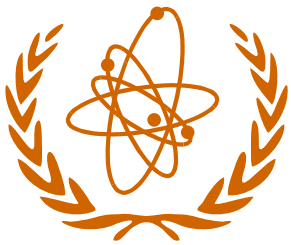
ISSN 0142-193X

TSETSE AND TRYPANOSOMIASIS INFORMATION QUARTERLY

Volume 13
Part 4, 1990
Numbers 6423–6545



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SECTION B — ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

[See also **13**: no. 6453.]

6423 **Anonymous, 1988.** En Afrique sub-saharienne, une lutte intégrée contre la mouche tsé-tsé. [In sub-Saharan Africa, integrated control of the tsetse fly.] *Afrique Agriculture*, no. 153: 40-42.

Although the chances of developing a vaccine against trypanosomiasis appear to be as remote as ever, three options still remain for combating the disease: tsetse control, chemotherapy and the development of trypanotolerant breeds. Several very effective drugs to treat or prevent trypanosomiasis are available but these are expensive, and there are problems of resistance as well as of the traffic of false drugs. CRTA's control campaign at Sideradougou in Burkina Faso is a model of integrated control. More than 7000 insecticide-impregnated screens and traps have been used to eliminate 90% of the tsetse flies from an area of 3500 km^2, followed by sterile male releases to achieve total eradication. Sterile males are also being used in collaboration with IAEA in Nigeria and may also be used in Ghana. A disadvantage of the method is the need to release 10 sterile males to every wild male. In order to maintain large numbers of tsetse, methods of artificial feeding are being developed since host animals such as rabbits are not suited to the tropics. The sterile male control method could not function without the populations of tsetse first being reduced by means of traps, and much research is being conducted on ways of improving their efficiency, by means of host odours, sex pheromones, and differences in shape and colour of traps. There is also the need to educate the local people to look after the traps. Research on trypanotolerance is being carried out by CRTA to try to gain a better understanding of the mechanisms involved so that animals can be selected for this trait. Cross-breeding of trypanotolerant breeds with susceptible ones to try to improve productivity and resistance is unfortunately leading to the disappearance of resistant local breeds in many places. There is also the need to plan for land use of tsetse-cleared areas to avoid conflicts between herders and cultivators, and to ensure that the land is fully developed and not re-invaded by tsetse.

6424 **Anonymous, 1988.** En Afrique australe, une stratégie d'éradication. [In southern Africa, an eradication strategy.] *Afrique Agriculture*, no. 153: 43.

The EEC-funded tsetse control programme for Malawi, Mozambique, Zambia and Zimbabwe aims to eradicate tsetse from an area of 322,000 km^2 in the four countries. Phase 1 of the programme includes the aerial spraying with endosulfan of 20,600 km^2 in Zimbabwe and Zambia. It is estimated that if tsetse were to be eradicated from the four countries, their present cattle population of 655,000 head could be increased to more than 6.7 million. Mozambique's 90,000 head of cattle could theoretically be increased to 4.3 million. It is estimated that, at the end of 10 years, the internal rate of return of the programme should be of the order of 14%. The programme should also result in a substantial reduction in the number of sleeping sickness cases.

6425 **Anonymous, 1988.** La FAO face à la trypanosomiase. [FAO confronts trypanosomiasis.] *Afrique Agriculture*, no. 153: 44-45.

Twelve years after the launching of FAO's Programme to control African animal trypanosomiasis, a mission was undertaken by two experts to six countries, four in West Africa and two in southern Africa, to evaluate progress so far and make recommendations for future action. The mission noted a lack of concern (or of means) in some African states, and the international community seemed to attach less importance to the development of tsetse-infested areas than did FAO, donating 23.5 million dollars in the 12 years of the programme, which was considered insufficient by the experts. The mission recommended that: tsetse and trypanosomiasis control projects should not be undertaken in isolation in the absence of well defined land use planning; future meetings of the commission on African animal trypanosomiasis should be held at the level of Ministries of Livestock and Veterinary Services; sub-regional development support units should be created, especially in southern Africa; information on activities and results should be made available regularly by governments of member states and by institutions; training at all levels should continue to receive the highest priority; donors should spare no effort to ensure the future of ELAT's training activities; FAO's policy of awarding small contracts to research institutes to work on particular problems is very productive and should concentrate on improving trap and screen technology. The mission also stressed the importance of research on trypanotolerance, and the need for continued emphasis on land use planning,

assured by national coordination committees. It also urged the proper evaluation of proposed projects; due attention must be given to the collection and analysis of biological and ecological data on tsetse and of data on land resources before any project is formulated. Wherever possible, such projects should be integrated within specific rural development projects. The mission recommended a long-term plan for funding regular activities.

6426 **Giblin, J., 1990.** Trypanosomiasis control in African history: an evaded issue? *Journal of African History*, **31** (1): 59-80.

University of Iowa, Iowa City, IA, USA.

Social control of trypanosomiasis in African history deserves further study. The pioneering work in this field is John Ford's respected but neglected *The role of the trypanosomiases in African ecology* (1971). While Ford's arguments have received support from recent findings in immunological, epidemiological and epizootiological research, they have rarely met with evaluation or engagement, either in historical or scientific literature. Historians have tended to describe trypanosomiasis control as a matter of avoiding contact with tsetse fly. In so doing they have implicitly rejected the position of Ford, who regarded infrequent contacts between tsetse and mammalian hosts as necessary for the maintenance of host resistance. Ford believed that host resistance, rather than avoidance of tsetse, was the basis of trypanosomiasis control. The historical nature of Ford's work requires that a satisfactory evaluation of *The role of the trypanosomiases* make use of historical, as well as scientific, data. The evidence of trypanosomiasis and cattle-keeping from one region of north-eastern Tanzania supports Ford and suggests that other explanations of trypanosomiasis control are inadequate. The Tanzanian evidence shows that precolonial societies coexisted with, but could not avoid, tsetse. They could not eradicate tsetse because scarcity of water prevented permanent occupation of large areas. Tsetse and trypanosomiasis did not prevent cattle-keeping, but helped to keep the region's cattle population low and confined it to relatively densely settled neighbourhoods. Social control of trypanosomiasis collapsed during the pre-Second World War period of colonial rule. Economic and political developments were primarily responsible for a series of famines between 1894 and 1934. Famine-induced depopulation allowed steady spread of tsetse

and wildlife reservoirs of trypanosomes into formerly cultivated areas which had been free of tsetse before the colonial period.
Author's abstract

6427 **Habtemariam, T., Howitt, R., Ruppanner, R. and Riemann, H.P., 1984.** Application of a linear programming model to the control of African trypanosomiasis. *Preventive Veterinary Medicine*, **3** (1): 1-14.
Department of Large Animal Medicine and Surgery, School of Veterinary Medicine, Tuskegee Institute, AL 36088, USA; Department of Agricultural Economics (Howitt) and Department of Epidemiology and Preventive Medicine, School of Veterinary Medicine (Ruppanner, Riemann), University of California, Davis, CA 95616, USA.
A linear programming (LP) model was designed to evaluate trypanosomiasis control activities in south-western Ethiopia. The objectives included maximising net benefits, utilisation of unskilled labour, and resettlement of reclaimed land, and decreasing the prevalence of trypanosomiasis from 20% to less than 5% at the end of 5 years, subject to epidemiological, ecological and economic constraints. The model was a multiperiod specification with 127 equations and 81 activities for the project period of 5 years. The optimal solution required reclamation of 5221 km^2 of tsetse-infested land and used treatment of cattle at maximal levels. At the end of the project period, the prevalence decreased to 2% with net benefits of E$1.281 million. LP provided a potentially optimal means of resource allocation in the short run and a means of identifying those restrictive resources which could be vital to long-range planning. (See also *TTIQ*, **13**: no. 6432.)
Authors' abstract

