ARNOLD THEILER

1867 - 1936

His Life and Times

By
Dr. Gertrud Theiler

PUBLIKASIES VAN DIE UNIVERSITEIT VAN PRETORIA. NUWE REEKS
NR. 61 — 1971

Redakteur van hierdie uitgawe : Prof. H. P. A. de Boom

Die Publikasie van hierdie reeks word moontlik gemaak deur fondse wat deur die Universiteit van Pretoria aan die Navorsings- en Publikasieskomitee beskikbaar gestel word.

Gedruk deur Craft Pers (Edms.) Bpk., Kerkstraat 353, Pretoria-Wes.

PUBLIKASIES VAN DIE UNIVERSITEIT VAN PRETORIA
NUWE REEKS
NR. 61

ARNOLD THEILER (1867 - 1936)
His Life and Times

by
DR. GERTRUD THEILER

In Commemoration of the Golden Jubilee
of the Faculty of Veterinary Science,
University of Pretoria.
1920 - 1970

UNIVERSITEIT VAN PRETORIA
PRETORIA
1971

Hierdie publikasie en die publikasies wat agter in hierdie publikasie vermeld word, is verkrygbaar by:

Van Schaik's Boekhandel (Edms.), Bpk.,
Burnettstraat 1096,
Hatfield,
Pretoria.

Prys R1,25

ISBN 0 86979 061 7

"Gentlemen, you may think it is only an old bone. You have to put your soul into that bone."

Theiler's remark in reply to the ovation he received after delivering his paper on bone disease at the 1935 Annual Congress of the South African Veterinary Medical Association at Onderstepoort (as remembered by H.P.A. de Boom then fourth year student).

FOREWORD

In the history of the veterinary profession in South Africa, the figure of Arnold Theiler stands like a colossus. With the celebration in September, 1970, of the Golden Jubilee of the Faculty of Veterinary Science of Pretoria University, greater impetus was given to the longfelt need of a biography of the first Dean of the Faculty. This work is the result. It has not been written by a professional historian, yet is uniquely valuable as it gives sidelights on Theiler's life and character as only seen in the intimate family circle, coming as it does from his daughter, Dr. Gertrud Theiler, who, until her retirement, was research worker at the institute her father founded in 1908 — the Onderstepoort Veterinary Research Institute.

The scientific legacy of Sir Arnold Theiler is found in the libraries of the world, but this represents only part of our South African heritage, as will be appreciated further on.

In 1891 a young Swiss veterinarian arrived in Pretoria, his profession completely unknown and any facilities for research or investigation non-existent. All he had, were his strength of character, his brain and his two hands, one of which he was to lose soon in an accident. Yet these, coupled with boundless determination, energy and exactness soon were to earn for him world-wide respect for his knowledge, his professional services and his profession. In 1908 a modern veterinary research institute was founded at Onderstepoort near Pretoria. This institute, under Theiler's leadership, was to achieve world fame. But of very particular moment in the present context is Theiler's contribution to veterinary education. The following paragraph comes from a letter dated lst February, 1911, and was written by F. B. Smith, Acting Secretary for Agriculture, to Arnold Theiler:

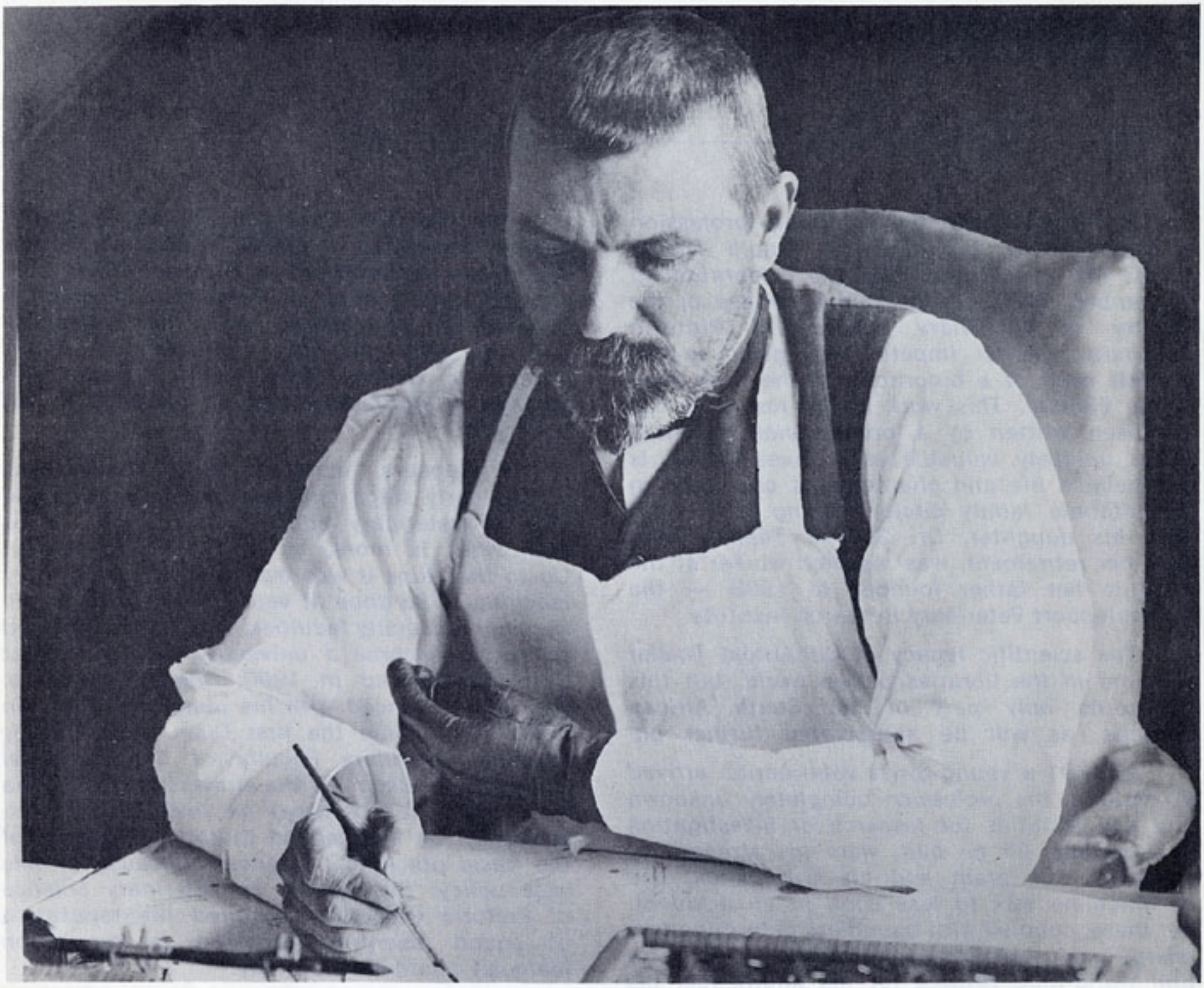
***"If, after the work you are now engaged** upon is completed or placed in such a position that it can be continued by someone other than yourself, and a chair of Veterinary Science be founded in connection with the University (i.e. the one and only University of South Africa) or Central Agricultural College, the Minister of Agriculture will do his best to get it for you."*

It appears, therefore, that Theiler was at this early stage engaged in propagating the idea of veterinary education in South Africa and, what is more, as part of a university. Up to that time it was traditional for veterinary teaching to be done at veterinary schools which were not university faculties. The first established school to become a university faculty was at Bern, Switzerland in 1900. Theiler, therefore, was very advanced with his planning. When, in 1920, he became the first Dean of the newly founded Veterinary Faculty of the Transvaal University College (as the University of Pretoria was called at the time) he insisted that the education be founded on thorough teaching of the basic preclinical sciences. Because of this wise policy, the Faculty of Veterinary Science of Pretoria University acquired the reputation of sound scientific teaching, a reputation jealously guarded to this day.

There was nothing small about Theiler's planning, no intimidation by opposition, no half-hearted pursuit of his aims. In the ever challenging tasks of veterinary education, may the example of Theiler act as beacon and inspiration.

C. F. B. HOFMEYR
DEAN FACULTY OF VETERINARY SCIENCE
UNIVERSITY OF PRETORIA.

5th September, 1971.



INTRODUCTION

Arnold Theiler was born in the village of Frick, Canton Argau, Switzerland on March 26th, 1867. He was born into a period of great scientific activity and progress; he was destined to join the band of enthusiastic workers and thus to help in the rapid advancement of the biological sciences at the end of the 19th and the beginning of the 20th century. He may truly be said to be a product of his times.

Schooling

He met the full impact of this scientific surge during his most formative years. His father, Franz Theiler (1832-1901), the Principal and the Science Master at Frick, was an able and dedicated teacher, who taught his pupils to appreciate the progress made in the development of steam engines, electricity and telecommunications by performing simple experiments, making his own apparatus to explain underlying principles. Biological classes were often out of doors, in the tradition of Prof. L. Rütimeyer (1825-1895) of Basel, stress being laid on each pupil making his own observations of when, where and how, thus laying a sound foundation for that part of natural history study, which came eventually to be known as Ecology.

The foundation laid at Frick was further enhanced by the Science Teacher, F. Mühleberg, at the Cantonal Schule in Argau, so that by the time Theiler came to the University at Bern and then to Zürich to further his studies, he had a keen love for biology and had been well grounded in how to observe and to think for himself.

Higher Education

At Zürich he came under the influence of A. Lang (1855-1914), a comparative anatomist, ("Handbuch der Morphologie der wirbellosen Tieren"), and of the genial botanist, H. Schinz (1858-1941, co-author with H. Durand of "Conspectus Florae Africae 1895-1898"), but above all of E. Zschokke (1855-1929), Professor of Veterinary Pathology and Anatomy. All three nurtured his love for the wonders of nature. Schinz and Zschokke undoubtedly also enjoyed life to the full and understood the moods and temperaments of their students. Theiler was influenced by their "heitere" attitude to life coupled with a stern discipline at work. Three things he brought away from Zürich; the compulsory white apron, the need to accumulate material for research, and the need for daily meteorological readings.

In 1889 Theiler passed his state examinations and qualified to earn his living as a veterinarian. But what was his background, beyond the knowledge of some surgical operations, some salves to be applied to wounds and simple medicaments for digestive troubles? What was the general background-knowledge of a student in the 1880's? What research was being done and where was the accent in the veterinary field?

State of Knowledge in the Eighties

In the field of zoology, Darwin's (1809-1882) travels and his theories of descent ("Origin of Species", 1859) and of survival of the fittest were much to the fore and were undoubtedly dealt with by Lang in his lectures. Darwinism also featured in the writings of Haeckel (1834-1919) of Jena, the propounder of the theory that ontogeny recapitulates phylogeny, and of the genial Swiss field naturalist and zoologist, L. Rütimeyer. The cell theory of Hook (1667), as enlarged upon by Schleiden (1804 - 1881) and Schwann (1810-1882), was well established; the microscopical techniques of R. Remak (1815-1865) and A. Kölliker (1817-1906) had opened up the studies of histology and of embryology. Hand in hand with advances in staining and sectioning techniques, we have the development of the microscope by C. Abbé (1840-1907). The Zeiss firm of Jena, founded in 1846, followed up with the improvement on the aplanatic lens of 1827 and of the immersion lens of 1850, and gave the scientific world the Abbé condenser, the camera lucida and dark field illumination. In 1870, W. His (1831-1904) introduced the microtome, which allows serial sections to be made, of such importance in the study of embryology and histology. In 1839 the Royal Microscopical Society was founded (it received its Charter 10th October 1866); at its second meeting it fixed the size of microscope slides at 3 inches by 1 inch. Another of its useful activities was the standardization of microscopical equipment, such as standard threads for objectives and standard diameters for eye-pieces, so that parts of the microscope are interchangeable from one instrument to another. P. E. Ehrlich (1854-1915), working with aniline dyes, introduced the first vital stain, methylene blue, in 1886.

Descriptive and Taxonomic Zoology was in its heyday with such standard works as: G. Bronn's (1800-1862) "Klassen und Ordnungen des Thierreichs", A. Brehm's (1829-1884) "Tierleben", the first of a series to introduce the idea of Ecology of animal life, and K. Gegenbauer's (1826-1903) "Grundzüge der vergleichenden Anatomie".

In the medical field, the principles of antiseptic surgery (Lord Lister, 1829-1912) were established. The classical work of E. Jenner

(1749-1826) on smallpox and cow-pox was standard knowledge. Louis Pasteur's work (1862-1879) on the rôle of bacteria in fermentation, both aerobic and anaerobic, had already laid the foundation for sterilization by pasteurization. The hunt was on for bacteria and their association with specific diseases, with Pasteur and Robert Koch (1843-1910) and their respective schools holding the limelight. Filterable microbes, or viruses, were beginning to be talked about. The principle of immunizing susceptible animals by using the attenuated strains of the causal organism had been established and the pasteur vaccine for anthrax, 1881, and for rabies, 1885, were in general use.

Early beginnings

Armed with his Swiss Veterinary Diploma, Theiler set up his plate in the local bakery at Beromunster towards the end of 1889. Though popular and falling into the ways of village life, even unto taking a leading rôle in amateur theatricals, he soon realized that being a private practitioner in a village would not keep him satisfied. He had his eye on the wide world, a world described by such scientist travellers as Darwin, "Voyage of the Beagle", (1845); A. R. Wallace (1822-1913), the father of zoogeography, "Geography of the Malay Archipelago" (1867) and the "Geographical Distribution of Animals" (1876), in which he associated present distribution with past changes in the earth's surface; Fritz and Paul Sarassin in the East Indies; the Swiss, Louis Agassiz (1807 - 1873), the first to popularize natural history, who travelled widely in North America and who founded the now famous Museum of Comparative Zoology at Harvard University in 1860. The publication of the results of the Challenger expeditions of 1872-76 also had its effect, but the one publication that really gave direction to Theiler's longings was Le Vaillant's "Travels into the Interior Parts of Africa by Way of the Cape of Good Hope in the years 1780 - 1785". In the years to follow, the writings of the incomparable observer and popularizer of Entomology, J. H. Fabre (1823 - 1915), was to refresh his interest in the simple out-of-doors natural history.

In the 1860's Africa was still the Dark Continent in which the European powers were staking claims to enlarge their "sphere of economic influence", partly with the intention of honest trade and partly with the excuse of bringing civilisation to the "heathens". When Livingstone explored the Zambesi during the years 1858 - 1864 and when H. M. Stanley (1841 - 1904) crossed the continent via the Congo in 1877, these "spheres of influence" were confined to the coast line. By the end of the eighties, when Theiler set sail, these "spheres of influence" had extended far inland and had become colonies; by 1912 the "Rape of Africa" was complete and the whole continent, barring Ethiopia and Liberia, was under colonial rule.

Departure

Unhappy in private practice, Theiler was ready to take the plunge when the chance came. The Swiss Diplomatic Representative in the Z.A.R. (Zuid Afrikaansche Republiek), ever ready to advance the interest of his countrymen, had indicated that, as there was no veterinarian in the Transvaal, he thought there was every opportunity of a young man being able to make a living either in the capital, Pretoria, founded in 1855, or in the fast growing mining camp of Johannesburg. (The Reef had been discovered in 1886 and the camp became a municipality in 1897). Whilst there was no medical or veterinary research organisation in the Zuid Afrikaansche Republiek in the 1880's, the need had been felt for some central consultant organisation in the Cape, not so much to cope with human epidemics but rather with the animal diseases that threatened the colony's agriculture, and that of the annexed Basutoland, with ruin. In 1891, the year Theiler arrived in South Africa, the Colonial Bacteriological Institute was started in Grahamstown under Dr. A. Edington (1865 (?) - 1928), a medical man, to serve both the medical and the veterinary profession; D. Hutcheon (1842 - 1907) had been appointed state veterinarian for the Cape Colony in 1880; Natal had one state veterinarian, C. Wiltshire (1844 - 1933), in its employ since 1874, to be succeeded in 1896 by G. B. Woollatt (1876 - 1942). As in the Zuid Afrikaansche Republiek, there was no veterinary surgeon in the Oranje Vrijstaat. The Colonial Army in Natal and in the Cape Province maintained its own veterinarians, whose records remain buried in at that time secret army files. The impression gained is that the management of stock throughout South Africa at the time was exceedingly primitive: much confusion existed between those diseases whose symptoms were not easily recognized either clinically or **post mortem**: even horsesickness and glanders were often confused.

At this period the newly developed vine and fruit orchards at the Cape were also threatened with ruin, but it was not until 1895 that the first full-time entomologist, the economic entomologist C. P. Lounsbury, (1872 - 1955) was appointed with head office in Cape Town.

In 1891 Theiler packed his bags, few books, microscope and surgical instruments, took steamer to the Cape, train to Kimberley* and post-chaise to candle- and paraffin-lit Pretoria. Electricity was to be installed the year after and the first train was to reach Pretoria only on New Year's Day, 1893, the year in which the first telephone exchange opened in the Transvaal, in Johannesburg.

Little did he realize how much he was to suffer "the lonely isolation of long distance" during the next two decades, an academic isolation that threw him on his own resources and which put him on his mettle. His "Heimweh" and emotional loneliness was alleviated by his marriage in 1893 to a school mate, Emma Sophie Jegge (1868 - 1951) from Frick, the school mate who had had so much faith in his abilities that she had financed his passage to South Africa.

The Struggle for Survival

Once again he put up his plate, this time in Pretoria, but clients were few and far between in that the Boers were used to doing their own "doctoring" and hence had no use for a veterinarian. Also, Theiler soon realized that he had to deal with many and various complaints and diseases about which nothing was known, except their vernacular name, such as heartwater, gallsickness, lungsickness, redwater, horsesickness, their symptoms, and that in most instances the final outcome was death. To make ends meet and to gain experience, he went as a farm hand to A. H. Nellmapius' (1847 - 1893) Irene Estates, part of the farm Doornkloof. There he made copious notes of the symptoms of sick animals and performed as many necropsies as he could muster in the district. It was here that he lost his left hand in a chaff cutter.

Nothing daunted, at the end of 1891 he once more put up his plate in Pretoria: he gradually worked up a small practice and did reasonably well. At that time he could not convince the authorities, neither civil nor military, that the appointment of a state veterinarian was essential.

When smallpox broke out in Swaziland in August 1892, it was feared that the disease might reach the Transvaal. He suggested to the Government that he would provide the lymph vaccine. In anticipation of possible needs, he ordered the necessary vaccine virus and instruments from overseas.+ When smallpox did break out in Johannesburg in 1893, he was not quite unprepared to take up the challenge. Upon recommendation of Dr. Aurel Schulz,** the Medical Officer of Health, he was appointed as Consultant Bacteriologist to the Rand Health Board and as Director of the Institute for Animal Vaccination. He continued producing lymph vaccine until the outbreak was quashed.

Despite the augmentation of his income from private practice in Johannesburg, apparently mainly on horses, the gold rush notwithstanding, as well as from the "lymph farm", the Theilers' finances remained straitened. His wife, who had studied "haute couture" in Paris, assisted in keeping the wolf from the door by rendering service to the élite. Roderick Jones (1877 - 1962, later turned journalist and finally head of Reuters, London) ran a small pharmacy at the corner. Were it not for his coöperation as well, Theiler would not have been able to meet his commitments so promptly. Besides assisting Theiler in this way, both Schulz and Jones, by their intellectual contact with him, played an important rôle in assuaging the "loneliness of academic isolation".

In 1895 he moved to Pretoria to maintain closer contact with Government circles and to help frame stock disease laws, such as those for the control of glanders. As Johannesburg and Pretoria were only to be linked by telephone in 1903, ten years after its installation in the former town, the lack of rapid communication may have influenced this move.

"Runderpest"

In March 1896, Paul Kruger, State President, was advised by the Cape Government that a mysterious disease had broken out in Bulawayo, Rhodesia. Theiler was sent to investigate and together with C. E. Gray (1864 - 1939) of Rhodesia diagnosed it as rinderpest. As the Matabele were rebelling, Theiler caught the next post-chaise out. Gray, the only veterinarian in Rhodesia and in sole charge of the campaign, adopted a policy of slaughter and compensation. En route southwards, Theiler saw the ravages of rinderpest throughout the Protectorate of Bechuanaland (under British protection since 1885). In Khama's town of Palapye he met Otto Henning (1865 - 1933), who had been seconded from the Cape to advise Khama. Together they toured the district and confirmed that the disease was rinderpest.

The more immediate effect of the rinderpest

---

* Grahamstown's surgeon/geologist Dr. William Guybon Atherstone (1814 - 1898) had identified the first diamond in the month Theiler was born.

\+ This preparing himself for possible future requirements and eventualities features time and again in Theiler's career.

** Aurel Schulz, ? - 1931, given as Cecil Schulz in Burrow's History of Medicine in South Africa, was a well-educated medical doctor, who had received his training in Germany. A restless spirit, he had explored the region of the Kunene River in 1884 - 1885 before taking up the post of Medical Officer of Health in Johannesburg in 1890. He left fairly soon afterwards, no-one knows whither.

epizootic was an economic and personal tragedy for the individual farmer, the transport-rider and for the numerous native tribes; its long term effect was for the good of Southern Africa. The veterinarians had proved their worth and the various governments had come to realize that the welfare of the country was dependent on organized research. On May 11th, 1896, Theiler was officially sworn in as State Veterinarian. The Zuid Afrikaansche Republiek and Natal combined to run a field laboratory at Dwarsberg on the Marico River, in the Rustenburg District, not far from the Bechuanaland border. H. Watkins-Pitchford (1866 - 1951), later to be responsible for the welfare of 4,000 horses during the five months' siege of Ladysmith, and F. A. Verney (1875 - 1952) from Natal, co-operated with Theiler to work on a serum method of control.

In the meanwhile the Cape Government had called in the aid of the well-known German bacteriologist, Robert Koch (1843 - 1910), had installed a laboratory for him at Kimberley and provided him with some of his own assistants: P. M. J. Kohlstock (1861 - 1901) and W. Kolle (1868 - 1935). G. Turner (1845 - 1915) was seconded from the Cape Colony to help. When Koch left, Turner was put in charge. This team was mainly concerned with the inoculation of bile from an affected beast to produce immunity.

The Z.A.R., thoroughly aroused, appealed to the Pasteur Institute in Paris for assistance. Early in 1897, the two savants, J. Bordet (1870 - 1961) and T. Danysz (1860 - 1928), arrived. Theiler had to close down the Marico Laboratory and set up another one on the farm Waterval (which adjoins the northern boundary of Onderstepoort). There the new team continued perfecting the serum method. Koch was first in the field with his bile inoculation, but in the course of time the perfected serum method replaced the more cumbersome bile technique.

From now on, as "Staatsveearts", Theiler was kept busy with the promulgation and the application of laws — working through the civil landdrosts and veldcornets — supervising the campaign, putting up fences, forbidding or regulating the movement of cattle, and even of natives, in an attempt to prevent the further spread and to stamp out the disease.

