

C. TROPICAL VETERINARY MEDICINE

1. The early beginning of the Veterinary Department

Right from the very beginning since the establishment of the School of Tropical Medicine in 1906 the directors and staff have always shown a lot of interest for animal parasites and veterinary medicine. Already in 1908 the first Belgian veterinarian, who was in active service in the Independent Congo State since the end of the 19th century, Dr. Eugene Meuleman was invited at the School in Brussels to give lectures about tropical veterinary medicine to his medical colleagues. At that time courses for veterinarians were not yet organised, but veterinarians, who prepared themselves for a career overseas, followed the same courses as the medical doctors, with only a few extra lessons specifically on tropical veterinary medicine. After an interruption because of World War I the courses for vets started again when the Institute moved from Brussels to Antwerp in the 1930s. With the exception of animal pathology the courses were exactly the same for veterinary as for medical students and this remained so until 1959 when J. Mortelmans was appointed as lecturer in tropical veterinary medicine. The following professors were involved as lecturers of tropical animal pathology at the ITM, Antwerp¹:

- 1934: Ch. Van Goidsenhoven. He was professor at the veterinary school of Cureghem (Brussels) and worked closely together with the directors of ITM, Broden and Rhodain, mainly on trypanosomiasis. He developed a complement fixation test for the diagnosis of dourine (due to *Trypanosoma equiperdum*) in horses. The technique was also used for the follow-up of sleeping sickness patients after treatment. This test is currently still the recommended test of the Office International des Epizooties (OIE) for the confirmation of dourine in equids.
- 1938: L. Tobback. He worked for a long time as veterinary consultant for the Ministry of Colonies and was appointed at the ITM for teaching the course for veterinary assistants. He wrote a standard work on diseases of livestock in the tropics: 'Les maladies du bétail du Congo Belge'².
- 1951-52: R. Guyaux replaced L. Tobback and L. Geurden, a professor at the Veterinary School of Ghent, was appointed to teach tropical veterinary medicine in Dutch. F. Schoenaers, a professor at the Veterinary School of Cureghem, replaced Van Goidsenhoven as a lecturer in animal pathology until 1979.

The close collaboration between veterinarians and medical doctors and the cross-fertilisation of both veterinary and human tropical medicine resulted in 1959 in the creation of the Veterinary Department by director P.G. Janssens. He appointed J. Mortelmans initially as lecturer and in 1962 as head of the Veterinary Department. J. Mortelmans can thus be considered as the founding father of the Veterinary Department. Under his direction the department evolved from a one person business to a fully-fledged department. As pioneers of the initial years P. Kageruka (†), V. Kumar, R. Van Brabant and P. Van Wettere (†) deserve to be mentioned among the scientific personnel and F. Ceulemans, P. Dumoulin, M. Jochems and L. Van Peer,

among the administrative/technical personnel. J. Mortelmans was succeeded in 1989 by S. Geerts, who was chairman of the department until 2000, at which time J. Brandt took over the chairmanship. In 2001 the department moved from the main building in the Nationalestraat 155 to the building in the Kronenburgstraat 25 and from 2002 until today P. Dorny is chairing the department.

Eugene Meuleman – first veterinarian in Congo and at the School of Tropical Medicine in Brussels

Eugene Meuleman was born in 1865 in Jodoigne. After his studies of veterinary medicine at the veterinary school of Cureghem (Brussels), he worked as veterinarian for the Belgian army. By decree of King Leopold II (1889) he was appointed veterinarian of the Independent Congo State. Meuleman stayed 3 years in the Congo and worked i.a. on the island Mateba, where cattle from Angola and Madeira were imported. He studied also the problems of transport of livestock between Matadi and Leopoldville. This was very important because the workers at the railway Matadi-Leopoldville needed a regular supply of meat. Once the railway was finished, Albert Theys, its builder, declared that the success of the enterprise was mainly due to the beefsteaks of Mateba.

In 1906 soon after the start of the School of Tropical Medicine in Brussels Meuleman was invited to give lectures to the medical doctors under training about meat inspection in the tropics. After some years he was appointed professor, which he remained until 1914 when the first World War started. During the period before the War the whole teaching staff of the School consisted of 5 members: 3 medical doctors, one entomologist and one veterinarian.

Meuleman published his observations on livestock in Congo in 1895 as a monograph³ '*Etude sur l'élevage des animaux domestiques au Congo*', later to be published in the '*Bulletin de la Société Belge d'Etudes Coloniales*' and in the '*Annales de Médecine Vétérinaire*'⁴ In this work he describes all aspects of animal husbandry in Congo and also the eating habits of Europeans and the indigenous population. As son of a butcher he comments on the organoleptic qualities of meat of animal and human (!) origin...Meuleman was also very much interested in the local climate. Together with Lancaster he publishes in 1898 a standard manual '*Le climat du Congo*'⁵ which received a lot of attention inside and outside Belgium. He passed away in 1932 at the age of 67 years.