6428 **Ikede, B.O., 1986.** Trypanosomiasis and livestock production in Africa: is current emphasis misplaced? (Editorial.) *Tropical Veterinarian*, **4** (1-2): 1-4.
Department of Pathology and Microbiology, Atlantic Veterinary College, University of Prince Edward Island, 550 University Avenue, Charlottetown, Prince Edward Island, C1A 4P3, Canada.
Although it is often repeated that African animal trypanosomiasis remains an intractable problem, it is only one of several constraints to livestock production. Many areas infested with riverine and forest species of tsetse could and do support livestock if other constraints are removed. In Nigeria, nomadic herdsmen are settling in such areas even without any specific tsetse control measures. High trypanosome infection rates in trade cattle reaching southern abattoirs are no longer seen since the animals are now carried rapidly through the deadly *Glossina morsitans* savanna belt by trucks or rail. Adverse climatic conditions, urbanisation and land cultivation due to human population pressures are also reducing the prevalence of

the disease by destroying the tsetse habitat. Consequently availability of land and funds, rather than trypanosomiasis, are the main constraints to dairy and beef projects in southern Nigeria today, together with a lack of incentive to change the tradition of arable farming. The use of trypanotolerant breeds and of relatively cheap and effective methods of tsetse control in the form of traps and screens should be promoted by national governments. The lack of new trypanocidal drugs is less of a problem than the lack of foreign currency to purchase existing drugs. Donor/aid agencies should therefore help needy countries to procure trypanocides for use in areas of high tsetse challenge. It is considered that adequate information on tsetse and trypanosomiasis exists, the application of which would make economic and viable livestock production possible in a large proportion of Africa's grasslands. Further research must give prominence to the application of existing knowledge in solving immediate and long-term livestock production problems.

6429 **Ikede, B.O., 1989.** *The Nigerian livestock industry: assets, liabilities and potentials.* (1987 Ibadan University lectures.) Ibadan, Nigeria; Ibadan University Press. 96 pp.

Department of Pathology and Microbiology, Atlantic Veterinary College, University of Prince Edward Island, 550 University Avenue, Charlottetown, Prince Edward Island, C1A 4P3, Canada.

The assets of the Nigerian livestock industry include a large population of different animal species (12 million cattle, 13 million sheep, 26 million goats, 1.3 million pigs, 160 million chickens, 1 million horses, mules and asses, and 0.02 million camels). About 80% of the cattle are of the Zebu type, reared by the Fulani under the traditional extensive management system characterised by very low productivity. Most of the sheep and goats are indigenous breeds but are relatively productive, especially under the improved system of management. A sizeable proportion of the poultry and piggeries consists of relatively productive exotic breeds. Land, human and institutional resources are available but require better coordination and management. The main liabilities of the industry, in addition to the rapid growth rate of the human population, are the availability of feed and water, disease, and management constraints. In spite of what is often said, tsetse flies are declining in density and distribution and the trypanosomiasis problem is diminishing, at least in Nigeria and some other parts of West Africa. Between 1955 and 1980, one fifth of Nigeria's land mass was reclaimed from tsetse by organised control measures. In addition, rapid population growth, increased hunting of game animals, development of industries, new towns, highways and farmlands, the use of trucks to transport trade cattle through areas of high tsetse challenge, and drought and desertification have had a considerable impact, and 40-50% of Nigeria is now free of tsetse. Even in areas where tsetse and trypanosomiasis still occur, they are usually at a much lower level than is generally believed. In particular, large areas of the derived savanna zone which has abundant rainfall and pasture can now be used for Zebu cattle production and would be ideal for commercial farms. Strategies for improving the beef industry are suggested (selection and breeding, fattening, resting sites for trade cattle, sedentarisation, veterinary services, encouragement of southerners to go into livestock production, marketing). Options for the dairy industry, for small

ruminants and poultry, and for other sources of animal protein (fish, bush meat, rabbits) are also discussed.

6430 **Jordan, A.M., 1989.** Man and changing patterns of the African trypanosomiases. *In*: Service, M.W. (ed.), *Demography and vector-borne diseases* (Boca Raton, Florida, USA; CRC Press), pp. 47-58.

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

The changes in the African human population in the past century, particularly the increasing population growth rate, are considered, together with the habitat and host requirements of *Glossina* spp. Tsetse flies of the *morsitans* group appear to be affected by the human population density, decreasing as human populations increase and vice versa, as a result of the changes in density of woodland and occurrence of wild animals caused by demographic changes. With present human population trends, areas infested by *morsitans* group tsetse are tending to decrease, but only where human populations are spreading into woodland areas rather than into cities. Events in Sukumaland, to the south of Lake Victoria, illustrate successively a decrease in human and cattle populations from 1890 to 1920, a massive increase in tsetse, an increase in human and cattle populations from around 1935, and by 1947 receding tsetse belts. In West Africa, from the 1960s, the human population explosion has resulted in the disappearance of *G. morsitans* and *G. longipalpis* from extensive areas, independently of organised control, especially in Nigeria. Tsetse species of the *palpalis* group are much less affected by the activities of man, and their distribution is probably much the same today as in the early years of recorded history except that the replacement of climax forest vegetation by oil palms and root crop farmland has favoured the southward movement of *G. tachinoides*, as far as the sea in east Nigeria. Although the trend from shifting to more permanent cultivation might be expected to reduce suitable *palpalis* group habitat and hosts, the group is very resilient and has shown willingness to adapt to man-made habitats and feed on man and his domestic animals. The effects of changes in *Glossina* populations on the epidemiology of human and animal trypanosomiases are discussed. Although the overall trend is for tsetse to disappear before the advance of man, predictions are difficult and there is no cause for complacency in disease control.

6431 **Jordan, A.M., 1990.** Tsetse research and control: 1910 to 2000. (Editorial.) *Bulletin of Entomological Research*, **80** (2): 117-120.

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

The author briefly reviews the subject matter of papers on tsetse published in the *Bulletin of Entomological Research* from 1910 to the present day and discusses the likely

topics to be covered in the next ten years. Further research on trapping, attractants and tsetse behaviour will certainly feature prominently. Hopefully the combined field and laboratory approach, seen increasingly in recent years, will continue. Further research on the interface between the fly and the trypanosome and between the fly and its mammalian host is needed to improve our understanding of the epidemiology of the disease. An important challenge for the next ten years will be to predict ways in which increasing human populations will affect local tsetse populations and to build these predictions into strategies, not just involving vector control, for the effective control of trypanosomiasis.

6432 **Koen, C., 1990.** A linear programming model of trypanosomiasis control reconsidered. *Preventive Veterinary Medicine*, **9** (1): 37-44.

134 Market Street, Boksburg 1459, South Africa.

A previously published linear programming model of a tsetse fly control project (see *TTIQ*, **13**: no. 6427) is re-examined and several simplifications leading to a substantially less complex system of equations are suggested. Two simple analytical solutions of the problem are indicated. It is recommended that a careful time-series analysis of historical tsetse fly prevalence be made to improve modelling.

Author's abstract

6433 **Lyons, M., 1985.** From `death camps' to *cordon sanitaire*: the development of sleeping sickness policy in the Uele District of the Belgian Congo, 1903-1914. *Journal of African History*, **26** (1): 69-91.

University of California, Los Angeles, CA, USA.

