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TSETSE AND TRYPANOSOMIASIS INFORMATION QUARTERLY

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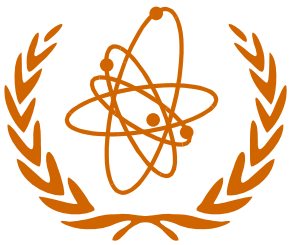

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section b — abstracts

1. GENERAL (INCLUDING LAND USE)

6810 **Institut Sénégalais de Recherches Agricoles, 1990.** *Présentation du Laboratoire National de l'Elevage et de Recherches Vétérinaires*. [Introduction to the National Laboratory of Livestock Rearing and Vet-erinary Research.] Dakar, Senegal; ISRA. Ref. no. 011/DOC. 11 pp.
LNERV, B.P. 2057, Dakar-Hann, Senegal.
The research activities of LNERV are listed and include three trypanosomiasis control projects: diagnosis using ELISA; therapeutics and tsetse control; pathology and productivity of trypanotolerant livestock.

6811 **International Laboratory for Research on Animal Diseases, 1990.** *ILRAD 1989* (annual report). Nairobi; ILRAD. 103 pp.
ILRAD, P.O. Box 30709, Nairobi, Kenya.
Trypanosomiasis research is being carried out on a broad front. Trials have shown ELISA to be sensitive and reliable for detecting the three major tsetse-transmittted species infecting livestock and *Trypanosoma evansi* in pigs and camels. DNA probes are being developed as alternative diagnostic techniques. Laboratory culture systems have been improved and the dividing mammal-adapted form of *T. b. brucei* can now be cultured indefinitely. Studies on trypanosome biology, to identify parasite-specific mechanisms that can be targeted for drug or immunological attack, and the genetic control of trypanosome life cycle stages are in progress. A gene that appears to be active only in the rapidly dividing mammalian form of *T. b. brucei* has been cloned. Comparative studies of susceptible (Boran) and resistant (N'Dama) cattle are increasing the understanding of immune and pathogenic responses, and cross-breeding experiments using embryo-transfer are under way to identify markers of genes that control trypanotolerance. Tests for levels of drug resistance are being developed and the genetic mechanisms of trypanosome resistance are being investigated. Breeding colonies of six species of *Glossina* are maintained. Studies have demonstrated the cyclical development of *T. vivax* in *G. morsitans centralis* and that the susceptibility of *G. m. centralis* to *T. congolense* infection is not associated with the presence of rickettsia-like organisms in the fly midgut, as previously believed.

6812 **International Livestock Centre for Africa, 1990.** *ILCA annual report 1989*. Addis Ababa; ILCA. 144 pp.
ILCA, P.O. Box 5689, Addis Ababa, Ethiopia.
The ILCA Trypanotolerance Thrust continues to pursue its objective of improved livestock production in four

main research areas: epidemiology, trypanotolerance, genetics of trypanotolerance, and biological and economic evaluation of productivity responses to interventions. The relationships between trypanosome prevalence, tsetse challenge and animal productivity in susceptible and trypanotolerant cattle have been quantified, and demonstrate the need for major reductions in tsetse populations before significant decreases in trypanosome incidence can be achieved. The ability to control anaemia in trypanotolerant cattle, measured in terms of average and lowest PCV, is related to increased productivity and has a greater effect on weight gain than the ability to control parasitaemia. High genetic correlations between average PCV and growth rate suggest that selection for PCV values would appear to offer an effective strategy for the rapid genetic improvement of trypanotolerant cattle. A tsetse control programme in northern Côte d'Ivoire, using cypermethrin-impregnated biconical traps, is continuing and mean trypanosome prevalence in 1989 was about one quarter of that in 1987. The introduction of N'Dama cattle for beef production in central Zaire showed positive but not outstanding returns. Lists of staff, publications, meetings attended and research collaborators are appended.

6813 **Jordan, A.M. and Langley, P.A., 1991**. The Tsetse Research Lab-oratory. *Annals of Tropical Medicine and Parasitology*, **85** (1): 11-20.

TRL, Langford House, Langford, Bristol BS18 7DU, UK.

The TRL was opened in December 1962 with the initial objective of developing techniques for rearing tsetse flies on a large scale outside Africa. The main species colonised is *Glossina morsitans morsitans*, which is fed *in vitro* on fresh defibrinated pig blood through silicone rubber membranes. Methods of determining nutritional status by measuring fat and haematin content and ageing by measuring the pteridine content of the head capsule have been developed. Metabolic processes have been studied with a view to selecting specific compounds which could block their action, such as the juvenile hormone mimic pyriproxyfen which acts as a chemosterilant on both sexes. Preliminary tests with pyriproxyfen-treated traps in Zimbabwe suggest that tsetse populations can be reduced to one millionth of their original levels in one year. Behavioural studies associated with the development of traps and targets have included the role of vision, olfactory stimuli and mating behaviour. Factors affecting the susceptibility

of tsetse to trypanosomiasis infection have also been studied.

6814 **Kuzoe, F.A.S., 1987**. The African trypanosomiases. *In*: UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases. *Tropical disease research: a global partnership. Eighth programme report: the first ten years, with highlights of the 1985-86 biennium*. (Eds Maurice, J. and Pearce, A.M.) Geneva; WHO. pp. 73-86.
TDR, WHO, CH-1211 Geneva 27, Switzerland.
Between 1977 and 1986, TDR spent US $12.6 million on 166 projects concerned with African trypanosomiasis. These included investigations into the epidemiology of *Trypanosoma brucei gambiense* and *T. b. rhodesiense*, tsetse fly control, parasitological and serological diagnosis, immunology, pathology and drug development. Future priorities for the Scientific Working Group on the African Trypanosomiases are identified.

6815 **Kuzoe, F.A.S., 1991**. Perspectives in research on and control of African trypanosomiasis. *Annals of Tropical Medicine and Parasitology*, **85** (1): 33-41.
TDR, WHO, CH-1211 Geneva 27, Switzerland.
African trypanosomiasis affects both man and his domestic animals, and is fatal if untreated. The risk of epidemics makes the disease a major public health problem in 36 sub-Saharan African countries, where some 50 million people are at risk of contracting the disease. Continued suppression of the disease through medical surveillance is indispensable to prevent epidemics which are difficult and costly to control. Recent epidemics and flare-ups have occurred in certain countries due to breakdown in medical surveillance occasioned by political, social and economic factors. The development of new tools through research over the last decade has improved the diagnosis of patients and vector control. The development of eflornithine (DFMO) for the treatment of *gambiense* sleeping sickness is a major breakthrough in view of its safety compared with current treatment alternatives, and it has been nicknamed the `resurrection drug'. In spite of these achievements, however, there is no radical solution to the problem of sleeping sickness. The use by the endemic countries of improved tools for disease control depends upon the availability of resources from national, bilateral and multilateral sources, and commitment of the countries concerned.

6816 **Lapeyssonnie, L., 1987**. *Moi, Jamot: le vainqueur de la maladie du sommeil*. [I, Jamot: conqueror of sleeping sickness.] Brussels, Belgium; Presses de l'Inam. 206 pp.
This book tells the story of the life and work of Colonel Jamot of the French Colonial Medical Service

whose pioneering spirit and phenomenal energy transformed campaigns against the devastating epidemics of sleeping sickness in French West Africa in the 1920s and 1930s. Jamot created mobible teams for rapid deployment where needed. These surveyed the whole population of a given area to discover all infected persons and treat them with arsenicals. His career ended tragically when he was suspended from duty following an incident in which 500 patients lost their sight when overdosed by an inexperienced young medical officer during Jamot's temporary absence. He retired, returned to France and died the following year at the age of 56, a lonely and bitter man.

6817 **Lyons, M., 1985**. Sleeping sickness in the history of northeast Congo (Zaire). *Canadian Journal of African Studies*, **19** (3): 627-633.

Epidemics of *Trypanosoma brucei gambiense* human trypanosomiasis in the Belgian Congo (Zaire) early in this century are related to the social and environmental changes that resulted from colonial conquest. Economic interests provided the main incentive for colonial medical activity. Before 1905 and the development of an effective trypanocide patients were segregated in special camps or *lazarets*, but during the 1920s the authorities were undertaking mass surveillance with chemotherapy. By 1931 over 2.5 million people had been screened for sleeping sickness in the Congo, although many Africans were reluctant to accept European medical provision. Socio-economic factors, such as diet and nutrition, fatigue and stress, social rank, occupation and sex, affect susceptibility to disease. The analysis of epidemic diseases, such as human trypanosomiasis, can therefore be used to explain aspects of social history.

6818 **Lyons, M., 1988**. Sleeping sickness, colonial medicine and imperialism: some connections in the Belgian Congo. *In*: Macleod, R. and Lewis, M. (eds), *Disease, medicine and empire: perspectives on western medicine and the experience of European expansion* (London and New York; Routledge), pp. 242-256.

This article presents a brief history of sleeping sickness epidemics in colonial Africa. Human trypanosomiasis, long known to be endemic, became progressively epidemic during the late 19th century due to colonial disruption of African societies and consequent changes in human ecology, including famine, exhaustion and disease, which resulted in increased stress and lowered resistance. This led to an upsurge of competitive research by the colonial authorities and prompted the development of the Belgian colonial medical service, which was used as propaganda for Belgian imperialism in the Congo (Zaire). Successive epidemics killed thousands of people in the Congo but the disease was gradually reduced. In 1925, 1,500,000 people were examined and 100,000 victims identified and treated; by 1955 there were 6,600,000 examinations but only 12,117 victims. The success of the Belgian medical service has been described as one of the major benefits of imperialism in the Congo, but first of all

imperialism had transformed an endemic disease into a major epidemic.

6819 **Nantulya, V.M. and Moloo, S.K., 1989**. Recent developments in trypanosomiasis. *International Journal of Animal Sciences*, **4** (2): 71-84.

ILRAD, P.O. Box 30709, Nairobi, Kenya.

Control of trypanosomiasis on a large scale is at present largely achieved through insecticide application to reduce or eliminate the tsetse fly population and is frequently accompanied by the administration of chemotherapeutic and/or chemoprophylactic drugs. Increased knowledge of tsetse ecology and greatly improved techniques for more effective aerial application of insecticides at low doses have resulted in substantially reduced environmental pollution. The development of synthetic pyrethroid insecticides represents a further advance in this respect. With their high toxicity for tsetse, good persistence and minimal environmental impact they appear to possess distinct advantages, although aerial spraying of u.l.v. endosulfan is at present still the insecticide of choice. The additional use of deltamethrin-impregnated traps and screens as simple, economic tools will effectively support the insecticidal aerial spraying operations. Incorporation of attractants in traps or screens will enhance their efficacy. Availability of improved drug formulations and new tools for diagnosis and epidemiological investigations should facilitate a more judicious and rational application of chemotherapy and chemoprophylaxis. The prospects for the development of new methodologies for prevention or control of the disease by immunological means still appear distant. No common protective antigen has yet been identified. The use of trypanotolerant livestock would appear to be a pragmatic approach but further studies are needed to identify the genetic markers that correlate with this trait to facilitate selective breeding.