Source: Mammerickx, M., Eugène Meuleman, premier vétérinaire de l'Etat Indépendant du Congo, in *Annales de la Société Belge de Médecine Tropicale*, 69, 1989, 181-190.

One of the reasons, why P.G. Janssens was so eager to start a veterinary department at the ITM, was his interest in zoonoses. In spite of the fact that about half of the infectious diseases can be considered as zoonoses his interest was exceptional at that time. Now that we are swept with threats like SARS and H5N1 avian influenza, it may seem surprising how neglected the zoonotic aspects of these infections we have in common with animals were. When in the early 1980s, the awareness of AIDS became tangible, yet with little diagnostic means available, attention of the clinicians was drawn to opportunistic infections as an early warning for HIV involvement. P. Kageruka developed a better staining method for the intestinal protozoon *Cryptosporidium*, well known in veterinary medicine yet up to then, hardly known in medicine. Also in the same period V. Kumar successfully identified *Oesophagostomum bifurcum*, an intestinal nematode in monkeys, as the

causal agent of the 'tumeur de Dapaong' (in a collaborative programme with a Dutch team of the University of Leiden). Equally in the early 1980s H. Taelman (†), head of the ITM clinic, confronted with a neurocysticercotic patient, turned to the vets, who at that time, had experience with praziquantel for treatment of bovine cysticercosis. Faced with huge problems of anthelmintic resistance in livestock, the vets were also the first to draw the attention of their medical colleagues to a number of errors that did occur in the control of helminths in farm animals and that should be avoided in the control of worms in humans.

Occasionally, ITM clinicians still find their way to the Veterinary Department for various problems, be it for determining the occasional helminth, or the tick vector of Lyme disease, or provision of antigens for a variety of infections like *Babesia*, *Sarcocystis*, *Trichinella*. It shows that the interest is still there and it makes the unique combination of human and veterinary medicine under one, albeit figurative, roof still attractive.

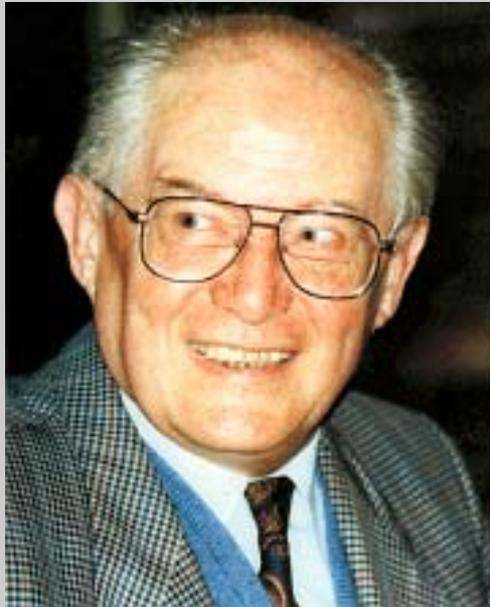
2. The collaboration between the Veterinary Department and the Zoo of Antwerp

In the early years (1959-1970) the Veterinary Department of ITM was based at the Antwerp Zoo. The Royal Society for Zoology of Antwerp (RSZA) made available a laboratory and supporting technical staff. The wealth of scientifically interesting material on tropical pathology in zoo animals, - most of the animals at that time were imported from Africa - and the fact that J. Mortelmans combined his post at the ITM with the management of the research lab of the RSZA made the location of the department at the RSZA an obvious choice.

Since long, the RSZA and ITM were closely collaborating. The first retraceable evidence dates from just after the first World War, when Louis van den Berghe, a lecturer in medical and veterinary parasitology at ITM with many years of professional experience in Africa, was appointed custodian of the Museum for Natural Sciences of the zoo. In this function and assisted by D. de Bisschop, then full-time zoo-vet, he laid the foundation for a scientific approach of the biological and veterinary activities at the zoo. This resulted in 1950 in the establishment of a laboratory and the foundation of a Board of Scientific Advisors by the newly appointed zoo director, W. Van den Bergh. Since then, directors or honorary directors of ITM were members of this board i.e. J. Rhodain, A. Dubois, L. Eyckmans and currently, B. Gryseels. Rhodain performed a lot of autopsies at the zoo and described in the thirties several parasites of the famous Okapi collection at the RSZA⁶.