When sleeping sickness was discovered to be epidemic in the Congo Free State in 1904, the administration responded by attempting to implement public health measures which had evolved in Europe in relation to plague and cholera epidemics. These measures were to identify and isolate victims and suspected victims of the disease and to map out the infected and uninfected zones. This article describes the early sleeping sickness campaign of the Belgian authorities in the Uele District of Province Orientale between 1904 and 1914, focusing on the formation of isolation camps or lazarets. Uele District had been identified as a potentially rich and uninfected zone to be protected from contamination by the establishment of a *cordon sanitaire*. Public health policy and practice during this period provides an example of attempted `social

engineering' on the part of a colonial authority. While sleeping sickness provided the major impetus for the gradual development of the colonial medical service by the 1920s, the early period between 1903 and World War I was particularly onerous for the African populations in the north-east. The public health policy was perceived by many Africans as one more element in the on-going conquest and exploitation of the region. Examples are provided to demonstrate the ways in which numerous sleeping sickness regulations affected African societies in Uele.
Author's abstract

6434 **Marchot, P., Leroy, P.L., Janicot, S. and Guillot, B., 1989.** The low tsetse challenge in the Accra Plains and consequent breeding prospects. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (3): 447-451.
ACR, c/o EEC Delegation, P.O. Box 9505, Accra, Ghana; Department of Genetics, Veterinary College, University of Liège, rue des Vétérinaires 45, B-1070 Brussels, Belgium; Météorologie Nationale, 2 avenue Rapp, 75340 Paris Cédex 07, France; ORSTOM/CMS, B.P. 147, 22302 Lannion, France.
Aveyime Cattle Ranch is a breeding station located in the Accra Plains of Ghana. Conformation of West African Shorthorn is improved by crossbreeding with White Fulani Zebu. The Plains benefit from a very dry microclimate, compared to neighbouring areas under similar latitudes. Consequently, tsetse challenge is so low and the incidence of trypanosomiasis so reduced that such genetic upgrading becomes realistic. This programme should be pursued, as long as no major modification of the climatic conditions, and consequently of tsetse distribution, occurs.
Authors' abstract

6435 **Waller, R.D., 1990.** Tsetse fly in Western Narok, Kenya. *Journal of African History*, **31** (1): 81-101.
Bucknell University, PA, USA.
This article studies the expansion of tsetse fly in one part of Kenya Maasailand between 1900 and 1950. It follows the lines of investigation first suggested by Ford's work and examines in detail the interaction between changes in four elements in the Mara ecosystem: climate, vegetation, land use and tsetse. Tsetse was able to expand because its habitat expanded and the spread of bush and fly into the grasslands both caused, and was facilitated by, shifts in patterns of Maasai grazing and occupation in the area. Up to the 1890s, the Mara Plains were regularly grazed by Maasai herds;

but the general depopulation of Maasailand in the aftermath of the rinderpest pandemic and civil war left the region vacant until after 1900 and allowed the spread of bush cover which was then colonised by tsetse. When Maasai returned, they altered their grazing patterns to avoid such areas. However, the progressive encroachment of tsetse-infested bush continued and was not halted until bush-clearing schemes and closer grazing forced the fly to retreat by destroying its habitat. The study is set within the wider context of ecological change and capitalist development in East Africa and suggests that the common assumption that colonial capitalism was responsible for the disruption of the ecosystem and, therefore, for the spread of disease and environmental degradation needs careful re-examination in the light of a more sophisticated understanding of the processes of ecological change.
Author's abstract

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

6436 **Challier, A. and Dejardin, J., 1987.** Variations morphologiques chez les mâles de *Glossina palpalis palpalis* (Rob.-Desv.) et *G. p. gambiensis* Vanderplank. Leurs implications taxinomiques. [Morphological variations in males of *G. p. palpalis* and *G. p. gambiensis* and their taxonomic implications.] *Cahiers ORSTOM, série Entomologie médicale et Parasitologie*, **25** (special number): 83-99.
ORSTOM, Centre de Bondy, 70-74 route d'Aulnay, 93140 Bondy, France; ORSTOM, 2051 avenue du Val de Montferrand, B.P. 5045, 34032 Montpellier Cédex, France.
Male genitalia of *G. p. palpalis* and *G. p. gambiensis* caught at 53 sites in 14 countries from Senegal to Angola were examined in order to specify the morphological variations and reconsider the taxonomic status of the two taxa. Among the characters studied, the head width of the inferior clasper allows, on its own, the determination of an individual's subspecies; there is no overlapping at all of the values of this character (*G. p. palpalis* 64-135 μm; *G. p. gambiensis* 145-213 μm). Some intermediate values between these two ranges were found at the geographical limits between the two subspecies. In West Africa, the means of the head width of the inferior clasper of *G. p. gambiensis* (172-186 μm) decrease from north to south and from west to east, while those of *G. p. palpalis* (79-109 μm) decrease from west to east;

from Cameroon to Angola, samples were not numerous enough to obtain with certitude the direction of clinal variations. Using the geographical positions of the head width values, a map of isophens is proposed. Minimum values in both subspecies seem to be situated in two particular regions – one in Guinea, the other in Cameroon – where forest relics remained during the last cool and dry period of the recent Quaternary; during this period, two geographical isolates formed which became the two taxa currently considered to be subspecies. The existence, at the limit between the distribution areas of the subspecies, of individuals with head widths intermediate between those observed in the two subspecies, and the narrowness of the hybridisation zone, as well as the complete sterility of hybrid males observed by other authors, are so many arguments in favour of species status being applied to these two taxa which have been considered as subspecies up to now. Studies on the genetics and biomolecular structure of the taxa could confirm this opinion.

Authors' abstract

6437 **Hargrove, J.W. and Coates, T.W., 1990.** Metabolic rates of tsetse flies in the field as measured by the excretion of injected caesium. *Physiological Entomology*, **15** (2): 157-166.

ODA Tsetse Research Project, Box 8283, Causeway, Zimbabwe; TRL, Langford, Bristol BS18 7DU, UK.

Teneral tsetse flies, *Glossina morsitans morsitans*, were injected with labelled caesium (^{137}Cs) < 18 h after emergence and released in the Zambezi Valley of Zimbabwe between May 1983 and June 1984, and again in February 1985. Radioactivity in flies recaptured time *t* days after injection indicated a three-stage exponential loss of caesium, identical for both sexes. For $t < 4$ the estimated rate constant (−0.119 per day) was significantly lower than for $4 < t < 12$ (−0.252 per day). By day 15 about 97% of the isotope had been excreted; thereafter the loss rate fell by an order of magnitude. The data for $t > 4$ days were well fitted by the sum of two exponentials but no smooth function was found to fit all three phases. The loss rate from the rapidly metabolised pool increased exponentially with temperature at the same rate as for male tsetse kept in the dark in the laboratory. However, the loss rate in the field was lower at every temperature, suggesting that these flies live at 2-6□C lower than the average Stevenson screen temperature. Published estimates of hunger cycle and daily flight durations, made on the basis of measured rates of caesium excretion, are invalid because they use the assumption that flies are living in the field at screen temperatures. The data suggest that both sexes have the same metabolic rate up to the age of about 15 days, which implies that the females (being larger and having to nourish a larva in

the latter stages of this period) must be less active and/or live at even lower temperatures than the males. Authors' abstract

6438 **Kaaya, G.P., 1989.** A review of the progress made in recent years on research and understanding of immunity in insect vectors of human and animal diseases. *Insect Science and its Application*, **10** (6): 751-769.

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

Different modes of immune reactions of insect vectors of human and animal diseases to nematode and protozoan parasites, fungi, bacteria, viruses and to other biological materials, e.g. xenografts, are discussed. Since most of the insect vectors of diseases are adult dipterans with low numbers of circulating haemocytes, their mode of defence against metazoan parasites and fungal pathogens is primarily by means of humoral encapsulation, with little haemocyte participation. Although earlier workers reported that humoral capsules in dipterans were formed without direct participation by haemocytes, this paper reveals increasing evidence of cellular involvement in the formation of humoral capsules, both at the initial and terminal stages of the encapsulation process. The role of the phenoloxidase system in non-self recognition and in the process of melanisation of haemolymph and capsules formed around parasites and fungal pathogens is also discussed. Immune defence of insect vectors against bacterial invasion by means of haemocytic reactions, e.g. phagocytosis and nodule formation, and by synthesis and release of humoral antibacterial factors, e.g. lysozyme, attacins and cecropins, is described and compared with similar reactions reported to occur in other insects. The role of lectins in defence of insect vectors against the parasites they transmit, e.g. sandflies against *Leishmania*, blackflies against *Onchocerca* and tsetse against *Trypanosoma*, is discussed and the possible mechanisms by which some parasites evade recognition and attack by the vector immune systems are also briefly discussed.

Author's abstract

6439 **Miyan, J.A., 1989.** `Killer'-cell-mediated destruction of dipteran eclosion muscles. *Proceedings of the Royal Society of London (B)*, **236** (1282): 91-100.