6820 **Troncy, P.M., Itard, J. and Morel, P.C., 1989**. *Manual of tropical veterinary parasitology*. Wallingford, UK; CAB International. 473 pp.

This is an English translation by Mira Shah-Fischer and Ralph Say of the tenth in the series *Manuels et précis d'élévage*, compiled by IEMVT and published in 1981 (see *TTIQ*, **5**: no. 2241). It consists of three parts: Helminths of livestock and poultry in tropical Africa by P.M. Troncy, African animal trypanosomoses by J. Itard, and Tick-borne diseases of livestock in Africa

by P.C. Morel. The part on trypanosomiasis (pp. 177-297) includes sections on the parasites (morphology, biology, hosts and geographic distribution), the vectors (morphology, biology, distribution), the pathology of animal trypanosomiases, epizootiology, diagnosis, vector surveys, treatment and prophylaxis, and tsetse control.

6821 **UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases, 1989**. *Tropical diseases: progress in international research, 1987-1988. Ninth programme report*. Geneva; WHO. 128 pp. (ISBN 92 4 156129 7. Price Sw. fr. 20.)
TDR, WHO, CH-1211 Geneva 27, Switzerland.
This report summarises some of the results of TDR-assisted projects. Current research on diagnosis of trypanosomiasis focuses on the development of antigen-detection methods, and new techniques being adapted for field evaluation include ELISA and the procyclic agglutination trypanosomiasis test (PATT). At present (1989) 30 million people are under active medical surveillance. Potential new drugs include DL-α-monofluoromethylornithine (MFMO) and inhibitors of the glycolytic pathway of trypanosomes. Possible vaccine targets include receptors for transferrin and low-density lipoprotein (LDL) in the flagellar pocket of bloodstream forms. The possibility that HIV-induced immunosuppression accelerates the progress of symptomless *Trypanosoma brucei gambiense* infection to overt sleeping sickness is also being investigated. The use of 40,000 deltamethrin-impregnated traps and screens for vector control over 1300 km^2 in the endemic focus of Vavoua, Côte d'Ivoire, resulted in a 99.9% reduction in flies in villages after 18 weeks. A similar approach is being adopted in Uganda, using 10,000 pyramidal traps to control flies in an area of 2000 km^2. The TDR programme included a budget of US $3.187 million for African human trypanosomiasis projects during 1988-89.

6822 **WHO Division of Control of Tropical Diseases and UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases, 1990**. *Tropical diseases 1990*. WHO report no. TDR-CTD/HH90.1. 26 pp.
TDR, WHO, CH-1211 Geneva 27, Switzerland.
The WHO Division of Control of Tropical Diseases (CTD) was established in January 1990 and collaborates closely with the Special Programme for Research and Training in Tropical Diseases (TDR) to evaluate control technologies and strategies, concentrating its efforts on the countries in greatest need. This joint report

summarises the causative agents, estimated number of cases and mortality rate, number of people considered at risk, number of countries affected, transmission, clinical symptoms, prevention and treatment of the major tropical diseases, including African human trypanosomiasis. This is mainly caused by *Trypanosoma brucei rhodesiense* in eastern and southern Africa and *T. b. gambiense* in western and central Africa. Thirty-six countries are affected with 50 million people at risk and 25,000 new cases reported each year. Research priorities include improving diagnosis and patient care, chemotherapy and vector surveillance techniques. Control priorities are regular medical surveillance, diagnosis and treatment, and developing and applying methods to reduce contact between humans and tsetse flies, such as trapping, use of insecticides, vegetation clearance and land use.

2. tsetse biology

(a) REARING OF TSETSE FLIES

6823 **Moloo, S.K., 1991.** Large-scale rearing of *Glossina longipennis* in the laboratory. *Acta Tropica*, **48** (2): 159-160.
ILRAD, P.O. Box 30709, Nairobi, Kenya.
The first successful large-scale rearing of *G. longipennis* is described. A total of 174 pupae were produced by 48 wild females caught in mid-1987 in Nguruman, Kenya. Flies emerging from these pupae formed the parental stock of the colony which increased to reach the target of 1500 breeding females in December 1988. Adults and pupae are kept in a climate-controlled room at 25 □ 0.5□C and 80-85% r.h. in wire-framed cages covered with 4 ∃ 4 mm mesh black Terylene netting. Flies are fed daily except weekends on the ears of lop-eared rabbits. A mating period of 72 h is used.

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

6824 **Elzinga, R.J. and Broce, A.B., 1986**. Labellar modifications of Muscomorpha flies (Diptera). *Annals of the Entomological Society of America*, **79** (1): 150-209.
Department of Entomology, Kansas State University, Manhattan, KS 66506, USA.
Labella of 35 families of flies were examined, primarily by scanning electron microscopy techniques. The ability to evert the labellar lobes beyond Stage IV to the Stage VI position was positively correlated with presence of prestomal teeth. Much variation in

prestomal tooth numbers and structure was seen, and the rasps of *Glossina* were determined to be prestomal teeth. Pseudotracheal ring tips were highly modified and variable and were represented in *Glossina* by denticles. Pseudotracheal diameter was measured and considered to be an important reflection of diet in nature. Families were characterised using the above adaptations, but these labial structures had many convergences and parallelisms and, therefore, were often unreliable taxonomic characters. Diet was correlated, wherever possible, with structural variations; most fly diets, however, remain unknown, so postulations were presented using morphological evidence.

6825 **Miyan, J.A., 1990**. Neural control in the immunocytotoxic destruction of muscles in Diptera. *Tissue and Cell*, **22** (5): 673-680.

Department of Physiological Sciences, University of Manchester, Stopford Building, Manchester M13 9PT, UK.

Following successful escape from the puparium (eclosion), sets of muscles in all three segments of *Glossina morsitans* degenerate. Whereas the head and abdominal muscles degenerate in response to hormonal triggers released before and immediately after eclosion, the thoracic muscles require a specific neural trigger encountered following eclosion. Evidence is presented for the role of neural activity in the activation of immunocytes that destroy the thoracic muscles. Removal of the neural input by severing the nerve to any particular muscle results in survival of the muscle and inactivation of the immunocyte. The destruction process can be stopped at any time by severing the nerve, and the muscle fibres that remain continue to show normal physiology and response to stimulation. Electrophysiological recordings of the response to lethal attack are presented, together with ultrastructural evidence demonstrating the invasion of muscle fibres by processes of the immunocyte.

6826 **Robert, A., Strambi, C., Strambi, A. and Delbecque, J.-P., 1991**. Ecdysteroids during the development of the tsetse fly. *Invertebrate Reproduction and Development*, **19** (1): 71-81.

Robert, Delbecque: Laboratoire de Zoologie, CNRS, UA 674, Université de Bourgogne, 6 boulevard Gabriel, 21000 Dijon, France; C. and A. Strambi: CNRS, LNB 5, B.P. 71, 13402 Marseille Cedex 9, France.

The data presented here document the variations of ecdysteroids in different tissues during the life-span of the tsetse fly. HPLC analyses were performed to

determine the nature of immunoreactive compounds detected by RIA. In milk glands, uterus and ovaries at the beginning of vitellogenesis, 20-hydroxyecdysone appeared as the main free ecdysteroid. However, conjugation occurred in mature ovaries where 85% of the immunoreactivity was found in highly polar fractions. During embryogenesis and larval development, the ecdysteroids detected in crude extracts mainly corresponded to polar or apolar metabolites. The nature of the high polarity products differed between adult tissues and developing flies. Similarly the apolar compounds, unchanged after hog liver esterase action in the 3rd larval instar, could liberate some free ecdysone and 20-hydroxyecdysone together with polar and unknown compounds especially in mature ovaries. In the haemolymph collected either during vitellogenesis or just before larviposition, polar and apolar conjugates could be evidenced together with authentic 20-hydroxyedysone and ecdysone. At the time of parturition an increase in ecdysone occurred, which possibly may be related to stimulation of uterus contraction.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **14**: no. 6833.]

6827 **Gibson, G., Packer, M.J., Steullet, P. and Brady, J., 1991**.
Orientation of tsetse flies to wind, within and outside host odour plumes in the field. *Physiological Entomology*, **16** (1): 47-56.

Gibson, Steullet: Department of Medical Parasitology, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK; Packer: Papua New Guinea Institute of Medical Research, P.O. Box 378, Madang, Papua New Guinea; Brady: Imperial College, Silwood Park, Ascot, Berks, SL5 7PY, UK.

Free-flying wild tsetse flies, *Glossina pallidipes* and *G. m. morsitans*, were video recorded in Zimbabwe as they flew within an artificial host odour plume at 3, 7 or 15 m from the source, or in no odour, with and without a 0.75 m^2 vertical, black visual target present aligned with the wind. With no visual target present, flights in odour were strongly biased upwind, and in the absence of odour strongly biased downwind. With the target present, between 16% and 40% of the upwind approaching flies responded visually as they passed the target, by circling it, in proportion to the proximity

of the source (taken to be proportional to the mean odour concentration). Crosswind approaching flies (for whom the target will have been visible for some metres away) circled more frequently (34-56%), but without obvious correlation with the odour concentration. Circling flies also responded orthokinetically, by slowing down as they passed the target. The departure directions relative to the wind of flies leaving the target were significantly affected by the odour concentration. At 3 m they left the target in all directions, except possibly avoiding due upwind. At 7 m they left with an obliquely upwind bias, but at 15 m and also in no odour, they left with a strong crosswind bias.

6828 **Hargrove, J.W., 1991**. Ovarian ages of tsetse flies (Diptera: Glossinidae) caught from mobile and stationary baits in the presence and absence of humans. *Bulletin of Entomological Research*, **81** (1): 43-50.
c/o Tsetse and Trypanosomiasis Control Branch, Department of Veterinary Services, P.O. Box 8283, Causeway, Zimbabwe.

Ovarian ages were obtained for tsetse flies *Glossina morsitans morsitans* and *G. pallidipes* caught in Zimbabwe using a stationary bait ox, an odour-baited trap in the presence or absence of humans, a mobile ox fly-round and a vehicle-mounted electric net. The biggest daily catches were obtained from the electric net and the unaccompanied trap, but while for *G. m. morsitans* the ratio of the catches from these two methods was 7:1, for *G. pallidipes* it was 0.7:1. Evening catches were 1.3-5.5 and 2.9-18.8 times higher than morning catches for the two species, respectively; the differences were greater for stationary than for mobile baits. The sample age structures differed significantly ($P < 0.05$: χ^2) between methods in six of the ten possible contrasts between pairs of methods in *G. m. morsitans* and for all ten in *G. pallipides*. The differences in age distribution and mean catch levels are attributed to increases in flight activity with age; at each age *G. pallidipes* is more active than *G. m. morsitans*. Man's presence in the trapping system reduced catches significantly ($P < 0.05$: t test) but this effect was small in the youngest and oldest flies. Odour-baited traps are biased in favour of *G. pallidipes* and, for both species, in favour of older flies; mortalities calculated from age distributions of trap samples therefore underestimate the true value.