In 1953, the Board initiated the publication of a scientific journal "Bulletin de la Société Royale de Zoologie", which, in 1962, was renamed as "Acta Zoologica et Pathologica Antverpiensia". Many research contributions of ITM staff were published in this journal, undoubtedly most of those written by A. Fain. As one of the most experienced acarologists, he described many newly discovered species and genera of mites in the bronchi of bats and primates. He named some of those even after his former and contemporary colleagues e.g. *Speleochir duboisi*, *Rhodainyssus* spp. en *Mortelmansia* spp. The board has always been supporting joint research programmes, as such, many scientific activities in benefit of the zoo have been undertaken in the laboratories of ITM, Janssen Pharmaceutica, the University of Antwerp, the laboratory of Patho-Anatomy of the 'Université Libre de Bruxelles' and

J. Mortelmans – founding father of the Veterinary Department



After his studies at the Veterinary School of Ghent J. Mortelmans obtained the diploma of 'Docteur en Médecine Vétérinaire Coloniale' in 1950 at the Institute of Tropical Medicine in Anwerp. His tropical career started in 1952 when he went to the former Belgian Congo and later to Rwanda-Urundi, where he worked in the veterinary laboratories of Kisenyi, Elisabethville, Stanleyville and Astrida. In 1959 he was appointed lecturer at the ITM, Antwerp and in 1962 professor and head of the Veterinary Department. After an initial period at the Antwerp Zoo, the Veterinary Department moved in the early 1970ties to the first floor of the building in the Rochusstraat 4. From that moment onwards there was a significant expansion of the staff of the department. J. Mortelmans manifested an intense activity both in the field of research, teaching and service delivery. He was a highly solicited expert and carried out a large number of overseas missions for a.o. DGCD, FAO, ILRI, PNUD, CGIAR. He became an authority in the field of animal trypanosomiasis and trypanotolerance and was very much involved in the creation of the International Trypanotolerance Centre (ITC) in the early 1980s in Banjul, The Gambia. At the top of his career he became member of the Technical Advisory Committee of the Consultative Group for International Agricultural Research (CGIAR, Washington). Furthermore, he was guest professor at the University of Leuven (1970-1989), president of the Association of Tropical Veterinary Institutes (1986-89), member of the Belgian Academy for Overseas Sciences (since 1968), president-founder of the organisation 'Agri-Overseas' and editor of the scientific journal 'Tropicultura' (1980-89). He was author or co-author of 262 scientific publications.

During his career J. Mortelmans has trained 615 students in tropical veterinary medicine. Some of them became minister in their home country, others occupied or still occupy important positions in the veterinary services of various African countries. But all remember with pleasure his interesting lectures full of fantastic stories, anecdotes and wisdom. Because of his important merits he was appointed in 1988 as 'Groot-Officier in de Kroonorde' and in 1993 'Groot-Officier in the Leopoldsorde'. In 1989 he became Prof. Emeritus of the ITM, Antwerp. He passed away in 2005 at the age of 81 years.

the Born-Bunge Foundation. These activities culminated in a symposium on 'Wild Animals in Medical and Veterinary Research' organised by J. Mortelmans in 1968. In those days, scientific research at the Veterinary Department and the RSZA had an enormous support from veterinarians working in the industry. They all had in common their friendship with J. Mortelmans, which almost invariably originated from their collaboration in Central Africa and they all shared a passion for developing a veterinary service, orientated towards the field requirements in tropical regions. As such, D. Thienpont from Janssen Pharmaceutica, J. Vercruyse (senior) from the Municipal Laboratory and Slaughterhouse of Antwerp and G. Sierens from the 'Boerenbond' remained close collaborators of both research laboratories.

In recent years, thanks to the financial support of the Flemish Government, research has seen a revival with ITM involvement in several new programmes in parasitology and mycobacteriology, often linked to MSc and PhD trainings, supervised by ITM staff. Since 2001 F. Vercammen, a former staff member of the Veterinary Department, has become full-time zoo-vet, assisted for emergencies and week-end guards by J. Brandt and R. De Deken.

3. Research at the Veterinary Department

The research priorities of the Veterinary Department were and still are trypanosomiasis, theileriosis (East Coast fever) and parasite zoonoses (mainly cysticercosis). From 1974 until 1994 some research was also carried out in the field of animal production. Since 1999 the department is strengthened by a unit of epidemiology and applied statistics.

Animal African trypanosomiasis

Animal African Trypanosomiasis (AAT) is one of the major threats to livestock production in sub-Saharan Africa. It is caused by different species of trypanosomes and is mainly transmitted by tsetse flies (*Glossina* spp.), which occur in 37 countries, covering about 9 million km². Some 50 million cattle are exposed to the infection. FAO estimates that AAT causes about 3 million deaths of cattle per year. The direct losses in cattle production are in the range of US \$ 1 to 1.2 billion whereas the indirect losses exceed this amount due inter alia to restricted access to cultivable land, reduced use of draught animals and less efficient nutrient cycling.