Department of Zoology, University of Edinburgh, West Mains Road, Edinburgh EH9 3JT, UK.

After successful escape from the puparium, dipteran flies lose sets of eclosion muscles located within the head, thorax and abdomen. The thoracic eclosion muscles of *Sarcophaga argyrostoma*, *Calliphora erythrocephala*, *Glossina morsitans morsitans* and *Drosophila melanogaster* are described, with details of the degeneration of one of them. This muscle is found to be attacked by a macrophage-like cell that attaches itself to areas around the Z-discs and sends processes along the length of the muscle that apparently stimulate autolysis. A dramatic increase in sarcoplasmic reticulum is

observed within muscle fibres, which spreads from the location of the macrophage and is coincident with degenerative changes. Neither nuclei nor mitochondria are observed to degenerate within the muscle although giant mitochondria in certain fibres are found to undergo degenerative changes. Phagocytosis was not observed. The system is not affected by hormones released before eclosion nor by bursicon, a hormone released after eclosion, and a direct neural trigger is discussed. The results are compared to the action of `killer' cells in the vertebrate immune system and contrasted with degeneration processes resulting from disuse.
Author's abstract

6440 **Okolo, C.J., Jenni, L., Molyneux, D.H. and Wallbanks, K.R., 1990.** Surface carbohydrate differences of *Glossina* salivary glands and infectivity of *Trypanosoma brucei gambiense* to *Glossina*. *Annales de la Société belge de Médecine tropicale*, **70** (1): 39-47.
Okolo, Molyneux, Wallbanks: Department of Biological Sciences, University of Salford, Salford, M5 4WT; Jenni: Swiss Tropical Institute, Socinstrasse 57, CH-4051 Basel, Switzerland.
Incubation of fluorescein- and biotin-lectin conjugates with the salivary glands of *Glossina* spp. has revealed inter- and intraspecific variation in the surface carbohydrates of the glands. The degree of Con A binding to the basal laminae of the glands of the two *Glossina palpalis* subspecies, *G. p. palpalis* and *G. p. gambiensis*, was markedly different. The infectivity of *T. b. gambiense sensu lato* isolates to *G. p. palpalis* and *G. p. gambiensis* was compared. *G. p. gambiensis* from the field and from laboratory colonies transmitted *T. b. gambiense sensu lato* isolated from patients in Côte d'Ivoire whereas *G. p. palpalis* appears totally refractory to all *T. b. gambiense* isolates used. Although the relationship between the surface of the basal laminae of the salivary gland exposed to the haemocoele and trypanosome infection is not known, the consistent differences observed in lectin binding to the salivary glands suggest that differences in basic physiology of the glands exist which might correlate with susceptibility to trypanosome infection.
Authors' abstract

6441 **Riddiford, L.M. and Dhadialla, T.S., 1990.** Protein synthesis by the milk gland and fat body of the tsetse fly, *Glossina pallidipes*. *Insect Biochemistry*, **20** (5): 493-500.
Department of Zoology, University of Washington, Seattle, WA 98195, USA; Department of Entomology, Michigan State University, East Lansing, MI 48824-1115, USA.
The patterns of protein synthesis by the milk gland and the fat body of female *G. pallidipes* during the pregnancy cycle were studied by incubation with [^{35}S]methionine both *in vivo* and *in vitro*. The pattern of protein synthesis by the milk gland changed with the stage of the larva in the uterus. Very little synthesis occurred in the milk gland until the first-instar larva hatched. Then four

proteins (13, 16, 24 and 72 kDa) were prominently synthesised. As the larva matured, the synthesis of 19, 38, 40 and 72 kDa proteins increased, whereas that of the 13 and 24 kDa proteins decreased. Just before larviposition, only the 16 and 72 kDa proteins were still being synthesised. The milk gland secreted into the medium primarily the 13, 16, 19 and 72 kDa proteins, all of which were found in the larval gut after a 5 h pulse of labelled methionine *in vivo*. During most of the pregnancy cycle protein synthesis in the fat body was low compared to that of the milk gland and only small amounts of several low molecular weight proteins (less than or equal to 16 kDa) were released into the medium. But when a large third-instar larva was present in the uterus, the fat body synthesised and secreted a 72 kDa and a 15-17 kDa complex of proteins.
Authors' abstract

6442 **Tarimo Nesbitt, S.A., Gooding, R.H. and Rolseth, B.M., 1990.** Genetic variation in two field populations and a laboratory colony of *Glossina pallidipes* (Diptera: Glossinidae). *Journal of Medical Entomology*, **27** (4): 586-591.
Zoology Department, E.E. Just Building, Room 126, Howard Uni-versity, Washington, DC 20059, USA; Department of Entomology, University of Alberta, Edmonton, Alberta T6G 2E3, Canada; ibid.
G. pallidipes from Lambwe and Nguruman in Kenya and a laboratory colony, originating from flies collected at Lambwe, were compared for 12 enzyme-gene systems using polyacrylamide gel electrophoresis. In the Nguruman, Lambwe and colony flies, mean heterozygosities were 9.1, 15.3 and 16.5%, and polymorphism was observed in 3, 4 and 5 loci, respectively. Significant differences in number of gene products were observed between Nguruman and Lambwe flies at three loci, between Nguruman and colony flies at four loci, and between Lambwe and colony flies at two loci. Evidence is presented indicating that the locus for phosphoglucomutase is on the X chromosome, whereas loci for octanol dehydrogenase, malate dehydrogenase, phosphoglucose isomerase and a thoracic esterase (Esterase-1) are autosomal.
Authors' abstract

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES
[See also **13**: nos. 6435, 6437, 6452.]

6443 **Gouteux, J.P., 1990.** Current considerations on the distribution of *Glossina* in West and Central Africa. *Acta Tropica*, **47** (3): 185-187.

Centre ORSTOM, B.P. 893, Bangui, Central African Republic.

Tsetse distribution maps are a useful tool but need frequent up-dating. Attention is drawn to several points that need clarification. *Glossina calliginea* has recently been reported in the Congo, and the new species *G. frezili* in the Congo and Gabon. The presence of *G. medicorum* in Zaire and the Central African Republic, and also in Togo and Guinea (Conakry), should be investigated; the records of this species in Gabon refer to *G. frezili*. The presence of *G. calliginea* in Ghana and the Central African Republic, and of *G. tabaniformis* in Côte d'Ivoire, and in Guinea and Ghana, should be queried. *G. palpalis palpalis* may be the only subspecies of *G. palpalis* occurring in Benin; it definitely occurs in Côte d'Ivoire. *G. brevipalpis* may occur in Rwanda. Further studies on the distribution of the *fusca* group of tsetse by means of long-term sampling with traps is recommended.

6444 **Langley, P.A., Hargrove, J.W. and Wall, R.L., 1990.** Maturation of the tsetse fly *Glossina pallidipes* (Diptera: Glossinidae) in relation to trap-orientated behaviour. *Physiological Entomology*, **15** (2): 179-186.

Langley, Wall: TRL, ODA/University of Bristol, Langford, Bristol BS18 7DU, UK; Hargrove: ODA Tsetse Research Project, Box 8283, Causeway, Zimbabwe.