6829 **Omoogun, G.A., Dipeolu, O.O. and Akinboade, O.A., 1991**. The decline of a *Glossina morsitans submorsitans* belt in the Egbe

area of the derived savanna zone, Kwara State, Nigeria. *Medical and Veterinary Entomology*, 5 (1): 43-50.
NITR, P.M.B. 2077, Kaduna, Nigeria; Department of Veterinary Microbiology and Parasitology, University of Ibadan, Ibadan, Nigeria; ibid.
In the early 1970s the Egbe area of Nigeria was known to be one of high trypanosomiasis risk, with four *Glossina* species, *G. m. submorsitans*, *G. longipalpis*, *G. palpalis palpalis* and *G. tachinoides*, present. Grazing by Fulani pastoralists used to be short-term and only in the dry season. In recent years these pastoralists have grazed their cattle in the area throughout the year and this has prompted a reappraisal of the tsetse situation. Tsetse populations were sampled for 3 years using hand-net catches from man or an ox and biconical traps. Resident livestock, slaughter cattle and some of the flies were examined for trypanosome infection. Of the four tsetse species previously reported from the area, only the riverine species, *G. p. palpalis* and *G. tachinoides*, were encountered during the investigation. None of the 152 *G. p. palpalis* and 52 *G. tachinoides* examined was infected with trypanosomes. No infection was detected in 101 slaughtered cattle, 65 live Muturu, 12 goats and two pigs by wet film examination. However, a 14.3% *Trypanosoma vivax* infection rate was detected by HCT examination in 21 slaughtered cattle. Increased human activities over the years had destroyed much of the vegetation and depleted the wildlife population to an extent that resulted in the disappearance of *G. m. submorsitans* and *G. longipalpis*, resulting in turn in a greatly reduced trypanosomiasis risk. It is likely that a similar trend is occurring in other areas of the Derived Savanna and Forest zones of West Africa as the human population expands. As a result, more cattle are resident in these zones now than in the past and a reappraisal of cattle distribution in Nigeria is required.
6830 **Packer, M.J. and Warnes, M.L., 1991**. Responses of tsetse to ox sebum: a video study in the field. *Medical and Veterinary Entomology*, 5 (1): 23-27.
Papua New Guinea Institute of Medical Research, P.O. Box 378, Madang, Papua New Guinea; TRL, ODA/University of Bristol, Langford House, Langford, Bristol BS18 7DU, UK. (Corres-pondence to Warnes.)
The behaviour of tsetse (mainly *Glossina pallidipes*) around odour-baited targets, with or without a coating of ox sebum, was recorded in the field using video. The addition of sebum increased the total time a fly was in

contact with the target, as well as the time spent flying around and landing on it. When carbon dioxide was released as part of the attractant odour plume, the presence of sebum on the target increased the number of landings made by each fly, but did not significantly affect the duration of each contact. When carbon dioxide was absent from the odour plume, sebum did not affect the number of landings made by flies but the duration of each contact with the target did increase. Evidence for an interactive effect of sebum and carbon dioxide was obtained. In addition, the presence of sebum on the target increased the percentage of landed flies which walked on its surface; such behaviour may represent an `inspection' of the artificial host. The potential tsetse control application of the current findings is discussed.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **14**: nos. 6812, 6821, 6853.]

6831 **Child, G.F.T. and Riney, T., 1987**. Tsetse control hunting in Zimbabwe, 1919-1958. *Zambezia*, **14** (1): 11-71.

Child: Department of National Parks and Wild Life Management, P.O. Box 8365, Causeway, Harare, Zimbabwe.

This paper provides detailed records of hunting operations in Zimbabwe and assesses their effectiveness in eliminating the wild vertebrate hosts of tsetse. Over 57,000 animals representing more than 36 species were shot in the period 1919-33 and a further 602,041 from 1933-58. A rapid fall-off in kills in the late 1950s reflects an increased emphasis at that time on fence-building to create game- and cattle-free corridors, the destruction of tsetse habitats and use of insecticides. The only species apparently eliminated were wildebeest in the Sebungwe area and black rhino generally. Some species actually increased in population in spite of being hunted, especially the four tsetse-preferred hosts, warthog and bushpig (contributing 64.8% of blood meals analysed) and kudu and bushbuck (11.5%). Habitat changes, especially regular burning of grazing early in the dry season, may have had more effect on wild animal populations than hunting. Also, if hunting influenced the behaviour of host species making them less accessible to tsetse, then the potential availability of these hosts would have increased when hunting ceased and normal behaviour

patterns were resumed. This study underlines the need for clearly-defined objectives and systematic monitoring. In this case, protracted and costly hunting over 26 years may have compounded the problem it sought to alleviate.

6832 **Diaite, A., 1987**. *La trypanosomiase animale africaine au Sénégal: la lutte antivectorielle*. [African animal trypanosomiasis in Senegal: vector control.] Dakar, Senegal; ISRA-LNERV. 7 pp.

LNERV, B.P. 2057, Dakar, Senegal.

A number of tsetse control campaigns were carried out in Senegal. Initial efforts were made in the 1970s in Les Niayes (vestiges of the Guinean forest, the habitat of *Glossina palpalis gambiensis*), based on a campaign of ground spraying with dieldrin. This chemical control was reinforced at the beginning of the 1980s with the use of insecticide-impregnated traps and screens. By 1983, the tsetse fly levels had decreased below detection levels in the region. An evaluation of insecticide-impregnated screens and traps was carried out in Kolda (southern Senegal), with a 98% reduction in *G. p. gambiensis*.

6833 **Diaite, A. and Vassiliades, G., 1984**. *Notes sur la situation des glossines au Sénégal*. [Notes on the tsetse situation in Senegal.] Dakar, Senegal; ISRA. Ref. no. 68/PARASITO. 5 pp. (Paper presented at an FAO/IAEA seminar on the use of sterile males for the partial or total eradication of tsetse in developing countries in Africa, held at Lusaka, 25-29 June 1984.)

LNERV, B.P. 2057, Dakar, Senegal.

Senegal is at the northern limit of tsetse distribution. Three regions are affected. Les Niayes, a swampy depression on the coast between 14□30ʃ and 15□N, is infested with *Glossina palpalis gambiensis*. This species and *G. morsitans submorsitans* are found in the south-east and in the southern part of the peanut-growing area, and in the Casamance region in the south where *G. longipalpis* also has a localised distribution around Ziguinchor and Oussouye. Recent droughts may have seriously disturbed tsetse ecology and distribution and new surveys are needed. Control campaigns are carried out by LNERV. In Les Niayes region 2% dieldrin sprays were applied and 6000 head of livestock were treated with diminazene aceturate from 1970-72. Nevertheless, some parts remained infested and reinfestation of other areas was confirmed in 1983. Spraying with 3% e.c. of

endosulfan was then combined with biconical traps and decamethrin (0.5% Decis) impregnated screens. Spray applications were made at 5 week intervals to kill newly-emerged adults and surveys carried out in February and April 1984 failed to capture any flies. Future control campaigns will use SIT and will concentrate on Les Niayes, which is of particular agropastoral importance.

6834 **Everts, J.W., Frankenhuyzen, K. van, Roman, B. and Koeman, J.H., 1983**. Side-effects of experimental pyrethroid applications for the control of tsetse flies in a riverine forest habitat (Africa). *Archives of Environmental Contamination and Toxicology*, **12** (1): 91-97.

Department of Toxicology, Agricultural University, 6703 BC Wageningen, Netherlands.

During tsetse control operations near Bouaflé, Côte d'Ivoire, a study was made of environmental side-effects of helicopter sprayings with permethrin and deltamethrin on a riverine forest. Terrestrial and aquatic arthropod populations and fish were observed for acute effects. The abundance of the species was assessed by various trapping devices before, during and after the spraying cycle. Populations of mayfly larvae and small shrimps (*Caridina africana*) were virtually eliminated after the spraying cycle. The Ephemeroptera recovered within the same season. Caddis fly and *Simulium* larvae populations were affected but they recovered within each spraying interval. Large shrimps (*Macrobrachium vollenhovenii*) were paralysed by the insecticide. Recovery occurred within 48 h. Among the terrestrial arthropods, the hymenopteran and dipteran populations were significantly affected. No effect was observed on bottom dwelling spiders. The ability of the ecosystems to recover from the disturbance is discussed.

6835 **Kaaya, G.P. and Okech, M.A., 1990**. Horizontal transmission of mycotic infection in adult tsetse, *Glossina morsitans morsitans*. *Entomophaga*, **35** (4): 589-600.

ICIPE, P.O. Box 30772, Nairobi, Kenya.

Adult *G. m. morsitans* exposed to wet conidia of *Beauveria bassiana* and *Metarhizium anisopliae* suffered high mortalities ranging from 90 to 100% by 2 weeks post-exposure. Infected males maintained in the same cages with non-infected females throughout the experimental period transmitted the fungal infection to the females resulting in mortalities of 65% with *B. bassiana* and 55% with *M. anisopliae*. Likewise, infected females maintained together with non-infected males transmitted the

infection to the males resulting in mortalities of 75% with *B. bassiana* and 45% with *M. anisopliae*. Female tsetse flies infected with *B. bassiana* and *M. anisopliae* and maintained in the same cages with non-infected females also transmitted infection to the non-infected tsetse resulting in mortalities of 62% and 48% with *B. bassiana* and *M. anisopliae* respectively. Infected tsetse exposed to non-infected tsetse of the opposite sex for only 30 min were also able to transmit the fungal infection. Pupae produced by female tsetse infected with *B. bassiana* and *M. anisopliae* exhibited higher pupal mortality than those produced by non-infected females. However, pupae exposed directly to dry spores of *B. bassiana* and *M. anisopliae* had no increase in pupal mortality but adults emerging from the *B. bassiana*-exposed pupae had markedly reduced longevity.

6836 **MacKenzie, J.M., 1988**. *The empire of nature: hunting, conservation and British imperialism*. Manchester, UK; Manchester University Press. 340 pp.

Chapter nine of this book, entitled `Reserves and the tsetse controversy', describes the establishment of game reserves in colonial Africa despite the fact that wild ungulates were known to be reservoir hosts for trypanosomiasis. The first decades of European rule facilitated tsetse expansion through a series of disasters (disease, drought and war) which resulted in depopulation and bush regeneration. The main concern to white settlers was the spread of nagana in cattle and the elimination of game became a favoured control policy, despite a strong conservationist lobby. In particular, Southern Rhodesia (Zimbabwe) adopted a hunting policy which effectively removed tsetse from 10,000 square miles of the Zambezi Valley between 1930 and 1950. Shooting policies were also started in Natal, Bechuanaland (Botswana) and Northern Rhodesia (Zambia) but were rarely pursued in East Africa, where tsetse mainly affected areas of African settlement. The depopulation of remote areas through rinderpest and human trypanosomiasis facilitated the establishment of reserves, although game continued to be shot in areas of white settlement until 1967. Overall, the clearance of land by white farmers was more effective in ridding areas of tsetse than deliberate control.