In 1897, Natal set up a Bacteriological Consultant Centre at Allerton on the outskirts of its capital Pietermaritzburg and appointed a team of veterinarians under the veteran S. Wiltshire (1844 - 1933) to combat rinderpest. In 1894, David Bruce (1855 - 1931), of Malta fever fame, was called in by the Natal Government to study the cattle disease "nagana" in Zululand. By 1897 he had established the association between the tsetse fly and the trypanosome, and also that game acted as the reservoir. In 1898 he was commissioned to work on horsesickness and to investigate the outbreak of dysentery in the colonial army. He was active in the RAMC in Ladysmith during its bombardment in 1899 - 1900.

The Grahamstown laboratories, now under D. Hutcheon (1842 - 1907), also had an increase in staff and another Consultant Bacteriological and Pathological Centre was set up in 1898 in Cape Town, in charge of Koch's assistant W. Kolle. O. Henning, of the Cape Services, was acting as "Staatsveearts" in the Oranje Vrijstaat and was keeping a watching brief on the rinderpest in Basutoland — which, in 1883, had reverted to the British Colonial Office — whilst Koch's other assistant, Kohlstock, took over in Deutsch Südwest-Afrika. Consequently, by the end of the century, each territory was under some sort of veterinary control.

The team at Waterval had also interested itself in horsesickness, against which Theiler felt a serum-virus vaccine could be developed. Unfortunately for the horsesickness studies, it had been decided to move the rinderpest work to Belfast on the highveld in August 1897, much to Theiler's disappointment (and probably high dudgeon). Nevertheless, he found grazing for his horses in the malarious lowveld at Elandshoek. By the end of the year, i.e. 1897, we find Theiler back in Pretoria and the two Frenchmen en route to France.

It is at this period Theiler proposed the establishment of a research institute under a state veterinarian, at which the production of vaccines against pleuropneumonia, black-quarter, rinderpest and smallpox could be carried out. He suggested that the disinfection station and stables at Daspoort, on the outskirts of Pretoria, could easily be converted into suitable quarters. This station had been set up for the screening of suspected glanders in horses, scab and mange in domestic stock, for the gross examination of animals destined for the slaughter poles, and for the disinfection of hides destined for export. Apart from the research into the animal diseases and the production of remedies to be carried out, he pointed out that the "staatsveearts" should also act as adviser to the government in all matters pertaining to animal diseases and hygiene and that the laboratory should act as a centre of consultation for the public.

In March, 1898, he received the glad tiding that his recommendations had been accepted and that he was appointed director of the Bacteriological Institute and a short while later "staatsveearts" to the artillery to the Zuid Afrikaansche Republiek. The laboratory was to be equipped with modern apparatus and above all there was to be stabling, **inter alia**, for thirty horses for his horsesickness experiments. It so happened that 1898 proved a severe horsesickness year. Until the completion of the buildings, Theiler, as heretofore, was producing calf lymph for smallpox in his private house at Les Marais, with his wife as assistant. "Modern apparatus" in 1898 still meant: methylated spirit burners, paraffin burning incubators, old-fashioned wax-sectioning microtomes, ice chests — the Trevenna breweries daily delivering the ice — hand-turned centrifuges, monocular microscopes, already with an Abbé condenser, but without revolving nose-piece, the objectives still having to be unscrewed and screwed in individually to effect interchange. Daylight was the only source of light.

With the rinderpest and the attendant promulgation of laws behind him, Theiler could now settle down to a more normal working life at Daspoort. In 1899 he published on black-quarter ("sponssiekte" or "Rauschbrand"), a disease known in South Africa since the days of the early travellers, Le Vaillant having described it in fair detail. Preparation of a vaccine had been attempted in 1887 at Grahamstown, and by Theiler in 1894, but it was not until Leclainche (1861 - 1953) and H. Vallee (1874 - 1949) of Alfort, France, in 1900 had attenuated the causative **Clostridium chauvoei** by heat, that a suitable and economical vaccine was produced. Leclainche further improved his method of production by formalizing his culture, the final refinement being given the vaccine by J. H. Mason and J. R. Scheuber at Onderstepoort in 1936.

It was during these early Daspoort days that Theiler felt "the academic loneliness of long distance" the most: it took ten to twelve weeks before he could expect a reply to a letter "home". He encountered so many problems, he was forever asking his father to send him text-books, periodicals and laboratory equipment, whilst Professor Zschokke was being bombarded for advice. Theiler's travels had heightened his interest in the vegetation of the veld: "could his father send him a geology book giving information on derived soils?".

Amongst the books and periodicals in his library around 1899 one assumes he had all those listed in the appendix.

Visit to Europe 1899

As head of the Bacteriological Laboratory, Theiler was also called upon to advise on medical matters, and it was a suspected case of bubonic plague in Middelburg that finally decided him to ask for permission and the wherewithal to visit various institutes in Europe to familiarize himself with the latest laboratory techniques. He eventually got permission in 1899 to attend the 7th International Veterinary Congress in Baden-Baden, Germany, as the official Z.A.R. delegate, and was asked to act as observer for the Cape, Natal and the Oranje Vrijstaat. Here he gave a preliminary report on horsesickness and on his efforts to produce an immunity against the disease. Here, too, he met F. von Hutyra (1860 - 1934), who was for 43 years a docent at the Royal Hungarian Veterinary School. Whilst overseas, he visited the ten year old Pasteur Institute, where he was well received by P. P. E. Roux (1853 - 1933) and met F. E. P. Mesnil (1868-1938) and A. Laveran (1845-1922), as well as Ed. Nocard (1851 - 1903) of the Alfort School in Paris. He also paid Koch's institute in Berlin a short visit. He did not fail, as on every subsequent visit to Europe, to go and see what Zeiss of Jena had to offer in improved glassware and microscopes. His government had also instructed him to study modern methods at the slaughter poles in some of the larger cities in Europe. The first of the South African municipal abattoirs, such as we know them today, was opened in 1910, as the "Johannesburg Abattoirs and Livestock Market" at the instigation of Irvine-Smith. In Pretoria, the slaughter poles were replaced by the Abattoir in 1913. As from 1st January, 1914, it was illegal for local butchers to slaughter on their own premises.

During his interviews with colleagues he undoubtedly heard of the discovery by W. K. Röntgen (1845 - 1923) of X-rays, first demonstrated in 1895, and of radium isolated in 1898 by Pierre (1859 - 1906) and Marie (1867 - 1937) Curie.

His stay was curtailed by rumours of war in South Africa; he just managed to get back to Pretoria before war was declared between Great Britain and the Zuid Afrikaansche Republiek.

South African War

As "staatsveearts" to the artillery, he was called to the front in Natal. During his absence, the Daspoort experiments were carried on by his lay staff under the supervision of his wife and the semi-qualified T. L. Ziehn (1869 - 1946).

He was equipped with a mobile field hospital drawn by mules. Since cattle were still at a premium after the rinderpest epizootic, much of the transport for both armies was with horses and mules; practically every burgher had his own horse. He assisted at the siege of Ladysmith in Natal, but as veterinarian had but little to do. Thus, after the relief of Ladysmith, when the fighting developed into guerilla warfare, General Botha released him from his military obligations and allowed him to return to Daspoort, to prepare smallpox and lungsickness vaccine and to go on with his horsesickness investigations: "salted" or immune horses were now more valuable than ever before. He remained at Daspoort and continued to work to the best of his ability with limited funds and facilities. It was here that the British Army of occupation found him upon the fall of Pretoria.

During the war, the Remount Department of the British War Office had bought horses indiscriminately, so that before long matters in the army became chaotic: mange, strangles and glanders became rampant, and a disease, new to South Africa, began insiduously to appear in various units. At the end of hostilities many thousands of British army horses, mules and donkeys were sold to the commission dealing with the rehabilitation of the devastated areas, thus spreading these diseases even more widely throughout South Africa. Colonel Blenkinsop in 1900 suspected that this new disease was epizootic lymphangitis. Theiler, in 1903, showed that the farcy-like lesions were indeed caused by the cryptococcus of Rivolta (**Saccharomyces farciminosus**, Vuillemin, 1901), known to cause the disease in countries from which the British had imported some of their horses.

Post War Developments

Daspoort was immediately commandeered for the Army's sick lines under Major Sanderson ("Sick lines" remains the native name, even for Onderstepoort, to this day). Upon strong recommendation from David Bruce and George Turner, Theiler was retained by the British as assistant to Major Sanderson until Irvine-Smith (1876-1966), R. S. Garraway (1876 - 1964) and J. M. Christy (1868 - 1917) took over and released him for research work. At this period, as head of the Bacteriological Laboratories, he acted as consultant to George Turner (1845 - 1915), who was now the Medical Officer of Health for the Transvaal, which office included health control in the prisoner of war and concentration camps. Typhoid and dysentery were rampant, aggravated by the seasonal malaria. Turner's efforts met with little success as the detainees' habits were not adapted to such close living. Yet Theiler may be considered as having worked towards the promotion of human health in this way as well.

In this context it may be mentioned that the old "Leprozenhuis", established in 1890, was not far from the Daspoort disinfection station. The present Westfort Leper Asylum was founded in 1898. Turner became superintendent in 1902. He was an extraordinarily efficient and humane person; a close personal tie developed between the two kindred spirits. Turner retired in 1907. He was awarded the C. M. G.; he died in England in 1915 — from leprosy.

After the Treaty of Vereeniging on May 31st, 1902, and the Annexation of the Transvaal and of the Orange River Colony, it was some time before the new regime functioned smoothly. A Department of Agriculture was set up, which, **inter alia,** provided a veterinary field service with Stewart Stockman (1869 - 1926) as Principal Veterinary Officer. Stockman was instrumental in producing a system of veterinary police control which finally stamped out rinderpest, which had threatened to ruin the livestock industry in South Africa.

As from 1st February, 1903, Daspoort was transferred from the charge of the Medical Officer of Health of the Transvaal (George Turner) to the Department of Agriculture, under F. B. Smith as Director.

Theiler, left to his research, continued with the diseases of horses and for a while gave his attention to "malaria", or biliary fever, in equines. He could prove that this disease was different from horsesickness, that it was due to a piroplasm, which, upon being referred to Laveran in 1901, was named **Babesia equi** (later to become **Nuttallia equi**) and that the disease could be transmitted by inoculation of blood from a sick or from a premune animal into a susceptible one. It was not until 1906, however, that he showed that it was a tick-borne disease, with **Rhipicephalus evertsi,** the red-legged tick, as the transmitter.

The Second Cattle Scourge, East Coast Fever

During 1901 a cattle disease broke out in Rhodesia with a mortality much higher than that of the prevalent and wide-spread redwater, which Koch in 1898 had shewn to be transmitted by **Boophilus decoloratus**, the blue tick. In 1902 a similar disease was reported by Irvine-Smith from the lowveld areas of Komatipoort

and Nelspruit in the Transvaal, where it was mainly associated with the introduction of cattle to restock the herds depleted by rinderpest and the war. It was also reported from the Northern Transvaal along the Rhodesian border.

In Rhodesia, C. E. Gray (1864 - 1939) and W. Robertson (1872 - 1918), seconded from Grahamstown, realized that the clinical symptoms and the **post-mortem** lesions were unlike those of redwater and that cattle raised on redwater veld were susceptible to the new disease. Koch, who at the request of the Rhodesian government had taken up headquarters at Salisbury, confirmed Gray's and Robertson's observation and likewise noted that the causative piroplasms were smaller than those of ordinary redwater. He referred to the disease as "Rhodesian Redwater", or, since the disease undoubtedly was introduced from the Eastern Coast of Africa, as "East African Coast Fever". In 1903 - 1904 Theiler showed conclusively that the disease was a separate entity due to small, rod-shaped piroplasms, which he named **Piroplasma parva**, designated by A. Bettencourt (1868 - 1930) of Lisbon as **Theileria parva** in 1907.

Working together with Theiler at the East Coast fever laboratories in hot and moist Nelspruit, which was rife with malaria, was the entomologist C. P. Lounsbury, seconded from the Cape. Lounsbury, working in Cape Town with very limited laboratory facilities, depending on the goodwill of friends for kennels, and adapting vacant iron sheds intended for the housing of builder's supplies as stables, already in 1900 had been able to show that heartwater was transmitted by **Amblyomma hebraeum**, the bont tick, as had been maintained by the Cape Eastern Province farmers. In 1901 he had demonstrated that biliary fever in dogs, **Babesia canis**, was transmitted by **Haemaphysalis leachii**, the yellow dog tick. Now, in 1903, he was able to show that the **Piroplasma parva** was transmitted by **Rhipicephalus appendiculatus**, the brown ear-tick, and not by **Boophilus decoloratus**, the blue tick, as is **Babesia bigemina** of redwater. In 1905 Theiler confirmed the transmission by **R. appendiculatus** and shewed that **R. evertsi**, the red-legged tick, was also a vector. This was confirmed by Lounsbury in 1906. The two ticks, **Rhipicephalus simus**, the glossy brown tick, and **R. capensis**, were also proven to be possible transmitters under laboratory conditions by both Lounsbury and Theiler working independently. To ensure that the ticks were correctly identified, they were referred to Prof. L. G. Neumann (1846 - 1930) at Toulouse, who was the first taxonomist to study ticks from all over the world.

For the next few years, Stockman and Theiler collaborated on elucidating East Coast fever and in drawing up control measures. Stockman left in 1905 to found the Weybridge Laboratories for the Control of Contagious Animal Diseases in Great Britain and was succeeded by C. E. Gray as Principal Veterinary Surgeon to the Transvaal.

During their investigations, Theiler and Lounsbury had set up dipping experiments at eight day intervals to test the efficiency of various arsenical and other fluids as used by farmers in Australia and by some farmers in Natal, as a means of controlling the brown ear-tick. The experiments were unsuccessful and the idea of controlling East Coast fever by eradicating the tick was dropped, only to be taken up in 1909-1910 by H. Watkins-Pitchford in Natal, who developed the spray-race and arsenical emulsion. Basing his recommendations on the very short feeding periods of the adult **Rhipicephalus appendiculatus**, Watkins-Pitchford advised dipping at 3 to 5 day intervals. From now on dips and dipping were to feature more and more in the regulations controlling tick-borne diseases in South Africa. Thus, during the next few decades, the accepted policy of the Department of Agriculture had been the enforcement of compulsory short interval dipping together with the application of strict quarantine regulations in all infected areas. These measures only became fully effective much later when augmented by slaughter of possible carriers. The last East Coast fever outbreak was reported from Rhodesia in February, 1954, and from South Africa in May, 1955. The disease has been eradicated, but the tick is still present in all the ecologically suitable areas.

Other threats from the North

Rinderpest came to South Africa from the North and from Bechuanaland. In 1917, during the military operations in East Africa, there was a gradual spread of movement in Tanganyika ever southwards of cattle infected with rinderpest. Gray was sent with a small team to prevent its spread across the borders into Rhodesia. Once again, during 1939 - 41, rinderpest threatened the territories, when a combined mass inoculation scheme under the leadership of Mitchell of Onderstepoort was undertaken by the Union and the Colonial Governments concerned. This campaign was carried out with such effect that one could consider the threat of rinderpest as a past hazard.

Other diseases to reach us from the north,

either directly across the Limpopo or via Bechuanaland, are three days stiff sickness or ephemeral fever ("drie dagen stijfziekte") in 1907, which by the end of the year had spread as far south as the Eastern Province, and lumpy skin disease (knopvelsiekte), first reported in Northern Rhodesia in 1931. It was next described from Ngamiland and appeared in the Marico district of the Transvaal in 1944. Both diseases are with us yet. It is surmised that Rift Valley fever, besnoitiosis and the 1930 foot and mouth disease outbreak came along the same route.

"Colonial Expansion" and the Search for Protozoa

At the end of the 19th and at the beginning of the present century we see that Theiler's investigations into the diseases of stock were gradually taking him away from the investigations of bacterial diseases and of improved methods of vaccine production, and were leading him onto the study of protozoan diseases and, concurrently, arthropod vectors. This trend is reflected in the work which was being done in tropical medicine throughout Africa.

The discovery by A. Laveran (1845 - 1922) of the malarial parasite (and later of Leishmannia) in Algiers (1880) and the suggestion by P. Manson (1844 - 1922) that mosquitoes might be carriers, basing his theory on the knowledge that the mosquito played a rôle in the development of some Filaria (1894), encouraged R. Ross (1857 - 1932) in India to continue his transmission studies with both human and bird malarial parasites (1897 - 1898). At the same time B. Grassi (1855 - ?) and colleagues working in Italy showed the close association between specific mosquitoes and the malarial plasmodium. The asexual cycle of plasmodia had already been described by Golgi in 1885. Ehrlich, in 1891, found that methylene blue very effectively stained the malarial parasites.

Thus, whilst the broad outlines of the malarial problem had been established by the turn of the century, much work was still to be done on the details of the various strains or species, and on the eradication of the various mosquitoes, whose life histories were still but vaguely known. It was soon discovered that no vaccines could be produced for malarial or other protozoan diseases, hence attention was directed to the study of the known cure, quinine, and to the study of arsenical preparations. The Liverpool School of Tropical Medicine (founded in 1898) took the lead in these studies on chemotherapy.

Besides the malarial problem, which has a world-wide distribution, the "Rape of Africa" also focussed attention on another disease, which became the centre of activity for the Colonial Powers during the next decade, i. e. sleeping sickness. The association of trypanosomes with stock diseases had already been established by G. Evans in 1880 with the endemic disease of Surra, (**Trypanosoma evansi**, Steel 1885), in horses in India. J. Rouget in 1894 described the trypanosome of dourine (**T. equiperdum**, Doflein 1901) in African horses, and D. Bruce in 1894 not only correlated nagana with **T. brucei** (Plimmer and Bradford, 1899) but also showed it to be transmitted by the tsetse fly Glossina. Theiler in 1902 described a large but relatively benign inhabitant of cattle, **T. theileri** (Laveran 1902). It was, however, left to T. E. Dutton (1874 - 1905), in connection with his work on human diseases in Gambia in 1901, to find a trypanosome in man. Trypanosomes were also seen in man by J. L. Todd (1876 - 1949) working in Gambia and in Senegal. A. Castellani (1876 - +), working in Uganda, first found trypanosomes in the cerebrospinal fluid of patients in 1902. It was left to D. Bruce to prove the trypanosome to be cause of the dreaded sleeping sickness.

Whilst the British investigators Dutton and Todd and A. Kinghorne were busy in West and in Central Africa, and W. Yorke (1883 - 1960) and R. E. Montgomery (1880 - 1932) in Nyasaland, the German scientists were active in Deutsch Ost-Afrika. Koch was in charge of a team, with F. K. Kleine (1869 - 1951), his rinderpest associate, C. K. Schilling (1871 - 1945), R. von Ostertag (1864 - 1940), of meat hygiene fame, and G. Lichtenheld (1877 - ?) as his assistants. In Angola, A. Bettencourt (1868 - 1930) had described sleeping sickness in 1901 and was busy studying avian and mammalian trypanosomes.

In 1909 Kleine was able to show that the trypanosome multiplied and developed in the tsetse fly, and furthermore that the fly was only capable of transmitting the disease after 21 - 25 days. The trypanosomes were obviously Dutton's **T. gambiense.** Whilst the Germans were busy in Deutsch Ost-Afrika, Bruce succeeded A. Castellani in Uganda. He was able to convince the local chiefs that where there were no tsetse flies, there were no cases of sleeping sickness; he advised that all lake dwellers be moved away from the lake and from other tsetse fly areas. In 1910 J. W. W. Stephen and H. B. Fantham (1877 - 1937, Professor of Zoology, Witwatersrand University, 1917 - 1933)

found another human trypanosome which was obviously not **T. gambiense** and which they named **T. rhodesiense.**

In the course of time it was shewn that all the economically important African trypanosomes were biologically transmitted by various species of Glossina, or tsetse flies, whereas **T. evansi,** (surra) and **T. theileri** were mechanically transmitted by biting flies, and dourine, caused by **T. equiperdum,** was transmitted during coitus. The difficulty of diagnosing diseases caused by trypanosomes was instanced when, in 1904, a batch of camels was introduced into the Transvaal from Somaliland, where E. Brumpt (1877 - 1951) had demonstrated the presence of trypanosomes in this species three years beforehand. Some camels had died en route. No trypanosomes could be detected in blood smears, but were demonstrated upon inoculation of the camels' blood into a dog and surra could be diagnosed. The slaughter of the camels was deemed necessary to prevent the possible spread of the disease. This difficulty of diagnosis explains why the disease was not recognized until 1910 in a later batch introduced directly into Deutsch Südwest-Afrika in 1905 for patrol work in the desert areas. In this instance the disease apparently ran a very mild course, so that surra remained unsuspected: fortunately it also remained confined to camels.

It is during this period of protozoan discoveries that the entomologists came into their own. In 1909 C. Nicolle (1866 - 1936) shewed the louse to transmit typhus. R. Newstead (1859 - 1947) and F. V. Theobald (1868 - 1930) began their life-long studies of flies and mosquitoes, whilst L. G. Neumann at Toulouse, and W. Dönitz (1838 - 1912) ("Die wirtschaftlich wichtigen Zecken") at Berlin, concentrated on ticks. R. W. Jack (1882 - 1970) in 1909 identified the puparium of **Glossina morsitans** and found its deposition sites in Rhodesia.

Second Visit to Europe

Theiler's six months' leave in 1905 was utilized in paying another visit to colleagues in Europe, and to represent the Transvaal at the Eighth International Veterinary Congress in Budapest, Hungary, by travelling via East Africa and Italy. At the Congress he reviewed the present knowledge of tropical diseases of domestic stock. It was at this Congress that he renewed his acquaintance with F. von Hutyra and his colleague J. Marek (1867 - 1952), co-authors of the standard text book, "Spezielle Pathologie und Therapie der Krankheiten der Haustiere (1905)". It was during this visit that for the first time he was able to discuss his findings orally with specialists in pathology: Hutyra in Budapest and, in London, J. M'Fadyean (1853 - 1941), the principal of the Royal Veterinary College at Camden Town and the founder in 1888 of the "Journal of Comparative Pathology and Therapeutics".

The work at Daspoort was increasing at such a pace that further workers were essential. Whilst overseas, Theiler discussed his need for specialists with his colleagues at Zürich, Paris, Berlin and London. Since he was concerned with producing immunity, he was interested to know what was the chemical or the biological reaction in the blood that conferred this property of immunity. Walter Frei (1882 - +) from Zürich was appointed to work on this problem. He served from 1906 until 1910, when he was appointed Professor of Veterinary Pathology and Physiology at Zürich in the following year. Sydney Dodd came from London as a general assistant but resigned to take up an appointment in Australia after contracting typhoid. As zoologist-entomologist, L. H. Gough (1876 - 1967) was recruited locally from the Transvaal Museum. He served from 1906 until 1911, then resigned to go to Trinidad and from thence to Cairo. Since horsesickness and bluetongue were undoubtedly insect transmitted, Gough was detailed to study the local mosquitoes and other night-flying insects and to inaugurate a series of studies on the helminth parasites of probable economic importance of domestic stock in South Africa.

During the next few years Theiler's own investigations were mainly centred on horsesickness and the possibility of producing a suitable serum by introducing different strains of the virus from various regions in South Africa, testing serum from horses, mules and donkeys intraspecifically and interspecifically from immune and from reacting animals, injecting blood alone or blood with serum from immune animals, and testing if it were possible to attenuate a strain by passing it through an abnormal host, such as a goat. One feels that every possible combination and permutation was tried in an effort to get a reliable polyvalent serum.