The fat-free dry weight or residual dry weight of the thorax (Trdw) increased linearly for the first 10 days of adult life in both sexes of *G. pallidipes* in the laboratory as their flight muscles developed. Using ovarian dissection to estimate the ages of nulliparous adult females of *G. pallidipes*, the Trdw was also found to increase linearly for at least 14 days in the field. Significant increases in pteridine fluorescence with age were measured in both laboratory-reared males and females of known chronological age and in wild-caught nulliparous females whose ages were estimated by ovarian dissection. A linear relationship existed between pteridine fluorescence and wing fray category for a wide range of ages of field-caught flies of both sexes. A stationary trap baited with ox odour was selective in that only the hungrier portion of the flies attracted to it actually entered. However, it was not selective in terms of the mean ages of flies caught. Comparisons were made of the age compositions of catches of both sexes of *G. pallidipes* attracted to a stationary trap baited with synthetic odours or to a mobile electrified net by plotting Trdw values against pteridine fluorescence. Nulliparous females were not attracted to the stationary trap, but were attracted to the mobile bait. Males of all ages appeared to be equally attracted to both. It is concluded that

nulliparous females do not respond to host odour stimuli until they are ready to mate, perhaps relying on the energy-conserving strategy of watching for a moving host animal before attempting to feed. Alternatively, synthetic odours may differ from natural host odours in terms of their attractiveness to young females. Males, however, probably exhibit dual sexual and feeding behaviour by responding to an odour-baited stationary trap even when young.
Authors' abstract

6445 **Mérot, P. and Filledier, J., 1989.** Résultats de recherches sur les écrans pour la lutte contre *Glossina tachinoides* en zone de savane soudano-guinéenne (Burkina Faso). [Results of research on screens for *G. tachinoides* control in the sudano-guinean zone (Burkina Faso).] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux,* **42** (4): 545-550. CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
Experiments on the behaviour of *G. tachinoides* towards the colours blue and white were carried out in Burkina Faso. The effectiveness of white fabric or black mosquito netting, used in conjunction with a blue screen, was compared. Results show that blue is more attractive than white for *G. tachinoides* but that white incites more flies to land. Black mosquito netting, invisible to tsetse, intercepts more flies than land on the white. The sex ratio is modified in favour of females. There is a large seasonal variability, and a progressive loss of efficacy of the white due to discoloration. The results are compared with those obtained for other species.
Authors' abstract

6446 **Republic of Malawi/Regional Tsetse and Trypanosomiasis Control Programme, 1990.** *National Tsetse and Trypanosomiasis Survey 1987-89. Final Report, 30 March 1990.* Düsseldorf, Federal Republic of Germany; GITEC Consult Gmbh. 65 pp.
The National Survey is part of the Initial Phase of the RTTCP and was undertaken to obtain a better understanding of tsetse distribution and of trypanosomiasis in man and his domestic animals, particularly cattle, in Malawi. The report reviews the primary physical and human elements of the environment in relation to the apparent current tsetse distribution, and presents detailed results of tsetse distribution and human and bovine disease incidence on a regional basis. A combined total of 15,618 trap/days at 984 sites caught 17,608 tsetse flies: 15,487 *Glossina morsitans morsitans*, 2046 *G. pallidipes* and 75 *G. brevipalpis*. The total area infested is estimated as 12,200 km^2. Eight primary tsetse foci were identified, with two small questionable secondary foci. In general, tsetse are confined to the most favourable habitat during the hot dry months (September to November). This is typically well developed woodland with some riparian forest and some wild animals. With the onset of the rains, tsetse can apparently extend

out into any area below 4000 ft (1200 m) where undisturbed natural vegetation provides shade and where suitable hosts (wild or domestic) occur. The greatest restraining factor is the human population. The major differences between the current tsetse distribution and that described by Mitchell and Steele in 1950-54 is the current presence of *G. pallidipes* in the Lengwe and Vwaza foci. Elsewhere, the Kasungu and Nkhotakota foci have both expanded southwards slightly and broadened laterally. The extent of the Lengwe and Mwabvi foci is little changed, and Majete remains questionable. Very distinct regressions are clear in the following places: *G. brevipalpis* in the Karonga area; the Dedza-Salima Escarpment area; and on the valley floor in the Salima area. The Phirilongwe focus is more restricted, and two large fly-belts in the Middle Shire Valley have apparently disappeared entirely. These regressions appear to be the result of settlement. In the bovine survey, a combined total of 27,809 bloodsmears revealed 538 cases of trypanosomiasis, predominantly *Trypanosoma congolense*. Some 85 cases of sleeping sickness were detected during the survey period.

6447 **Rogers, D.J. and Randolph, S.E., 1990.** Estimation of rates of predation on tsetse. *Medical and Veterinary Entomology*, **4** (2): 195-204.

Department of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS, UK.

The levels of natural predation of puparial and adult tsetse flies, *Glossina pallidipes*, were investigated at Nguruman, Kenya, during January 1989. Puparial experiments involved the production, by individually tubed female flies, of naturally deposited, unhandled puparia in soil cores; handled puparia were obtained from groups of caged flies kept in the normal way. Equal numbers of handled and unhandled puparia were planted out at different densities (1, 2, 4 or 8 per linear metre) in fifty-one natural puparial sites in four major vegetation types. After 10 days puparia were recovered using a soil corer and sieving system. Average predation rates (adjusted for the displacement of puparia by vertebrate activity at the puparial sites) were 9.4% and 7.8% for the two types of puparia during the experiment, equivalent to an average loss of 23.7% of all puparia during a normal 30-day development period. Maximum potential predation rates of adult flies were investigated by pinning freshly killed adults at densities of 1, 2, 4 or 8 per m^3 to natural vegetation and scoring the results after 24 h. 70% of flies were attacked during this time, by a variety of predators, thought to include both vertebrates and invertebrates. No density dependence was detected in the experiments, either because natural puparial densities were too low for it to occur at this stage of the

life cycle or because adult predation levels were too high for it to be detected. Present results are compared and contrasted with previous results for this and another species of tsetse. Calculations of the life-time fertilities of female tsetse suggest that the levels of puparial predation revealed by the present experiments are entirely realistic. Behaviour of the adult flies allows them to escape most of the considerable predation pressure under which they live. How they do so remains a mystery.
Authors' abstract

6448 **Warnes, M.L., 1990.** The effect of host odour and carbon dioxide on the flight of tsetse flies (*Glossina* spp.) in the laboratory. *Journal of Insect Physiology*, **36** (8): 607-611.
TRL, ODA/University of Bristol, Langford House, Langford, Bristol BS18 7DU, UK.

Video recordings of the flight behaviour of *Glossina morsitans morsitans* and *G. pallidipes* were made in a wind tunnel. The flight speed of males and females of both species was significantly reduced when ox odour was added to the airstream. In addition the number of flights which turned through > 90□, over the period recorded, was greater when ox odour was present. Comparison of those flights that turned through < 90□ (`straight' flights) with or without odour, revealed that the reduction in flight speed was not caused by the increase in turning. Addition of carbon dioxide to the airstream also resulted in significantly reduced flight speeds by male and female *G. pallidipes*. The flight speed decreased in proportion to the log of the carbon dioxide concentration from 0.04% (control) up to 1.0% at source. In addition, with increasing concentrations of carbon dioxide the proportion of flights that turned also increased significantly ($P < 0.01$) up to a concentration of 1%. The results are discussed in the light of current theories of host-location and the likely behavioural mechanisms used by tsetse to find hosts.
Author's abstract

6449 **Williams, B., Brightwell, R. and Dransfield, R., 1990.** Monitoring tsetse fly populations. II. The effect of climate on trap catches of *Glossina pallidipes*. *Medical and Veterinary Entomology*, **4** (2): 181-193.
ICIPE, P.O. Box 30772, Nairobi, Kenya.

In part I (see following abstract) it was shown that the sampling distribution of trap catches of tsetse flies, *G. pallidipes*, at Nguruman, Kenya, using unbaited biconical traps follows a Poisson distribution. In this paper we examine the effect of humidity and temperature on day-to-day and seasonal variations in

the trap catches. It is shown that the seasonal variation is significantly correlated with maximum daily temperature, the catches increasing with temperature when the maximum temperature is below 34□C and decreasing with temperature when it is above 34□C. The correlation between trap catches and relative humidity is not as good as the correlation with the maximum temperature, and the two together do not improve the fit to the trap catches. The day-to-day variation is significantly greater than the intrinsic variation due to the stochastic nature of the sampling process and for some traps it is correlated with temperature and humidity. An autoregressive model gives a half-life for the decay in departures from the mean of about 1 day and it is suggested that this indicates the movement of flies in response to animal movement or to climatic factors other than temperature or humidity. After removing the temperature-dependent part of the seasonal variation and the autoregressive component of the data, the male and female catches are still significantly correlated.
Authors' abstract

6450 **Williams, B., Dransfield, R. and Brightwell, R., 1990.** Monitoring tsetse fly populations. I. The intrinsic variability of trap catches of *Glossina pallidipes* at Nguruman, Kenya. *Medical and Veterinary Entomology*, **4** (2): 167-179.
ICIPE, P.O. Box 30772, Nairobi, Kenya.
During 1986 the tsetse fly *G. pallidipes* was monitored daily at Nguruman, south-western Kenya, using three unbaited biconical traps. This was done to investigate the nature and causes of daily variation in trap catches. The variability of the observed catches was compared to a model which includes the trapping probability and the stochastic variation in the sex-ratio. By comparing the catches of male and female flies we are able to establish the sampling distribution of the trap catches. In addition to seasonal changes in the trap catches, day-to-day variations are observed and these are considered greater than the variation arising from the stochastic nature of the sampling process. Recommendations are made in relation to sampling tsetse fly populations.
Authors' abstract

3. tsetse control (including environmental side effects)

[See also **13**: nos. 6426, 6427, 6432.]