6837 **Okoth, J.O., Okethi, V. and Ogola, A., 1991**. Control of tsetse and trypanosomiasis transmission in Uganda by applications of lambda-cyhalothrin. *Medical and Veterinary Entomology*, **5** (1): 121-128.

Okoth, Ogola: UTRO, P.O. Box 96, Tororo, Uganda; Okethi: Tsetse Control Department, Ministry of Animal Industry and Fisheries, Kampala, Uganda.
The pyrethroid insecticide λ-cyhalothrin was evaluated in field trials against *Glossina f. fuscipes* and sleeping sickness transmission in Iyolwa sub-county, Tororo District, Uganda. The insecticide was applied selectively to the resting-sites of tsetse, by bush-spraying, using 10% wettable powder (10WP) formulation at an application rate of 11.6 g a.i./ha over an area of 28 km^2, or by a 2% Electrodyn formulation (2ED) applied at 0.9 g a.i./ha over 30 km^2. In a third trial area of 32 km^2, 215 pyramidal traps treated with λ-cyhalothrin 100 mg/m^2 were set. The best impact was obtained with 10WP λ-cyhalothrin which eliminated tsetse within 1-2 months, whereas *G. f. fuscipes* persisted at very low density in part of the area treated with 2ED λ-cyhalothrin. In both treated areas the numbers of human sleeping sickness cases fell to no more than one per month, compared with four to twelve per month previously. The overall rate of cattle trypanosomiasis (*Trypanosoma brucei* and *T. vivax*) was also reduced slightly. Insecticide-treated traps remained fully effective for a least 6 months under field conditions and catches were reduced 20-90-fold. These results in the control of tsetse and trypanosomiasis transmission lead us to recommend λ-cyhalothrin for tsetse control operations.

6838 **Otieno, L.H., Onyango, P. and Mpanga, E., 1990**. Effect of insecticide spraying operations on a *Glossina pallidipes* Austen (Diptera: Glossinidae) population and on animal trypanosomiasis in Lambwe Valley, Western Kenya. *Discovery and Innovation*, **2** (1): 97-102.

ICIPE, P.O. Box 30772, Nairobi, Kenya.
A *G. pallidipes* population in the Lambwe Valley, western Kenya, was monitored monthly from July 1983 to December 1987. During this time, the population was subjected to dieldrin and cypermethrin spraying campaigns. The population was markedly suppressed when the campaigns were regular, but quickly recovered when the operations were relaxed and became irregular. Before the operations started there was a preponderance of younger flies in the catch, but when the spraying operations were intensified the age structure changed and older flies became predominant. With regular spray operations, it took 6 months for the prevalence of cattle trypanosomiasis to drop from 5% to 2%, but only 2 months to revert to 5%, when the operations were relaxed. The change in sex ratio observed suggests

that insecticide operations were more effective against male than female populations.

6839 **World Health Organization, 1990**. *Equipment for vector control*. 3rd edn. Geneva; WHO. 310 pp.
WHO, CH-1211 Geneva 27, Switzerland.
The new edition of this book, first published in 1964, includes information on new types of equipment and describes improvements in aerial spraying techniques. Cone or swirl nozzles are used extensively for residual spraying of trees for tsetse control; a 60□ or smaller spray cone angle is preferred for selective spraying of resting sites. Biconical (Challier and Laveissière), monoconical (Lancien) and monopyramidal (Lancien-Gouteux) traps and flat screens for trapping tsetse flies are described and illustrated. Recommended aerial control methods for tsetse include residual spraying by helicopter using a medium spray of 150-250 μm and space spraying with fixed-wing aircraft (helicopters for riverine species) using an aerosol of 30 μm v.m.d. Windmill-driven atomisers have been used for applying aerosols in tsetse control. An introductory chapter describes the principal methods of pesticide application for integrated vector control, and a series of annexes provide practical information and guidelines but with no specific reference to tsetse.

4. EPIDEMIOLOGY: VECTOR-HOST AND VECTOR-PARASITE INTERACTIONS

[See also **14**: nos. 6811, 6812, 6857, 6872.]

6840 **Auguadra, P.A., 1987**. Le tripanosomiasi animali come zoonosi. [The animal trypanosomiases as zoonoses.] *Obiettivi e Documenti Veterinari*, **8** (1): 31-33.
The article briefly discusses the problem of wild and domestic animal reservoirs in the control of *gambiense* and *rhodesiense* sleeping sickness.

6841 **Gilles, N. and Ricossé, J.-H., 1983**. La trypanosomiase humaine en Afrique occidental: racines géographiques d'une maladie. [Human trypanosomiasis in West Africa: geographical origins of a disease.] *Cahiers d'Etudes africaines*, **22** (1-2): 79-100.
Gilles: Ecole des Hautes Etudes en Sciences Sociales, Marseille, France.
This article reviews the epidemiology of *Trypanosoma brucei gambiense* sleeping sickness in West Africa. There are four main sections which consider the historical background, the bioecology of the parasite and its vectors *Glossina palpalis* and *G. tachinoides*, factors favouring

the spread of the disease, and control. The last epidemic was first reported in Senegal in 1876 and by the 1920s affected most of West Africa, resulting in a 50% reduction of the human population in some areas. The main foci were associated with the Volta river system and Upper Volta (Burkina Faso) was severely affected, with 110,000 cases and 20,000 deaths in 1932. Improved methods of control after 1940 helped bring this epidemic to an end but the disease was not completely eradicated. The important role of both vector and human ecology in its occurrence and distribution is stressed. One of the main factors affecting the spread and/or resurgence of the disease is human population movement. The efficacy and limitations of various control measures, including prophylactic drugs, habitat alteration and insecticides, are discussed.

6842 **Honigberg, B.M., Hampton, R.W. and Cunningham, I., 1991**. Effect of polyclonal anti-procyclic antibodies on development of *Trypanosoma brucei brucei* in tsetse flies. *Parasitology Research*, **77** (1): 39-43.

Department of Zoology, University of Massachusetts, Amherst, MA 01003-0027, USA.

Results obtained in experiments testing the efficacy of anti-procyclic-form rabbit sera on the development of homologous and heterologous stocks of *T. b. brucei* in *Glossina morsitans morsitans* indicated that this development was affected little, or not at all, by such sera. The absence of effect of anti-procyclic stage antibodies can be explained by the failure to detect by either direct or indirect fluorescent antibody methods the presence of antibodies acquired *in vivo* by either the midgut procyclic forms or by uncoated salivary gland forms.

6843 **Leak, S.G.A., Colardelle, C., d'Ieteren, G., Dumont, P., Feron, A., Jeannin, P., Minengu, M., Mulungu, M., Ngamuna, S., Ordner, G., Sauveroche, B., Trail, J.C.M. and Yangari, G., 1991.** *Glossina fusca* group tsetse as vectors of cattle trypanosomiasis in Gabon and Zaire. *Medical and Veterinary Entomology*, **5** (1): 111-120.

Leak: ILRAD, P.O. Box 30709, Nairobi, Kenya; Colardelle, Dumont, Jeannin, Ordner, Sauveroche, Yangari: ILCA, P.O. Box 46847, Nairobi, Kenya; d'Ieteren, Trail: OGAPROV, Moanda, Gabon; Feron, Mulungu: c/o Cie Jules van Lancker, Kinshasa, Zaire; Minengu, Ngamuna: Développement et Progrès Populaire, Kinshasa, Zaire.

The significance of *G. fusca* group tsetse flies as vectors of cattle trypanosomiasis was examined using biconical traps to survey tsetse populations at one site in Gabon and two sites in Zaire. Mean trypanosome infection rates in *G. tabaniformis* over the study period ranged from a minimum of 8.9% at one site to a maximum of 17.7% at another. The mean infection rate in *G. nashi* was 6.0%. Up to 49% of bloodmeals of *G. tabaniformis* were from cattle. Trypano-some prevalence in cattle where *G. tabaniformis* appeared to be the main vector was 9.5% and 5.4% at the Mushie and OGAPROV ranches, respectively. A highly significant positive correlation was found between tsetse challenge and trypanosome prevalence in N'Dama cattle across sites. Tsetse challenge was defined as the product of tsetse relative densities, trypanosome infection rates in the flies and the proportion of feeds taken by them from cattle. Thus, *G. tabani-formis* can be an important vector of pathogenic *Trypanosoma* species in cattle.

6844 **Makumi, J.N. and Moloo, S.K., 1991.** *Trypanosoma vivax* in *Glossina palpalis gambiensis* do not appear to affect feeding behaviour, longevity or reproductive performance of the vector. *Medical and Veterinary Entomology*, **5** (1): 35-42. KETRI, P.O. Box 362, Kikuyu, Kenya; ILRAD, P.O. Box 30709, Nairobi, Kenya. (Correspondence to Moloo.)

Feeding behaviour of *G. p. gambiensis* infected with *T. vivax* was studied and compared with that of uninfected control tsetse. The parameters measured were: total number of probes into the ear-skin of rabbits; rate of bloodmeal engorgement; weight of freshly ingested blood; survival; and mean weight of pupae. The results showed that the rosettes of *T. vivax* parasites in the labrum did not interfere with the feeding behaviour of the vectors. Furthermore, mean survival of *T. vivax*-infected males was significantly higher (82.2 □ 4.2 days) compared with that of uninfected ones (70.5 □ 3.1 days). However, with the female tsetse, mean survival of those infected was lower (98.8 □ 4.0 days) compared to the uninfected controls (102.2 □ 5.6 days), but the difference was not significant. A few infected males and females lived a little longer than the uninfected ones. Fecundity of the female tsetse remained unaffected by the infection, and furthermore the mean weight of pupae from the infected females was not significantly different from that of pupae from the uninfected control group. Thus the physiology of pregnant female tsetse in terms of nourishment of the intra-uterine larva was unaffected by *T. vivax* infection.

Two successive probes into the skin of two different goats followed by feeding on a third goat by each of four infected tsetse resulted in successful transmission of the infection to 11 out of 12 goats. Thus probing alone into the skin of this host can result in the transmission of *T. vivax* infection.

6845 **Maudlin, I., 1991**. Transmission of African trypanosomiasis: interactions among tsetse immune system, symbionts, and parasites. *Advances in Disease Vector Research*, 7: 117-148.

TRL, University of Bristol, Langford, Bristol BS18 7DU, UK.

Factors affecting the remarkably low trypanosome infection rates observed in wild tsetse populations are evaluated in this review article. They include: temperature, age of the fly, age structure of fly populations, fly sex and species, availability of infected hosts, fly feeding preferences, infectivity of different trypanosome species, and susceptibility of individual flies to infection. Immunological studies show that trypanosomes are killed by a lectin secreted by the tsetse midgut. This lectin exists at very low levels in teneral flies, which are more susceptible to trypanosome infection. Lectin secretion is increased in response to blood serum and infection rates are low in flies that have taken a blood meal. The amount of midgut lectin secreted varies according to species of fly and those which secrete more, such as *Glossina palpalis palpalis*, are relatively poor vectors. Notwithstanding, haemolymph lectin stimulates the maturation of established infections. A maternally-inherited extrachromosomal factor that increases the susceptibility of flies to infection has been identified as rickettsia-like organisms.