During the East Coast fever experiments, another piroplasm was "uncovered", **P. mutans** (Theiler, 1906) — later **Gonderia mutans** — which gave a benign reaction and which differed morphologically from **Theileria parva.** Much work was done on checking cross-immunity between the two parasites.

In 1907 we find attention being given to another disease besides horsesickness which

was apparently being transmitted by a night-flying insect: bluetongue in sheep. In each instance animals stabled before sunset did not contract the respective disease. Numerous tests showed the causative agent to be a filterable virus, the filtrate being extremely virulent after passing through a Berkefeld filter, as was the dried blood. A short immunity could be produced after a second inoculation, the serum from recovered sheep possessed protective properties, and sheep injected simultaneously with 5 ml serum and 2 ml virus did not contract the disease.

Further investigations carried on in relation to redwater brought to light another protozoön, one which had untoward protozoan characteristics, being coccus-like, lacking the usual cytoplasm, and invariably congregating as marginal points in the blood corpuscle. It was named **Anaplasma marginale**, Theiler 1908. The disease caused by this organism eventually came to be called gallsickness, this name thus denoting a specific entity. The disease, though accompanied by severe anaemia and jaundice, differs from redwater in that the urine is not discoloured. There is no cross-immunity with redwater, and the incubation period is longer, viz. 3 to 6 weeks. By cross-immunity tests **Piroplasma bovis**, now known as **Babesia bovis** and the causative agent of European redwater, was confirmed as a separate entity from **P. bigeminum (B. bigemina)** and from **A. marginale.** In 1910 Theiler discovered **A. centrale,** in which the cocci congregate in the centre of the corpuscle. It caused a mild form of gallsickness and could be used to immunize cattle against the virulent **A. marginale.**

Daspoort too small

Since the two cattle scourges were well under control and since the preventive measures taken against horsesickness were proving successful, stock raising was beginning to be a paying proposition. Generally speaking, the economy of the Crown Colony of the Transvaal, aided by the income from gold and diamonds, was on a sound footing, so that Theiler's plea for a larger and a more modern laboratory did not fall on deaf ears. Theiler's pleas were based on the fact that more and more work was thrust upon Daspoort in the form of vaccine production and advice to the field staff and to the farmers. His plea was strongly supported by the farming community, who were converted to accept veterinary advice by the outstanding results of the work delivered to date. It was impossible even to attempt to meet the demands in the temporary and inconvenient quarters at Daspoort. The area had been used as a disposal site of carcases both before and during the rinderpest epidemic. Also, the station was dependant upon a hand-drawn well for its water supply and this apparently had become contaminated, not necessarily from the carcass waste. Every year, from 1902 to 1906, saw the occurrence of typhoid fever amongst members of the staff, of which several succumbed. The enteric outbreak in 1906 made it a matter of necessity that a move should be made to a healthier situation.

Plans for a new building were approved in 1907 by Louis Botha, then Minister of Agriculture, and a site chosen seven miles to the north of Pretoria on a portion of the farm "De Onderstepoort 496". The farm was chosen partly for its location on the railway line and its easy access by animal transport from town, but mainly for its semitropical climate and the abundance of mosquitoes and other fly plagues, i.e. it was chosen for its suitability for further work on horsesickness and on other essentially tropical diseases. Highveld farms to the south of Pretoria were ruled out because of their climatic unsuitability.

Thus, in October 1908, Theiler and his staff moved from Daspoort to the new "modern" laboratory. "Modern" now meant gas and electricity produced on the premises (but ice continued to be shipped out from Pretoria); a local bore-hole with an electric pump gave running water. Much as Theiler hated the telephone as an interrupter of activities, he nevertheless appreciated the convenience of being in telephone communication with Pretoria and elsewhere. Each room was planned with a flue so that it could be used as a chemical laboratory: the whole set-up was a veritable "dream come true". All stabling was built to the latest requirements for the individual species of experimental animal, ranging from mouse bins, rabbit- and guinea-pig hutches, pigsties and dog kennels through sheep pens to loose and individual stalls for the larger animals. A large incinerator for the disposal of refuse and carcases had been installed. Much to her relief, Theiler's wife was at last relieved of the burdensome work of rearing some of the smaller animals. Official transport to and from Pretoria North, or, if needed, to and from Pretoria, was provided in the form of a horse-drawn spider or buggy or a four-span mule-drawn cape cart. As much thought was given to the housing of the staff as to the stabling of the animals, each house was well screened with mosquito netting: the district, as well as Pretoria North, was rife with malaria-carrying mosquitoes. The residential area was laid out as a garden city, each

house having a large garden. Though running water was provided in the houses, candles and paraffin lamps still had to be lit at night. The native staff was provided with well-built thatched huts and a small plot of land, where chickens and a crop of mealies could be raised. Associated with the laboratory were lands sufficiently large to produce green fodder for the experimental animals. The adjoining farm, Kaalplaas, was acquired for free-ranging reserve stock. Ploughing, farm work and heavy transport were still ox-drawn. Many were the times when an ox-wagon got bogged down in the thick Onderstepoort black "turf" (black cotton soil), when the trek chain broke to the pull of a double span.

In March, 1907, the Crown Colony of Transvaal was superseded by Responsible Government, with Louis Botha as its first Prime Minister, as well as Minister of Agriculture, and F. B. Smith as Director of Argriculture. Upon the withdrawal of the British troops, various remount depots throughout the Transvaal and the Orange River Colony were handed over to the local governments, amongst other Nooitgedacht near Ermelo, Transvaal, and Bestersput near Petrusburg in the Bloemfontein District of the Orange Free State. These farms later mainly served as holding grounds for stock or were used for specific experimental work which could not be done under the local vegetational and climatic conditions obtaining at Onderstepoort.

Shortly before the move to Onderstepoort, J. Walker (1868 - 1952) was transferred from the field staff at Ermelo to Daspoort as Assistant Government Bacteriologist. He held office from 1907 until 1917, when he took a post at Kabete, Kenya, and succeeded R. E. Montgomery as Director during 1918 - 1932. He acted as Director for the Department of Animal Industries, Kenya, during 1932 - 33. Shortly after the move, K. F. Meyer (1884 - +) from Zürich was appointed as Pathologist. He remained until 1910 and eventually took up a professorship at the University of California in July 1913. Later he joined the Hooper Foundation for General Infectious Diseases. Another specialist to be appointed was R. Gonder (1881 - 1917) from the "Institut der Tropen-Medizin", Hamburg. Trained in bacteriology and protozoology, he worked at Onderstepoort from 1909 until 1911 on elucidation of the life history of **T. parva,** both in the final host (bovine) and in the intermediate host (tick). His work was later confirmed by E. V. Cowdry (1888 - +), a guest worker at Onderstepoort during 1924 - 25. Together with Gonder came his colleague H. Sieber, who worked on the haematology and the biology, morphology and incubation period of **A. marginale** from 1909 to 1911. Besides the professional staff, Theiler took with him his old Daspoort hands: E. H. B. Parkes as superintendent, H. W. R. King and C. F. Hinds as clerical administrators, F. T. Mauchle in charge of the "library" and stock records, Theo Meyer as photographer and in charge of the maintenance of microscopes and of other delicate apparatus, S. B. Teek as farrier and later as yard foreman, and the two old stalwarts, R. (Jock) White and W. F. Averre, as his "left-hand" lay assistants, R. J. Varley as yard foreman and general factotum and Miss L. Basson as typist; a few other lay staff were appointed, of whom the farm manager, W. B. Beeton, served a long time and became one of the characters of the institute. Last but no means least was "ou Piet", Theiler's "post-mortem boy". The death of "ou Piet" from glanders a few years later was a deep personal loss.

Theiler's work at Onderstepoort continued to be centred on the protozoan diseases. In a series of ingeniously devised experiments, **P. bigeminum** and **P. mutans** were shown to have different development rates. For the first time since pre-rinderpest days, when Theiler promulgated laws for its control, interest was again focussed on glanders, which had spread extensively throughout the country during the war. It was shown that not only pus but also blood from diseased animals was highly infective. By 1910 the disease was again well under control.

The Coming of Union

With the coming of Union it was obvious that Onderstepoort was destined to be the centre of veterinary research; it was appropriately situated for the study of the major, and of the majority, of the South African diseases.

Thus in 1909 - 10, when Theiler went on his five-yearly leave overseas, one of his objects was to recruit more staff, preferably specialists in their disciplines. He was also concerned with seeing the work being done by the veterinarians in Nairobi. Nairobi, started as the terminus and depot for the Coast-to-Uganda railway, commenced in the 1890's, was already a small town in 1902, but was only proclaimed a township in 1910. In 1907 R. J. Stordy was appointed Chief Veterinary Officer, with a one-roomed office in town. Upon his recommendation a properly equipped laboratory and research station was built. In 1907 R. E. Montgomery from Muktesar, India, was appointed as the first Veterinary Pathologist (1907 - 1917).

The present buildings were finally built at Kabete, a suburb of Nairobi, during J. Walker's days (1918 - 1932) and are hence very reminiscent of Onderstepoort.

His next concern was seeing the sleeping sickness and trypanosome work that was being carried out by Bruce and his team in British East Africa and by Kleine and his co-workers in German East Africa. He was saddened by the sight of the ravages of the disease in its final and lingering stages. His next port of call was Cairo to see Piot Bey (1857 - 1935) from Alfort, and A. Loos (1861 - 1923) from Giessen, and the latter's investigations on the helminths of Egypt, more particularly on the life histories of **Ancylostoma** and of horse strongyles. From Cairo onto Turin, Italy, he went to visit another helminthologist, E. Perroncito (1847 - 1936), who, in 1880, had worked out the life cycle of **Ancylostomum duodenale** and by applying his knowledge of this life cycle had enabled work to continue on the building of the Gotthard tunnel, work which had come to a stop due to some, until then mysterious, debilitating complaint. Perroncito lived to see ancylostomiasis recognized as one of the most important diseases of man in hot climates.

En route to the Ninth International Veterinary Congress at the Hague, in Holland, where he talked on the "Prophylaxis of Tropical and Sub-Tropical Diseases of Domestic Stock", Theiler called in at the Institut Pasteur to compare notes on protozoa and on ticks and other transmitters of diseases with Ed. Sergent (1876 - 1969) of the Institut Pasteur in Algiers, co-founder with Laveran of the "Bulletin de la Sociéte de Pathologie Exotique" in 1908, and to discuss his experimental findings on trypanosomes and trypanosomiasis with F. E. P. Mesnil (1868 - 1938, Professor at the "Académie des Sciences," Paris and founder of the "Bulletin de l'Institut Pasteur Revue", in 1903) and with Emil Brumpt (1877 - 1951) at the medical school. In London he met his old friends, Stewart Stockman, J. M'Fadyean and F. Hobday (1870 - 1939). For the first time he met H. R. F. Nuttall (1862 - 1937) to whom he had sent some South African ticks infected with **Theileria parva,** and who, together with H. B. Fanthan and Annie Porter (1880 - 1963), was studying parasitic protozoa. Nuttall's interest in ticks dates back to the time when ticks were first shown to be carriers of disease. Together with C. Warburton (1854 - 1959!) as his main collaborator, he brought out the classical "Ticks. A Monograph of the Ixodoidea", volume I appearing in 1908, volume IV and the last, under the authorship of L. E. Robinson, in 1925. Theiler's next visit was to talk about mosquitoes and their habits with F. V. Theobald (1868 - 1930), the economic entomologist and zoologist at the Imperial Bureau of Entomology, and lecturer in these subjects at the South East Agricultural College at Wye. His last visit was to the Veterinary College in Dublin to consult with Prof. A. E. Mettam (1865 - 1917), the principal since its foundation in 1900.

During the first part of the journey, the accent fell on comparing notes with colleagues on trypanosomes, and on protozoan and helminth-induced diseases: after all, one receives much more satisfaction from the interchanges in a verbal discussion than one does from reading publications or from written discussions, which still needed six weeks for the round trip. In the second part, the main purpose was recruiting staff for the Veterinary Research Laboratory at Onderstepoort. This was attended by considerable success as is shown by the following list: from Perroncito's laboratory, F. Veglia (1881 - 1965) as helminthologist from 1915 until 1928; from London: W. H. Andrews (1887 - 1953), from 1910 until 1924; he was to succeed Stockman as Director of the Laboratory at Weybridge in 1927; D. T. Mitchell (1885 - 1943), who remained from 1910 until 1927 when he was sent to Burma, where he successfully organized the campaign against anthrax in elephants; P. R. Viljoen (1889 - 1964), who served from 1913 until 1929 when he was appointed Secretary for Agriculture, eventually to be the Union's High Commissioner in Canada; from Wye, G. A. H. Bedford (1891 - 1935) to serve from 1912 until 1935 and succeed Gough as entomologist; from Dublin, D. Kehoe (1888 - 1928), who served from 1910 until 1918. On the death of Prof. Mettam, Kehoe returned to Dublin to help his **Alma Mater.**

Union brought the veterinary organisation of all four provinces under the central control in Pretoria, thus Grahamstown under W. Robertson (1872 - 1918) and the Allerton Laboratories at Pietermaritzburg under Watkins-Pitchford came to act as substations to Onderstepoort. Veterinary research in the adjoining Basutoland was in the hands of F. Verney from 1909 - 1939; his main achievement lay in clearing the country of scab and his main interest (or hobby) lay in improving the conformation and endurance of the Basuto pony. Rhodesia was under the control of L. E. W. Bevan (1878 - 1957) from 1905 to 1933. He was succeeded by one of Theiler's students, D. Lawrence. Deutsch Südwest-Afrika was under O. Henning.

Onderstepoort gets into its stride

With adequate laboratory and stabling facilities, and with an enlarged and well-qualified staff, Theiler's more immediate load of urgent routine was lightened, long term projects could be envisaged and information could be gathered gradually, each staff member adding to the whole. The urgency of combating devastating epizootics was a thing of the past: it might be said that at last it had become possible to see the wood and not only the individual trees. Given the possibility of long term planning, it would also be possible to estimate yearly expenditure more accurately, but not always accurately enough, so that, as in the past, F. B. Smith, the Secretary for Agriculture, annually still had to table supplementary estimates for Theiler, who regularly overspent his appropriation.

Under the more settled conditions, Theiler could fall into a planned daily routine of work: an early morning round of the stables to check on experimental animals and on the efficiency of the yard and stable staff, after breakfast the routine examination of temperature charts and the progress reports of his staff, the daily correspondence and then his own research work, with thirty minutes sleep after lunch. The reading of scientific literature was reserved for after hours, before and after supper, when there would be no interruptions. On three nights of the week, together with his wife, he indulged in mathematics as a form of relaxation and to take his mind from milling around the day's problems. The farm lands and native quarters were visited at the week-end. If there were any critical experiments, a visit at night in the dim light of a storm lantern was also a routine. It could be truly said that the Director knew what was going on in the organisation under his care.

Not only did Union bring enlarged laboratory facilities but also improved library facilities: more journals were ordered, as many new journals had come into being since his arrival in South Africa; new editions of the old standard text-books, as well as new text-books appeared on the shelves. Yet Theiler found it essential to supplement the official library with a private collection of books, not so much on veterinary subjects as on ancillary subjects, for he felt that it was an increase in general knowledge that was necessary to give an informed background to the problems to be solved.

It might be said that from now on Theiler did not suffer so acutely anymore from "the intellectual loneliness of long distance". He had a qualified staff with whom to talk things over. To keep them from ever feeling cut-off from the world of science, he instituted the Wednesday evening gatherings, which came to be referred to as the "weekly prayer meeting", in which the staff took turns to review the literature, each in his own field, and to report on any scientific fact which could prove of interest to the others. With the founding of the South African Institute of Medical Research by the Chamber of Mines in 1912 in Johannesburg, under W. Watkins-Pitchford (1894 - 1952), brother of the Natal veterinarian, and who remained Director until 1926, a link with the medical profession was forged, especially in the person of A. J. Orenstein (1879 - +) a member of Gorgas' team. W. C. Gorgas (1854 - 1920), director of the campaign for the eradication of yellow fever and malaria during the construction of the Panama Canal, had visited the Rand at the request of the S.A. Institue of Medical Research to give advice on pneumonia and other complaints then rampant in the mines. His visit to Onderstepoort was a memorable occasion for Theiler.

Interest in the sister biological sciences was maintained by joining the South African Association for the Advancement of Science, whose peripatetic annual meetings he attended as regularly as work allowed. In Pretoria he helped to found the Ornithological and the Biological Societies. His staff were encouraged to become members and to attend the meetings in Pretoria. Distance and time were to be no excuse: come hail, come shine, official transport was provided and Onderstepoort was always well represented. These "extra-veterinary" meetings acted as a continual stimulus, and to a certain extent compensated for the lack of time and opportunity of keeping abreast in the natural sciences. It was at these gatherings that he maintained his associations with such South African leaders of science as L. Péringuey (1855 - 1924) of the South African Museum, Cape Town, with A. L. du Toit (1878 - 1948), the leading geologist, with Austin Roberts (1883 - 1948), whom he encouraged in his natural history studies and who eventually became the leading South African ornithologist and mammologist at the Transvaal Museum in Pretoria, with Robert Broom (1866 - 1951), whom he encouraged to leave his medical practice and to concentrate on his palaeontological studies — for which studies General Smuts finally found the money and a post at the Transvaal Museum, with J. W. B. Gunning (1860 - 1913) who in 1896 became the first Director of the State Museum in Pretoria, with H. W. R. Marloth (1855 - 1931), who gave up

his professorship in Chemistry at Stellenbosch (1889 - 1892) to practise as a private analytical chemist in Cape Town, but above all to allow him time to tramp the country to study its flora. Another South African whose career Theiler influenced, this time indirectly, is H. van der Bijl (1887 - 1948), the founder of the Iron and Steel Corporation (ISCOR) at Pretoria. The story goes that father van der Bijl met Theiler at the club and complained bitterly that he had sent his son overseas and had allowed him to spend a few years on post-graduate work, so that he returned to South Africa highly qualified, but that there was no post for him: it was B.Sc. graduates that were wanted, not the specialist. Theiler's reply was: "Send your son back overseas to specialize even more so that when he returns to South Africa he will be indispensible" — advice well given and well taken.

Theiler's association with the staff of the Botany Division was a close one, officially and personally, both under J. Burt-Davy (1870 - 1940), Agrostologist and Botanist to the Transvaal Department of Agriculture since 1903, who resigned in 1913 to become lecturer in Tropical Forestry at the Imperial Forestry Institute, Oxford, in 1926, and under his immediate successor, I. B. Pole Evans (1879 - 1968), who served in the Department from 1905 until 1939.

With the increase of staff and of facilities, the range of the work became ever more widespread, so that it is difficult to detail separate events: remarks will have to be confined to broad outlines of the main undertakings with apologies if full credit is not always placed on the individual to whom credit is due.

Theiler, by interchanging infected ticks with Bruce and with Nutall, could establish the main differences between the organisms causing gallsickness, redwater — European and American — and also that the East African "Amakebe" was due to **T. parva.** H. H. Sieber confined his investigations to the haematology and to the study of the morphological and biological characters of anaplasmosis due to **A. marginale;** he traced the course of events in the bovine and gave details of incubation periods.

Ehrlich, who in 1891 had shewn that methylene blue stained malarial parasites in the body and that it had some curative properties, made another exciting discovery during his systematic studies of the benzopurine dyes and their possible use in chemotherapy. In 1904 he showed that trypan red was both curative and prophylactic for **Trypanosoma equinum** ("Mal de Caderas"). This was the first cure of an experimentally produced disease by the administration of a synthetic organic substance of known chemical composition. Trypan red, however, had but little practical use, as it was relatively ineffective against other species of trypanosomes. Nevertheless, the discovery led Mesnil and Nicolle in 1906 to two other dyes, trypan blue and afridol violet, which were effective against **T. brucei** in mice and cattle. Early in 1909 Nutall and Hadwen (1877 - 1947), the latter having been with the Canadians in South Africa during the Anglo-Boer War, shewed that trypan blue was also effective against biliary fever, **B. canis,** in dogs, but that the dogs remained infected for years. This work was confirmed by Bothelo in 1910 in South Africa. (Many of us remember our "blue-blooded" dogs). In 1913 Theiler could confirm Stockman's and Nuttall and Hadwen's findings on the dye's action on **P. bigeminum,** and that it also had a curative action on **B. caballi,** but that it never produced a sterile immunity and that it had no effect on **A. marginale.** At the present day trypan blue has been superseded by other drugs, but Ehrlich's discovery of the therapeutic action of an organic substance paved the way for the modern trends of therapeutics.

With the rapid increase in knowledge, not only in his own field of research, but also in the accompanying sciences, Theiler wanted to make sure that he was qualified to appreciate his staff's problems and to direct their research. Hence he decided to spend his long leave at Basel for the academic year 1912 - 1913, where he attended lectures mainly in pathology and physiology, and especially helminthology under F. Zschokke (1860 - 1936); he also brushed up his botany.

Once again he visited his colleagues at the different European institutes to compare notes and to search for qualified staff. He recruited H. H. Green (1885 - 1961), a biochemist and physiologist from Scotland, who was to serve from 1914 till 1927. Later he served under his old colleague Andrews as head of the Biochemistry Department at Weybridge from 1933 to 1953. Another recruit was E. M. Robinson, the first South African to be appointed to his staff, also the first son of a veterinary surgeon practising in South Africa. Whilst waiting for his boat to sail from Cape Town, Theiler paced the decks with a young B.A. graduate from Stellenbosch who had continued his biological studies in Berlin and Zürich and who was seeking advice about a future career: were there any openings for a zoologist? The outcome of the interview was that the young student, P. J. du

Toit (1888 - 1967) went to study at the Veterinary High School in Berlin, where during the 1914 - 18 war years he became co-author with his professor, P. Knuth, of the volume under the editorship of C. Mense, "Handbuch der Tropenkrankheiten", 1921.

Onderstepoort in full swing

Onderstepoort could now be said to be functioning in different sections : Helminthology, Entomology, Protozoology, Plant Poisons, and Chemistry in its wider sense.

Helminthology: Veglia was busy with his classical work on the anatomy, the life history and the treatment of **Haemonchus contortus,** the wire-worm, his laboratory being full of jam jars of sheep's droppings, with larvae crawling up their sides. This work was followed up by investigations into oesophagostomiasis in sheep. Theiler himself also published on wire-worms in sheep and in ostriches (together with Robertson of Grahamstown) and described the lesions caused by the nodular worm. A piece of work that pleased him much, mainly because it took him out-of-doors, was the finding and describing of the life history of **Filaria gallinarium** Theiler 1918, a nematode of fowls with a termite as intermediate host. He also ascertained the exact proportions of copper sulphate and arsenic necessary in the wire-worm remedy.

