserve of a white male elite and believed that the indigenisation of the veterinary service should include Africans, too.

The 'South Africanisation' of science involved more than the training of experts. It also entailed interaction with farming communities. Farmers and herders had first-hand experience of the environmental factors that undermined livestock rearing. They could therefore contribute ideas about possible lines of research whilst their agricultural methods provided models that could be scientifically assessed as poor or sustainable husbandry practices. Many diseases, especially those conveyed by arthropods or those that emanated from deficiencies in the veld, were not the same as those found in Europe, thereby enabling farmers to play a pivotal role in the expansion of South Africa's veterinary knowledge. Khoisan and Xhosa herders, for instance, postulated a link between the '*nenta*' plant and *krimpsiekte* in goats.⁴⁹ Farmers also provided vital information regarding the distribution of ticks and brought to entomological attention new species for identification. Entomologists believed that an understanding of the anatomy, the lifecycle and the habitat of arthropods was fundamental to their control or eradication. Literate and enterprising farmers, in turn, used this knowledge to devise their own practical means of combating these pests. In the first decade of the twentieth century, Joseph Baynes from Nels Rust in Natal, worked with the bacteriologist, Herbert Watkins-Pitchford, and put Lounsbury's analysis of the lifecycle of the brown tick to practical use by producing a three-day arsenical dip to cleanse his stock. Veterinarians later introduced this method to East Coast fever areas.⁵⁰ The expansion of veterinary knowledge and the refinement of methods of disease control therefore involved a two-way interaction between scientists and farmers.

African observations of the natural environment and the way that it could be manipulated were also important in relation to the way South African veterinarians, as well as other colonial authorities, would deal with nagana. Statements by officials and European travellers indicated that the Zulu had a clear understanding of the disease, which pre-dated David Bruce's reports first published in 1895. In 1891, the Resident Commissioner of Natal, F. Cardew reported that: 'The natives assert that the disease is caused by cattle when grazing where big game abound eating the saliva of the latter left on the herbage'.⁵¹ The British traveller, E.C. Buxton, also noted that '[t]he belief of the natives in the dangerous character of the fly is universal'.⁵² When Bruce detected trypanosomes in animals ailing from nagana, as well as in the blood of various species of game, he provided a bacteriological corroboration of Zulu ideas about a faunal link and he also proved that tsetse flies transmitted the disease.⁵³ Bruce's reports demonstrated an interrelationship between indigenous knowledge emanating from the colonial periphery and founded on close observation of the local environment and western biomedical systems sponsored by the European metropole: in this instance each informed and consolidated the other.

Almost 30 years later, Herbert Curson commented positively on how the Zulu used their understanding of the cause of nagana to protect their cattle from tsetse flies by periodic game slaughter, veld burning and by cultivating along river banks, thereby removing the dense thickets favoured by *Glossina pallidipes*. Settler farmers, however, failed to clear the bush properly and they overstocked their farms, giving rise to denser secondary vegetation,

which forced animals to graze on more marginal and fly-infested grasses, especially in dry seasons.⁵⁴ Curson's report indicated a sensitivity to and appreciation of African methods of farming, which is particularly interesting because much of the historical analysis has focused on those cases where scientists criticised African farming as wasteful and environmentally destructive.⁵⁵ For Curson, however, whites, not blacks, were responsible for propagating disease by misusing the environment.

With colonialism, however, Africans lost some of their ability to manage their surroundings and tackle diseases such as nagana on their own terms. In particular, the introduction of restrictions on hunting, as well as the founding of game reserves in Natal, during the 1890s prevented Africans from removing wildlife at will. As already discussed, however, the presence of nagana meant conservation was a problematic issue in Zululand and, despite opposition from the wildlife lobbies, the Veterinary Department was able to copy Zulu precedents by organising game drives and slaughter campaigns periodically from the 1920s onwards.⁵⁶ By the 1940s, scientists also tacitly endorsed Zulu methods of bush clearance as they used bulldozers and chains to clear vegetation from identified tsetse breeding sites, riverbanks and pathways frequented by game.⁵⁷ Researchers at Onderstepoort therefore learnt much from African experiences, which were especially important in dealing with diseases for which there were no vaccines. In the case of nagana, scientists introduced modern technology in the form of guns and machinery to clear game and vegetation, but the underlying reasons for doing so originated with the Zulu.