6846 **McNamara, J.J. and Snow, W.F., 1991**. Improved identification of *Nannomonas* infections in tsetse flies from The Gambia. *Acta Tropica*, **48** (2): 127-136.

TRL, Department of Veterinary Medicine, University of Bristol, Langford, Bristol BS18 7DU, UK; ITC, P.M.B. 14, Banjul, Gambia.

Trypanosomes from 36 midgut infections were isolated in procyclic culture from *Glossina morsitans submorsitans* and *G. palpalis gambiensis* in The Gambia. Twenty-eight stocks (78%) were identified using DNA probes specific for: (a) *Trypanosoma (Nannomonas) congolense* savanna type, (b) *T. (N.) congolense* riverine-forest type, (c) *T. (N.) simiae* and (d) *Trypanozoon*. *T. simiae* and savanna type *T. congolense* were found only in *G. m. submorsitans* while the riverine-forest

type *T. congolense* was restricted to populations of *G. p. gambiensis* from two isolated areas of relict forest; one *Trypanozoon* stock was isolated from *G. m. submorsitans*. *T. congolense* accounted for only 17% of all *Nannomonas* infections, as identified by dissection, in *G. m. submorsitans*. This re-emphasises the importance of differentiating infections below the subgeneric level when estimating challenge to domestic animals. *T. simiae* could not be distinguished from *T. congolense* by the arrangement of trypanosomes in the fly proboscis. The eight stocks which were not identified by DNA probes were separated into two groups on the basis of hybridisation with total DNA probes and the cycle of development in experimental tsetse. One group of four isolates, all from *G. m. submorsitans*, was a new kind of *Nannomonas* which appeared to be common and widespread in The Gambia. The second group, which was found only in *G. p. gambiensis*, had a stercorarian cycle of development, maturing in the hindgut, and was morphologically similar to insect forms of the crocodile parasite *T. grayi*.

6847 **Snow, W.F., Declercq, J. and Nieuwenhove, S. van, 1991**. Watering sites in *Glossina fuscipes* habitat as the major foci for the transmission of *gambiense* sleeping sickness in an endemic area of southern Sudan. *Annales de la Société belge de Médecine tropicale*, **71** (1): 27-38.

ITC, P.M.B. 14, Banjul, Gambia; ABOS, Belgian Medical Develop-ment Cooperative, Brussels, Belgium; ibid. and Institute of Tropical Medicine, B-2000 Antwerp, Belgium.

In an area of endemic *gambiense* sleeping sickness in southern Sudan, the vegetation around 40 wells was categorised in terms of potential habitat for the vector, *G. fuscipes*, and the probability of repeated man/fly contact. These observations were related to the results of sleeping sickness surveys including the use of serodiagnostic (ICHA and CATT) tests which allowed the detection of the great majority of cases. Riverine woodland and gallery forest were the primary habitat of *G. fuscipes* and 1286 people using wells in this vegetation had an 11.1% infection rate including parasitological, clinical and serological cases. In contrast, 638 people using wells in open situations, where the presence of *G. fuscipes* was unlikely, showed a significantly lower (4.5%) infection rate. These observations provide a basis for planning localised tsetse control, using, for example, insecticide-

impregnated targets, coordinated with mass survey and treatment of the human population.

5. human trypanosomiasis
(a) SURVEILLANCE
[See also **14**: nos. 6818, 6873.]

6848 **Asonganyi, T., Hengy, C., Louis, J.P. and Ghogomu, N.A., 1991**. Reactivation of an old sleeping sickness focus in Mamfe (Cameroon): epidemiological, immunological and parasitological findings. *Revue d'Epidémiologie et de Santé publique*, **39** (1): 55-62.
CUSS, University of Yaoundé, Yaoundé, Cameroon; OCEAC, Yaoundé, Cameroon; ibid.; Directorate of Preventive Medicine, Ministry of Health, Yaoundé, Cameroon.
We report the reactivation of an old sleeping sickness focus in Mamfe (Cameroon). Screening of 9827 people using the Testryp CATT gave a total of 137 positive cases (1.4%). The prevalence of CATT positivity was significantly linked to sex, age, place of residence and type of occupation of the people. Twenty-six of these immunological suspects were later confirmed as sleeping sickness patients, giving a morbidity index of 0.26%. Only 44% of 16 sera from these confirmed patients were CATT positive on serum while only 31% of the sera had a positive IFAT reaction, supporting the hypothesis of the existence of a new *Trypanosoma brucei gambiense* serodeme in this region. The reasons for the reactivation of this old sleeping sickness focus are discussed.

6849 **Ekejindu, G.O.C., Edeghere, H., Olatunde, D.S. and Magaji, Y., 1989**. Human trypanosomiasis: a fresh profile of a debilitating disease in Nigeria by serodiagnosis. *Nigerian Journal of Science*, **23** (1-2): 45-48.
Pathology Division, NITR, P.M.B. 2077, Kaduna, Nigeria.
In recent surveys of Bauchi, Benue, Gongola, Kaduna, Kano, Niger and Plateau States of Nigeria, sleeping sickness was identified in all communities visited. This followed the introduction of an improved sensitive immunological technique, the Cellognost indirect haemagglutination (IHA) test, to support the conventional parasitological methods of diagnosis. A high infection rate of 41% was recorded by the IHA test in a definitive assay, instead of the 0.36% rate observed by the parasitological methods. The results highlight the inadequacies of the conventional parasitological methods. A great concern is hereby expressed for the welfare of the rural farming

communities among whom the devastating consequences of this disease are manifested.

6850 **Lozac'Hmeur, P., 1984**. Données épidémiologiques sur la trypano-somose humaine africaine dans les pays membres de l'OCCGE de 1940 à 1983. [Epidemiology of human African trypanosomiasis in the member countries of the OCCGE, 1940-83.] *OCCGE Informations*, **12** (93): 5-48.

The countries covered are Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo. Data for Togo are available only since 1964. A short description is given of the situation in each country, supported by numerous tables, maps and other figures. The last case in Niger was reported in 1973 and in Senegal in 1977. In Togo there have been only eight cases since 1982 but it is feared that there may be problems ahead. In the other countries the position is regarded as encouraging but eradication is unlikely because of the number of technical, social and political-economic problems.

6851 **Mbulamberi, D.B., 1991**. *Uganda Ministry of Health. National Sleeping Sickness Control Programme. Fourth quarterly report 1990*. 23 pp.

National Sleeping Sickness Control Programme, P.O. Box 1241, Jinja, Uganda.

During the period October to December 1990 68 cases of *rhodesiense* sleeping sickness were detected and treated in the Busoga region, 69 in Tororo district and 20 in Mukono district. The male/female ratio was 1.5, 2.0 and 0.5 respectively. During the same period 323 cases of *gambiense* sleeping sickness were reported in north-western Uganda with a male/female ratio of 0.8. Some of these cases (144) were Sudanese refugees. Compared with the previous quarter (July-September 1990), these figures represent reductions in the incidence of *rhodesiense* sleeping sickness in south-east Uganda of 43.3% in the Busoga region and 36.7% in Tororo district and an increase of 33.3% in Mukono district. The incidence of *gambiense* sleeping sickness in north-western Uganda decreased by 27.9%. The report describes the activities of the National Sleeping Sickness Control Programme (NSSCP) during the period under review: the main constraints are lack of funds, trained staff and equipment. An appendix lists the incidence of sleeping sickness per 100,000 persons in the counties and subcounties of south-eastern Uganda for which current population figures are available.

6852 **Milleliri, J.M., Tirandibaye, H.N. and Nan-Madjoum, B., 1989**. Le foyer de trypanosomiase humaine africaine de Moissala

(Tchad): enquête de prospection dans 16 villages avec utilisation du test d'agglutination directe sur carte (Testryp CATT) et de la minicolonne échangeuse d'ions (mAECT). [The human African trypanosomiasis focus of Moissala (Chad): prospective study of 16 villages using CATT and mAEC.] *Médecine tropicale*, **49** (3): 253-258.
Médecine Préventive et Santé Rurale, B.P. 84, Sarh, Chad.
The Moissala focus in southern Chad, an ancient focus which was considered to be almost extinct in 1963, flared up again in 1965 and has produced new cases regularly ever since. On 1 January 1988 there were 41 known cases of trypanosomiasis in the focus. From March to April 1988 a survey was undertaken in 16 villages in the two worst affected cantons, Dembo and Gon, which border on the Central African Republic. A total of 2947 agglutination card tests (CATT) were carried out; 184 of them were positive, of which 176 were new suspects and eight old cases. Only 66 of the suspects had enlarged cervical lymph nodes: of the 51 it was possible to examine, two showed trypanosomes. A further 17 cases were confirmed by mAEC. The possible reasons for the large number of serologically positive cases which were not confirmed parasitologically (157) are discussed.

6853 **Simarro, P.P., 1988**. Estrategia actual de la lucha contra la tripano-somiasis humana en la República de Guinea ecuatorial. [Current strategy in the campaign against human trypanosomiasis in the Republic of Equatorial Guinea.] *Revista de Sanidad e Higiene Pública (Madrid*), **62** (5-8): 1483-1493.
Centro de Control de la Tripanosomiasis, Bata, Equatorial Guinea.
The control of human trypanosomiasis caused by *Trypanosoma brucei gambiense* in Equatorial Guinea presents several difficulties, namely the lack of symptoms in the latent phase of the infection, the low sensitivity of the classical diagnostic methods, and the difficult access to health centres experienced by part of the population. A strategy has therefore been developed which is based on the mobile unit as the operative method and on the indirect immunofluorescent antibody technique as the method of diagnosis. Details are given of the different phases of the strategy. Vector control is based on monopyramidal traps which the local communities help to maintain. At present the Trypanosomiasis Control Centre (CCT) in Bata coordinates all the action but it is planned to

integrate all aspects of trypanosomiasis control into a revised primary health care programme.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **14**: no. 6860.]

6854 **Kalanda, K., 1991**. A case of twin delivery of a mother suffering from trypanosomiasis in Kasongo (Zaire). (Letter.) *Annales de la Société belge de Médecine tropicale*, **71** (1): 67-68.

Projet de Recherche sur la Trypanosomiase, Zone de Santé Rurale, B.P. 186, Kasongo, Zaire.
Twin girls were born in Kasongo hospital to a woman suffering from first-stage trypanosomiasis. Physical examination of the first twin revealed abnormal archaic reflexes and a slight lack of tonus while the second twin appeared normal. Laboratory tests on the first twin gave a positive serological result (immunofluorescence) and showed trypanosomes by thick smear and buffy coat examination; the second twin's results were negative. One month after delivery the mother and the first twin received trypanocidal treatment. The second twin was followed up with weekly serological examination, the results of which became positive in the sixth week after delivery. This observation shows that a child born from a mother with trypanosomiasis should be considered at high risk of developing the disease, whatever the results of the serological and parasitological examinations at birth.