Entomology: Bedford continued the collection and the classification of mosquitoes started by Theiler and identified by F. V. Theobald in 1911 - 12. Horse-baited traps were scattered over the Onderstepoort farmlands in the hopes of incriminating a definite species as carrier of horsesickness. In 1932 he brought out "A Synoptic Check List and Host List of Ectoparasites of South African Mammalia, Aves and Reptilia" in which he gathered together the information which he had garnered during his twenty years of work. Despite the many night-catches on horses, the transmitters of horsesickness and of bluetongue eluded him.

Protozoology, Bacteriology and Virology: In this section work was continued on horsesickness, pleuropneumonia (lungsickness), drug treatment of trypanosomes (Andrews), anthrax (Kehoe), and jaagsiekte or chronic catarrhal pneumonia of sheep (Mitchell), epizootic contagious catarrh of equines (Theiler), anthrax in the ostrich and contagious abortion in cattle (Theiler).

Poisonous plants: Ever since the publication by Burt-Davy in 1910 on **Crotalaria burkeana,** attention was given to the investigation of many obscure diseases to see whether they were due to plant poisoning. Thus "Gouwziekte" was studied by Walker in 1909, and by Theiler, Mitchell and du Toit in 1923; Kehoe in 1912 reported on the poisonous properties of **Cotyledon orbiculata.** The Imperial Institute of the United Kingdom reported on **Acokanthera venenata** from the Transvaal. Mitchell, in 1918, reported on the toxic effect of the slangkop, **Urginea macrocentra,** and on maize infected with the mould, **Diplodia zea,** and the grass, **Paspalum dilatatum,** infected with an ergot, **Claviceps paspali.** Andrews in 1923 published on staggers or pushing disease of cattle in Natal due to **Matricaria nigellaefolia** and together with Green on the toxicity of **Adenia digitata,** whilst from 1918 to 1923 Theiler studied geeldikkop **(tribulosis)** in sheep, jaagsiekte in horses (crotalariasis), "dunziekte" (chronic seneciosis) and acute liver atrophy (staggers) in horses.

Chemistry: During his first few years, Green was fully occupied with "Dips and Dipping", with the analysis of the chemical reactions that take place in the dipping fluids. His first publications were on sulphur sheep dips and the polysulphide solutions, and on the oxidation by bacteria of arsenite to arsenate and of bacterial reduction of arsenate to arsenite in arsenical dips. He devised a vat-side arsenic dip tester. He also helped the helminthologists in setting up the composition of the wire-worm remedy.

Pathology: With a trained staff lightening his load of routine work, Theiler was at last able to work up his copious notes on "Nodes and Nodules in the Lungs of South African Equines", published in 1918. This paper can be taken as an example of the care given by Theiler to every necropsy that he conducted. Even good memories are not infallible and, lest he forget, Theiler noted every detail whether at the moment it appeared pertinent or not (one assumes that the expression "N.U." or "Nothing Unusual", was never used by him). His early notes proved of great value in later investigations, when decisions had to be made as to whether a particular sequence of symptoms or a particular lesion had been noted before, and if so, in what connection. It was this extreme attention to detail which made it possible to diagnose glanders with certainty and thus to apply control measures which resulted in the disappearance of the disease from South Africa.

Theiler retires

With the major cattle diseases either controlled or gradually disappearing, with the sheep industry on a sound footing thanks to the use

of attenuated virus for inoculation against bluetongue and of the efficient wire-worm and nodular worm remedies, and with a qualified staff "au fait" with the conditions prevailing in the country, Theiler felt he could retire and thus escape the ever-increasing burden of administrative setbacks. There were still many notes to be sifted, there were several large collections of helminths to be studied: Zschokke had trained him to collect. As his children were studying at Cape Town, he decided to settle in this town. Here he was happily occupied and as relaxed as he had not been for many a long year. The Department put a small laboratory at his disposal. During his out-of-office hours, he explored the Cape Peninsula and its flora, and had many a long chat and outing with the "ever green" Marloth, and, remembering his father's training, he collected plants on each trip. Theiler was getting quite knowledgeable about the Cape Flora. Theo Wendt's Thursday night orchestral concerts were attended regularly.

But Theiler was not destined to enjoy his leisure — not just yet: at fifty odd he was still very active. The post 1914 - 18 war influenza epidemic was such a disastrous one that the Government set up a Commission under Paul Cluver, Director of SAIMR, on which **inter alia** Theiler as an epidemiologist and his friend Orenstein, well versed in tropical and other diseases, were asked to serve. Never was there a commission that worked so expeditiously or that produced such down-to-earth findings and recommendations. The report in effect indicted the inadequacy of the Public Health Department both as to its staffing and the concept of its functions. Instead of pursuing a chimerical panacea for the evil which the country had suffered a toll of 140,000 lives, the Commission rightly stressed the need of recognizing the fundamental realities of the problem. The "Magic Wand", which no one more than Theiler was always expected to have ready to wave over the ailments of man or his animals, was dismissed as fantasy; the remedy lay in research, education, organisation and hygiene. The report hastened the enactment of the Public Health Act of 1919. Thus, for the third time of his career, Theiler, the veterinarian, came to the medical assistance of his adopted country.

R. E. Montgomery, who, with his wide experience of tropical diseases had built up the Veterinary Institute and Veterinary Service as Veterinary Pathologist and Director at Kabete, Kenya, was appointed Theiler's successor. It did not take him long to realize that although the livestock industry was picking up in most parts of South Africa, in the dry arid areas the farmers were battling against the very uneven odds of the crippling "lam- (or "gallam-) ziekte", crippling both to the beast and to the owner's livelihood. Farmers who had been petitioning the government for many a long year to help them in their dire need, farmers whose lands were riddled with the bleached — and not so bleached — bones of dead stock, stock (to quote a newspaper report) "which in bad years had perished in their tens of thousands, horses, cattle, buck, sheep and goats. In this huge land the bones of the slain lay where they fell".

"Lamziekte" had been well described by the earliest and by subsequent travellers. Local farmers were conversant with its symptoms and its appearance with the dry veld of late winter and its disappearance with the sprouting of the green grass after the first rains. Many theories were postulated as to its cause, farmers and veterinary observers all stressed the craving for bone, bleached or unbleached. Both Hutcheon in 1884 and Borthwick in 1896 had associated the disease with a possible deficiency of lime and phosphates and had recommended the feeding of bran and bone meal. Spreull and Robertson in 1907 incriminated **Pasteurella;** Keeling-Roberts, working on the farm Bestersput, tried to reproduce "lamsiekte" experimentally by means of inoculations of cultures with a bacterium obtained from the intestines of sick animals and also by the oral administration of carcass material or ingesta from affected animals. He undoubtedly produced "lamziekte" but failed to give a correct explanation of his own results. Two other "near-misses" were those by Walker in 1913 and by Mitchell in the same year with their administration of carcass material and crushed bones in various stages of putrefaction. Busy with plant poisons, Burt-Davy and Theiler in the same year suggested that a toxin was produced in the grass under certain climatic conditions, but the testing of over 60 plant species indicated that in all probability plants, as purveyors of toxins, were blameless in this instance. E. Hedinger (1873 - 1924) from Basel, working as guest at Onderstepoort on the pathology of the disease, concluded that it was caused by sarcosporidia. Vitamins, or accessory food factors as they were known at this period, also came into the picture when A. Stead in 1913 postulated a vitamin deficiency.

The time was ripe for a full-time, concerted attack on this baffling disease. Montgomery stressed the importance of the vast areas of land rendered unproductive for the livestock

industry and advised the government to finance investigation. A farm, appropriately named Armoedsvlakte ("Poverty Flats"), situated in the limestone regions near Vryburg, was bought and a small laboratory set up. Theiler was appointed as Director of "Lamziekte" Research, with H. W. R. King as his secretary and Th. Meyer as technician, both old hands from Daspoort days, as well as the necessary farm labourers to handle the cattle and to erect the fencing to camp off the various experimental batches.

Thus in 1919 Theiler was back in the veld, watching his experimental cattle, walking behind individual beasts, watching what they ate, studying their plant preferences. This time, however, he was unaccompanied by the vultures of his rinderpest and East Coast fever days, when at times they had been so satiated that they could not take off in flight and could move around but groggily and drunkenly. More copious notes were made, each lead of previous observers and workers was followed up and checked, such as the phosphorus content of the soil and of its pasture, the importance of bone chewing and the value of bone meal feeding. Eventually he came to the problem why it was that only the chewing of decaying bones brought out the paralytic symptoms of the disease.

The project obviously was not a one-man job. During 1919, P. J. du Toit (plus wife), the young student who had paced the deck with Theiler in 1912, appeared at Armoedsvlakte in the official transport, a rickety ex-army "Oldsmobile". The luggage, however, followed in the fourteen-span ox-wagon, still the recognized transport for heavy goods. At this period in Bechuanaland mainly donkeys were used for ploughing and transport, and the locals were very proud of the power and strength of their donkey teams. Du Toit, fresh from theoretical book work, was catapulted into the veld on the "lamziekte" problem. Green advised and assisted with the chemical aspect. By early 1920, Theiler and his colleagues could state that "lamziekte" resulted from a chain of events, beginning with the craving for phosphorus by cattle on pastures growing on phosphorus deficient soils, and the cattle eating what bones they could find on the veld, and frequently other abnormal objects, be it a dead tortoise, rat, "mossie" or larger animal, that these bones were infected with some bacterium which produced a toxin, and that it was this bacterial toxin which caused the paralysis and other symptoms to which the animal finally succumbed. It was left to Robinson in 1927 to identify the organism as belonging to the **Clostridum botulinum** group or **Parabotulinus bovis.**

From the control angle the problem was solved: clean the veld of all decaying carcasses and supplement the daily ration with an adequate amount of phosphate, but for Theiler there remained quite a few questions still to be answered. One that worried him inordinately was why the pasture was more nutritious when green than when dry. Phosphates were present in the leaves during summer. What happened to them in winter? Was there any translocation? Obviously a plant physiologist was needed to answer this one. Marguerite Henrici (1893-1971) from Basel was appointed in the early 'twenties as plant physiologist in charge of Armoedsvlakte, with instructions to study the movement of chemicals in the leaves of grasses and their value as food for livestock. Later, upon transference from the Veterinary to the Botany Division, she worked at the special station set up at Fauresmith in the Orange Free State.

The studies on "lamziekte", and the preceding osteophagia, pica or bonechewing, also introduced a whole new concept, that of the rôle played by minerals, and later the vitamins, in the maintenance of the health of animals. Green's "The Minimum Mineral Requirements" (1927) finally lead to "trace element" studies. The deficiency diseases had come into their own as a subject for research, to include soil analysis and the associated study of the different species of plants in their ability to take up, but above all to store, the chemicals in the soil as compounds available to livestock.

This series of investigations into "lamziekte" showed the necessity for an interdisciplinary approach to research, that "no research worker is an island, and that no scientist can any longer function in isolation, he must be part of the continent". To quote Victor Hugo, in turn quoted by the physiologist Claude Bernard (1813 - 1878): "L'Art c'ést moi; la Science c'ést nous" (I am art, but science is us).

During the hours Theiler was dancing attendance on his individual bovines, he had time to look around and note the vegetation peculiar to the limestone flats, the geological map of which showed nothing but underlying limestone. Bird life was also noted, nor did he fail to make use of the opportunity of collecting the fauna and flora, as also helminths and bones from his experimental animals. His mind at these times was probably back in Switzerland with Professor Schinz, publishing

on the flora of Africa, and with Professor Zschokke and his colleague, Karl Hescheler, who were both interested in "Entwicklungsstörungen und Krankheiten der Knochen". It can truly be said that at this period he was a happy man who lived his work and his hobbies. He made a good listener to what the local farmers had to say, and kept up with the times during his weekly visit to the barber and to J. Smollan, the owner of the only hotel.

The livestock industry in Bechuanaland, in which nature is so lavish and kindly in good seasons and harsh and repellent in bad, took on another look with the advent of bonemeal feeding; from being the Cinderella of the Union with poor stock, the country changed into a great progressive farming community; stock has been upgraded so that some claim that Bechuanaland now carries the best herds of dairy and ranching cattle in South Africa. As one farmer put it: "Truly does Bechuanaland owe everything to Theiler" — "for his monument, look around".

Onderstepoort gains Momentum

Veterinary science had come a long way since Theiler had come to South Africa. By 1920 the demand for the veterinarian was great, the term veterinary surgeon now had a new meaning. Briefly one can trace this change by recapitulating four extracts from the literature on the history of veterinary science. The first veterinary school to be founded was in Lyon in 1761, to be followed by that at Alfort (Paris) in 1768 with the main object of keeping the valuable army horses in good trim and to act as a bulwark against the possible entrance of the animal diseases met with during the numerous campaigns in Europe. Both these two schools were instigated by Claude Bourgelat (1712 - 1778), the Director of a riding school.

This same accent on the importance of the Farrier-Surgeon is seen in the charter granted by George III, Herzog zu Braunschweig und Lüneburg, for the "Ross-Arzney Schule vorzunehmenden Anatomien in Hannover" on 18th July, 1778, for the furtherance of "Arzney-Wissenschaft für Ross-Aerzte und Cur-Schmiede" with the reference to give instruction not only in "Ross-Arzney" but also in the course of time to include the teaching of curing other animals and eventually to include a school for the teaching of "Vieh-Arzney".

The School at Utrecht, founded 30 July, 1820, was based not on the value of the army horse, but on the need (as in South Africa, one hundred years later) to protect the important cattle industry against the "runderpest", which had invaded the Netherlands several times during the 18th century.

It was not until 140 years after founding of the first school that Bern, in 1900, became the first veterinary school to demand a compulsory matriculation, when it became a separate university faculty granting its own university degree (over and above the compulsory state examination). Theiler probably featured amongst its first candidates to qualify for a Doctorate by submitting a paper on "Die Malaria des Pferdes" in 1901. In due course all other European veterinary schools followed suit and the "Farrier-Surgeon" became a phenomenon of the past: the university-trained veterinarian was well on the way to take his appropriate place amongst the scientists.

The last reference to "Ross-Arzney", seen per chance by the chronicler, was made at the Annual General Meeting at Wilkes-Barre of the Pennsylvania State Veterinary Medical Association in 1923, where Theiler was a guest. V.A. Moore, talking on "Veterinary Education and the Future" dwelt on the fact that motor transport had dealt the veterinary profession a sharp blow, forcing many of the smaller American colleges to close down. Fully 75% of the veterinarian's income, previously contributed by the horse, had disappeared; new venues of work were being explored, more interest being taken in pigs and poultry.

It is interesting to note the change of accent on the rôle of the veterinarian in municipal affairs in South Africa: from horse-doctor to abattoir superintendent. Horse-trams in Pretoria operated from the end of 1895 till 1910, when they were replaced by electric trams. Gradually animal-drawn transport and refuse carts were replaced by motor vehicles, till finally the municipal stables were closed in 1947.

With the decrease of the epizootics and the control of the ever-recurrent diseases, it began to be realized that the future of South Africa lay in the development of agriculture, particularly in stock raising for the production of food and wool. With the more intensive farming practices, the higher value of the stock would call for better care and attention both in the prevention and cure of disease. Upon the demand of the farmers, and at the suggestion of the Agricultural Faculty of the Transvaal University College for the establishment of a veterinary school in South Africa, a Government Commission was appointed to make recommendations. This commission realized that there was a shortage of veterinarians, not only in South

Africa but throughout the world, and also that the urgent and genuine necessity for meeting the veterinary demands was not likely to diminish. The Commission, therefore, recommended the establishment of teaching facilities in this country, **inter alia** pointing out that the training received in the country would have to be adapted to the needs of the stock-raising conditions in South Africa. It advocated a five year course, the final four years ultimately to be given at Onderstepoort, whose teaching staff, though members of the civil service, would be associated with the Transvaal University College (later Pretoria University). In November 1919 the Government decided to establish a Veterinary Faculty, General Smuts invited Theiler to draw up a five year syllabus. The training was to be such that the South African student would be primarily equipped for research.

Although still at Armoedsvlakte, Theiler, with his knowledge of the overseas schools, set to work to outline a syllabus, with the assistance of H.H. Green and P.J. du Toit. It was recommended by them that the teaching staff be made up of research members and the teaching be well spread so that no one member would have too heavy a load, the underlying idea being that the research officer would, by teaching, remain in constant touch with the literature of his subject as a whole, whilst the student would receive instruction from the expert. Each teacher under this arrangement was to be primarily a research officer in the employment of the state. Under this dual approach the prediction was that the new institute would afford opportunities superior to those of any other teaching veterinary institute in the world. This was indeed a bold and progressive move, and well in step with, if not ahead of, the times.

It is interesting to note that the Royal Microscopical Society, many years before, had also come to the conclusion that it would be desirable to found a permanent microscope centre, where instruction and research could be carried out in the same building, "for it is thought that teaching is best done by those actively engaged in research".

As the first year courses in the general ancillary sciences were not to be given at Onderstepoort, Theiler had one year's grace in which to select and equip his staff. Each member was to be an expert in his subject; to ensure that they were properly prepared, he arranged for a year's study leave for each one.

The staff selected was:-

A. Theiler (1867 - 1936) : Dean of the Faculty. Professor of Pathology, later Tropical Medicine (1920 - 1927).

P.J. du Toit (1888 - 1967) : Tropical Medicine and Hygiene (1920 - 1948)

H.H. Green (1885 - 1961) : Biochemistry (1920 - 1928)

W.H. Andrews (1887 - 1953) : Physiology (1920 - 1925).

G. van de W. de Kock (1889 - +) Anatomy, since 1923 Pathology (1920 - 1949)

P.R. Viljoen (1889 - 1964) : Medicine (1920 - 1933)

E.M. Robinson (1891 - +) : Bacteriology (1920 - 1958)

C.P. Neser (1889 - 1929) : Veterinary Medicine (1920 - 1929)
Later appointments were:

F. Veglia (1851 - 1965) : Helminthology (1923 - 1927)

J. Quinlan (1887 - 1970) : Surgery :1922 - 1947)

H.H. Curson (1892 - 1968) : General Hygiene, Anatomy after 1927. (1923 - 1936)

P.J.J. Fourie (1894 - +) : Pharmacology, subsequently Pathological Physiology and Meat and Milk Hygiene.

A.O.D. Mogg (1886 - +) : Ecology and Special Botany (1922 - 1946)

W. Steck (1893 - +) : Physiology (1923 - 1926)

M.W. Henning (1894 - 1962) : Anatomy (1923 - 1925) succeeded by R.W.M. Mettam (1895-1951), who had held the chair of Veterinary Anatomy at the Johannesburg Technical College, later University of Witwatersrand, during the years 1920 - 1925, i.e. the period of abandoned trial of teaching the basic subjects elsewhere than at Onderstepoort.

Prof. J.C. Faure of the Transvaal University College lectured in Entomology for many years.

In 1920, in preparation for their respective Professorships, Theiler, Viljoen and Robinson spent a year in Berne, Andrews a year with the physiologist Bayliss at the University College London, Green went to Yale. In 1921 - 22

de Kock and Curson went to Berne, Fourie to Utrecht, and Quinlan to Hannover. During his stay in Berne, Theiler recruited W. Steck (1893 - +) who served from 1922 until 1926, since when he became Director of the Veterinary Medical Clinic at Berne until 1965, as well as J.R. Scheuber, M, Zschokke, G.G. Kind and H. Meier. Theiler realized that this would be the last batch to be recruited from Switzerland. The more recent additions to his staff had been South Africans who had trained mainly in the British Isles. He was a proud man on the day when his first graduates were appointed to his lecturing staff: J.H.R. Bisschop and J.I. Quin in 1926.

Montgomery, upon his retirement, returned to East Africa as Veterinary Adviser to Kenya, Uganda and Tanganyika (1920 - 1926) and in 1930 - 33 was adviser on animal health to the Colonial Office in London. Thus in 1920 Theiler took over in the dual capacity of Director of Veterinary Research and Veterinary Education

The research projects in the various established fields continued. It is during this 1920 - 1927 period that P.L. le Roux and H.O. Mönnig commenced their studies of the South African helminths, to be joined later by R.J. Ortlepp. It is not mere co-incidence that there were four South Africans studying helminthology overseas at the same time. Theiler's interest in helminths was almost an overriding one, hence his advice to zoology students was to specialize on worms. His vast collection he handed over in 1920 to Otto Fuhrmann (1871 - 1945) at Neuchâtel, the world authority on cestodes. Theiler's daughter, Gertrud, spent two years working on horse strongyles and in 1926 J.G. Baer published on the cestode collection. Theiler was sad to have to forego the pleasure of at last getting really acquainted with helminths, but he had other material, which he had also saved up or was still busy collecting, for the day when he would be on pension and would have the time to study at his leisure.

In 1923 Theiler represented the Union at the World Dairy Congress in Washington. Whilst in America, he took the opportunity of visiting as many institutes as possible, commencing in Canada and eventually leaving for the Far East from San Francisco. At Ottawa he had a re-union with E.A. Watson, who had fought with the Canadian contingent, as had Hadwen, during the Anglo-Boer War, and at the end had been stationed as a trooper with the horse-lines at Daspoort. On the advice of Theiler he studied veterinary science upon his return to Canada. Later in Australia Theiler also had a re-union with an Australian trooper, name unfortunately unknown, who, on Theiler's advice, also had switched to veterinary science and who also was then carrying a responsible post. This tour through the American institutions proved interesting to both Theiler and the Americans. Theiler's stories on South African parasites, tropical diseases, plant poisons and aphosphorosis led to many and long discussions after the lecture sessions at night, carried on during day-time in the laboratory or in the stable. In Texas, Theiler found that the complaint known as "loin disease" was similar to lamsiekte. In the discussions with the farmers he gathered that bone craving was as prevalent in Texas as it was in the arid regions of South Africa. He also gathered that the Texas complaints, "creeps", was the South African aphosphorosis or stywesiekte, most marked in growing calves and lactating cows, which suffer swelling at the joints and abnormality in hoof development, but without the acute bone craving associated with lamsiekte.

The helminthologists, H.B. Ransom (1879 - 1925) and his successor, Maurice Hall (1881 - 1938), of the Zoological Division of the Bureau of Animal Industries in Washington and author of "Diagnosis and Treatment of Internal Parasites" published in 1923, had a lot to tell him. Hall was busy on helminth control, basing his measures on known life-histories and making control as practical as possible. He was then busy testing carbon tetrachloride as a remedy for hookworm in man. In Washington he also met Hall's assistant, A. Hassall (1862 - 1942), who was responsible for the "Index Catalogue of Medical Veterinary Zoology". In New York he met Flexner of the Rockefeller Institute. The outcome of the meeting was that the Institute was prepared to send V.F. Cowdry (1880 - +) to Onderstepoort to carry on cytological studies on heartwater in ticks and in the organs of animals suffering from the disease, and to look for rickettsiae and also to undertake the investigation of **B. canis** in the yellow dog tick. Some of the "organisms" described by Cowdry have subsequently been shewn to be tick cells undergoing phase changes and not to be symbionts, as Cowdry thought. At Princeton, Theiler paid his respects to Theobald Smith (1859 - 1934), successor to D.E. Salmon (1850 - 1914) at the Bureau of Animal Industries. Smith had first described **Babesia bigemina** in America, whilst F.L. Kilborne (1858 - 1936) had discovered that the tick, **Boophilus annulata** was the transmitter of the disease, there known as "Texas fever".