In contrast to the immediacy of disease control lay the long-term problem of conserving the veld and promoting animal health. The natural veld symbolised the South African landscape and from the 1920s onwards the Veterinary Department collaborated with botanists and ecologists in the Plant Industries Division, as well as with universities, and in particular the University of the Witwatersrand.⁵⁸ Granting primacy to the indigenous grasslands represented a change in environmental thinking since the late nineteenth and early twentieth centuries when scientists had made assumptions that South African trees and vegetation were deficient compared with the trees and vegetation of other continents.⁵⁹ Now the emphasis was on the fact that the South African environment was harsh – subject to frequent droughts, violent storms, easily eroded soils and fragile grasses – but not that it was intrinsically inferior. It simply required careful management. Some scientists took great pride in the assumption that the South African environment was somehow unique. Douw Steyn, for example, revelled in the fact that South Africa had a plethora of poisonous plants, which were part of the country's rural identity and provided exciting opportunities for research. Similarly, Theiler boldly stated that '*Gousiekte* is a disease of South Africa', whilst the biochemist A.I. Malan argued for a South Africanist approach to nutritional research: '[T]he problems of animal nutrition must be considered as national problems and we must not be content to look to other countries for help and solutions'.⁶⁰

Work on the veld showed that South African scientists had embraced the new science of ecology.⁶¹ In this context debates about overgrazing became more involved. Although much of the rhetoric still contained a critique of overstocking and kraaling, some of the arguments were not so simple. Each animal species, whether wild or domestic, engaged in different grazing habits that were now analysed within the remit of the ecological language of vegetation succession and climax. Botanists and toxicologists discussed popular perceptions that plant poisoning was becoming more common in terms of an increase in secondary or *opslag* grasses that were less palatable and possibly poisonous to stock.⁶² Veld research and grazing practices became increasingly localised, because flora could be poisonous on one farm and not on another due to different soils that affected the chemical composition of plants. Paddock rotation, therefore, came to mean more than just resting sections of the grasslands to enable regeneration. It also meant having the right proportion of

different animals on the land, which had to be worked out on a farm-by-farm basis. Philip Viljoen, amongst others, invoked the language of a 'balance of nature' and suggested that it was essential to restore or create a 'natural' equilibrium through sophisticated grazing practices, based on a careful assessment of the carrying capacity of the land. Viljoen also emphasised the importance of indigenous, as opposed to exotic, grasses, along with the need to cultivate fodder.⁶³ The indigenisation of grassland research reflected a dramatic shift from the acclimatisation experiments using alien flora that had characterised both veld and forest policies in the early twentieth century. Ecology encouraged a local focus, and international ideas about plant succession became 'South Africanised' through their specific application to the veld.

Moving from the very local environment to a broader geographical field, the 'South Africanisation' of the country's scientific culture and practice contributed to the emergence of a sub-metropolitan science in which South Africa, to some extent, replaced Europe as the font of veterinary authority in parts of Africa. Some colonial veterinarians had consulted Theiler and others prior to the founding of Onderstepoort, but, from the 1920s onwards, this *rapprochement* became far more commonplace and it was South African nationals, as opposed to foreign-trained scientists, who provided this expertise. Tony Kirk-Greene has noted that the size of the British colonial veterinary service in Africa was particularly small.⁶⁴ This provided opportunities for practitioners from Onderstepoort, and Britain affirmed its belief in its skills by inviting South African veterinarians to investigate disease in other parts of the Empire, such as Nigeria (toured by Petrus du Toit in 1927).⁶⁵ South Africa's success in eliminating rinderpest, East Coast fever and nagana boosted institutional self-confidence and encouraged scientists at Onderstepoort to take the lead in African disease eradication campaigns. During the Second World War, for example, D.T. Mitchell set up a mobile laboratory on the Tanganyikan plains to produce vaccines against rinderpest, whilst René du Toit and others later advised the Tanganyikan and the Southern Rhodesian governments on the destruction of tsetse belts.⁶⁶ Having cleared the country of epizootics that had hampered pastoral development in the past, South Africa was determined to mitigate the possibilities of re-infection from the north. In turn, other African states wished to benefit from South African knowledge and experiences, as these were often more appropriate for the continent's disease environment than discoveries made in the temperate European metropole.