6855 **Raadt, P. de, 1985**. Trypanosomoses et leishmanioses congénitales. [Congenital trypanosomiasis and leishmaniasis.] *Archives françaises de Pédiatrie*, **42**: 925-927.

WHO, CH-1211 Geneva 27, Switzerland.
Trypanosoma cruzi can infect the placenta, with or without transmission to the foetus. Risk of congenital infections is less important in African trypanosomiasis and leishmaniasis. African trypanosomiasis frequently causes amenorrhoea, so pregnancy is rare, and if it does occur the foetus is often aborted. However, in the small proportion of patients whose pregnancies go to term, congenital infection is likely and should be borne in mind by physicians, especially when considering infection of the new-born in the first 5 days after birth when a tsetse bite is a less probable cause. The clinical picture for new-born infections is

similar to that for adults. Many cases have been successfully treated with melarsonyl-potassium.

6856 **Tatibouet, M.H., Gentilini, M. and Brucker, G., 1982**. Lésions cutanées au cours de la trypanosomiase humaine africaine. [Cutaneous lesions in human African trypanosomiasis.] *Semaine des Hôpitaux (Paris)*, **58** (40): 2318-2324.

Service Pr Gentilini, CHU Pitié-Salpêtrière, 47 boulevard de l'Hôpital, 75634 Paris Cedex 13, France.

We report the case histories of 12 patients infected by *Trypanosoma brucei gambiense* seen between 1967 and 1979. The course of the disease follows two stages, with the lymphatic and haematologic stage preceding invasion of the CNS. The following cutaneous lesions were recorded: five patients had trypanomas or chancres which are inflammatory nodules on uncovered areas; five patients showed trypanosomal skin rashes with erythematous, infiltrated, transient and recurring trypanids; five patients had soft transient oedema, affecting mainly the face; three patients experienced pruritis, which was usually mild and limited to small areas; three patients had cutaneous lesions induced by melarsoprol. Thus dermatologic features are common in human African trypanosomiasis; they were found in 75% of the patients in our department.

(c) TREATMENT

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

[See also **14**: no. 6873.]

6857 **Institut Sénégalais de Recherches Agricoles, 1990**. *Rapport annuel 1989. Département de Recherches sur les Productions et la Santé Animales*. [Annual report 1989. Department of Research on Animal Health and Production.] Dakar, Senegal; ISRA. 213 pp.

ISRA Direction générale, B.P. 3120, Dakar, Senegal.

Two trypanosomiasis control projects were carried out in 1989. The ELISA technique was used to detect the incidence of trypanosomiasis in Zebu-N'Dama crossbred cattle in the Diakore area. A preliminary survey suggested that trypanosomes were rare in cattle from January to April, which is the dry season in Senegal. *Trypanosoma congolense* was most frequent in June at the start of the rainy season, which affects vector density. *T. vivax*, *T. brucei* and *T. theileri* were virtually absent. There was some discrepancy between the results obtained by microscopic examination and serological tests: only two of seven cases of *T. congolense* infection were confirmed serologically and some apparently

trypanosome-free animals were sero-positive. This is attributed to trypanosome antigenic variation and ELISA is envisaged as a test to supplement and not replace microscopic examination. The second project was an on-going study of livestock trypanotolerance. In the study area (the villages of Yassiriba, Salamata and Tabendinta) tsetse were more frequently infected with *T. vivax* than with *T. congolense*, although *T. congolense* infections were more frequent in cattle. The relationships between size of infections, treatment given and herd dynamics are being assessed.

6858 **Seye, M., Mane, A., Ndiaye, T., Ba, A. and Diaite, A., 1987**. *Dépistage sérologique par micro-ELISA des trypanosomiases bovines au Sénégal. 1. Enquête en fin de saison sèche en milieu enzootique (Kolda, juin 1987)*. [Serological detection of cattle trypanosomiasis in Senegal by micro-ELISA. 1. Survey at the end of the dry season in the enzootic area (Kolda, June 1987).] Dakar, Senegal; ISRA-LNERV. 7 pp.

LNERV, B.P. 2057, Dakar, Senegal.

Micro-ELISA serological detection of antibodies was carried out on 89 N'Dama cattle sera in the department of Kolda, southern Senegal. The results indicate that most cattle in this area have antibodies for *Trypanosoma congolense*, *T. vivax* and, to a lesser extent, for *T. brucei brucei*. The widespread use of this serological technique is recommended for sero-epidemiological monitoring of the various ecological zones, particularly in tsetse-liberated regions.

6859 **Williamson, C.C., Stoltsz, W.H., Matthews, A. and Schiele, G.J., 1988**. An investigation into alternative methods for the serodiagnosis of dourine. *Onderstepoort Journal of Veterinary Research*, **55** (2): 117-119.

Veterinary Research Institute, Onderstepoort 0110, South Africa.

The complement fixation test (CFT), indirect fluorescent antibody test (IFAT), card agglutination test for trypanosomiasis (CATT) and enzyme-linked immunosorbent assay (ELISA) were compared in their application to the serological diagnosis of *Trypanosoma equiperdum* infection in 43 horses. The CFT remains a reliable test for dourine, especially in countries where other members of the subgenus *Trypanozoon* do not occur. The IFAT is a good `back-up' test, but, requiring skilled operators, it has the disadvantage of making it labour-intensive, and interpretation of results subjective. This makes it more suited to small numbers of samples. The ELISA is suitable for large numbers of samples and could readily be used in routine

diagnostic procedures. The CATT could be of value in field situations, although it does not appear to be as sensitive as the CFT. Its possible application under these conditions should be further investigated.

(b) PATHOLOGY AND IMMUNOLOGY

6860 **Gombe, S., 1989**. Endocrine effects of trypanosomiasis: recent studies. *Discovery and Innovation*, **1** (1): 30-33.

Reproductive Biology Unit, College of Biological and Physical Sciences, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.

Endocrine disturbances resulting from human and animal trypanosomiasis are briefly reviewed. Hypothyroidism is one of the earliest symptoms recorded in sleeping sickness patients and thyroid malfunction has also been reported from cattle, sheep and goats. Effects on reproduction resulting from reduced hormone levels include abortion, infertility, stillbirths, delayed sexual maturity and impaired ovarian and testicular function in livestock. The menstrual cycle may be affected in humans. Adrenal changes have not been extensively studied but pathological changes and hypertrophy have been reported from cattle, goats, sheep and voles (*Microtus montanus*). Pituitary damage is found in both blood borne and tissue type trypanosomiasis and it is suggested that this is mediated through impaired hypothalamic function, since replacement therapy with luteinising releasing hormone can restore gonadal function.

6861 **Härter, G.H., Röttcher, D., Schillinger, D. and Zweygarth, E., 1985**. Experimentelle Nagana-Infektionen beim Kamel (*Camelus dromedarius*). [Experimental nagana infections in camels (*C. dromedarius*).] *Berliner und Münchener Tierarztliche Wochenschrift*, **98** (10): 346-350.

Zweygarth: P.O. Box 29231, Nairobi, Kenya.

The pathogenicity of the East African agents of nagana was examined in camels (*C. dromedarius*) following experimental infection. Three camels each were injected intravenously with either *Trypanosoma* (*T.) b. brucei*, *T. (N.) congolense* or *T. (D.) vivax*. *T. (T.) b. brucei* could be detected in the blood of infected camels 2-4 days post-infection. Parasitaemia persisted and could be demonstrated almost daily, up to the end of the observation period of 3 months. An initial rise in fever and declining values in PCV and haemoglobin content, combined with an absence of serious clinical symptoms, is for *T. (T.) b. brucei* infections very similar to

the course of subacute to chronic *T. (T.) b. evansi* infections. *T. (N.) congolense* infection of camels resulted in an acute disease leading to death between days 22 and 37 after infection. The course of the illness was characterised by fever, gravitation oedema, general weakness, extravasations into the body cavities and haemorrhages on the serous membranes. Attempts to infect camels with two different strains of *T. (D.) vivax* failed.

6862 **Onah, D.N. and Uzoukwu, M., 1991**. Porcine cerebral *Trypanosoma brucei brucei* trypanosomiasis. *Tropical Animal Health and Production*, **23** (1): 39-44.

CTVM, Easter Bush, Roslin, Midlothian, EH25 9RG, UK; Department of Veterinary Pathology and Microbiology, University of Nigeria, Nsukka, Nigeria.

This paper describes the investigation of a disease outbreak among ten adult pigs in Nsukka, Anambra State, Nigeria. Prior to the investigation one sow died of the disease. Trypanosomes were later detected in the blood of two of the nine pigs subsequently investigated. All the pigs were then treated with deep intramuscular injection of 8 mg/kg diminazene aceturate (Berenil). Thirty-six days after treatment a boar and a sow relapsed with signs similar to the ones shown previously. Further examination of their blood and faeces revealed nothing of parasitological significance. Following deteriorating condition and development of nervous signs the boar was salvaged while the sow died of the infection. Brain impression smears taken from both animals during post-mortem examination revealed numerous trypanosome parasites identified by morphology and blood incubation infectivity test (BIIT) as *T. b. brucei*. The clinical and economic significance of the outbreak are discussed.

6863 **Raina, A.K., Singh, R.P., Rajora, V.S., Sharma, R.D. and Banerjee, D.P., 1986**. Haematobiochemical changes in induced trypanosomiasis in buffalo calves. *Revista di Parassitologia*, **3** (**47**) (2): 263-270.

Department of Veterinary Medicine, Haryana Agricultural University, Hisar-125004, India.

Twenty-four male buffalo calves were divided into four groups of six animals each. Group I animals were left as uninfected controls and animals in Groups II, III and IV were each inoculated subcutaneously with 8-10 $\exists$ 10^6 *Trypanosoma evansi* trypomastigotes. Group II animals were used as infected, untreated controls and animals in Groups III and IV were treated with Gilpol (suramin) intravenously at 0.5 g/45 kg bodyweight or Tribexin

prosalt (quina-pyramine) subcutaneously as a 10% suspension at 1.3 ml/45 kg bodyweight respectively. The study was conducted for 70 days. A significant decrease in PCV, haemoglobin, mean corpuscular volume and mean corpuscular haemoglobin was seen in Group II calves. Haematological values in animals in Groups III and IV returned to pre-infection levels after treatment. Blood urea nitrogen (BUN) values significantly increased in Group II animals, while no significant alterations in blood glucose and serum creatinine levels occurred. In Group III animals, a non-significant decrease in BUN levels and a slight increase in serum creatinine levels were seen, while in Group IV animals, a significant fall in BUN levels and a slight increase in serum creatinine levels were observed.

6864 **Yagoub, I.A., 1989**. Haematological studies in dromedary camels with single or concurrent natural infections of *Trypanosoma evansi* and *Haemonchus longistipes*. *Acta Veterinaria (Beograd)*, **39** (2-3): 109-119.

Regional Veterinary Research Laboratory, P.O. Box 237, Kassala, Sudan.