The triumphal tour, which put Onderstepoort on the American veterinary map, proved fatiguing, so that both Sir Arnold and his wife were too tired to appreciate the Grand Canyon and San Francisco, where he met K.F. Meyer at Berkeley.

The Far East came up to tourist expectations, mainly because Theiler, with his usual thoroughness, was "reading up" as he went along. Japan after an earthquake, Hong Kong, Singapore, Kuala-Lumpur, Penang, Rangoon, Calcutta, Pusa, Muktesar, Lahore, Delhi, Bombay and the Taj-Mahal were visited, fascinating places all, with the lure of the East and the attendant lack of hygiene and the prevalence of numerous tropical diseases. He visited Montgomery's old station at Muktesar, then under the direction of T.E. Edwards, where good work was being done on rinderpest. The other veterinary institutes did not impress him.

Though delightful, this American and "round the world" trip was not just a pleasant outing, it was sheer hard work, sharing ideas, gaining new ideas for future lines of research, absorbing other points of view, and giving advice here and there. Possibly the most gratifying experience was meeting colleagues and contemporaries whom he knew from the literature and with some of whom he had corresponded.

His associations with Zürich were renewed when M. Küpfer (1888 - 1940), busy on oestrous cycles of domestic animals, came as a guest-worker during 1925 to study the cycle in horses and donkeys. He was stationed at Bestersput, commenced his observations at 4 a.m. and worked till late at night by lamplight; ice came daily by train from Bloemfontein. When not in the laboratory, he was out in the kraals watching the behaviour of the male and the female before, during and after the period of heat of the female. He was amazed and gratified at the "unlimited" amount of material placed at his disposal.

The only Belgian working in the Congo whom Theiler had ever met, was J. Schwetz (1876 - 1957), who called in at Onderstepoort during 1926. Schwetz was one of the early twentieth century die-hards of the trypanosome-sleeping sickness fraternity, who had elected to continue working in Africa, and who had stayed on in the Congo until the early thirties, interesting himself in medical and veterinary entomology in its broadest sense.

There now remained but the Australian and the South American veterinarians whom he had not yet met. He would have liked to have met J. Lignières (1865 - 1933), of Mal de Caderas fame, at Buenos-Aires, Argentine, and to have visited the Oswaldo Cruz Institute at Rio de Janeiro, founded in 1900 and named after the Hygiene "Dictator" of Brazil, Oswaldo Cruz (1871 - 1917). This institute is often referred to as the Onderstepoort of South America.

He was sorry not to have seen some of the "Natural History" of South America so fully described in the Voyage of the Beagle.

Upon his return from the world tour, Theiler settled down with renewed energy to the vast programme of work at Onderstepoort, but above all to enjoy his life's ambition of talking to students, his own students! One gathers that his "lectures" were talks rather than formal lectures. He had lived the increase in knowledge in veterinary science; one can always be both fluent and interesting when talking from experience, especially when that experience was as exciting and varied as his had been.

Thus when he retired early in 1927 he had established himself as past master in three separate fields : as a research worker in the spheres of Bacteriology, Protozoology, and Virus- and Helminth-induced diseases; as an organizer and leader in a country with an expanding livestock industry, with the switch in accent from epidemics to the health of the herd or even of the individual animal; and as an educationalist.

By 1927 the veterinary profession had proved its worth and service to the country and was in very good standing. The Provincial Associations had amalgamated to form the South African Veterinary Medical Association in 1920, which association gave out the first issue of its Journal in 1927. But despite the fact that various bills had been drafted and presented to parliament to secure legal recognition for the profession and to protect the public from unqualified practitioners, it was not until 1933 that a bill to provide for the establishment of a Veterinary Board for the registration of veterinarians and for other matters incidental thereto was placed on the Statute Book as Act No. 16 of 1933.

When Theiler retired, Onderstepoort had gained such momentum that not only was it well equipped and staffed by workers, each a specialist in his own field, but also overseas workers were coming to South Africa for research facilities and for consultation; above all it was providing an ever more grateful farming community with veterinarians trained to the problems of the country.

To his mind Onderstepoort, and with it the veterinary profession, could now take its place amongst the leading schools of the world — Onderstepoort had reached MATURITY

Though sad at the departure, he left with a feeling of gratification that the opportunity had been given him of working for the welfare of his adopted country.

Extra-mural work

Theiler's fourth reputation is founded on his investigations into the osteodystrophic diseases, of which more particularly "osteoporosis in horses" since the early days had attracted the attention of South African veterinarians: D. Hutcheon in 1904 - 1905, W. Robertson in 1904 - 1905, A.H. Lane in 1906 and Theiler in 1907. The symptoms of "stijfziekte", stywesiekte or stiffsickness in cattle had also been commented on by various observers. It was not, however, until the work on lamsiekte drew attention to the rôle played by phosphorus deficiency that concerted attention was given to malformations of bones and their associations with mineral and other possible deficiencies. Green, du Toit and Theiler and their collaborators set up a series of experiments to determine minimum mineral requirements in cattle and the effect of greater or lesser deficiencies of calcium and phosphorus on growth and on bone formation, on lactation and on maintenance of health.

To appreciate any malformations, Theiler renewed his knowledge of the growth and the structure of "normal" bone: he reviewed the function of bone as a support to take the stresses and strains of the animal at rest and in movement, the function of bone as a reservoir for the storage of the elements calcium and phosphorus necessary for the general physiological activities of the organism as a whole. He noted that the composition of bone may vary according to whether calcium and phosphorus are resorbed when needed for growth or lactation, or whether they are being deposited when absorption from the gut is greater than the drain from the bone. Resorption is quite normal within certain fairly wide physiological limits, the process being a destructive one in that every time minerals are withdrawn an actual breakdown of bone occurs. As long as resorption and deposition occur more or less contemporaneously, or follow one another within a reasonable time interval, no gross changes will be observed in the general structure of the bones. But the moment a clear disproportion occurs, either through increased resorption or decreased deposition, definite changes will follow, and the total amount of bone tissue will be decreased: the result is a reduction in the weight and an increase in the porosity of the bone, although it may often be difficult to say where the normal ends and the abnormal begins. The changes can be best observed in comparing bones of animals fed on mineral deficient rations with those fed on rations adequate in minerals, preferably with a wide range between extreme deficiency and optimal nutrition. The above Onderstepoort experiments provided skeletal material suitable for such histopathological studies.

In his monograph of 1932: "Untersuchungen über den Bau normaler and durch calcium- and phosphorarme Nahrung veränderter Rinderknochen", which many scientists consider to be his **magnum opum**, and in his three lectures delivered at the Royal Veterinary College in London under the auspices of the London University, he outlined his findings on the bovine aphosphorosis or stywesiekte material, as well as on material from South African horses and some material placed at his disposal by Sturgess and Crawford from Ceylon. A careful review of the literature on the bone diseases, not only in man but also in pigs, dogs, mice, sheep and goats, enabled him to bring clarity into the aetiology, histopathology and nomenclature of the heretofore described bone lesions. He clearly defined rickets, osteomalacia and osteodystrophia fibrosa, and was able to state that osteoporosis appears to be in most cases a transient stage in the evolution of some diseases, the last phases of which are not always reached and hence not always definitely recognized. Thus, in going on to rickets or osteomalacia, one of the grosser characteristic features would be a softening of the hard bone and an increase in osteoid tissue. This softening of the tissue in rickets and stywesiekte exposes the nerves to the influence of pressure, and stiffness and lameness follow. In order to relieve pain, animals take up unphysiological positions, which in their turn lead to malformations. In osteodystropnia fibrosa the compacta of the soft, porotic bone has been replaced by a fibrocellular tissue, which also fills the spaces of the former medullary cavities, giving the bone a tumourlike appearance.

In summarizing the results of his own investigations and his survey of the literature on rickets and osteomalacia Theiler felt justified in concluding that:

(a) The existence of rickets and osteomalacia in the strict pathological anatomical sense has been proved in the case of cattle and sheep, and in these species the disease apparently occurs in pure form without complications.

(b) The disease is also found in pure form in pigs, but is sometimes associated with osteodystrophia fibrosa, a disease which can also appear independently.

(c) These two diseases also occur in dogs, but rickets seems to be more common than osteodystrophia fibrosa.

(d) In horses and goats osteodystrophia fibrosa is the common bone disease.

(e) Although the osteodystrophic malacia (rickets and osteomalacia) of the domesticated animals, as observed in practice, is pathologically the same, it is aetiologically different in different species. In the case of bovines and ovines it is primarily an aphosphorosis, in pigs an acalcicosis, and in dogs an avitaminosis.

"In conclusion, however, I may summarize the facts on the osteodystrophic diseases as I see them with as little speculation as possible:

(1) The osteodystrophic diseases of the domesticated animals, rickets, osteomalacia and osteodystrophia fibrosa, can all be classified as dietary diseases, even if dietary factors are not always the only ones in their aetiology.

(2) They affect the whole skeleton, and arise from a withdrawal of calcium phosphate which cannot be replaced. Pathological changes in the bones are, therefore, inevitable, but the changes may vary according to age, species of animal and mode of life.

(3) The organism attempts to repair the defects, but does not succeed in restoring the former architecture, since sufficient supplies are not coming in. The result is a structure of inferior quality, usually amounting to a mere makeshift.

(4) The normal functioning of the mineral metabolism of an animal depends upon the harmonious interaction of three dietary factors: vitamin, calcium and phosphorus. The absence of any one of them might be expected to have the same result in all animals, but in practice this does not seem to be the case. Some species react more readily to one deficiency than to another, whilst in other species the same individual may react in two different ways at the same time. Different pathological pictures appear to result from identical causes, and the same pathological picture may be presented by diseases which, from the aetiological point of view, are different.

(5) The part possibly played by disturbance of endocrine functions, with or without concomitant dietary defects, and the possible significance of differences in endocrine mechanisms controlling mineral metabolism, are as yet unexplored in the domesticated economic animals".

Since Zschokke and Hescheler first asked for diseased bones, the advances in the methods for decalcifying and sectioning bone and its differential staining make it possible to note the minutest changes in bone structure and the movement of the separate cell elements, allowing of a detailed histopathological picture being drawn, which could not have been made with the techniques available in the early 1890's.

Release from Administrative Obligations

Theiler retired early in 1927, the year in which C. A. Lindberg completed the first solo crossing of the Atlantic. Together with his wife and a goodly collection of carefully collected and selected bones he went as a guest worker under the pathologist R. Rössle (1876-1956) in Basel. He was given all facilities, even a personal lady assistant trained to section and to stain bones. For the first time in his career, life was not "all work and preparation for more work": recreation crept into his weekly routine, with attendance at every change of programme of the operatic and orchestral societies, with many visits to the local art gallery. He also allowed himself time off to get re-acquainted with the Swiss flora and avifauna by attending meetings and outings of the different "naturforschenden" societies. He was back in his youth and took a child-like joy in renewing his youthful hobbies and in filling in the gaps left in his upbringing in the Arts and in the Humanities.

His bone work was interrupted when the Colonial Office, at the request of the Australian Prime Minister, Lord Stanley Bruce, asked him to visit Australia to advise on veterinary and nutritional problems, on the organisation of the veterinary services and on the establishment of a veterinary school. Part of the time he travelled with Lord Boyd Orr (1880 - +) director and founder of the Rowett Institute in 1914 at Aberdeen, and co-founder of Nutrition Abstracts and Reviews in 1931. At last he met his Australian contemporaries — Ian Clunies Ross (1899 - 1959) at Sydney and Lionel F. Bull at Victoria — and had a chance

of studying Australian farming and ranching practices and veld conditions at first hand. He found that most problems had their counterpart in South Africa. His travels convinced him of the need for the establishment of a large central federal laboratory, with the existing provincial laboratories acting as regional laboratories to serve the more immediate needs of the local communities. In due course the Australian Prime Minister invited him to accept the post of Director of Animal Health and to initiate the programme he had recommended. Previous to the Australian visit, Theiler had served on a committee called together by the Colonial Secretary in England to report on the re-organisation of the Colonial Veterinary Services. This Committee had recommended the provision of extensive facilities for research on tropical diseases and animal health, with the establishment of an Animal Research Institute in London and the East African Veterinary Research Organisation at Muguga, twenty miles from Nairobi. A special research post in the organisation was offered to Theiler. Much to his regret, and acting on the advice of his doctor, he could not accept either offer, so that he was back in Switzerland in 1929.

His next few years were spent in Lucerne where his brother was domiciled. Here his laboratory and workroom were in his flat, with his wife once more acting as his general factotum and bottle-washer, besides being his typist and secretary. The bones were still being sectioned in Basel but all the photographing and the developing was done at home, so that he was fully occupied. Once again the Theilers fell into the habit of attending operatic and orchestral concerts.

Having suffered so many years from the drawbacks of long distance and slow transport, he now availed himself of the relatively short distances in Europe and the fast transport provided by electric trains and motor cars. Thus he took time off during 1929 to visit his trypanosome associates, G. Lichtenheld in Wiesbaden and Ostertag in Berlin, to visit the pathologist, Th. Kitt (1858 - 1941), in Hannover, H. Miessner (1871 - 1949), Director of the Veterinary School and Editor of the "Deutsche tierärztliche Wochenschrift", and the protozoologist, W. Nöller (1890 - 1964), in Berlin.

Every once in a while, upon the slightest excuse, he would go to Paris, meeting Schwetz from the Belgian Congo, Mesnil, Brumpt and LeClainche. There he also renewed his association with M. C. Guérin (1872 - 1961), the collaborator with A.L.C. Calmette (1863 - 1933) in developing the B.C.G. vaccine, who had paid Onderstepoort a fleeting visit some time previously; or he would slip down to Lausanne to talk things over with B. Galli-Valerio (1858 - 1943), who was reputed to be the only parasitologist treating medical and veterinary parasites as a unit in the same lectures.

In July 1930, for the first time in his life, he had a set-back in health and went to Aix-les-Bains in the French Jura to recuperate. Ever full of "Wanderlust", the Theilers explored the district and returned via the tourist route Grenoble, Chamonix, Martigny and the Grand San Bernhard to Switzerland.

As both were finding the Swiss winters gloomy, cold and severe, they planned to recuperate from them by taking trips somewhere down south every spring. Thus the 1930 spring was spent in Florence, partly to visit the pathological institute but mainly to visit the art galleries and to listen to operas at the Scala and to explore the neighbourhood. Much preparation had been given to this visit, books on art had been studied and a somewhat rusty knowledge of Italian brushed up, the lessons given by Radio Roma proving most helpful. From Florence their steps took them to Southern Italy, where they studied some of the antiquities and art galleries in Sicily, Naples, Rome, Pisa, Bologna and Milan, not forgetting to call in at the Institute Zootecnico in Palermo, the Marine Zoological Laboratory in Naples, the Agricultural Institute in Rome and the new veterinary school in Milan.

The 1931 holiday was a pleasure-cum-work motor coach trip in North Africa, partly as the guest of La Société de Médicine et d'Hygiène. Landing at Tunis, they travelled westwards, taking in the Roman ruins at Constantine and Tingard, calling in at Algiers, Oran, Oudja, Fes, Rabat and Casablanca. He met C. Nicolle (1866 - 1936) in Tunis, where the Pasteur Institute had been founded in 1893, Ed. Sergent (1876 - 1969) in Algiers, where the Institute had been established in 1909, and H. Velu and J. Hintermann in Morocco, where the Institute had been established in 1928. Much to his regret he could not call on P. Remlingen (1871 - 1964) at Tangiers, where the Institute had been founded in 1913. He was greatly impressed by the services rendered to their communities by these branches of the Pasteur Institute, not only in providing vaccines and remedies but also in advising on animal management and animal nutrition, both extremely important in the semi-nomadic existence of part of the population. Through the

veterinarians' enterprise, grasses were being tested as pasturage in marginal areas, two of the favoured grasses being Kikuyu from East Africa and Rhodes from South Africa. At the time of his visit the French had a breakdown in their vaccines against anaplasmosis. Theiler asked Onderstepoort to send over some calves that harboured **A. centrale**. Sergent also showed him some of his tick transmission work with **Hyalomma.**

The return trip was via Bordeaux, Toulouse, Nîmes and a stay over at Lyons to meet Porcher (1871 - 1933) and O. Marotel (1873 - 1945) at the veterinary school. In September he was in London for the Centenary Meeting, opened by General Smuts, of the British Association for the Advancement of Science, where Theiler presented a paper.

The 1932 trip was a purely tourist one through Spain. It was so well guided that there was no time off to hunt up institutes or veterinarians, but much scenery was seen and agricultural methods gauged **en passant**. A wide range of architectural styles was observed, and, of course, a visit paid to the world famous art gallery, the Prado, at Madrid and the El Greco Gallery in Toledo.

The 1933 trip was an extensive one: from Venice to the Greek Islands, to Athens, not only to see the Parthenon but also Prof. Collette, then on to Palestine, where S. Adler (1896 - 1966), recently arrived from the Liverpool School of Tropical Medicine and then at the Hebrew University of Jerusalem, had a lot of questions that needed answering. The long term agricultural reclamation schemes were only just beginning but impressed Theiler as being practical and viable. After touring Palestine the route took the tourists to see the wonders of Cairo, where a visit was paid to the old-time friend Piot Bey, to Luxor, Karnak, the Valley of the Kings, the Assuan Dam, Memphis, Sakhara, Alexandria and home again via Italy.

In the meanwhile South Africa had gone off the Gold Standard and with the rate of exchange for the Swiss franc against him, Theiler moved to London, where F. Hobday, Principal of the Veterinary School at Camden Town, put a laboratory and an assistant at his disposal. Re-united with Green at Weybridge, Theiler promptly started planning further deficiency experiments, with P. J. du Toit and A. I. Malan, Green's successor at Onderstepoort, doing the feeding of the horses, sheep and pigs. Green was to advise on the quantities of calcium, phosphorus and vitamins to be administered and Theiler to study the histopathology of the resultant bone lesions.

In August 1934, as the Swiss delegate, he attended the 12th International Veterinary Congress in New York, where he met his two sons and his successor, P. J. du Toit, who had come over as the South African delegate. The Conference over, the Theilers' wanderlust took them on a sight-seeing trip through the States. On medical advice he was to go slowly and not to try to fit in any work. So for the first time in his life the accent was **not** on visiting institutes and contemporaries. Nevertheless, he visited Cowdry and, in Berkeley, the parasitologist C. A. Kofoid (1865 - ?), Editor of the American Journal of Hygiene.

The highlight of the tour was the visit to the two National Parks, Yellowstone and Yosemite. At last he had time and leisure to appreciate Agassiz' "Natural History" of America.

From Vancouver they travelled directly to New Zealand. There, partly as the guest of Lord Bledisloe, the Governor, he was shown New Zealand, North, Central and South, and was given every opportunity of seeing local farming communities and their farming practices and of discussing their problems with the veterinarians: Sir Ian Fraser, Barry, Hobkirk, Marsden and J. A. Gilruth (Wallaceville). The problems of the intensive farming in the lush New Zealand pastures was something quite new to him and he would have liked to have stayed on longer, but by now he was anxious to get back to South Africa. Unlike Darwin one hundred years before, he found New Zealand a pleasant place, the country most attractive, the inhabitants cultured and hospitable and he was loth to leave. If in the good old days he felt the "loneliness of long distance" in South Africa, he realized that his feeling of academic isolation was nothing compared with what the New Zealanders and the Australians were still feeling: Amy Johnston had not yet done her solo flight to Australia.

His second visit to Australia was but a short one to say good day and good-bye to his 1928 associates.

In December he touched at Durban and was immediately back in the days of the rinderpest and the first tick-dipping trials, when the old-established Natalian, S.T.A. Amos (1876 - 1948), came on board to welcome him back to South Africa. Before returning to Onderstepoort, together with his daughters, he did an extended tour through the Union, not by ox-wagon as did Le Vaillant, but by motor car, visiting old personal friends as also such old associates as F. Verney, then farming in Kokstad, and Marguerite Henrici, stationed at the nutrition experimental farm at Fauresmith. By mid-January he was ready to

start work at Onderstepoort. P.J. du Toit had offered him the use of his old laboratory, a technical assistant and one of his own trained veterinarians, A.O.D. Thomas. He was also provided with his "compulsory white apron".

It was good to be back in sunny South Africa, amongst the familiar staff and surroundings and to meet the newcomers to Onderstepoort. It was good to be a guest visitor, whose every need was attended to by his own old staff and to know that there were to be no more financial or administrative difficulties, no need to do any "homework" if he did not feel like it and that he could go off on a holiday when he was in the mood for one. Whilst he was still Director, apart form his periods of leave overseas, he had never taken time off for recreation, except once, on doctor's orders after a bout of bronchitis, when he thoroughly enjoyed Durban and the Natal Coast. One such holiday was a tour through the Kruger National Park, where he exchanged reminiscences of the old East Coast fever days with Colonel J. Stevenson-Hamilton (1867 - 1957), Game Warden since proclamation of the original "Sabie Game Reserve" in 1902 and who was to retire in 1946. The abundance of game in the park amazed him; even in his "veld days", when he occasionally shot for the pot, he had never seen so many of any one species together at any one time.

At no stage were the Theilers allowed to feel lonely: staff members, students and "Biological Science" associates dropped in to pass "the time of night". One particularly welcome guest was A. Pijper (1886 - 1964), who originally in 1913 had settled as a medical practitioner in Bethal, where he had set up a small pathological laboratory supported by a donation from Prof. van Calcar of Leiden. Theiler, remembering his own early struggles away from any library facilities, had advised Pijper to move to some centre of learning where he could have somebody with whom to discuss his problems and where the necessary reference books and journals could be consulted more readily. In 1920 Pijper transferred to Pretoria and did not hesitate to consult with Onderstepoort. His private laboratory was soon the official consultant pathological laboratory for the Provincial Hospital, the Municipal Health Department and the Mental Asylum. Thus, when the Faculty of Medicine was instituted at the University of Pretoria in 1945, he was the obvious choice for the Chair of Pathology and Director of the Pathological Institute. Like Theiler, Pijper was always as full of ideas as he was of enthusiasm for his work on rickettsia, on the structure and movement of bacteria and on the improvement of his own microscopic and cinematographic equipment.

True, Pretoria did not offer any orchestral concerts or operas but that was not such a great deprivation, for after the day's work he did not always have the necessary energy to attend a performance. Theiler at last had to admit that he was not as young as he used to be.

Once again the wanderlust came to the fore and in April 1936 he left for Europe. Despite his not being so young any more, he did an extended tour, landing at Rotterdam, then on to Hamburg to see his friends at the Tropen-Institut, thence to Berlin, where Rössle was now Professor, to Cologne, Koblenz and Wiesbaden, to see Lichtenheld, and to Frankfurt and the tourist route of Nürnberg, Rotenburg, Dinkelsbühl, to Augsburg and München to see the art galleries and Prof. Kitt at the Veterinary School, and some friends from the pre-Anglo-Boer war days from Pretoria, then on to Luzern to see his family and to visit Frei, Küpfer, Zschokke and Steck. After Switzerland he visited the Netherlands for the Tricentenary Celebrations of the University of Utrecht. There, on the 24th June, together with Generals Smuts and Hertzog, he received an honorary Doctorate, amidst much pomp and splendour, for Queen Wilhelmina and Princess Juliana graced the proceedings. This was the first time Theiler had met his Netherlands colleagues in their own home-setting, otherwise he knew them as "conference attenders".