One of the most important parasites of livestock in Africa, *Trypanosoma congolense*, has been detected in 1904 by the first director of ITM, A. Broden. During his stay in Congo Broden had observed this parasite in the blood of sick donkeys and sheep. He published the first description of this very pathogenic parasite in the 'Bulletin de la Société des Etudes Coloniales'⁷. Since then this parasite is mentioned in all textbooks as *Trypanosoma congolense*, Broden 1904. A. Broden was not the only medical doctor interested in animal trypanosomiasis. J. Rhodain, who succeeded Broden as director of ITM, was also very much interested in animal trypanosomes. He studied trypanosomes of frogs and fishes and carried out several treatment trials in animals affected by trypanosomiasis. He described *T. congolense* in dogs and goats and *T. cazalboui* (later called *T. vivax*) in antelopes, elands and goats in

Katanga⁸. He was also very much interested in the role of domestic animals as a reservoir of pathogenic trypanosomes for man⁹.

Over the years, the study of *T. congolense* and the animal reservoir of human trypanosomes has remained an important research topic of the Veterinary Department. Currently, *T. congolense* is no longer regarded as a single entity, but rather a complex of different types (savannah, forest and kilifi). Staff members of the department studied in depth the genetic diversity of the savannah type *T. congolense* and showed that there are significant differences in the virulence of this parasite. Novel treatment systems and the problem of drug resistance in *T. congolense* were other topics, which received considerable attention. The Veterinary Department was the first to describe the use of polymer-based sustained release devices which were able to extend the prophylactic activity of the conventional trypanocides by a factor 2 to 3. Furthermore, the department played a crucial role in drawing the attention of the scientific community to the increasing threat of trypanocidal drug resistance. Large-scale surveys were carried out in eastern and southern Africa which showed that more than half of 140 *T. congolense* isolates examined were resistant to one or both of the two most commonly used trypanocidal drugs, diminazene aceturate and isometamidium chloride.

Within the framework of the Programme Against African Trypanosomiasis (PAAT), a joint initiative of FAO/WHO/IAEA/AU-IBAR, the department made important contributions to the development of guidelines to delay the development of trypanocidal drug resistance¹⁰. Given the fact that the treatment of animal trypanosomiasis depends on a very limited number of drugs which are already in use for the past 40 years or longer and taking into account that no new drugs are under development, these guidelines are still of utmost importance to maintain the efficacy of the few trypanocides currently available. The trypanosomiasis unit of the department invested a lot of time and energy in the standardisation of the tests for the detection of trypanocidal drug resistance and in the development of molecular tools for the fast/early identification of drug resistant *T. congolense*.

As described above, attention to the role of animals as reservoirs of *Trypanosoma brucei gambiense* was drawn by J. Rodhain and several Belgian researchers in the beginning of the 20th century. At that time experimental infection of human volunteers was still not considered as unethical as it was considered a benefit for the community and Belgian researchers in Congo used *T.b. gambiense* of animal origin to experimentally infect humans in order to prove the infectivity of these isolates for man¹¹. Later on, using more modern tools, the role of domestic (pigs) and wild animals (lions, antelopes) as reservoir of *T.b. gambiense* was highlighted by staff members of the department^{12,13}. Currently, the study of the animal reservoir of sleeping sickness in man is pursued. Due to the alarming increase in the incidence of human trypanosomiasis cases within the city of Kinshasa in recent years, the Veterinary Department in a multidisciplinary collaboration with other departments of ITM started to study the possible transmission sites and more particularly the piggeries in the city and the infection of pigs with trypanosomes infective for humans. After the recent detection of the important role of cattle as reservoir of *Trypanosoma brucei rhodesiense* in East Africa, the department did also some work on the transmissibility of the latter parasite in cattle.

Research on the vectors of trypanosomiasis, the tsetse flies, was initiated at the Institute by J. Mortelmans by the creation of a tsetse breeding unit in 1986. Although in the beginning 4 species of *Glossina* were bred: *G. morsitans morsitans*, *G. palpalis palpalis*, *G. palpalis gambiensis* and *G. tachinoides*, currently a breeding colony of

only the former species is still maintained. The Veterinary Department focused mainly on the study of the vectorial capacity of *Glossina* spp. and the external and internal factors which influence this capacity.

Trypanotolerance

Trypanotolerance is the capacity of certain taurine breeds of cattle (i.a. N'Dama, Baoulé,) and of several breeds of sheep (e.g. Djallonke) and goats (e.g. West African Dwarf) to survive, reproduce and remain productive under trypanosomiasis risk without the aid of trypanocidal drugs. Exposed to similar challenges of tsetse and trypanosomiasis zebu cattle and many other breeds of sheep and goats do not survive without treatment. It is commonly accepted that the taurine breeds arrived much earlier in Africa than the zebus and consequently, similar to many game animals, developed a genetic resistance to trypanosomiasis by natural selection.