Single and concurrent natural infections of camels with *T. evansi* and *H. longistipes* were studied in 642 camels of varying ages. The concurrent infection was found to induce the most highly significant changes in haematological parameters of infected camels: PCV (17.4%), Hb (8.5 g/100 ml), neutrophils (43.9%), eosinophils (2.9%) and lymphocytes (51.0%). This was followed by single *T. evansi* infection: PCV (19.6%), Hb (9.4 g/100 ml), neutrophils (43.9%), eosinophils (2.1%) and lymphocytes (51.8%); then camels positive for both *H. longistipes* and the mercuric chloride test: PCV (24.0%), Hb (11.2 g/100 ml), neutrophils (46.5%), eosinophils (4.5%) and lymphocytes (46.9%). Camels singly infected with *Haemonchus* showed significant changes in their Hb (11.9 g/100 ml) and eosinophils (7.2%) only. Those camels positive for the mercuric chloride test only had no significant changes in their PCV (24.2%) and Hb (12.1 g/100 ml) but their neutrophils (46.3%) were significantly decreased together with the increase in their lymphocytes (47.4%). The mean haematological values for apparently healthy camels were found to be: PCV (25.9%), Hb (13.1 g/100 ml), neutrophils (53.2%), eosinophils (5.7%), basophils (0.2%), lymphocytes (39.5%) and monocytes (1.4%). The data obtained from infected camels were statistically compared to those of healthy ones. Treatment of infected camels before and

after the rainy season is suggested as a practical means of control under nomadic conditions.

(c) TRYPANOTOLERANCE

[See also **14**: no. 6812.]

6865 **Jordt, T. and Lorenzini, E., 1990**. Multiple superovulations in N'Dama heifers. *Tropical Animal Health and Production*, **22** (3): 178-184.

Slotsdalen 135, 2980 Kokkedal, Denmark; ILRAD, P.O. Box 30709, Nairobi, Kenya.

As part of an embryo transfer project to produce N'Dama cattle for trypanotolerance studies in Kenya, five N'Dama heifers were superovulated with follicle stimulating hormone (FSH-P or Folltropin) six times each. The superovulations were carried out between ongoing experimental *Trypanosoma congolense* infections. Twenty-four (80%) of the 30 superovulations resulted in a good ovarian response, with 21 (70%) producing an average of 2.7 □ 0.4 embryos. The highest embryo production was achieved at the third and fourth superovulations, after which the number of embryos and their quality declined. It is recommended that, after four superovulations, the heifers are allowed to go through a normal pregnancy before being superovulated again. The overall pregnancy rate after transfer to Boran recipients was 50.9%.

6866 **Trail, J.C.M., d'Ieteren, G.D.M., Maille, J.C. and Yangari, G., 1991**. Genetic aspects of control of anaemia development in trypanotolerant N'Dama cattle. *Acta Tropica*, **48** (4): 285-291.

ILCA, P.O. Box 46847, Nairobi, Kenya; ibid.; OGAPROV, Moanda, Gabon; ibid.

One hundred and forty-eight one-year-old N'Dama cattle, progeny of 29 sires, were exposed for 92 days to a medium natural tsetse-trypanosome challenge in Gabon, Central Africa. Matching health and performance data were recorded on 11 occasions. Average PCV and lowest PCV reached during the period were evaluated as measures of ability to control the development of anaemia. Attempts were made systematically to control other possible causes of anaemia. In animals detected as parasitaemic, those with above-average PCV values or above-average lowest PCV reached had 34% and 35% respectively higher daily weight gains than those with below-average. Even when not detected as parasitaemic, those with above-average average PCV values or above-average lowest PCV reached had 14% and 12% respectively higher gain indicating that a proportion of these

animals actually were parasitaemic. When all environmental and parasitaemia information was taken into account, the heritability of growth, average PCV and lowest PCV reached was 0.39 ± 0.31, 0.64 ± 0.33 and 0.50 ± 0.32 respectively. The genetic correlation between average PCV and growth was 0.70 ± 0.42 and between lowest PCV reached and growth was 0.28 ± 0.55. While the standard errors are large, the higher heritabilities of PCV measures compared to animal growth and the positive genetic correlations between PCV and growth do indicate an opportunity for selection on PCV when animals can be detected as parasitaemic. All heritabilities and genetic correlations increased in size when parasitaemia information was utilised in the analysis. Thus more sensitive field tests for trypanosome detection, and early onset of parasitaemia through very high natural infection or an acceptable experimental alternative, could speed up selection for ability to control the development of anaemia.

(d) TREATMENT

6867 **Aliu, Y.O., 1990**. Pharmacokinetics and therapeutic efficacy of diminazene in *Trypanosoma congolense*-infected Zebu cattle. *In*: Peregrine, A.S. (ed.), 1990 (see **14**: no. 6895), pp. 161-162.

Department of Physiology and Pharmacology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria.

Future research at ILRAD will include studies to determine the pharmacokinetics and urinary excretion of diminazene aceturate (Berenil) in Zebu cattle and the efficacy of various Berenil therapeutic protocols in treating *Trypanosoma congolense* infections in goats that are resistant to diminazene.

6868 **Kinabo, L.D.B., 1990**. Pharmacology of anti-trypanosomal drugs. *In*: Peregrine, A.S. (ed.), 1990 (see **14**: no. 6895), p. 153.

Department of Veterinary Pharmacology, Glasgow University Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

Current research at the Glasgow University Department of Veterinary Pharmacology on the use of isometamidium chloride (Samorin) to control bovine trypanosomiasis is briefly outlined. Aspects examined include pharmacokinetics using high-performance liquid chromatographic and radioimmunoassay techniques, adverse reactions in cattle, and the toxicology of isometamidium residues in meat.

6869 **Kinabo, L.D.B. and McKellar, Q.A., 1990**. Isometamidium in goats: disposition kinetics, mammary excretion and tissue residues. *British Veterinary Journal*, **146** (5): 405-412.
Department of Veterinary Pharmacology, Glasgow University Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.
The pharmacokinetics of the antitrypanosomal drug isometamidium were studied in lactating goats after intravenous and intramuscular administration at a dose of 0.5 mg/kg bodyweight, in a crossover design at an interval of 6 weeks. Following intravenous administration, the half-life of the disappearance of the drug from plasma during the terminal phase was 3.2 h, and the mean residence time was 2.4 h. The apparent volume of distribution averaged 1.52 l/kg, and the mean total body clearance was 0.308 l/kg/h. After intramuscular administration, the absolute bioavailability was low, averaging 27%. This was consistent with a low mean maximum concentration of 24 ng/ml which occurred after 6 h. No drug was detectable (< 10 ng/ml) in milk samples collected over a period of 14 days following drug administration by either the intravenous or intramuscular route. In tissues analysed when the goats were killed 6 weeks after administration of the second dose, no drug was detectable (< 0.4 μg/g wet tissue) in the liver, kidney and muscle. However, at the injection site, drug concentrations varied from < 0.4 to 18.8 μg/g wet tissue.

6870 **Peregrine, A.S., Moloo, S.K. and Whitelaw, D.D., 1991**. Differences in sensitivity of Kenyan *Trypanosoma vivax* populations to the prophylactic and therapeutic actions of isometamidium chloride in Boran cattle. *Tropical Animal Health and Production*, **23** (1): 29-38.
ILRAD, P.O. Box 30709, Nairobi, Kenya; ibid.; Department of Veterinary Parasitology, Glasgow University Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.
Isometamidium chloride was administered as a single prophylactic dose of 0.5 mg kg^{-1} bodyweight to each of ten Boran (*Bos indicus*) steers. At monthly intervals following drug administration, groups of five cattle each were challenged with one of two different *T. vivax* populations transmitted by infected *Glossina morsitans centralis*; one with a stock (IL 2982) from Galana, Kenya and the other with a stock (IL 2986) from Likoni, Kenya. Prophylaxis was afforded for less than one month against the Galana *T. vivax* and for one month

against the Likoni *T. vivax*. In a therapeutic study a further ten Boran steers were similarly infected with either of the *T. vivax* populations; five steers per population. Eleven days after infection all animals were treated with 0.5 mg kg^{-1} isometamidium chloride and all were cured. These findings demonstrate that, as defined in the field, the two Kenyan *T. vivax* populations express a high level of resistance to the prophylactic action of isometamidium yet a low level of resistance to the therapeutic action of the drug. The results also indicate that differences in drug resistance between different isolates play a major role in determining the apparent period of prophylaxis afforded by isometamidium chloride.

6871 **Peregrine, A.S., Sutherland, I.A., Mutharia, L., Jamnadass, R., Gray, M.A., Codjia, V., Aliu, Y.O., Mamman, M., Silayo, R., d'Ieteren, G.D.M., Moloo, S.K. and Murphy, N.B., 1990**. Overview of the chemotherapy research program at ILRAD. *In*: Peregrine, A.S. (ed.), 1990 (see **14**: no. 6895), pp. 3-8.

Peregrine, Jamnadass, Codjia, Mamman, Moloo, Murphy: ILRAD, P.O. Box 30709, Nairobi, Kenya; Sutherland: Department of Veterinary Physiology, Glasgow University Veterinary School, Bearsden Road, Glasgow G61 1QH, UK; Mutharia: Department of Biochemistry, Nairobi University, P.O. Box 30197, Nairobi, Kenya; Gray: KETRI, P.O. Box 362, Muguga, Kenya; Aliu: Department of Physiology and Pharmacology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria; Silayo: Faculty of Veterinary Medicine, Sokoine University of Agriculture, P.O. Box 3019, Morogoro, Tanzania; d'Ieteren: ILCA, P.O. Box 46847, Nairobi, Kenya.

The long-term efficacy of diminazene, homidium and isometamidium as trypanocidal drugs for cattle is being studied, with reference to their mode of action and pharmacokinetics, the phenotypic and genetic basis of resistance, and field-usable techniques for quantifying drug resistance. Current research falls into eight broad categories: the development of *in vitro* culture techniques for identifying and quantifying drug resistance; the efficacy of isometamidium chloride and diminazene aceturate in Zebu cattle; the mode of uptake of isometamidium by clones of *Trypanosoma congolense*; the epidemiology and molecular biology of drug resistance; the development of drug assays; studies on the productivity of trypanotolerant livestock by ILCA; and training and outreach.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

6872 **Majiwa, P.A.O., 1989**. Recombinant DNA probes as tools for epidemio-logical studies of parasitic diseases. *Discovery and Innovation*, **1** (2): 35-40.
Laboratory of Eukaryotic Gene Expression, National Cancer Institute, Frederick Cancer Research Facility, Building 539, P.O. Box B, Frederick, MD 21701, USA.
The use of recombinant DNA probes for the identification of parasitic protozoa is reviewed. Repetitive DNA sequences from cultured organisms are isolated, identified, cloned in plasmids and propagated in bacteria. The recombinant plasmid can be used as a probe to identify any organism containing similar DNA sequences. This method may be used in large-scale surveys and has a high sensitivity. Unlike ELISA it is not susceptible to antigenic variation. It can identify trypanosomes whatever their developmental stage and morphology and can distinguish between *Trypanosoma simiae* and *T. congolense*, which are morphologically identical. Recombinant DNA probes have confirmed the intra-specific division of *T. congolense* into three genetically distinct types: Kilifi type, West African forest/riverine type and savanna type. DNA probes should soon be available for routine epidemiological studies.