6451 **Cuisance, D., 1989.** Le piégeage des tsé-tsé. [The trapping of tsetse flies.] *Etudes et Synthèses de l'IEMVT*, no. 32: 172 pp.

IEMVT, 10 rue Pierre Curie, 94704 Maisons Alfort Cedex, France.
This handbook describes and illustrates the different types of traps and screens which have been developed from 1930 to the present day and discusses the factors, both tsetse- and trap-related (including odour attractants and insecticides), which affect their functioning. The effect on a tsetse population of using traps or screens which capture or kill the flies is compared with that of using traps which sterilise and release the flies. The use of targets to survey tsetse populations, as a barrier against reinvasion, and for the control of human and animal trypanosomiasis (sometimes integrated with other methods such as aerial spraying or SIT) is reviewed, and the costs, and the advantages and disadvantages, are discussed. In spite of its relative simplicity and cheapness, trapping has its limitations, more particularly those related to the human milieu: thus settled agricultural communities more easily perceive the need for tsetse control and accept the discipline involved in trapping than do nomadic pastoralists. The author describes the necessary stages in a control campaign for pastoralists in which information and training play a vital part in encouraging their participation. The use of livestock themselves as `living targets', with insecticidal dips or pour-on formulations, ear-tags and invermectin, is also discussed. National and international considerations suggest that the future emphasis will be on tsetse control rather than eradication. Research should aim to increase the efficiency of targets so as to reduce their density per km^2 and thus make easier their adoption by local communities, leading eventually to reduced trypanocide use.

6452 **Filledier, J. and Mérot, P., 1989.** Pouvoir attractif de l'association m-crésol 1-octen-3-ol dans un type de diffuseur pratique pour *Glossina tachinoides* au Burkina Faso. [Attractive power of a combination of m-cresol and 1-octen-3-ol in a dispenser for *G. tachinoides* in Burkina Faso.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (4): 541-544.
CRTA, B.P. 454, Bobo-Dioulasso 01, Burkina Faso.
Preliminary field trials have shown that some phenolic compounds derived from cattle urine are attractive to *G. tachinoides*, and further studies on the combination of such compounds with other products showed m-cresol and 1-octen-3-ol in a ratio of 3:1 to be the most effective mixture. It was then necessary to find a dispenser which would be easy to use, cheap, and would remain effective for a

comparable length of time to the insecticides used to impregnate the targets used in control campaigns. A long-lasting flexible polythene tube dispenser, of 4 ml capacity, containing the attractive mixture was placed at the base of the support of each biconical trap. Captures of *G. tachinoides* were increased by 2.5 times for a period of at least 10 weeks, indicating that the dispenser would be suitable for use in control campaigns against *palpalis* group tsetse. Each dispenser costs 230 F CFA (June 1988). Differences from the results of other research teams are discussed. Natural urines are too variable for use as attractants in Burkina Faso.
Based on authors' abstract

6453 **Food and Agriculture Organization of the United Nations, 1989.** *Integrated tsetse control and rural development*. (Report of a Joint Meeting of the FAO Panels of Experts on Technical, Ecological and Development Aspects of the Programme for the Control of African Animal Trypanosomiasis and Related Development, Accra, Ghana, 7-9 November 1988.) Rome; FAO. 42 pp.
FAO, Via delle Terme di Caracalla, 00100 - Rome, Italy.
The Experts reviewed recent developments in tsetse control techniques and discussed their future role as part of integrated trypanosomiasis control in the development of African rural economies. Vector control is only one of the available strategies to control trypanosomiasis and should be integrated with other approaches such as the use of trypanocidal drugs and trypanotolerant cattle. In agricultural economies, the development of pasture and water resources is often as important as disease control, and tsetse control can no longer be seen as an end in itself. Project objectives first need to be defined: is sustainable eradication feasible or must an on-going commitment to control be recognised? It is relatively easy to kill tsetse but much more difficult to prevent reinvasion. After eradication techniques have been used, any residual tsetse populations must be located and dealt with promptly and adequate monitoring continued. High-cost techniques, such as SIT or aerial spraying, may be economically justified if eradication is feasible in the short term. When there is a continuing commitment to control, low-cost methods, such as the use of visual and olfactory attractive devices, are more appropriate. In planning campaigns, expenditures should be justified through the anticipated increased economic and social benefits. Analysis of benefits must take account of direct losses from trypanosomiasis, treatment costs

saved, the potential of new land for development, the value of the introduction of draught animals and of livestock products. Reclaimed areas need to be fully consolidated through the support of integrated area development and settlement, otherwise they will be lost through reinvasion. It is important that regional programmes for trypanosomiasis control or eradication be developed as an element in rural development, necessitating greater collaboration between governments and assistance agencies. Adequate staff training is an important factor. Much information is now available on the, generally limited, environmental impact of the various methods of tsetse control. Such concerns must not detract from the wider issue of ensuring that tsetse control does not result in an acceleration of land degradation through uncontrolled land use. Annexes to the report include details of attractants, dose rates and dispensers, and of the dark ground/phase contrast buffy coat technique for trypanosome detection.

6454 **Harris, E.G., Cooper, J.F., Flower, L.S., Smith, S.C. and Turner, C.R., 1990.** Toxicity of insecticide aerosol drops to tsetse flies. I. Some effects of temperature, formulation and drop size. *Tropical Pest Management*, **36** (2): 162-165.

NRI, Central Avenue, Chatham Maritime, Chatham, Kent, ME4 4TB, UK.

A technique for applying mature drops of insecticide aerosols, the Mature Aerosol Placement (MAP) technique, has been used in laboratory bioassays with tsetse flies (*Glossina morsitans morsitans*) to study a number of variables which could affect the efficacy of aerial applications in the field. Deltamethrin was more toxic to tsetse flies than endosulfan and this superiority was greater at a lower temperature, with factors of ∃ 26 at 25□C and ∃ 64 at 10□C. Toxicities of endosulfan-deltamethrin and endosulfan-alphacypermethrin mixtures were not affected by the different temperatures. The endosulfan-deltamethrin mixture was superior to the endosulfan-alphacypermethrin mixture by factors of ∃ 1.4 at 10□C and ∃ 2.0 at 25□C. The conventional e.c. formulation of endosulfan was less effective than the special T formulation, but the presence of emulsifiers in the T formulation did not affect its toxicity. No clear differences in LD_{50}s (expressed as active ingredient) could be demonstrated between 15 μm and 20 μm drops of deltamethrin or of PP321 (lambdacyhalothrin).