The tour next took them to the Scandinavian countries, which they toured fairly thoroughly, not forgetting to visit the Mermaid, Thorwaldsen's Museum, the Veterinary College in Copenhagen and later the Veterinary College in Stockholm, Uppsala and the Linnaeus Museum, Oslo, Bergen and the Fjords. Finally they went back to England for the Second International Microbiological Congress in London, where his son Max was to talk on his yellow fever work.

On July 24th he died of a heart attack. Lady Theiler in her sad bereavement had the comfort of many old friends around her: an old medical friend, Dr. Pettavel from Johannesburg, Sir Frederick Hobday from Camden Town, Dr. Green and family, the Alfred Theilers from Luzern and her son Max and family. Under the direction of the High Commissioner for the Union of South Africa, a service was arranged and Arnold Theiler was cremated in London.

Thus ended the life of a simple veterinarian, with friends the world over: a man who had made his mark as one of the world's leading workers, who had helped to give direction

to trends in the biological fields during a period of great scientific activity and progress at the end of the 19th and the beginning of the 20th century.

World Appreciation

Theiler was popular among members of the platteland community, probably because he was a patient listener and never thought an observation made by even the most humble farmer too trivial or unimportant not to be treated with consideration. Experience had taught him that the South African farmer was a keen and careful observer where the ailments of his livestock were concerned, even though his interpretation of the symptomatology was sometimes faulty. This, to some extent, would probably account for the retention in the nomenclature of animal diseases in this country of names such as "gallamsiekte" "bloutong" "vuilbek", "naelstring", "pisgoed", "bankrotwurm", "domsiekte", "snotsiekte", "olifantvelsiekte" and many others.

His contemporaries, veterinary, medical and biological, are agreed that the success attending his undertakings were due to his innate doggedness and undaunted determination, to the infinite care taken in preparing himself for a new project, his wide learning and his ability to absorb new ideas from sister disciplines, to his practical outlook, his application to the matter in hand, together with a keen insight. But they concede that, as in all genius, there was the occasional lucky bit of intuition added to the infinite capacity to take pains. As a private individual, his contemporaries, like his students and colleagues found him approachable and despite all the honours bestowed on him, ever with a balanced dignity and scientific humility; they found him to be a man with a quiet humour and full of human kindliness and understanding. His enthusiasm for the work being done or to be done he could pass on to all with whom he came into contact at conferences or on his visits to sister institutes. Wherever he went, he was a welcome guest and a good companion in any circle of friends. He was both a good listener and good raconteur — in other words, when not at work, he remained the "fidéle Schweizerbub".

As a scientist he has been acclaimed by the veterinarians as the great outstanding scientific veterinarian in his day and generation, which was again the greatest period of discovery in the history of veterinary science, by his medical contemporaries as ranking amongst the Medical Greats, by his biological contemporaries as one of the outstanding pioneers in biology, high tribute indeed for any man who started his career under such inauspicious circumstances.

Given the opportunities, he did full justice to the trust placed in him by the Government, by the farming community and by his school-mate and wife.

At the suggestion of the South African farming community that a fund be initiated for a statue in honour of the memory of their friend and benefactor, the Government decided, since all South Africa and not only a part thereof was indebted to Theiler, it should finance the project. Coert Steynberg was commissioned to do the statue. He chose granite as his medium to reflect the character and determination of his subject.

The statue was unveiled and dedicated with all official pomp by Theiler's life-long friend, supporter and admirer, General J.C. Smuts, on behalf of the Government of the Union of South Africa on 15th November 1939.

It is to the memory of this man and his times, to whom and to which the Faculty of Veterinary Science of the University of Pretoria owes its existence, that this work is dedicated in commemoration of its Golden Jubilee.

Lady Theiler

On her 80th birthday on 21st November 1948, the Onderstepoort Staff, the Division of Veterinary Services and the Veterinary Profession in South Africa met to extend to Lady Theiler their best wishes. In his congratulatory speech, Dr. Gilles de Kock, the Director, on behalf of those present and of those many friends absent and overseas, paid high tribute "to the sacrifices made by the Theilers in their early up-hill struggle. Behind the throne there was a power, the wife, who assisted the restless, energetic and untiring investigator. She was his sole counsellor and created an atmosphere of calm and with it all remained collected and steadfast. Her outstanding qualities as wife, mother, secretary and even as technical assistant, with only primitive laboratory facilities, are well known to us. She assisted with the manufacture of smallpox vaccine, bred the laboratory animals and, despite her ordinary household duties, was the general factotum. It is stated that from 1893 to 1905 she did not have a day away from her troubles and worries. Together they plodded, worked and struggled from the Les Marais tin shanty to the Daspoort shanties and from there to their ultimate goal: a modernly equipped scientific laboratory at Onderstepoort. Here Lady Theiler was known for her dignity, hospitality and friendliness to all. Some of the old stagers, like Walker, Andrews, Robinson, and Theo Meyer, Averre,

Pretorius and van Niekerk, who are here today, can recall the important part she played as wife of the Director. There is no doubt that her name is closely associated with the history of Onderstepoort and its achievements. It is for this reason that we wish to pay tribute to, and to honour you on this momentous occasion, your 80th birthday and the 50th birthday of Daspoort-Onderstepoort."

It is fitting that her ashes also rest under the Granite Statue.

Reminiscences: Contemporaries and Colleagues

Contemporaries were given an opportunity to contribute to the memory of one of the greatest scientists in South Africa. Extracts of letters follow:

Dr. Ed. Sergent, one time Director of the "Institut Pasteur" in Tunis, at the age of 90 years, writes: "C'ést avec le plus grand plaisir que je vous envoie le témoignage de ma souvenir trés chalereux de Sir Arnold Theiler pour lequel j'avait acquis un attachment très vif qu'en écrivant je tâche de voux exprimer non seulement pour ses travaux remarquables, mais aussi la haute qualité de sa valeur morale, qui infuse toute son activité".

K.F. Meyer, who came to Onderstepoort straight from veterinary school in 1908 to test his fledgeling wings and who visited Onderstepoort in 1964, testifies as follows: "as the years pass by ... I appreciate more than ever the privilege of having been introduced into the realm of bacterial, protozoan and viral diseases of animals and man. The opportunities to search, test in model experiments the pathways of infection and to elucidate the epidemiology of the infections in field studies were unique. A dynamic, adventurous spirit permeated the establishment. It still prevails on the centenial of the birth of Arnold Theiler. Building on a vast experience and a broad knowledge acquired through years of study and reading, Sir Arnold contributed to the welfare, health and economy of South Africa. As one of his colleagues, I acknowledge my indebtedness to his guidance in making me a life-long student of the diseases of animals transmissible to man. Thus I will never forget him as a scientist and leader".

Extracts from Dr. A.J. Orenstein's speech on the occasion of Lady Theiler's 80th birthday and the 50th anniversary of the beginning of Onderstepoort as an Institute, 22nd November, 1948. (Orenstein reckons Onderstepoort started when Theiler got his first laboratory at Daspoort in 1898).

"Perhaps I had best begin by telling you what was my outstanding mental picture of South Africa at the time I was offered an appointment here, with the Rand Mines Ltd., in 1914. This was that there were in South Africa many gold and diamond mines and Arnold Theiler at a Veterinary Institute".(His Chief, Gorgas, had been to South Africa in 1912). "The latter I must say, intrigued me much more than the gold and diamonds. Not many days passed after my arrival here, before I went to see Sir Arnold, and found that what I had heard of him and the Institute was not only true, but in some ways an understatement. It was made clear to me that here was a team of workers who sought for truth and in seeking it were attacking their problems with no bias or prejudice. Most of all I was impressed by the fact that these men were a true team and that they were a happy and enthusiastic body of scientific workers because they were led by a man of quite unique vision, enthusiasm and that most precious of gifts, the gift of leadership and power of inspiring his co-workers and so there and then I joined the band of respectful admirers of Arnold Theiler and of his Institute. Nothing that has happened in the 34 years which have passed since then has in the least shaken this admiration and respect for both. What constitutes a great research laboratory? It is the men who work in the laboratory and the spirit which guides and inspires them that makes a research institute great!"

A Pijper: "Theiler was one of my heroes long before I ever sighted South Africa. At the University of Leiden, pathology and bacteriology were taught by two veterinarians, Poels and de Jong, who were members of the medical faculty, having been brought there by my Chief, Professor van Calcar, who taught human bacteriology himself. And so the medical students, who felt so inclined, could be initiated early into the great work Theiler was doing, in my youthful imagination quite by himself and in a complete wilderness, on the fields of South Africa. The conception of the essential unity of human and veterinary pathology, so dear to the heart of Theiler, and so often emphasized by him, and now I hope firmly established by the regular participation of Onderstepoort in the annual scientific meetings of the S.A. Medical Association, became a habit in the mind of the students of that period. Soon after arrival in 1913, I called on Theiler at Onderstepoort, and made my first personal contact with the man whose work and outlook would become quite unforgettable. Outstanding in my recollections of that first interview was the impression that one was

dealing with something "outsize", something that could not be discussed in terms of ordinary human beings. And that impression has lasted till the end. Theiler always knew more, saw more, read more, penetrated deeper and judged better than one did oneself.

"Interviews with Theiler did not exactly increase one's vanity! I don't know that he ever saw this himself, and I am quite certain he never wanted to produce this effect. I felt that at that first interview, for though I went home "a smaller but a wiser man", I also carried home an impression of having met a man whose kindness and loyalty, once you had made friends with him, would be invaluable. And that was another impression that turned out to be correct".

"Theiler fired some rapid, very direct questions at me. 'Why had I come to this country? What did I want to do here? What kind of work was I interested in? Why had I not become a veterinarian? Didn't I know there was such a lot of work to be done in that line? How many languages could I read?' I replied as best I could, expressing regret I was not a veterinarian, and feeling sorry that I could not saddle over then and there, for I would have loved to work with that man. I have been sorry ever since".

"Onderstepoort was not such a big place then (1912) as it is now (1929), but I saw that I had to correct my original idea that he worked quite by himself; there was already quite a large staff then, mostly young men, and all devoted to "the chief". But I also noticed that in the more literal sense of the word he was 'single-handed', and from then onwards I have never caused to marvel at the dexterity with which he overcame that terrible handicap. He managed so well with that one hand that, even when in his company, one was apt to forget it. Years later I once found myself forcing a drink and a cigar on him at the same time, and I still can hear Theiler's voice, a trifle indignant: 'Can't you see, man, that I've got only one hand!' and in the same way as he had got over that drawback he got over all the others: there were many, especially in the early days. Theiler's mind never seemed to age".

W. Steck: "When I joined Theiler's Onderstepoort staff in 1922, his creation, Onderstepoort, was already a world famous centre. Perhaps what impressed me most was that this same man who directed the large organisation of Veterinary Education and Research, could also, at an autopsy or behind the microscope, be absorbed in the finer details of an organ or of a section. I had little opportunity to study the functioning of the organisation mainly because it did function. But it was possible to discover some of the main roots of his scientific activity. Once, when I met Sir Arnold during the later years in Switzerland, he told me he had spent a day going on an excursion with the 'bird enthusiasts'; he said this perhaps with a touch or irony. But he was an enthusiast himself. He was a passionate biologist, interested in practically all fields of biology, whether they were of immediate practical interest or not at all. No wonder he had a broad biological view when he tackled problems of veterinary science. Coming from Europe with a marked specialisation in different institutes, I was struck by the way Onderstepoort tackled problems. In the foreground was the study of diseases, not of single patients or organs or material derived from them. The tools, clinical, pathological, chemical or physiological were used as they were required. One did not start off with a tool and look for the occasion to use it. This general trend did not exclude the collaboration of specialists; Sir Arnold had gathered many around him. Among them I would like to mention one great man and scientist, H. H. Green.

"...I would like to express my personal gratitude to Sir Arnold, who was to me, from the time I joined his staff to the end of his life, a fatherly friend".

Lord Boyd Orr (private correspondence, 1970): "My wife and I travelled for a bit with Sir Arnold and Lady Theiler (in Australia) and I was much impressed by his ability as a scientist and his devotion to veterinary research ...In spite of his great learning, he and Lady Theiler were two of the most modest people we had ever met. He was a man for whom I had a very great respect and for whose friendship I was indebted".

(Boyd Orr visited South Africa and Onderstepoort in 1920 and was shown the experimental lamziekte and phosphorus deficiency work by H. H. Green, a university contemporary in Scotland).

Gilles de Kock: "It was in the Department of Pathology and Pathological Histology that his studies greatly interested and impressed me, and assisted me in planning my own career. The carrying out of autopsies in his investigations served him well, and the **post-mortem** room and microscope demanded a great deal of his time. My personal debt to him in this respect is indeed great.... With his diligence and background, added to his investigations and his knowledge of overseas institutions, he occupied a unique position to guide and advise members of his staff with regard to their studies and their

visits overseas.... He adapted himself strictly to rules, and undoubtedly created a discipline for which Onderstepoort is noted. He was quite unstinting of himself in his work from early morn to late at night... I am truly grateful that I had the honour to work under the guidance of this great scientist, and to understand this courageous man".

J. R. Scheuber: "I remember an occassion, a graduate class students' dinner, when Sir Arnold, speaking of the early days and the final success of Onderstepoort, modestly remarked that the opportunities were there, all he did was recognize them and make use of them, someone else could have done the same".

P. J. J. Fourie: "Sir Arnold Theiler, or as we knew him 'the Old Man', ' die Ou Baas' was first and foremost a great pioneer...

"My own personal association with Sir Arnold had its ups and downs, but I shall never forget the inspired leadership he gave me when I approached him for a problem for a thesis for a Doctor's degree. It was more than 40 years ago, but I can still see him clearly in his laboratory working at his microscope, when I put my request. He turned round and looked me straight in the face and without hesitation said: 'My boy, we in the practice know that when a sheep has worms, it develops an anaemia. Find out which worms cause the anaemia and how this anaemia is produced'. No details discussed, to him the directive was clear enough; all facilities were placed at my disposal: stable accommodation, as many sheep as I required and no limit to any equipment I needed for the work.

"He was the great pioneer of Veterinary Research in South Africa and I believe his work at Onderstepoort has also had a great influence on the development of medical research as well".

Marguerite Henrici: "Sir Arnold and I got to know one another not only in the lecture rooms" (Basel 1912 - 1913) "but rather through our love of plants which was shared on the different excursions and through his ideas of the interrelations of plants and animals. Upon my arrival in Cape Town, Sir Arnold had arranged for Dr. Marloth to meet me and to see me into my train. Sir Arnold himself met me at Pretoria and looked after me.

"In due course I was conducted to Armoedsvlakte. It was not easy for a person accustomed to Swiss University life" (and a lady at that: Ed.) "to get on with life on an out-station with its mixed personnel (i.e. White, Black and Coloured). Also in this instance Sir Arnold helped a lot. Later, with a somewhat improved knowledge of English and Afrikaans, I was made Officer-in-Charge — and I as botanist had to have a crash course on identifying anthrax, and other possible and probable diseases for the district, from smears! And when Sir Arnold came on his check visits he insisted that I be present at all the post mortems. To add to my troubles, the locusts were swarming and the locust control officers got busy with their arsenic solution — came the rains, and the cattle in the district died like flies. Rinderpest was suspected, but we at Armoedsvlakte could prove that all the intestines from dead animals contained arsenic! All this work from a plant physiologist! My next station was Ermelo, where I was to go on with the phosphorus deficiency work" (and where P. le Roux, the helminthologist, on some subsequent occasion, used all her dinner and soup plates to store his sheep worms — and that for a lady nurtured in the strict academic circles of Basel!) "At all times when called to Onderstepoort to report on progress of work, I was made welcome in the Theiler household... What impressed me most, apart from the scientific talks, was how Sir Arnold cared for his staff. He maintained that, if a scientific staff is not cared for and happy, they cannot work well. What a lot of trouble he took when I had to get naturalized and with only two days to go before the law changed to a prolonged period of stay... When I had to sit my Afrikaans examination I think he was more afraid of my possible failure than I was. He had a good sense of humour; he liked women but not stupid ones. We had a good few jokes together, as he liked teasing. He was fond of curious plants and on an excursion in Namaqualand was as eager as any young student: an unknown Lithops or a scarce Asclepiad delighted him.

"To this day I still think he was my best friend in South Africa".

E. M. Robinson: "So much has been written about the scientific career of Sir Arnold Theiler and his efforts in solving the stock diseases of South Africa, that I feel there is little that I could personally add and will content myself with my impressions of him gained in an association which extended over twenty-two years. The first time that I saw him was when he gave a public lecture on trypanosomiasis at the South African Association for the Advancement of Science's meeting in Grahamstown in 1908, when I was a student at Rhodes University College. I still remember the tremendous impression he made on me at the time though I did not actually meet him. The next time I saw him was in October 1913, when I was working as an

assistant to a veterinary surgeon in Warwickshire in England after I qualified. He had been on a year's study leave in Europe and in his absence a vacancy had occurred on the staff of Onderstepoort. I met him at the hotel where he was staying in London and he offered the vacant post to me, a condition being that I take the bacteriological course included in the Diploma of Public Health at University College Hospital in London. My father, who was lecturer in Veterinary Science at Grootfontein Agricultural College at Middelburg, Cape, was a great admirer of Sir Arnold and he felt that great credit was due to him for being the first man to investigate stock diseases in South Africa systematically. He was a guest of my parents during a visit to Grootfontein and my father told him that I was studying in London. My mother told me in after years that he had 'the eagle eye'.

"In December 1913 I saw Onderstepoort for the first time. For anyone visiting it today it is difficult to realize what it was like then, five years after its establishment. On my arrival in the morning, I was interviewed by Sir Arnold who wanted to know about the studies I had made and then proceeded to give me a programme of work which I sincerely hoped I would be able to cope with. I was put into a laboratory under Walker to find my feet and it was not until after work in the afternoon that I had the opportunity to find where my quarters would be in the old hostel. At that time the professional staff consisted of Messrs. Walker, Mitchell, Andrews, Kehoe, Viljoen, Veglia and Bedford. At the time Mitchell was at Allerton Laboratory, Pietermaritzburg, and Viljoen at Armoedsvlakte. Only two of these could be considered as specialists, Veglia in helminthology and Bedford in entomology. Two months later Green and De Kock arrived. All these, except Dr. de Kock, have now (1966) passed on. Sir Arnold, having just returned from Europe, had commenced having **post-mortems** made very thoroughly on the lines of human **post-mortems** This entailed being up at 7 a.m. summer and winter, so for the first few months I had to be there every morning until I could take my weekly turn. He always came himself to see how the **post-mortems** were going and it was a very valuable training. At that time the **post-mortem** room was in the main building next to the bleeding hall. This was sometimes very obvious. In those early years Sir Arnold used to go through his charts, then do an inspection of his experimental animals, after which he would go through his correspondence with the chief clerk, H. W. R. King. That over, he retired to his laboratory and none of us dared to intrude on his privacy except for very urgent matters. I must confess that in those days we all stood in awe of him, due to his powerful personality. He was accused of being a slave driver, but this was not the case. He expected his staff to pull their full weight and nobody could have worked harder than he did himself. He had a flair for the dramatic on occasions and I well remember the opening of the new **post-mortem** room in 1917 which was almost like a state function. In 1918 he decided to resign at the early age of 50 and to hand over his post to R. E. Montgomery, at that time Director of Veterinary Research in Kenya. Here again the actual handing over was dramatic and took place in the bleeding hall. Sir Arnold made a speech, handed over the keys and burst into tears. Montgomery remained as chief for about eighteen months. It was very difficult to follow a man of Sir Arnold's calibre and I think Montgomery realized this, for the farming community still looked on Sir Arnold as if he were still there.

"After his final retirement I did not see him for some years, but in 1930 my wife and I were his guests at his flat in Lucerne. He was then busy with his studies on bone pathology and I struggled to grasp the intricacies of what was to me a somewhat unfamiliar subject. One morning in 1936, as I was sitting at my microscope I heard the news of his sudden death in England. It came as a shock to me and I felt his death as a great personal loss. He was certainly the greatest man with whom I have had any personal contact and I do not think we shall see his like again".

J. Quinlan: "I made the acquaintance of Sir Arnold at Onderstepoort in 1913. He granted my request that I be permitted to work at Onderstepoort as an honarary worker during students' vacation from the College of Agriculture, Potchefstroom, to which institution I was attached. I spent several vacations at Onderstepoort prior to the outbreak of war in 1914, and again from 1918 - 20.

"Sir Arnold was always most encouraging to me. My problem at the time was an outbreak of brucellosis in the herds of imported cattle at the school. Being a young veterinarian, I knew little of the practical and economic methods of dealing with the outbreak. Sir Arnold put laboratory facilities at my disposal. He welcomed my queries and helped me in every possible way. With his help and advice the disease was eradicated in a very short period. Sir Arnold's suggestions and encouragement were respon-

sible for the rapid result during this period, and with his advice, I did research into brucellosis in calves, which enabled me to obtain the degree of **Doctor Medicinae Veterinariae** in Germany.

"Sir Arnold's enthusiasm for research and his untiring efforts appeared to be infectious. At this time his young associates, most of whom lived in the staff quarters at Onderstepoort, spoke of little else but their research work. There were meetings once a week at which progress of the research work was discussed and literature on current advances in veterinary research in other countries was summarized.

"Workers were encouraged to learn German, a language in which there were excellent journals.

"During the years 1912 - 20, Sir Arnold had built up a team of research workers, who later, by their publications, gave Onderstepoort an international reputation. He lead this team as a general. He was their ideal leader and all were loyal to him. Every member gave his best. Everyone had become dedicated to veterinary research.

"Many of the diseases of domestic animals in South Africa had been conquered, or the foundation for their solution had been laid. Sir Arnold's dedication to research work is excellently illustrated by his work on lamsiekte of cattle and on horsesickness. Both diseases required years of patient research. The challenge was accepted and eventually overcome.

"I joined the staff at Onderstepoort, as a research worker, in 1920. Two years later I was appointed to the Chairs of Surgery, Gynaecology and Obsterics in the Veterinary Faculty of which Sir Arnold was Dean. At that time I came into daily contact with him and learned to know him as Director of Veterinary Research, and also as a man. His advice and encouragement, so eagerly sought, were willingly given. To me he had become a great man.

"About this time I became interested in the pathology of the genital tract and in sex physiology. Sir Arnold visualized the necessity for this study, and its importance to the future of animal industry in South Africa. As usual, my approach was met with enthusiasm. During the years which followed, my almost daily interviews were received with courtesy, encouragement and advice. He seemed to be able to overcome economic obstacles into this costly, long-term research at a time when the money available for research was not easily found. Sir Arnold's enthusiasm was such that he appeared to be able to overcome all obstacles. Research was his life and Onderstepoort his home. His pride in Onderstepoort and its achievements was tremendous.