6873 **Oreagba, L.O., 1990**. *Comparative studies on diagnostic techniques of African trypanosomiasis with emphasis on immunodiagnosis*. Ph.D. thesis, University of Jos, Nigeria. 177 pp.
Federal Department of Livestock and Pest Control Services, P.O. Box 3557, Kaduna, Nigeria.
Current non-immunological methods of diagnosing African trypanosomiasis were investigated in mice and rats experimentally infected with *Trypanosoma brucei brucei*, *T. b. gambiense* and *T. congolense*. In the mouse system, the haematocrit centrifugation technique (HCT) was the most sensitive, detecting the parasite on day 2, followed by buffy coat method (BCM) on day 3, while the standard trypanosome detection method (STDM) detected the parasite on day 5. In the rat system, the HCT and BCM were consistently more sensitive than the STDM. Crude antigens of *T. b. brucei*, *T. b. gambiense* and *T. congolense* were prepared from locally isolated strains and tested by counterimmunoelectrophoresis (CIE) adapted in this study from Ouchterlony's immunodiffusion test. This system, with the crude trypanosomal antigens, was used to investigate the prevalence of human sleeping sickness and animal trypanosomiasis in Plateau State,

Nigeria. *T. b. gambiense* antigen detected multiple antibodies in sera of 74 (38.74%) of suspected sleeping sickness cases out of 191 sera tested. The positive sera were those obtained from Keffi (14), Pankshin (5), Obi (24), Akwanga (17), Keana (7), Shendam (2), Toto (3) and Dengi (2). The remaining 117 (61.26%) sera from Lafia, Barkin Ladi and Jos were negative. In the animal survey, antibody activities to *T. b. gambiense* varied from high seropositive values of 19 (59.37%) in sheep, to low values of 10 (31.25%) in cattle and 0 in domestic chicken. The CIE test detected a total of 139 (24.13%) seropositive cases while the indirect haemagglutination test was less sensitive with only 82 (14.23%) positive cases. A simple direct haem-agglutination test was used to follow up immunological changes in infected rats when immunised with an innocuous antigen such as sheep red blood cells (SRBC). Control animals, Group A, immunised with SRBC only, showed remarkable antibody responses which were detectable on day 5, with a mean titre of 1:32 and reaching a maximum titre of 1:256 by day 19. Another group of rats, Group C, immunised and challenged simultaneously with *T. b. brucei*, showed severe immunodepression. Antibodies were detected on day 5, with a mean titre of 1:21 which was the highest recorded in this group. Infection was patent on day 7 in rat C3, with $2 \exists 10^6$ trypanosomes per ml. The trypanosomal antigens prepared in this study recognised specific antibodies. The CIE test, as well as the haemagglutination test, proved to be a simple, relatively cheap immunodiagnostic tool for the detection and follow-up of host-parasite immunological changes during African trypanosomiasis.

(b) PATHOLOGY AND IMMUNOLOGY

6874 **Amole, B.O., Thomas, K.D. and Asemota, D.O., 1990**. Cations in body fluids of *Trypanosoma brucei* [in] infected rabbits. *Annales de Parasitologie humaine et comparée*, **65** (4): 155-161.

Amole: Department of Medical Microbiology and Parasitology, Faculty of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria.

6875 **Frommel, T.O., Fujikura, Y. and Seed, J.R., 1991**. Tissue alterations in *Microtus montanus* chronically infected with *Trypanosoma brucei gambiense*. *Journal of Parasitology*, **77** (1): 164-167.

Frommel: Department of Genetics (M/C 669), University of Illinois, 808 S. Wood Street, Chicago, IL 60612, USA.

6876 **Jauberteau, M.-O., Younes-Chennoufi, A. ben, Amevigbe, M., Bouteille, B., Dumas, M., Breton, J.-C. and Baumann, N., 1991**. Galactocerebrosides are antigens for immunoglobulins in sera of an experimental model of trypanosomiasis in sheep. [*T. b. brucei*.] *Journal of the Neurological Sciences*, **101** (1): 82-86.

Baumaun: Neurobiology INSERM Unit 134, University Hospital La Salpêtrière, 47 boulevard de l'Hôpital, 75651 Paris Cedex, France.

6877 **Kageruka, P., Mangus, E., Bajyana Songa, E., Nantulya, V., Jochems, M., Hamers, R. and Mortelmans, J., 1991**. Infectivity of *Trypanosoma (Trypanozoon) brucei gambiense* for baboons (*Papio hamadryas*, *Papio papio*). *Annales de la Société belge de Médecine tropicale*, **71** (1): 39-45.

Kageruka: Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.

6878 **Marck, E. van and Chirimwami, B., 1985**. *Trypanosoma brucei gambiense*: een licht- en elektronenmicroscopische studie van de hersenletsels bij chronisch besmette ratten. [*T. b. gambiense*: a light and electron microscopic study on the brains of rats with a chronic infection.] *Verhandelingen: Koninklijke Academie voor Geneeskunde van België*, **47** (2): 129-172.

Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.

6879 **Oliveira, T.C.G. de, Meneguin, J.M. and Pereira, E.A., 1989**. Comportamento do *Trypanosoma evansi* (*T. equinum*) em animais de laboratorio. [Behaviour of *T. evansi* (*T. equinum*) in laboratory animals.] [Rats, guinea pigs.] *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia*, **41** (4): 271-277.

Departamento de Parasitologia, Instituto Biocências do `Campus do Botucatu', UNESP, 18600 Botucatu SP, Brazil.

6880 **Rifkin, M.R., 1991**. *Trypanosoma brucei*: cytotoxicity of host high-density lipoprotein is not mediated by apolipoprotein A-I. *Experimental Parasitology*, **72** (2): 216-218.

Rockefeller University, 1230 York Avenue, New York, NY 10021, USA.

6881 **Wiesenfeld-Hallin, Z., Kristensson, K., Samuelsson, E.-B. and Schultzberg, M., 1991**. Studies of hyperalgesia induced by *Trypano-soma brucei brucei* infection in rats. *Acta Tropica*, **48** (3): 215-222.

Wiesenfeld-Hallin: Department of Clinical Physiology, Section of Neurophysiology, Huddinge Hospital, S-141 86 Huddinge, Sweden.

(c) CHEMOTHERAPEUTICS

[See also **14**: no. 6943.]

6882 **Arowolo, R.O.A., 1990**. Chemotherapy for animal trypanosomiasis. [*T. vivax*, *T. congolense*, *T. brucei*; sheep, goats, rodents.] *In*: Peregrine, A.S. (ed.), 1990 (see **14**: no. 6895), pp. 155-156.

Department of Veterinary Physiology and Pharmacology, Faculty of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.

6883 **Bacchi, C.J., Yarlett, N., Nathan, H., Goldberg, B., Garofalo, J., Sayer, P.D., Njogu, A. and Clarkson, A.B., 1990**. Polyamines in chemotherapy for African trypanosomiasis. *In*: Peregrine, A.S. (ed.), 1990 (see **14**: no. 6895), pp. 17-24.

Bacchi, Yarlett, Nathan, Goldberg, Garofalo: Biology Department of Haskins Laboratories, Pace University, 41 Park Row, New York, NY 10038, USA; Sayer, Njogu: KETRI, P.O. Box 362, Muguga, Kenya; Clarkson: Department of Medical and Molecular Parasitology, New York University Medical Center, 550 First Avenue, New York, NY 10016, USA.

The inhibition of polyamine synthesis in *Trypanosoma brucei brucei*, *T. b. gambiense* and *T. b. rhodesiense* by DL-α-difluoromethylornithine (DFMO), the specificity and efficacy of this drug in controlling trypanosomes, the susceptibility of *T. b. rhodesiense* to DFMO and arsenical drugs, and trypanosome resistance to DFMO and arsenical drugs are briefly reviewed.

6884 **Byers, T.L., Bush, T.L., McCann, P.P. and Bitonti, A.J., 1991**. Antitrypanosomal effects of polyamine biosynthesis inhibitors correlate with increases in *Trypanosoma brucei brucei S*-adenosyl-L-methionine. [Rats, mice.] *Biochemical Journal*, **274** (2): 527-533.

Bitonti: Merrell Dow Research Institute, 2110 E. Galbraith Road, Cincinnati, OH 45215, USA.

6885 **Craciunescu, D.G., Molina, C., Alonso, M.P., Parrondo Iglesias, E., Doadrio Villarejo, J.C., Gutierrez-Rios, M.T., Gaston de Iriarte, E., Ghirvu, C.I. and Ercoli, N., 1990**. Relaciones estructura-actividades farmacológicas (antitumorales y antitripanosómicas) para los nuevos complejos [M^{I} (NBR) (L)]□, donde M^{I} = Rh(I) o Ir(I), NBR = norbornadieno y L = aniones xantatos. [Pharmacological structure-activity relationships (antitumoral and antitrypanosomal) for the new [M^{I} (NBR) (L)]□ complexes, where M^{I} = Rh(I) or Ir(I), NBR = norbornadiene and L = xanthate anions.] [*T. evansi*, *T. equiperdum*, *T. congolense*, *T. cruzi*; mice.] *Anales de la Real Academia de Farmacia*, **56** (4): 469-486.

Craciunescu: Departamento de Química Inorgánica y Bioinorgánica, Facultad de Farmacia, UCM, 28040 Madrid, Spain.

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This brief review summarises some of the major developments which have taken place during the last decade. These include research on trypanosome metabolic pathways as targets for new drugs, host-related and parasite-related drug resistance, and drug-delivery systems.

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8. TRYPANOSOME RESEARCH

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(b) TAXONOMY, CHARACTERISATION OF ISOLATES

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TRL, Department of Veterinary Medicine, University of Bristol, Langford House, Langford, Bristol BS18 7DU, UK. (Corres-pondence to Godfrey.)
Professor Kershaw's encouragement of the development of anion-exchange separation of African trypanosomes from blood led to two decades of activity when, for the first time, considerable progress was made in the intrinsic characterisation of these parasites. Such characterisation depended on establishing high infections in laboratory rodents. However, the

collection of samples from the field was restricted by the failure of certain trypanosomes either to infect, or to multiply adequately in, rodents. More recently, *in vitro* culture has come to play an increasingly important role in producing material. By obtaining procyclic forms directly from wild tsetse flies, or by transforming low numbers of bloodstream forms in field samples to the procyclic phase in experimental tsetse, trypanosomes of poor or nil infectivity to rodents were readily cultured in the large amounts required for biochemical characterisation. A number of specimens of a new kind of *Nannomonas*, of *Trypanosoma simiae*, of *T. grayi*, and of an antigenically distinct *T. brucei gambiense* were found. Evidence is presented that many other kinds of trypanosome may be eluding isolation by their inability to infect rodents.

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