Authors' abstract

6455 **Holloway, M.T.P., 1989.** Alternatives to DDT for use in ground spraying control operations against tsetse flies (Diptera: Glossinidae). *Transactions of the Zimbabwe Scientific Association*, **64** (4): 33-40. TRL, ODA/University of Bristol, Langford, Bristol BS18 7DU, UK.
Increasing pressure to reduce the use of DDT in tsetse control operations because of environmental considerations has led to a search for suitable alternatives. The present study indicates that synthetic pyrethroids such as deltamethrin, alphacypermethrin and lambda-cyhalothrin, sprayed at 0.05-0.2% a.i., could provide effective control of tsetse in ground spraying operations in Zimbabwe. High cost may be a factor limiting the large-scale use of synthetic pyrethroids.
Author's abstract

6456 **Langley, P.A., Felton, T., Stafford, K. and Oouchi, H., 1990.** Formulation of pyriproxyfen, a juvenile hormone mimic, for tsetse control. *Medical and Veterinary Entomology*, **4** (2): 127-133.
TRL, University of Bristol, Langford House, Langford, Bristol BS18 7DU, UK; ibid.; ibid.; Sumitomo Chemical Company, 15 5-Chome, Kitahama, Higashi-Ku, Osaka, Japan.
A topical dose, in 1 µl acetone, of 0.02 µg 2-[1-methyl-2-(4-phenoxyphenoxy) ethoxy] pyridine, the juvenile hormone mimic pyriproxyfen (S-31183, Sumitomo Chemical Co.), caused an adult female tsetse, *Glossina morsitans morsitans*, to produce non-viable offspring for the whole of her life. Using ^{14}C labelled pyriproxyfen it was determined that as little as 0.001 µg transferred to the *in utero* larva was sufficient to arrest development in the pupal stage. A formulation in vegetable oil was prepared for treating black cotton cloth targets which caused females to pick up 0.1 µg a.i. by tarsal contact during 1 min of exposure. Males exposed similarly for between 1 and 5 min transferred up to 0.016 µg a.i. to females if they mated immediately after treatment. Doses as low as 0.01 µg in 10 µl oil cm^{-2} on black cotton cloth targets caused females to produce non-viable offspring for at least two reproductive cycles following exposure. However, a dose of 0.1 µg in 10 µl oil cm^{-2} was necessary for an exposed male to cause disruption of the reproductive potential of his mate. This juvenile hormone mimic has potential to induce sterility via both sexes of tsetse using treated targets or traps under field conditions.
Authors' abstract

6457 **Laveissière. C. and Grébaut, P., 1990.** Recherches sur les pièges à glossines (Diptera: Glossinidae). Mise au point d'un modèle économique: le piège `Vavoua'. [Research on tsetse fly traps: development of an

economic model, the Vavoua trap.] *Tropical Medicine and Parasitology*, **41** (2): 185-192.
IPR/OCCGE, B.P. 1500, Bouaké, Côte d'Ivoire.
Traps are a very effective and cheap method of controlling tsetse flies but there is a need to reduce their cost further in view of the large numbers needed in the forest zone. Research on *Glossina palpalis palpalis* behaviour in Côte d'Ivoire has resulted in a new model of trap, the `Vavoua' trap, being developed from the biconical and pyramidal traps. It has a similar efficiency but costs only half as much (1139 F CFA without manpower, i.e. 3.55 US $, compared with 6.68 and 6.98 US $ respectively for the biconical and pyramidal traps). The Vavoua trap has an upper cone of nylon mosquito netting, kept rigid by a ring of galvanised iron wire round its lower edge, above three screens (length 45 cm), sewn at 120□, composed of a blue external part (cotton/polyester) and a black internal part (nylon) with a blue/black ratio of 2. The low cost of the traps, and the possibility of the farmers themselves reimpregnating them with insecticides, make their use feasible for large-scale tsetse control by rural communities in the forest zone. Based on authors' abstract

6458 **Onoviran, O., Hamman, H.J., Adegboye, D.S., Ajufo, J.C., Chima, J.C., Makinde, A.A., Pam, G. and Garba, A., 1985.** A bacterium pathogenic to tsetse fly (*Glossina palpalis*). *Tropical Veterinarian*, **3** (1-4): 22-24.
Onoviran, Ajufo, Chima, Makinde, Pam, Garba: National Veterinary Research Institute, Vom, Nigeria; Hamman: Biological Control Unit, Federal Department for Pest Control, Vom, Nigeria; Adegboye: Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria. (Correspondence to Chima.)
Various laboratory colonies of *G. palpalis* died 24 h after feeding on blood through a silicone membrane. The bacterium *Serratia marcescens* was isolated from most of the flies. In an experimental infection, 65-90% of the flies died within 4 days of feeding on infected blood compared with only 15% of flies fed on uninfected blood.

6459 **Semple, J.L. and Forno, I.W., 1990.** Susceptibility of the salvinia biological control agent *Cyrtobagous salviniae* (Coleoptera: Curculionidae) to chemicals used to control tsetse fly (*Glossina morsitans*) (Diptera: Glossinidae)) in Botswana. *Bulletin of Entomological Research*, **80** (2): 233-234.
Department of Primary Industries, Animal Research Institute, Yeerongpilly, Queensland 4105, Australia; CSIRO, Division of Entomology, Long Pocket Laboratories, Private Bag no. 3, Indooroopilly, Queensland 4068, Australia. (Correspondence to Forno.)
The effects of endosulfan and deltamethrin, chemicals used to control the tsetse fly *G. morsitans*, were tested against *Cyrtobagous salviniae*, a biological control agent for the floating fern *Salvinia molesta*. The weevil was very susceptible to deltamethrin and less susceptible to endosulfan. The use of these chemicals for control of *G. morsitans* in Botswana, where the biological control agent is active, is discussed.
Authors' abstract

6460 **World Health Organization, 1990.** Pesticide application equipment for vector control. (Twelfth report of the WHO Expert Committee on Vector Biology and Control, Geneva, 4-11 April 1989.) *WHO Technical Report Series*, no. 791: 58 pp. (ISBN 92 4 120791 4. Price Sw. fr. 8.)
WHO, 1211 Geneva 27, Switzerland.
The report (1) discusses the present status of pesticide application equipment; (2) reviews new trends in the development of equipment and materials; (3) considers the importance of integrated control; (4) outlines future strategies and makes recommendations

for the development of pesticide application equipment for use in the public health sector, with special reference to the safe use of such equipment in community-based vector control; and (5) reviews the role of WHO collaborating centres dealing with the subject.

4. epidemiology: vector-host and vector-parasite interactions

[See also **13**: nos. 6426, 6438, 6440.]

6461 **Filledier, J. and Mérot, P., 1989.** Étude de l'attractivité de solutions isolées par fractionnement de l'urine de bovin Baoulé pour *Glossina tachinoides* Westwood, 1850 au Burkina Faso. [Study of the attractiveness of solutions isolated by fractionation from the urine of Baoulé cattle for *G. tachinoides* in Burkina Faso.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (3): 453-455.

CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.

Baoulé urine has been shown to be superior to that of Zebu cattle as an olfactory attractant for *G. tachinoides*. Fractionation of this urine was undertaken and the different fractions were tested for their attractiveness to tsetse using a latin square arrangement of biconical traps. All fractions tested were found to be more attractive than the control (unbaited) but less attractive than the unfractionated urine. The phenolic fraction was nearest in attractiveness to the unfractionated urine.

6462 **Küpper, W., Staak, C., Kröber, T. and Späth, J., 1990.** Natural hosts of *Glossina tachinoides* (Diptera: Glossinidae) in northern Côte d'Ivoire. *Tropical Medicine and Parasitology*, **41** (2): 217-218.

Küpper, Kröber, Späth: Projet de Lutte contre la Trypanosomiase Animale et les Vecteurs, B.P. 3301, Bouaké, Côte d'Ivoire; Staak: Institut für Veterinärmedizin des Bundesgesundheitsamts, Berlin, Federal Republic of Germany.