"Sir Arnold gave little praise to his staff, but his pride in their work was tremendous. He encouraged workers to be inquisitive, to know what work others on the staff were doing. He had an intimate knowledge of everything that was being done and could, in fact, have done the work of any of his workers, so closely had he studied the activities of the institute.

"Sir Arnold encouraged all his workers to work for post-graduate degrees. He made arrangements for them to visit overseas universities for post-graduate study. He favoured study in Germany and Switzerland, obtaining leave for them and full pay for periods of a year. So great was the enthusiasm he created that most of his staff, who were later to become lecturers and professors in the Veterinary Faculty, held post-graduate degrees. His unbounded enthusiasm did not end here. Several of his men continued to publish research work which obtained two and even three higher degrees. All these academic efforts were due to Sir Arnold's unquenchable enthusiasm, energy and his ability to impress South Africa and the scientific world of the local and international value of Onderstepoort.

"After his death his spirit continued to live on in his associates. The energy and enthusiasm with which he inspired his staff, perhaps, paled a little, but the spirit of research remained. Many of the researches which were begun in his time were completed by the staff he left behind. They had absorbed from him his ideals, enthusiasm, energy and pride in the institute he founded and loved so well. His statue, erected later in front of the main building, still keeps his ideals alive in his successors.

"Outside work Sir Arnold had a reputation of authority and difficulty of approach. I always found Sir Arnold and Lady Theiler charming hosts when my wife and myself were invited to join them at their home or at the Pretoria Club. On such occasions he never mentioned work. He had world-wide experience, having visited many countries and understood their people. He was an excellent raconteur and on those occasions, too few so far as my wife and I were concerned, one needed only be a good listener to enjoy the company of this distinguished man in a relaxed atmosphere.

"Sir Arnold was intolerant to lack of enthusiasm, to indifference and disloyalty. On occasions he would express disappointment when he thought he had been treated with

indifference or disloyalty. However, there was not a trace of vindictiveness in his character.

'Sir Arnold always tried to improve the position of his professional and lay staff, provided they showed the characteristics he desired. He showed the same loyalty towards them that he expected of them. He knew only too well that he could not get the output expected from his staff unless their "out-of-office" hours were contented. He created a beautiful environment at Onderstepoort with lovely homes, gardens and recreation facilities. He did his utmost to make his workers happy.

"I always thought Sir Arnold was particularly happy when teaching clinical medicine to veterinary students. He was an excellent teacher, as one would expect from a man with such wide experience. His students loved his lectures.

"I always appealed to him to come and give me his opinion on a surgical case that presented difficulty to me. Then I found his logical reasoning and keen observation of great value. He had the most extraordinary knowledge of anatomy, physiology, nutrition, and pathology in their relation to surgery. I can honestly state that I have never met anyone with such varied and profound knowledge of our science. This general statement includes professors I have met in Germany, Switzerland and Ireland. His general knowledge was immense and astonishing.

"I am proud to record that I have been a co-worker with Sir Arnold at Onderstepoort. My success in life, in no small way, has been due to my long association with this great man of science. There are few men of his status that have honoured and ornamented the field of veterinary science".

A. O. D. Mogg: "As one of the surviving foundation members of the Faculty of Veterinary Science at Onderstepoort, I count it a privilege to have been asked to recount some of my recollections of that great man whom we honour so much... Of course, as an old Pretorian from 1886, I knew of his research station at Daspoort,... which was later transferred to the larger institution at Onderstepoort. Little did I think that one day I should join its staff. On my return from active service in East Africa, March 1917, Sir Arnold asked Dr. I. B. Pole-Evans, Chief of the Division of Botany, whose staff I had joined in 1913, for me to be seconded to his division as Government Ecologist, as I was 'the only staff member who had shown an interest in field botany'...

"In my preliminary briefing at Onderstepoort, Sir Arnold had outlined that he had been worried by the accounts of a serious lung condition in equines reported by the Veterinary Research Officer at Allerton. Death was not primarily due to the lesions, but to a secondary bacterial infection. Sir Arnold expostulated: 'What I want to know is the cause of the primary lesions. Our careful preliminary investigations have ruled out any cause except a plant one. Now, Mogg, you must find that plant!' I was flabbergasted. I opined that I did not know the plants of Natal at all, let alone unknown poisonous ones. But such was his wonderful, infective inspiration. He fixed me with his critical — but kindly — eye, and, brushing aside my fears, said: 'Go to it man! Live with the animals. Let them get to know you as a friend. Talk to them! But watch all the time what they eat. Get material unobtrusively and send it up to me. If you don't know it at first, we'll soon help you find out. Pole-Evans will see that your botany colleagues will help!'

"He went on: 'Now that isn't all. You must similarly apply your wits and find methods to solve styfsiekte in cattle and dunsiekte in horses in such and such areas of Natal, Zululand and Pondoland. Make your own arrangements with farmers and stay as long as necessary. But always I want your experimental material and specimens to build up a reference herbarium at Onderstepoort.' What an assignment!

"By systematically exploring a set of farms in one general area... and by listing the determinations comparatively, the common factors soon began to silhouette the particular causative plants for special attention... When fed to animals they eventually proved to be the cause...

"Thus the material of **Crotalaria dura** and **C. globifera** were proved to reproduce the typical symptoms and post mortem lesions of jaagsiekte in horses, mules and donkeys — but not in cattle.

"Sir Arnold was not satisfied. Having had success with **Crotalaria dura** and **C. globifera** in equines, he was determined to test all crotalarias and so his genius enabled him to discover that **C. burkeana** was the causal agent of that hitherto baffling specific laminitic condition, — the abnormal growth of the hoofs — in cattle, goats and some antelopes...

"Similarly, when **Senicio latifolius** (as it then was known) was found to be the causal agent of dunsiekte in horses at Mooi River, Sir Arnold initiated a big campaign to examine the effect, if any, on all kinds of livestock, of the most prevalent species of senecio throughout the country. This was very fruitful in that

attention was drawn to the enormous number of species containing toxic alkaloids, many of which produce acute or subacute poisoning...

"I should like to recount some details"... of the gousiekte investigations... "which I believe are little known. In briefing me, Sir Arnold explained that farmers in certain high-veld grassland areas of the Transvaal, particularly Kaalfontein near Kempton Park, had complained that sheep and cattle, after being introduced to the grazing in early summer for just over a month had suddenly dropped dead... A plant cause seemed to be indicated. I was required to go and report upon the veld and bring material of any known poisonous plants for testing. The areas were examined far and wide, the species being listed; but no known poisonous ones could be found.

"However, shortly after that, a farmer, who had reported deaths on particular pasturage in early summer, again telephoned one afternoon that he had had deaths. Sir Arnold immediately arranged that I should take him to meet the farmer on the spot the next morning at 9 a.m. We arrived at 8.45 by my Indian motor cycle and side car. As we approached, we could see a large number of sheep at rest,... Sir Arnold cautioned me to go at snail's pace and we stopped about 200 yards from the animals and watched them silently.

"At 9 a.m. we espied the farmer approaching across the veld, with his herdsman and a dog. As soon as these arrived within 100 yards of the sheep, the huge dog rushed forward barking loudly and aggressively. The sheep jumped up in alarm and commenced to scatter. Then we witnessed a tragic thing: a large number just dropped dead. Over 200 were found! Well, instead of examining the grassland, we were engaged in post mortems until past midday — the hearts, chiefly, were taken to Onderstepoort. Before leaving, Sir Arnold obtained the farmer's permission to conduct experiments on his veld.

"At Onderstepoort that afternoon, whilst Sir Arnold was demonstrating to me the full, regular post mortems on several of the sheep ... sections of the hearts... were flashed on to screens in the post mortem hall alongside similar sections of normal hearts. Sir Arnold then expounded how the ventricular muscle had been progressively changed by the plant toxin, causing the development of a fibrotic myocarditis. Thus the fierce barking of the dog would cause fright and sudden strain on the sheep's heart in jumping up and running, that syncope would result.

"The area and the disease being well defined, Theiler was determined more than ever to find the plant cause. He instructed me to do two things: to mark out two adjoining half-acres on the farmer's veld. On the one all the grasses were to be removed and kept out, leaving only the non-grasses: all geophytes. On the other he required all the non-grasses to be scoffled out. When these areas had recovered and were in full growth, he had them fenced and experimental sheep from Onderstepoort were introduced. Needless to say that no symptoms of gousiekte occurred in any of the sheep grazing on the pure grass patch. However, after 4 - 6 weeks, many gousiekte cases occurred on the other enclosure. On another near-by portion of veld he required a helicoid spiral of 50 foot squares to be laid out. Sir Arnold meanwhile had a 50 foot square cage constructed of trestles on wheels. This was transported to the area and wheeled into position over square 1. At once I carefully listed all the plant species present, noting broadly their abundance. Then, at 9 a.m., 50 sheep, brought from Onderstepoort, were introduced into the cage.

"Immediately one noted what species were avidly eaten, which tasted, and which were avoided. At noon another tally was taken. As by that time most of the 'readily eaten' column was grazed down, some of the tasted plants were more consumed. Also, some of the avoided ones became tasted, and a few were still untouched. At 3 p.m. a similar picture emerged and at 5 p.m. some of the erstwhile tasted plants had been completely grazed short. The second day the cage was wheeled on to square 2 and so on.

"As the days passed (February — April period) it was interesting to note with the ceasing of the seasonal rains the change in palatability of pasturage constituents as reflected in the grazing tally. When the procedure round the spiral ... had lasted ... 36 days, we were not surprised when the first case actually occurred. Naturally I at once critically examined my data for squares 1 - 7. The plant **Pachystigma pygmaea** was pin-pointed: a species hitherto unknown to be toxic and very prevalent and well grazed in the scoffled camp, where deaths also soon began to appear.

"It remained to gather sacksful of this subterranean shrub and test it in graded doses at Onderstepoort. Dr. Douw Steyn did this and established that 5 lbs. green or dry weight was lethal, with typical pathology...

"It was the genius of Sir Arnold Theiler in planning the whole which led to this magnificent

achievement: the discovery of the causal agent to be a plant hitherto unsuspected as being toxic, the toxin of which has a prolonged or 'long incubation period', and, acting specifically on the heart, brought about a particular condition which incapacitated its function.

"As Sir Arnold used to say of all this group of plant poisons: 'Why is the active principle not eliminated in the urine, or broken down by the liver and evacuated in the faeces? Where is it stored in the body? Lymphatic system? Why a prolonged and specific action on a particular organ? These were previously unknown things and we don't fully understand them yet'.

"So, apart from Sir Arnold Theiler's leadership and genius in other fields, his considerable achievements in the new field of prolonged-action plant toxins, giving rise to the understanding of hitherto unexplained stock diseases of high mortality, will remain a lasting monument to a wonderful researcher".

Reminiscences: First Students

Here follow extracts from letters of members of the first batch of students, who are grateful of the opportunity of contributing to the memory of the "Grand Old Man". Student ancedotes are many, usually very much to the point but never unkindly. His wit was always a match for theirs.

With a B.Sc. degree in Agriculture and Bacteriology C. Martignalia (1888 - 1967) was appointed to the Onderstepoort staff in 1922 when the first class of South African Veterinary students were in their third year. On the advice of Sir Arnold he followed the necessary lectures to enable him eventually to qualify as a veterinarian. Martignalia, like many of the professional staff members before him, was flung into work immediately: "I was instructed to assist Viljoen in the Department of Bacteriology. At the end of my interview with Sir Arnold he said quite seriously: 'I want you to start work immediately, I want you to **work, work, work**.' This he emphasized by striking his desk three times. I soon learnt what **work** meant. To his students he was always kind, and some of his humerous remarks have become legend. He had much guidance to offer, and while on his rounds often related some interesting personal experience. He had worked under unusual conditions which future veterinarians are not likely ever to encounter. What these early primitive conditions were like I realized in 1923 when Dr. Viljoen and I were sent to the Marico Bushveld (where rinderpest had entered the Transvaal) to investigate a heavy mortality in calves. For months we carried out intensive investigations before it became apparent that a number of protozoan and bacterial diseases were operating at the same time.

"On Graduation Day, 1924, the students were gratified and happy to see Sir Arnold receive the first Honorary Doctorate in Veterinary Science conferred by the University of South Africa.

"Like many of our great pioneers, he came to South Africa with a mission, stood up to every challenge and saw the fulfilment of an ideal".

Th. S. Snyman: "I am confining myself to a few incidents which happened during our student days, and which showed Sir Arnold up as a great teacher and a meticulous research worker.

"The very first lecture at Onderstepoort was scheduled for 8 a.m. in the **post-mortem** hall. We arrived two or three minutes late and, on arrival, Sir Arnold was already waiting. He looked at us and in a soft but firm voice said: 'Gentlemen, this lecture starts at 8 a.m.' and turning to the assistant said: 'Appleton, give these gentlemen their aprons'. Punctuality was one of his mottos.

"Shall I forget the day when he made us all feel like small green peas. We were busy with a **post-mortem** examination when it came to the relation of the vessels in the thorax. After we all had a guess, Sir Arnold admitted that he was not sure himself and there the matter ended as far as we were concerned. He was fond of interrupting a lecture to discuss some or other minor detail.

"The following morning, before the lecture started, he recalled the guesswork of the previous day. We all had to admit that we gave it no further thought, whereupon he said that he had looked it up, and with no further remarks continued with the lecture.

"This is a very insignificant incident but it taught me a great lesson. In later life, when I occupied a responsible position, this overcame half my troubles. This particular characteristic of making sure, made Sir Arnold the meticulous research worker he was.

"Towards the end of our final year, in discussing the future, we came to the conclusion that our knowledge of veterinary science was very poor and the future was not too bright. It was decided that the late J. Quin, who was later to become a Director of the same Institute, and myself should discuss our troubles with Sir Arnold.

"We waited on Sir Arnold in his office and even before we had time to explain our troubles to him he smiled and told us that at the time he qualified he did not know the difference between his thumb and his great toe, but that we should just have a little confidence in ourselves.

"Not very many months later, I had to examine the carcase of a bovine suspected of having died from East Coast fever, and this in the presence of some very critical farmers. The microscopic diagnosis confirmed my suspicions and I could state with confidence that the cause of death was East Coast fever and nothing else. Self-confidence is what Sir Arnold said we should have.

"These few incidents showed up the qualities of a great Scientist and Teacher".

M. Bergh: "He is always remembered by me as a great leader who was an inspiration to his students, not only for the vast knowledge he had of his subject, but also for his patience, his diligence and the human approach to his methods of instruction. There was no detail too small for his colossal powers of observation.

"As one of the first batch of his graduates, I shall always remember him for his readiness to assist with advice and encouragement as well as his keen sense of humour, sometimes bordering on the Rabelaisian.

"I must also mention his great gift to be stimulated by difficulties which he inevitably was able to overcome.

"These few memories will remain with me always".

J.G. Williams: "After a spell of more than two score years it is no easy task to reflect on the past to recall the incidents of one's student days. Yet as one of the first eight students of the Transvaal University College to qualify in 1924 at the Onderstepoort Veterinary Research Institute under the direction and leadership of that great teacher and eminent scientist, Sir Arnold Theiler, certain events stand out so prominently that it seems but yesterday one had the honour and privilege of studying under him and attending his clinics and practical classes. They never failed to evoke enthusiasm and always kept the class spell-bound in anticipation of what was to follow. Often an apt remark, or light-hearted banter in mirthful mood, would serve to stimulate renewed interest in his lectures or to stress the point he really wished to drive home.

"An outstanding trait in Theiler's character as teacher was his profound interest and sympathetic understanding of the individual. He was at all times courteous, tolerant and patient with his students, and, as examiner seemed to prefer a well-reasoned answer, even if not always strictly correct, to a parrot-like reply direct from the textbook. When he found his candidate somewhat at sea, he would persist in jogging the latter's memory, rather than confound him by causing him unnecessary embarrassment. His dictum, stressing the importance of knowing where to look for things in preference to cramming the brain with knowledge, which in any case would again be forgotten, had proved only too correct with the passing of time and the increase of one's responsibilities. The occasion is vividly recalled of a question once put to the class that noboby could answer. When a few days later he re-iterated the same question and there still was silence, he remarked that he, too, had not known the answer but had since consulted the textbooks. The moral of his remark went home so forcibly that the class subsequently seldom found itself in a similar predicament".

J.H.R. Bisschop: "I have been asked to tell of my experiences and what I can remember of my associations with the Grand Old Man. The first time I saw and heard Sir Arnold was when he came to the University College of the Transvaal, to speak about the proposed new veterinary faculty. I was one of the agricultural students whose interest was roused in this new faculty. During this talk he described how he liked smoking very much, but, as he put it in his quaint way, it did not increase his capacity for work and, therefore, he chucked it, and in the same way he had also found that the daily sundowner of whisky and soda did not necessarily increase the capacity for work and, therefore, he also chucked it. This is my first recollection of the Head of Onderstepoort.

"As teacher he took us for part of infectious diseases and also for practical clinical work. Once during a lecture on infectious diseases, the subject for the day was bovine tuberculosis. Whilst describing the methods of culturing the tubercle bacillus and the various media used for the purpose, he came to the potato medium; all of a sudden he hesitated and said: 'potato, topato,' not sure what the correct word was; finally he burst out: 'Topato'. You can imagine the effect on the class.

"The clinical period, with the fourth and fifth years, was always the last one in the morning. He would take out a case, have us examine it, describe the symptoms and make a differential diagnosis, when he would give his opinion. Very often, if there was time left at

the end of the period, he would describe his experiences in the early days of the Transvaal. On one occasion he asked: 'Now in those early days what do you think were the required tools of our profession?' Of course we suggested that the microscope would be one of the essential instruments. He said no, in those days the microscope really was not as practical an instrument as it is nowadays (in the year 1923), but that he, in going about the country, needed the following three tools: to satisfy the outlook of the farmers he met, he always carried a Bible, then to satisfy his own requirements, he obviously always carried a corkscrew, and then, as far as his profession was concerned, he found the most useful instrument to be the pleximeter and percussion hammer. Now, amongst the students of that day listening to him, was John Dixon, who was quite an artist in his way. That evening after supper he disappeared and did not turn up again until next morning, when, at breakfast, he produced a drawing in the form of a shield, and on it an open Bible with a corkscrew on one page and on the other a percussion hammer. This he suggested would be a very good badge for our student body. In fact in time it became the badge of the veterinary faculty.

"When the first batch arrived, there was no students' hostel at Onderstepoort and we were housed in the quarters for the unmarried professional men directly across the road from the residence of Sir Arnold. As there were then no extraneous noises, sound easily travelled the intervening distance of about 150 feet. Absolutely as punctual as clockwork, every evening at 9 o'clock, you heard the door of his study open, then the door with the mosquito netting bang, and that meant that Sir Arnold was on his way for his final inspection of the stables.

"Another thing that I remember, was that he had a habit of strolling after supper from his house to the main gates and back, accompanied by Lady Theiler and whichever of his children happened to be at home. These are a few things I personally as a student remember of the Old Man.

"The following three stories were told by Mr. C. Hinds at the time junior clerk to Mr. King. On Saturday afternoons, as a keen horseman, Theiler used to inspect the farms at Onderstepoort and at Kaalplaas on horseback, taking Mr. King with him. On one occasion he also took his daughter Margaret, when her horse shied at something and broke away. As apparently she could not manage the horse, Sir Arnold set out after her, riding up to her on her near side and with his good hand took hold of the bridle of the runaway horse and brought it to a standstill, but in doing so he lost his artificial left hand. King, seeing his artificial hand falling, stopped, picked it up and then, as Hinds put it, feeling somewhat embarrassed and shy, walked up to Sir Arnold and said: 'May I give you your hand'.

"Another story features Sir Arnold and Dr. Harry Green, who every now and then went to Armoedsvlakte to inspect the progress of the experimental work on bone meal feeding. They took Hinds with them to manage all the administrative and expenditure business. Hinds described how on these occasions, coming back in the slow train from Vryburg to Fourteen Streams and then on the mail train from Fourteen Streams to Johannesburg, they used to discuss Armoedsvlakte matters, especially after they had entered the Mail train at Fourteen Streams and had gone into the dining room. The usual procedure was that they would have dinner with drinks and keep on talking at the table as long as was necessary. On one occasion they had a lot to talk about; when it was time for the diner to be closed for the night, the chief steward reminded them: 'Gentlemen, I am afraid I will have to close down; is there anything I can serve you with?' Sir Arnold said: 'Put a bottle of whisky down and a few bottles of soda. ' Now they had been imbibing all evening whilst discussing things, and the chief steward put down the bottle of whisky and the necessary soda and water and, instead of going to bed, stood in his little office watching these two, talking and talking until finally the bottle of whisky was gone, and the two, as sober as owls, stood up and Sir Arnold said: 'Well, I think it is time to turn in.' As they passed the steward, he stood up and saluted them: 'May I say that I have been on the railways many years, but what I have seen tonight, your capacity and the result of liquor on you two, I have never seen before. May I salute you.'

"Hinds' third story, which brings out the fact that Theiler could understand his fellowmen, tells about an incident when he was working at Armoedsvlakte. Here there was a big main laboratory and separated from it by a little stoep was Sir Arnold's office. At the time two of the technical assistants there were Bachmann and Badenhorst. When Sir Arnold wanted the one or the other, he had the habit of calling them by name, shouting 'BACHMANN' or 'BADENHORST.' It became a little game between these two, the one sitting at the one end and

the other at the other end of the main laboratory, when they wanted to call one another, to imitate Sir Arnold, by Bachmann saying to Badenhorst 'BADENHORST' and when Badenhorst wanted Bachmann, for him to say 'BACHMANN.' One day, when Sir Arnold called for 'BADENHORST,' Badenhorst, sitting at the further end of the laboratory with his back to Sir Arnold, thought that it was Bachmann calling, so instead of standing up he simply replied 'BACHMANN.' Sir Arnold, not knowing what had happened, again called 'BADENHORST'; Badenhorst came back with 'BACHMANN.' The old man, realizing what the situation was, simply smiled at the nearby Bachmann and went back to his office to await events.

"When I worked under Sir Arnold as an assistant in the animal hospital at Onderstepoort, I came to know and to appreciate his methodical and accurate mind. Every morning at half past eight Sir Arnold had the habit of starting on his round of inspection of the whole of the station; at about nine o'clock he used to arrive at the west door of the hospital, where I had to meet him. Then we would go right through the hospital; I telling him what cases had come in, he discussing the cases with me and then he would leave the hospital again at the east door. This was a daily routine and what astounded me always was his terrific memory. It often happened that we would discuss a case and he would all of a sudden say: 'Yes, but we had a similar case about 6 or 7 months ago; do you remember animal DOB 8972?' and I had to admit that I could not remember. His memory for individual animals, and for separate incidents certainly was something exceptional.

"Another example of his exceptional memory is shown by the following incident: We junior members of his staff had to take turns in writing little articles for the public press, or for the farmers' advice system. I was given the subject of warts on cattle. I looked up the literature and worked up a little article and took this into Sir Arnold. He said: 'Come back and we will discuss it.' Shortly afterwards, he called me in: 'Look here Bisschop, I have been through it and as far as it goes it is quite alright, but I suggest that you have not been through all the literature. I want you to look up so and so,' and he quoted a particular reference. This precise pinpointing of a reference was not an isolated occurrence.