The Veterinary Department has played an important role in the study and the promotion of trypanotolerant livestock in West and Central Africa. N'Dama cattle were introduced in the early 1920s in the D.R. Congo and currently there is still a large population present in the country. J. Mortelmans and several Belgian scientists were involved in the study of the performance characteristics of these trypanotolerant animals within the framework of the 'Trypanotolerant Livestock Network', which had two field stations in the 1980ties in Congo, Mushi and Idiofa where the N'Dama were kept under ranching and village conditions, respectively. During the same period the International Trypanotolerance Centre (ITC) was created in Banjul, The Gambia with the initial aim of producing, multiplying and disseminating this breed all over sub-Saharan Africa. J. Mortelmans, who was asked by Dr. Jawara, veterinarian and president of the Gambia at that time, to become member of the Council of ITC¹⁴, was able to convince the Belgian Government to financially contribute to ITC. Several scientists from Belgium and elsewhere have carried out research at ITC under the supervision of J. Mortelmans, A. Verhulst and S. Geerts. Interesting new observations which resulted from this research were, among others, the genetic resistance to certain species of ticks, which could be demonstrated in the N'Dama cattle and the lower degree of trypanotolerance in Djallonke sheep and West African Dwarf goats as compared to N'Dama. Based on the results of many field and on-station trials it now seems more appropriate to characterise trypanotolerance in small ruminants as a resilience rather than resistance to infection. A. Verhulst and his collaborators also did some interesting work with the aim of developing a test for the early identification of trypanotolerance in cattle. E. Thys¹⁵ in his book 'Des taurins et des hommes' (1998) drew the attention to some almost forgotten taurine trypanotolerant breeds in Cameroon and Nigeria (Kapsiki, Namchi and others), which are threatened by extinction.

Currently, the Veterinary Department is still playing a prominent role in ITC. In 1996 J. Mortelmans was succeeded by S. Geerts as member of the ITC Council and in 2004 at the 20th anniversary of the Centre the latter was chairman of the Council.

East Coast fever

East Coast fever (ECf) is the most important tick-borne disease of cattle in eastern, central and southern Africa. It caused an estimated loss of US \$ 186 million in 1989 in the 11 countries where it occurs. It is caused by the protozoan parasite *Theileria parva* and is transmitted by the tick *Rhipicephalus appendiculatus*. 'Throughout its history, ECf has been a source of great anxiety and cost to farmers, and of intense interest to research workers. Many dogmas and misconceptions have become established, some of which still flourish while others took years to demolish.' (Dolan, T., 1997. International Colloquium on the Epidemiology and Control of Theileriosis, ITM, Antwerp)

Similarly to the trypanosomes, *Theileria* parasites have fascinated the scientists working at the ITM. Soon after the discovery of *Theileria parva* as the etiological agent of East Coast fever (ECf) Broden and Rhodain (1908) reported the presence of piroplasms in the red blood cells of cattle at Stanley Pool, which they identified as '*Piroplasma mutans* of Theiler', later called *Theileria mutans*¹⁶. In 1916 Rodhain¹⁷ described for the first time *Theileria ovis* in sheep of the Uele (D.R. Congo), a parasite which is closely related to *T. mutans*.

Contrary to the benign theileriosis caused by *T. mutans*, ECf is a killer disease, which was and even is today very much feared by the livestock owners. At the beginning of the 20th century, Katanga, which was at that time still free of the disease, was threatened by the introduction of ECf. This was one of the reasons why the vice-governor of Congo, Mr. Ghislain insisted in 1909 to Mr. Renkin, the Minister of Colonies in Brussels, that veterinarians should follow courses at the ITM, Brussels before leaving for the Congo and that more veterinary laboratories should be created in Congo¹⁸.

After World War I ECf remained a challenge to the vets. R. Van Saceghem (1884-1965), a Belgian vet in Congo who became reputed for his discovery of *Dermatophilus congolensis*, the etiological agent of an important skin disease of livestock, did several treatment and immunisation trials¹⁹. After the discovery of the effect of aureomycin on *T. parva* by Neitz in 1953, one of the first experiments to protect cattle against ECf using the so called 'infection and treatment (I&T) method', which is still in use today, (which at the time of writing, is still the only available immunisation method for large scale application in the field) was carried out by a team of Belgian vets working in Rwanda in 1959²⁰. It is worth mentioning that these authors advised to use local strains because the Onderstepoort strain of *T. parva* did not give sufficient protection. Since tetracyclins were very expensive in those days and since long acting formulations were not yet commercially available, it would take about 20 years before the I&T technique could be applied on a larger scale.