Conclusion

Onderstepoort Veterinary Institute made an important contribution to South Africa's economic development as well as to its scientific culture. The Institute was born out of an imperial and South African material ideal of agricultural progress. Increasingly, veterinary medicine developed as an inclusive rather than a discrete science, and by the 1920s a more holistic approach to animal health, as explicated by Petrus du Toit, embraced the ecological, toxicological and biochemical disciplines, as well as the purely biomedical.

Nevertheless, veterinary science involved more than just cures and prophylaxis, accompanied by strategic grazing and supplementary feeds; it also encompassed more coercive dimensions. Governments used scientific knowledge to legitimise greater state intervention into the lives of rural communities, and at times veterinary policing superseded animal husbandry as a method of disease control. This can be seen most clearly with respect to East Coast fever, which took 50 years to eradicate. During that time many people suffered considerable economic hardship due to the cost of dipping and restrictions on stock movements. In the longer term, however, eradication of this disease, along with *Glossina pallidipes*, did provide new opportunities for cattle farming. This was complemented by a large increase in sheep and cattle numbers despite the presence of numerous infections and recurrent periods of severe drought. Of course, it is impossible to determine conclusively the

extent to which veterinary science alone contributed to this increase in this process, given that other variables such as political and economic contingencies, as well as weather patterns, available grazing and changing farming practices, affected livestock populations too. Nonetheless, the fact that much of this growth occurred during the first three decades of the twentieth century, corresponding to the decline in epizootics, implied that the development of vaccines and the enforcement of quarantines significantly influenced this outcome. From the 1930s, the livestock population began to stabilise as epizootics gave way to poisonous plants and internal parasites as the major killers. This in itself demonstrated contradictions in the beneficence of veterinary science. Scientists attributed the growing danger of toxicosis to overstocking, which biomedical advances had helped to promote.

The expansion of veterinary research also reflected a cultural belief in science as a tool for ameliorating the natural world. Veterinarians regarded scientific applications, as well as legislative interventions, as essential features of a modernising state that strove towards self-sufficiency not only in terms of pastoral output but also in relation to the country's ability to resolve its own epidemiological and environmental problems. Arnold Theiler was instrumental in pushing for the establishment of a university faculty at Onderstepoort and 'South Africanising' veterinary medicine in order to end the country's dependence on European scientists and their publications. The consolidation of a national body of veterinary knowledge came to be rooted partly in metropolitan biomedical systems and partly in the scientific analysis of the observations and methods used by local farmers. Africans in particular made an important contribution to the identification of toxic plants as well as to the aetiology and control of nagana. Comparative success in tackling a number of dangerous stock diseases boosted institutional self-confidence and encouraged South African scientists to intervene in disease control campaigns beyond South Africa's borders.

Despite the significant role played by Africans in the expansion of veterinary knowledge, however, veterinary scientists tended to regard settler farming as the key to economic progress. In this respect, some historians have emphasised the exclusive advantages agricultural science brought to white commercial farmers.⁶⁷ The priority attributed to settler interests was clearly shown in relation to veterinary interventions against nagana in Zululand from the 1920s onwards. Nevertheless, this inequality in veterinary provision was not always so blatant, especially when it came to dealing with contagious diseases such as rinderpest, in which case vaccines were distributed to all. The East Coast fever inoculation campaign in the Transkei also complicated arguments about the provision of biomedical resources. In that case, African cattle were the subjects of experiments but, at the same time, their owners had access to a procedure that was officially denied to others. Ultimately both African and settler farmers experienced an increase in their livestock holdings during the first half of the twentieth century, but the broader racially defined political and economic agendas ensured that the former could not benefit to the same degree as the latter from the material gains that veterinary science could bring.

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67. For example Krikler, *Revolution from Above*, Chapter 3 and Conclusion, pp. 64–92, 220–35; Jeeves and Crush, *White Farms, Black Labor*, Introduction, pp. 1–28.