"In 1926, after I had been on the Onderstepoort staff for two years Sir Arnold sent me to Armoedsvlakte to take charge of the newly instituted bonemeal feeding experiments. In these experiments there were to be four herds totalling some thousand head. After outlining the main features of the experiments, he advised me to consult the Records Officer, Mr. Victor de Kock, to have him explain the Onderstepoort system of animal and experimental work registration. In all my subsequent experiences in other departments, I have found no system of technical administration which can compare with that initiated by Theiler. I was also reminded that even though there may be many animals to an experiment, it is advisable (or necessary) to note what is happening to each separate animal and not to lump a batch together: that in all experimentations it is better to make too many than too few notes, advice which I followed throughout my research career.

"In 1927 Sir Arnold finally left Onderstepoort, having reached the pensionable age. At the time there were about 4 or 5 of his past students on the Onderstepoort staff. We asked him whether we could give him a little farewell party, to which he kindly agreed. We clubbed together and bought him an old edition of a book ("Burchell's Travels") he was keen to have and gave him a little dinner party. It was quite a sad little event, in that the old man was feeling somewhat bitter of having to leave, and had not been offered facilities to remain at Onderstepoort as a guest-worker: he felt like an orange or lemon which had been squeezed out.

"Theiler, in his retirement, as conscientiously prepared himself for the next move as he did during his active career. In 1929, when we visited him in Berne, he was able to give us a well-balanced picture of the city. Later in the year, on doctors' advice, the Theilers went to stay in warm, sunny Florence. Here we visited them and once again found them to be excellent guides, not only to the city and its surroundings but also to European culture. Meticulously they had studied the paintings and painters, sculptures and sculptors in the various art galleries. Sir Arnold usually did all the talking, but when he fumbled or slipped up, Lady Theiler would assist him or gently correct him. Thus, in their leisure moments, she continued to give him the support she had given him during their working career. Lady Theiler, to my mind, was in her own right a very, very great personality.

"When, in 1934, Sir Arnold returned as a guest-worker, we tended to look upon him as our oldest "Statesman" at Onderstepoort for the way in which he was always ready to give advice, to read through manuscripts, and

to listen to, and help us with all our little troubles. This attitude of kindly consideration, which gave us the feeling that he looked upon us as his children, as his protegés, is something which we ex-students and younger staff members will never forget, nor can we believe that, in his early days, he was said to be a bit of a martinet, and that people went in fear of him; at all times he always treated us with the greatest consideration. To my mind there have been, and there will be, very few people like the Old Man."

APPENDIX A

DEGREES AND HONOURS CONFERRED UPON ARNOLD THEILER

Honorary Doctorate in Science:

University of the Cape of Good Hope 1911
University of Syracuse, U.S.A. 1923
University of Bern 1923
University of Witwatersrand 1935
University of Cape Town 1935
University of Utrecht 1936

Honorary Doctorate in Veterinary Science:

University of South Africa (first award of its kind) 1925

Appointed Honorary Professor in Tropical Medicine,

University of Pretoria 1936

Medals

Bronze Medal and Grant of the South African Association for the Advancement of Science. (first award) 1908

Captain Scott Medal of the South African Biological Society. (first award) 1918

Gold Medal ("à l'effigie Laveran") de la Société de Pathologie Exotique. Paris. (first award) 1927

Budapest Gold Medal for Research in Veterinary Science. (Second award, first being to von Hutyra) 1934

Gold Medal for Distinguished Service to Agriculture, Royal Agricultural Society of England. (Second award, first being to Sir Thomas Middleton) 1934

King's Silver Jubilee Medal (including a private gift and personal souvenir by King George V and Queen Mary) 1935

Honours

Commander of the Order of St. Michael and St. George 1907

Chevalier de l'Ordre de la Couronne Belgique 1912

Knight Commander of the Order of St. Michael and St. George (first colonial veterinarian to be knighted) 1914

Honorary, Corresponding or Associate Membership:

Switzerland:

Ehrenmitglied der Gesellschaft der Schweizerischen Tierärzte 1909 and 1923

Korrespondierendes Mitglied Basler Naturforschenden Gesellschaft (Centenary Celebration) 1917

Ehrenmitglied des Vereins Bernischer Tierärzte 1921

Ehrenmitglied Schweizerischer Naturforschenden Gesellschaft (Schaffenhausen) 1921

Ehrenmitglied der Naturforschenden Gesellschaft Bern 1921

Ehrenmitglied der Naturforschenden Gesellschaft Luzern (75th annual celebration) 1931

Swiss Delegate to 12th International Veterinary Congress, New York 1934

France:

Correspondant Etranger de la Société Centrale de Médecine Vétérinaire. Paris. 1906

Membre Associé de la Société de Pathologie Exotique. Paris. 1908

Membre Titulaire de la Société des Sciences Vétérinaires de Lyon. 1913

Membre Correspondant de la Société de Biologie. Paris. 1928

Membre Associé de la Société de Biologie. Paris. 1936

Correspondant de l'Académie des Sciences. Institut de France, Section d'Economie Rurale. 1930

Correspondant Etranger dans la 5me Division: Médicine Vétérinaire, Académie de Médicine. Paris 1932

Associé Etranger de l'Académie Vétérinaire de France ?1906

Membre Associé de l'Académie des Sciences Coloniales. Paris. ?1931

Belgium

Membre Associé de l'Institut Royal Colonial Belge, Section des Sciences Naturelles et Médicales. Bruxelles. 1930

Membre Honoré de l'Association Vétérinaire de la Provence de Brabant ?1912

Italy

Corrispondenti Stranieri de Reale Accademia di Agricolturo di Torino 1909

Collegium ad rem Agrariam Internationes Provenendam. Roma. 1927

Co-opted as expert to the International Agricultural Institute. Rome. 1927

Spain

Honorary Associate of the Societas Veterinaria et Medica Hiberniae 1910

Austria

Ehrenmitglied Wiener Gesellschaft fur Mikrobiologie 1927

America

Honorary Member of the American Veterinary Medical Association 1923

Corresponding Member of the Society of American Bacteriologists 1927

Honorary Foreign Member. American Academy of Arts and Sciences. Boston. 1929

Honorary Foreign Member. American Society of Parasitologists. Princeton. 1930

Honorary Fellow. American Society of Tropical Medicine. 1935

Honorary Member of the Entomological Society of Washington. ?1923

United Kingdom and Ireland

Honorary Associate of the Royal College of Veterinary Surgeons of Great Britain and Ireland. 1908

Honorary Fellow of the Royal Society for Tropical Medicine and Hygiene. London. 1926

Corresponding Honorary Member of the Royal Society of Medicine. London. Section of Comparative Medicine. 1932

Honorary Member of the Midland Counties Veterinary Association. ?1932

Honorary Member of the Veterinary Association of Ireland ?1932

Honorary Fellow of the Royal Society of Medicine. London. 1934

Canada

Honorary Member of the Medical Association of Toronto. ?1923

Australia

Honorary Member of the Australian Veterinary Association ?1928

New Zealand

Honorary Member of the New Zealand Veterinary Association. ?1928

South Africa

Erelidmaatskap van die Afrikanerkring. Pretoria 1927

Honorary Fellow of the Royal Society of South Africa 1929

Honorary President of the Biological Society ?1927

Honorary Life President of the South African Association for the Advancement of Science ?1927

Honorary Life Vice-President of the South African Veterinary Medical Association 1927

International

Honorary President of the International Veterinary Congress. London. 1930

Honorary President of the International Veterinary Congress. New York. 1934

APPENDIX B

SCIENTIFIC LITERATURE AVAILABLE AT TURN OF THE CENTURY

Techniques:-

Abderhalden: "Handbuch der biochemischen Arbeitsmethoden" 1877.

Protozoology:

F. Dujardin (1801 - 1860): "Histoire Naturelle des Zoophytes". O. Butschli (1848 - 1920) in Bronn's "Klassen und Ordnungen der Thiere" issued during 1880-1889, in which cell division was first described; R. Blanchard (1859 - 1919) "Traité de Zoologie Médicale" 1885 - 1890; "Archives de Parasitologie", founded in 1898; "Annales de L'Institut Pasteur", founded in 1886; F. Doflein (1873 - 1924): "Lehrbuch der Protistenkunde".

Helminthology:

C. Th. von Siebold (1804 - 1885): "Vergleichende Anatomie der Wirbellosen", 1848; R. Leuckardt (1822 - 1898): "Die menschlischen Parasiten und die von ihnen herrührenden

Krankheiten", 1879; R. Leuckardt and J. Loeffler (1852 - 1915): "Centralblatt für Bacteriologie und Parasitenkunde", founded in 1887; R. Virchow (1821 - 1902): "Parasiten des Menschen", 1863 - 1871; F. Zschokke (1860 - 1936): "Seltene Parasiten des Menschen; Cooper Curtice (1856 - ?): "The Animal Parasites of Sheep", 1890.

Biochemistry:

F. Hoppe-Seyler (1829 - 1895): "Handbuch der physiologisch-und pathologisch-Chemischen Analysen" 6th Edition, 1893; W. Ostwald: "Grundriss der algemeinen Chemie", 1884.

Pathology:

Th. Kitt (1858 - 1941): "Algemeine Pathologie".

Physiology:

Claude Bernard (1813 - 1878): "Vergleichende Physiologie"; L. Asher and K. Spiro: "Ergebnisse der Physiologie", 1902.

Palaeontology:

K. U. von Zittel (1839 - 1904): "Handbuch der Paläontologie", 1893.

General Texts:

Lubarsch and Ostertag: "Ergebnisse der algemeinen Ätiologie von Menschen- und Thierkrankheiten", founded in 1896: "Schweizer Archiv fur Thierheilkunde" (Vol. 37 in 1895); A. Laveran (1845 - 1922): "Traite des Fièvres Palustres", Paris, 1844; L.G. Neumann (1846-1930): "The Parasites of Domesticated Animals" 1892; M. Braun (1850-1930): "Lehrbuch über die Parasiten des Menschen", 1895; A. Railliet (1852-1930): "Traité de Zoologie Médicale et Agricole", 1886; A. Railliet "Récueil de Médicine Vétérinaire", new series, 1894; "Virchows Archiv für pathologische Anatomie und Physiologie und für klinische Medicin", founded in 1847; Virchow und Hirsch: "Jahresbericht über Leistungen und Fortschritte der ganzen Medicin", founded in 1866. Th. Kitt and Fröhner "Monatshefte für praktische Thierheilkunde", founded in 1890.

ACKNOWLEDGEMENT OF PERSONS WHO HAVE CONTRIBUTED INFORMATION.

Public Relations Officer, City Council, Pretoria.
Dr. and Mrs. E. Brauchli-Lyss, Muttenz bei Basel, Switzerland.
Director, Rowett Institute, Aberdeen, Scotland.
Lord Boyd-Orr, Angus, Scotland.
Mlle Wrdnowska, Conservateur du Musée Pasteur, Paris, France.
Principal, Dublin Veterinary College of Ireland, Ireland.
Professor Werner Steck, Bern, Switzerland.
Dr. Glen M. Kohls, Hamilton, Montana, U.S.A.
Dr. Walter Frei, Zurich, Switzerland.
Dr. A. J. Orenstein, Johannesburg.
Dr. H. Vogel, Hamburg, Germany.
Dr. Owen Evans, London, England.
The Registrar, Liverpool School of Tropical Medicine, England.
The Registrar, Royal Veterinary College, London, England.
The Librarian, Botanical Research Institute, Pretoria.
Prof. A. Fain, Antwerpen, Belgium.
Librarian, Instituut voor Tropische Geneeskunde Prins Leopold, Antwerpen, Belgium.
Librarian, Wellcome Laboratory, Royal College of Veterinary Surgeons, London.
The Rector, Universita degli Studi, Torino, Italy.
Prof. Dr. G. Henneberg, Berlin, Germany.
Dr. Kenneth Green, Higher Sulton Macclesfield, England.
Dr. Lionel B. Bull, Victoria, Australia.
Prof. Itard, Paris.
All Theiler Memorial Lecturers.

OPSOMMING

Arnold Theiler is op 26 Maart 1867 in die dorpie Frick, in die Kanton Argau, Switserland, gebore, as seun van Franz Theiler, hoof en wetenskaponderwyser aan die plaaslike skool. Die aansporende tuis- en skoolagtergrond is uitgebrei deur bywoning aan die Kantonskool Argau, die Universiteit te Bern en die Veeartsenyskool te Zurich.

In 1889 lê hy sy staatseksamen af en begin te Beromunster praktiseer. Aangevuur deur beskrywings van ontdekkingsreisigers, veral Le Vaillant, en aangemoedig deur die Switserse Diplomatieke Verteenwoordiger by die Zuid-Afrikaansche Republiek, kom hy in 1891 te Pretoria aan. Aangesien soiets soos 'n veearts aan die destydse boere onbekend was, was Theiler se eerste jare alhier 'n finansiële stryd om bestaan. Hy het as hulp gaan werk by A. H. Nellmapius se plaas te Irene, teneinde o.a. meer inligting en ervaring van plaaslike siektes te bekom. Hier het hy sy linkerhand in 'n hooisnyer verloor.

Theiler se eerste groot kans het gekom toe hy die plaaslike voorbereiding van kalflimf as entstof teen pokke kon onderneem; daarna was dit die bevestiging van runderpes wat hy op versoek van President Paul Kruger in Rhodesië gaan doen het. Hy is as „Staatsveearts" aangestel en het met Bordet en Danysz van Frankryk die serum-metode van enting vervolmaak. Sy een droom is bewaarheid toe 'n navorsingstasie te Daspoort vir hom ingerig is. In 1899 is hy op 'n wetenskaplike reis na Europa, om net voor die uitbreek van die Tweede Vryheidsoorlog terug te wees. Na 'n dienstyd te velde as veearts verbonde aan die Staats-artillerie, is hy terug na Daspoort, alwaar sy diens deur die Britse regime behou is.

In 1908 is die navorsingsinstituut te Onderstepoort betrek. As gevolg van Theiler se intensiewe arbeid en sy leierskap, is 'n hele reeks plaaslike siektes se wese uitgepluis en kon in baie gevalle geskikte entstowwe vervaardig word. Teen 1918 was navorsing in al die belangrike vertakkings in volle swang en die meeste episoötiese siektes onder beheer. Theiler het op vroeë uittrede besluit, teneinde 'n magdom versamelde wetenskaplike monsters te bestudeer, maar sy hulp was nog nodig. Hy het op 'n kommissie van ondersoek gedien na aanleiding van die destydse griepepidemie. Daarna het die probleem van lamsiekte sy aandag vereis en was Theiler terug in die tuig, eers net as navorser te Armoedsvlakte, later weer as Direkteur van Veeartsenykundige Navorsing en Opleiding, lg. as gevolg van sy ywer en bemoeienis vir 'n volwaardige plaaslike Veeartsenykundige Fakulteit, wat in 1920 aan die destydse Transvaalse Universiteitskollege tot stand gekom het. Hy was dan ook die eerste Dekaan en kon so aan 'n diep begeerte om studente op te lei, voldoen.

In 1927 het hy finaal afgetree en hom aanvanklik in Switserland gevestig, waar hy sy magnum opum — oor beensiektes as gevolg van minerale wanbalans — voltooi het. In 1933 het hy na Londen verhuis; na 'n laaste wêreldreis het hy in Suid-Afrika aangekom alwaar hy vanaf Januarie 1935 weer te Onderstepoort as gas werksaam was. In April 1936 het hy weer na Europa vertrek. Op 24 Julie 1936 is hy te Londen aan 'n hartaanval oorlede.

Theiler was 'n kind van sy tyd, 'n tyd van intensiewe biologiese ontwikkeling op alle gebiede, en as sodanig het hy as navorser op die gebied van die Bakteriologie, Virologie, Protosoölogie, Helmintologie, Plantvergiftigingsleer en Minerale Voedingsteurnisse uitgemunt. Hy was 'n inspirerende leier en leermeester: sy internasionale roem was welverdien. Sy aktiwiteite temidde van die ontwikkelings en sy kontakte met die vooraanstaande figure van sy tyd word geskets.

Die dinamiese beeld van Theiler word afgerond met 'n waardering van sy vrou, Lady Emma Sophie Theiler (geb. Jegge), asook deur huldeblyke van wetenskaplikes buite Onderstepoort, van sy Onderstepoort-kollega's en van oud-studente. 'n Lys van ere-toekennings en benoemings verskyn as aanhangsel. In 'n tweede aanhangsel bied 'n lys van belangrikste biologiese boeke en tydskrifte 'n verdere kyk op die stand van die biologiese wetenskap ten tye van die eeu-wenteling.

PUBLIKASIES IN DIE REEKS VAN DIE UNIVERSITEIT

1. ,,Gids by die voorbereiding van wetenskaplike geskrifte'' — Dr. P. C. Coetzee.
2. ,,Die Aard en Wese van Sielkundige Pedagogiek'' — Prof. B. F. Nel.
3. ,,Die Toenemende belangrikheid van Afrika'' — Adv. E. H. Louw.
4. ,,Op die Drumpel van die Atoomeeu'' — Prof. J. H. v.d. Merwe.
5. ''Livestock Philosophy'' — Prof. J. C. Bonsma.
6. ''The Interaction Between Environment and Heredity'' — Prof. J. C. Bonsma.
7. ,,Verrigtinge van die eerste kongres van die Suid-Afrikaanse Genetiese Vereniging — Julie 1958''.
8. ,,Aspekte van die Prysbeheersingspolitiek in Suid-Afrika na 1948'' — Prof. H. J. J. Reynders.
9. ,,Suiwelbereiding as Studieveld'' — Prof. S. H. Lombard.
10. ,,Die Toepassing van fisiologie by die bestryding van Insekte'' — Prof. J. J. Matthee.
11. ''The Problem of Methaemoglobinaemia in man with special reference to poisoning with nitrates and nitrites in infants and children'' — Prof. D. G. Steyn.
12. ''The Trace Elements of the Rocks of the Bushveld Igneous Complex'', Part 1 — Dr. C. J. Liebenberg.
13. ''The Trace Elements of the Rocks of the Bushveld Igneous Complex. Part II. The Different Rock Types'' — Dr. C. J. Liebenberg.
14. ''Protective action of Fluorine on Teeth'' — Prof. D. G. Steyn.
15. ''A Comparison between the Petrography of South African and some other Palaeozoic Coals'' — Dr. C. P. Snyman.
16. ,,Kleinveekunde as vakrigting aan die Universiteit van Pretoria'' — Prof. D. M. Joubert.
17. ,,Die Bestryding van Plantsiektes'' — Prof. P. M. le Roux.
18. ,,Kernenergie in Suid-Afrika'' — Prof. A. J. A. Roux.
19. ,,Die soek na Kriteria'' — Prof. A. P. Grové.
20. ,,Die Bantoetaalkunde as beskrywende Taalwetenskap'' — Prof. E. B. van Wyk.
21. ,,Die Statistiese prosedure: teorie en praktyk'' — Porf. D. J. Stoker.
22. ,,Die ontstaan, ontwikkeling en wese van Kaak-, Gesigs- en Mondchirurgie'' — Prof. P. C. Snijman.
23. ''Freedom — What for'' — K. A. Schrecker.
24. ''Once more — Fluoridation'' — Prof. D. G. Steyn.
25. ,,Die Ken- en Werkwêreld van die Biblioteekkunde'' — Prof. P. C. Coetzee.
26. ,,Instrumente en Kriteria van die Ekonomiese Politiek n.a.v. Enkele Ondervindinge van die Europese Ekonomiese Gemeenskap'' — Prof. J. A. Lombard.
27. ''The Trace Elements of the Rocks of the Alkali Complex at Spitskop, Sekukuniland. Eastern Transvaal'' — Dr. C. J. Liebenberg.
28. ,,Die Inligtingsprobleem'' — Porf. C. M. Kruger.
29. ''Second Memorandum on the Artificial Fluoridation of Drinking Water Supplies'' — Prof. D. G. Steyn.
30. ,,Konstituering in Teoreties-Didaktiese Perspektief'' — Prof. F. van der Stoep.
31. ,,Die Akteur en sy Rol in sy Gemeenskap'' — Prof. Anna S. Pohl.
32. ''The Urbanization of the Bantu Homelands of the Transvaal'' — Dr. D. Page.
33. ,,Die Ontwikkeling van Publieke Administrasie as Studievak en as Professie — Prof. J. J. N. Cloete.
34. ,,Duitse Letterkunde as Studievak aan die Universiteit'' — Prof. J. A. E. Leue.
35. ,,Analitiese Chemie'' — Prof. C. J. Liebenberg.
36. ,,Die Aktualiteitsbeginsel in die Geologiese navorsing'' — Prof. D. J. L. Visser.
37. ,,Moses by die Brandende Braambos'' — Prof. A. H. van Zyl.
38. ''A Qualitative Study of the Nodulating Ability of Legume Species: List 1'' — Prof. N. Grobbelaar, M. C. van Beyma en C. M. Todd.
39. ,,Die Messias in die Saligsprekinge'' — Prof. S.P.J.J. van Rensburg.
40. Samevattings van Proefskrifte en Verhandelinge 1963/1964.
41. ,,Universiteit en Musiek'' — Prof. J. P. Malan.
42. ,,Die Studie van die Letterkunde in die Bantoetale'' — Prof P. S. Groenewald.
43. Samevattings van Proefskrifte en Verhandelinge 1964/1965.
44. ,,Die Drama as Siening en Weergawe van die Lewe'' — Prof. G. Cronjé.
45. ,,Die Verboude Grond in Suid-Afrika'' — Prof. D. G. Haylett.

46. ,,'n Suid-Afrikaanse Verplegingscredo'' — Prof. Charlotte Searle.
47. Samevattings van Proefskrifte en Verhandelinge 1965/1966.
48. ,,Op Soek na Pedagogiese Kriteria'' — Prof. W. A. Landman.
49. ,,Die Romeins-Hollandse Reg in Oënskou'' — Prof. D. F. Mostert.
50. Samevattings van Proefskrifte en Verhandelinge — 1966/1967.
51. ''Inorganic Fluoride as the cause, and in the prevention and treatment, of disease'' — Prof. Douw G. Steyn.
52. ''Honey as a food and in the prevention and treatment of disease'' — Porf. D.G.Steyn.
53. ''A check list of the vascular plants of the Kruger National Park'' — Porf. H. P. van der Schijff.
54. ''Aspects of Personnel Management'' — Prof. F. W. Marx.
55. Samevattings van Proefskrifte en Verhandelinge 1967/68.
56. ,,Sport in Perspektief'' — Prof. J. L. Botha.
57. ,,Die Huidige Stand van die Gereformeerde Teologie in Nederland en ons Verantwoordelikheid'' — Prof. J. A. Heyns.
58. ,,Onkruide en hul beheer met klem op chemiese beheer in Suid-Afrika'' — Prof. P. C. Nel.
59. ,,Die Verhoudingstrukture van die Pedagogiese Situasie in Psigopedagogiese Perspektief'' — Prof. M. C. H. Sonnekus.
60. ,,Kristalhelder Water'' — Prof. F. A. van Duuren.

ISBN 0 86979 061 7