In 1982, when the Belgian Administration for Development Co-operation requested the support of the Veterinary Department to supervise an ambitious programme to control animal diseases and particularly ECf in the Eastern province of Zambia, regular dipping of cattle with acaricides was still the major control method of ECf. However, due to problems with the maintenance of the dipping infrastructure and to the threat of development of resistance to acaricides in ticks, efforts concentrated on alternative control of ECf. The programme in Zambia, which was supervised by J. Mortelmans and later by J. Brandt, started with the setup of a diagnostic laboratory, an in depth study of the vector of the disease, *Rhipicephalus appendiculatus*, and the epidemiology of the disease. The Belgian-Zambian team very soon proved that

the so called 'Muguga cocktail', a mixture of 3 *T. parva* stocks, which was used in East Africa to immunise cattle against ECf, did not give sufficient protection against the local *T. parva* strains. The use of the local 'Katete' strain, however, was shown to provide excellent protection. This laid a sound basis for an intensive immunisation programme by the infection and treatment method, on a scale that still to date remains unique for the endemic ECf regions in Africa. Until 1996 about 150,000 animals were immunised which allowed to reduce calf mortality from 25-50% to 2.5-3.5%. This resulted in an effective control of the disease in the Eastern Province of Zambia. Consequently in a second phase, a similar action was started in the Southern Province, where three quarters of the cattle, counting over a million heads, were at risk of contracting ECf. Although at certain moments there was a strong pressure from international organisations to use the Muguga cocktail in Zambia, the Zambian veterinary authorities refused to do so, because they didn't want to introduce foreign *T. parva* strains in the country. This led to serious debates, and sometimes heavy disputes, about the advantages and disadvantages of the I&T method using local versus foreign strains.

The Belgian Animal Disease Control Project in Zambia (BADCP, 1982-93) which was later continued by ASVEZA (Assistance to the Veterinary Services of Zambia, 1993-2002) has given a major boost to the research on ECf. Besides the important observations mentioned above, the project brought a lot of new insights on several aspects of the epidemiology and control of the disease. It was shown that the ecology of the *R. appendiculatus* - complex in Zambia (where a behavioural diapause was observed) was different from that in East Africa and consequently the epidemiology of ECf was also different. Through molecular epidemiological studies the risk of introducing foreign *T. parva* genotypes by using the Muguga cocktail was demonstrated. The project realised several important improvements of the immunisation technique against ECf. Instead of using live animals for the titration of *T. parva* stabilates an in vitro method was developed, which allows a significant reduction of the numbers of experimental animals for the production of the immunising stabilates. The field delivery of the vaccine was also much improved through the use of ice-baths instead of liquid nitrogen and the use of cheaper long-acting tetracycline formulations.

Eventually seven members of the current staff of the department - D. Berkvens, V. Delespaux, D. Geysen, M. Madder, T. Marcotty, N. Speybroeck and P. Van den Bossche - were active in the project with activities that formed a firm base for their respective PhD theses. In addition, several other Belgian project collaborators and Zambian counterparts finished a PhD training and four more are expected to present their theses very soon.

Taeniasis-cysticercosis

Taenia saginata and *Taenia solium* are known as the beef tapeworm and the pork tapeworm, respectively. Man infects himself with a tapeworm by eating raw or undercooked beef or pork. Unfortunately, the eggs of *T. solium* are also infective to man and can develop into cysticerci in the muscles and the brain. The latter infection is known as neurocysticercosis and is a major cause of epilepsy in developing countries. Taeniasis/cysticercosis is one of the many so called 'neglected diseases' linked to poverty. The burden of this zoonotic disease is not well known, but it is estimated that 50 million people worldwide are infected and that it causes 50,000 deaths per year.

Research on helminths and helminth diseases was initiated by V. Kumar and J. Brandt in the early 1970s. Initially research was focused on *Taenia saginata* and bovine cysticercosis, since funding came from the Belgian Institute for Scientific Research in Industry and Agriculture (IWONL), which is only interested in specific problems for the Belgian livestock and agriculture. Contrary to *Taenia solium*, which has been eradicated in Belgium long time ago, getting rid of the taeniasis/cysticercosis complex due to *T. saginata* proved to be a different matter, mainly because of the inefficacy of the current meat inspection procedures at the slaughterhouses and the existing stigma on worm infections in man. Although the economic losses due to bovine cysticercosis in Belgium are not negligible, the losses in many developing countries, which are endemic or hyperendemic for the parasite, are much higher and form a real obstacle for meat export. The primary objective of the research project funded by IWONL was the development of improved diagnostic techniques for the detection of cysticercosis in cattle. The veterinary team of the ITM succeeded in producing monoclonal antibodies (MAbs) against the excretory-secretory products of *T. saginata* and developed a MAb-based sandwich ELISA system for the diagnosis of bovine cysticercosis²¹. It allowed the detection of cattle harbouring cysticerci, albeit restricted to viable larvae, because the circulating antigens, which are detected by the MAbs are only present in animals in which living cysts are present. In a large-scale survey in Belgium P. Dorny and collaborators were able to detect 10 times more infected animals using the MAb-based ELISA (3%) than by conventional meat inspection (0.3%).

Since the MAbs are genus-specific, but not species-specific, it was possible to apply them not only for the detection of circulating antigens in cattle infected with *T. saginata* cysticercosis, but also in pigs and man infected with *T. solium* cysticercosis. This allowed research to be focused more intensively on the problem of neurocysticercosis in man, whose prevalence is largely underestimated in many developing countries. Serological surveys using this technique allowed detecting new foci of the disease in Ecuador, Cameroon, Vietnam and Zambia and to study the epidemiology of the disease and the associated risk factors in these countries. The fact that the technique is able to distinguish people carrying living cysts from those, who carry only dead cysts, is responsible for its success as a diagnostic tool. Indeed, treatment is usually limited to those patients who are infected with viable cysts. Furthermore, preliminary results indicate that there is an excellent correlation between the disappearance of living cysts after treatment and the disappearance of circulating *T. solium* antigens. The assay might therefore become an excellent and cheap alternative tool for the follow-up of neurocysticercosis after treatment, hitherto only possible by sophisticated equipment such as CT-scan or Magnetic Resonance Imaging. Very often these machines are not available in rural areas, where *T. solium* cysticercosis is endemic, and – if they are available – they are usually too expensive for the poor, which are at the highest risk to become infected.

Epidemiology and applied statistics

Although the Veterinary Department has been involved in epidemiological studies for many years, it was only in 1999 that a separate unit of epidemiology and applied statistics was created. D. Berkvens, who was appointed as head of the unit, was already involved long before 1999 in the analysis of the epidemiological data about

ECf in Zambia collected within the framework of the ASVEZA project. He also played an important role in strengthening the capacity of the Centre for Ticks and Tick-borne Diseases (CTTBD, Lilongwe, Malawi) in the field of epidemiology. Currently, the unit focuses on the Bayesian analysis of diagnostic test results and risk analysis of infection or re-infection with certain diseases after the execution of control programmes. Using these methodologies it has been possible to obtain more reliable figures on the prevalence of porcine cysticercosis, bovine brucellosis, giardiasis and cryptosporidiosis in various countries.

Tropical animal production

In the early 1970s J. Hardouin was invited by J. Mortelmans to set up an animal production unit. A. Verhulst joined the unit very soon and later on J. de Borchgrave, F. Demey and V. Pandey were appointed as staff members. The major research topics of the unit were genetic resistance of livestock to trypanosomiasis and other parasitic diseases (see above), mini-livestock and alternative sources of proteins and the production of small ruminants and poultry under village conditions in the tropics.

At a time when the scientific community had very little interest in small ruminants and poultry at the small scale village-level, they constituted an important resource and therefore were selected as one of the research priorities of the animal production unit. Times have changed a lot and nowadays nobody denies the importance of these animals to improve the livelihood of villagers in the developing world. Research networks dealing with small ruminants and village poultry have been created and are active all over the world to try to improve the productivity of both groups of animals, which have been neglected too long.

Poor productivity is one of the big problems in traditional livestock breeding. One of the reasons is a precocious fecundation of females by free roaming males. An original approach, which was tried out by the unit, was to temporarily sterilise rams and bucks, because male castration is often refused by the traditional Islamic livestock owners. This was achieved by enveloping the scrotum in an insulated sack or by pushing the testicles under the belly skin, which resulted in a local increase of temperature and a consequent decrease of the viability of the spermatozoa. The advantage of both techniques is that the process is reversible hence, contrary to castration, the intervention did not affect the retail price of the animals and favoured lean deposit instead of fat.

The unit did also some interesting work to reduce mortality and improve productivity of village poultry. In Africa 80% of the poultry population is found in traditional production systems. Long before it became fashionable to work on the so called backyard chickens, the unit did a lot of studies on various aspects of traditional poultry production in Africa. Special attention was given to improved vaccination against Newcastle disease, one of the major constraints to rural poultry breeding, using heat tolerant vaccines.

The demand for 'bush-meat' in the humid tropics was already strongly increasing in the early seventies with the risk of disappearance of some species of bush animals. At the request of the Technical Centre for Agriculture and Rural Cooperation (CTA, Wageningen) the unit of animal production evaluated the situation of small bush animals such as bush rats, giant snails, lizards and frogs. With EU-funding research was undertaken to produce some of these animals under controlled conditions. Five animal species were targeted: giant African snails, guinea pigs, cane rats, Gambian

rats and manure worms. The production of the latter worms is interesting because they can be bred in household garbage and then used as a protein source for monogastric animals. Interesting observations were i.a. the high inbreeding level in traditional guinea pig production in Africa, hampering their tremendous productivity potentials, the absence of the thermolabile anti-growth factor in the tropical manure worm *Eudrilus eugeniae* (this factor is present in the temperate worm *Eisenia fetida*) and the identification of the intestinal helminth *Meggittina cryocetomydis* and hepatic capillariasis in the giant rat. Experiments to breed the cane rat (*Thryonomys swinderianus* or aulacode, erroneously called 'agouti', which is in high demand and therefore sold at high prices), under controlled conditions were successfully carried out within the framework of the Kasongo project in the current D.R. Congo. In order to improve the dissemination of this type of information J. Hardouin created in 1991 the Bureau for Exchange and Distribution of Information on Mini-livestock (BEDIM)¹⁹. With the financial support of FAO an information bulletin on mini-livestock was launched, the 14th volume of which appeared in 2005.

4. Collaborative projects with the South

It is nearly impossible to give an exhaustive overview of all projects in which the department has been involved in the past. However, besides the longstanding collaboration projects with the Veterinary Services of Zambia (Asveza project) and with the International Trypanotolerance Centre in The Gambia, which were mentioned earlier, the department has been active in many African countries, but particularly in Cameroon and Zaïre.

Since the early 1970s the department has supervised projects in Cameroon both in the field of research and teaching. Several of the current staff members of the department have worked in the country. E. Thys has been involved in the training of veterinary assistants first in Maroua at the 'Centre National de Formation Zootechnique et Vétérinaire' and later on at the Ministry in Yaounde for curriculum review at the national level. J. de Borchgrave has worked as expert in the 'Centre Zootechnique de Kounden'. Joint research projects were carried out with the 'Institut de Recherches Zootechniques' (Yaounde) and with the University of Dschang (West Cameroon) on traditional breeding of small ruminants and animal health problems, respectively. Due to the intensive collaboration particularly with the faculty of Agronomy of the latter university several of its graduates and staff members have obtained MSc and PhD degrees in Belgium.

In Congo the department has been involved in the Kasongo project, where research was carried out on mini-livestock. In the field of animal health the department has given scientific and technical support to the veterinary laboratory of Kinshasa and the anaplasmosis project in Lubumbashi. Unfortunately, in 1990 when the Belgian authorities decided to stop all development cooperation with Zaïre, all these projects were suspended. It is only during the last years that some collaborative projects have started again with the veterinary laboratory of Kinshasa.

Since 1998 the Framework Agreement between the Department for Development Cooperation (DGCD, Brussels) and the ITM has created a very favorable environment for joint research projects with partners in the South. The Veterinary Department is currently involved in the following projects: support to the training programme of the Centre for Ticks and Tick-borne Diseases in Lilongwe (Malawi), research on zoonoses together with the International Centre for Zoonoses in Quito

(Ecuador), studies on taeniasis and cysticercosis in collaboration with the National Institute for Malariology, Parasitology and Entomology in Hanoi (Vietnam), research on the animal reservoir of sleeping sickness together with the 'Institut National de Recherche Biomédicale' and the Veterinary Laboratory of Kinshasa (D.R. Congo) and last but not least an institutional collaboration programme with the Department of Veterinary Tropical Diseases (DVTD) of the Onderstepoort Veterinary Faculty of the University of Pretoria. Indeed, the good contacts between scientists of the Veterinary Department of the ITM and Onderstepoort has resulted in 2003 in the launching of an ambitious programme involving teaching, research and institutional strengthening. The DVTD is a major player in the field of veterinary research and capacity building in Southern Africa. The institutional collaboration aims at increasing the DVTD's capacity to deal with trypanosomosis, East Coast fever and helminthosis. This is achieved through (i) improving the DVTD's diagnostic capacity for the specific diseases, (ii) developing a web-based MSc course in Tropical Animal Health and (iii) conducting research in the specific diseases in Southern Africa. P. Van den Bossche set up a tsetse/trypanosomosis unit with the entomology section of the Onderstepoort Veterinary Institute that can support research in tsetse and trypanosomosis in the region. Within the framework of the collaboration 7 PhD students and one MSc student are currently conducting their research in the fields of trypanosomosis and tsetse control, Corridor disease and *Theileria* identification, modelling in ovine haemonchosis, canine babesiosis, and tuberculosis. The ITM also supports the development of the modules on trypanosomosis, tick-borne diseases and helminthology of the web-based MSc course in Tropical Veterinary Medicine, which has been launched in 2005.

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