Bloodmeal samples of *G. tachinoides* were taken at the Comoé National Park in northern Côte d'Ivoire. The total of 1154 identified samples consisted mainly of ruminants (37%, whereof bushbuck represented 57%), hippopotamus (34%), and monitor lizard (19%). These proportions changed with the seasons. In the rainy season the proportion of hippopotamus samples increased, whereas that of reptiles decreased. Primate blood was identified only in samples taken in the dry season. Authors' abstract

6463 **Majiwa, P.A.O. and Otieno, L.H., 1990.** Recombinant DNA probes reveal simultaneous infection of tsetse flies

with different trypanosome species. *Molecular and Biochemical Parasitology*, **40** (2): 245-253.
National Cancer Institute, Frederick Cancer Research Facility, Building 539, P.O. Box B, Frederick, MD 21701, USA; ICIPE, P.O. Box 30772, Nairobi, Kenya.
The utility of recombinant DNA probes in the detection of natural trypanosome infection of tsetse flies has been assessed in Lambwe Valley, near the shores of Lake Victoria, Kenya. The tsetse flies were surveyed during two different seasons in 1988. Three different probes used each contained highly repetitive DNA sequences specific for a species or subspecies of trypanosomes of the *Nannomonas* subgenus. A fourth probe contained repetitive sequences common to trypanosome species of the *Trypanozoon* subgenus. Mixed mature or immature infections were detected in a variety of combinations in different individual tsetse flies. Such infections were detected in both the guts and mouthparts of some tsetse flies. Simultaneous natural infection of tsetse with the savanna type *Trypanosoma congolense* and Kilifi type *T. congolense*, *T. congolense* and *T. brucei*, or *T. congolense* and *T. simiae* were demonstrated. The probes have thus been used to demonstrate the presence in Lambwe Valley, south-western Kenya, of a type of *T. congolense* first observed among trypanosome isolates obtained from sentinel cattle exposed to natural infection on a ranch at Kilifi on the Kenya coast. This type of *T. congolense* appears not to be confined to the coastal region nor to any particular species of tsetse flies and may contribute significantly to livestock morbidity in other areas of eastern Africa. In the Kilifi area, *T. congolense* was found primarily in *Glossina austeni*: in Lambwe valley, it was found in *G. pallidipes*.
Authors' abstract

5. human trypanosomiasis
(a) SURVEILLANCE
[See also **13**: nos. 6433, 6446.]
6464 **Milleliri, J.-M. and Tirandibaye, H.N., 1989.** Historique de la trypanosomiase humaine africaine dans le Moyen-Chari (Tchad). [Historical record of human African trypanosomiasis in Moyen-Chari (Chad).] *Médecine tropicale*, **49** (4): 381-387.
Section 4, Médecine Préventive Rurale, B.P. 84, Sarh, Chad.
The first case of sleeping sickness in Moyen-Chari in southern Chad was recorded in 1914, although the disease had undoubtedly been present in the area for a long time. The period 1920-1927 was marked by great activity, directed by Dr Muraz who set up mobile teams which travelled 30-40 km daily in search of new cases. Clinical suspects were confirmed by lymph gland

aspiration and treated with Atoxyl. In some villages in 1921, up to 44% of the inhabitants were infected, and, by the end of 1926, 6351 new cases had been recorded. The situation necessitated the creation of an isolation camp, a treatment centre, an observation post and 12 special villages where patients could gather for treatment by mobile teams. During the period 1928-1960 the sleeping sickness control services were reorganised in various ways, but continued to function well in spite of some difficulties during the Second World War. Pentamidine was used for treatment from 1945, and Arsobal was introduced in 1953. The number of new cases fell from 1991 in 1930 to 12 in 1959. By 1963 the Moyen-Chari focus was considered almost extinct. In 1967, a survey of 135,780 people uncovered 11 new cases. Mass chemoprophylaxis with pentamidine, which had been stopped in 1957, was restarted, and by 1975 only six known cases remained. In 1978 an amazing 235,633 people were screened, and only 2 new cases found. In 1988, IFI, CATT and other modern diagnostic methods became available: in this year 32 new cases were diagnosed. Thus, sleeping sickness, which seemed on the point of extinction in Moyen-Chari in 1978, is still a reality in this focus.

6465 **Ominde, S.H., 1989.** Demography and vector-borne diseases in Kenya. *In*: Service, M.W. (ed.), *Demography and vector-borne diseases* (Boca Raton, Florida, USA; CRC Press), pp. 317-332.

Population Institute, University of Nairobi, Nairobi, Kenya.

A short section on trypanosomiasis discusses the history of the disease in Kenya. During the first half of this century, sleeping sickness in Kenya was due to *Trypanosoma brucei gambiense*, the parasite probably being imported from the Congo Basin and southern Sudan, with *Glossina fuscipes* being the only vector. Kenya experienced successive waves of sleeping sickness outbreaks coming from Uganda via the dense forests around Lake Victoria and its fishing islands. From 1940, migrants from Tanzania to the sugar plantations of Busoga in Uganda introduced *T. b. rhodesiense* whose principal vector was *G. pallidipes*, and outbreaks of this type of sleeping sickness have recurred to the present day.

6466 **Sicard, J.M., Le Mao, G., Merlin, M. and Jeandel, P., 1989.** Lutte contre la trypanosomiase humaine africaine dans le foyer de Douala (République de Cameroun). Intérêt du Testryp C.A.T.T. [Control of African human trypanosomiasis in the Douala focus (Cameroon).

Evaluation of the Testryp CATT.] *Médecine tropicale*, **49** (4): 375-379.

Section Provinciale de Médecine Préventive du Littoral de Douala, Cameroon; Organisation de Coordination pour la Lutte contre les Grandes Endémies en Afrique Centrale; Institut de Médecine Tropicale du Service de Santé des Armées, Le Pharo, Marseille, France; Hôpital d'Instruction des Armées, A. Laveran, Marseille, France.

The Douala trypanosomiasis focus records 10-30 new cases per year. Since it had not been evaluated for 13 years, the authors carried out a survey in 1985 to assess the epidemiological importance of trypanosomiasis in the focus and also to evaluate Testryp CATT as a tool for mass immunological screening. Altogether 11,614 people were tested (52.2% of the total population). There were 39 clinical suspects of whom 5 were CATT positive, representing a 0.04% sero-positive rate for the population visited. All these suspected cases were examined for trypanosomes and found to be negative. Some bias in the population sampled (age, type of population) makes these results less reliable than they might be, but it appears that the focus is stable and can be considered a residual focus of weak endemicity. Some difficulty was experienced at the start of using Testryp CATT when 29 false positives were recorded (not confirmed by indirect immunofluorescence). When the test card was examined under the microscope, it became clear that particles of cotton or dust were responsible for errors of interpretation by the naked eye. Apart from this difficulty, Testryp CATT was found to be easy to use and rapid (55 persons per hour tested on average), though its cost needs to be carefully weighed before use in an area of low trypano-somiasis prevalence.

6467 **Stanghellini, A., Josse, R., Cattand, P., Bopang, T., Tirandibaye, N., Emery, P., Milleliri, J.M. and Cordoliani, G., 1989.** Aspects épidémiologiques de la trypanosomiase humaine africaine dans le sud de Tchad. [Epidemiological features of human trypanosomiasis in southern Chad.] *Médecine tropicale*, **49** (4): 395-400.

OCEAC, Service National de Trypanosomiase, Libreville, Gabon; Service Epidémiologique de l'OCEAC, Yaoundé, Cameroon; Parasitic Diseases Programme, WHO, Geneva, Switzerland; Secteur des Grandes Endémies de Moundou, Chad (Bopang, Emery); Secteur des Grandes Endémies de Sarh, Chad (Tirandibaye, Milleliri); Direction de la Médecine Préventive et de la Santé Rurale, Ministère de la Santé Publique, N'Djaména, Chad.

A period of political and military instability from 1978 to 1982 disrupted health care in southern Chad and caused a large part of the population to flee from their villages and take refuge in remote areas or in neighbouring countries. No large-scale trypanosomiasis survey had taken place since 1978 so a survey was undertaken in 1988 to investigate the situation in three foci in south-western Chad. In Tapol, surveys of 13 villages in 1985, 1986 and 1987 had found 118, 119 and 178 new cases respectively. In the 1988 survey, 411 out of 1982 people were positive by CATT, of whom 126 were positive by lymph gland aspiration, a prevalence of 6.3%. Indirect immunofluorescence tests carried out on 80 of the serological suspects showed high levels of serum antibodies, indicating probable infection. This finding, together with under-representation of the active part of the population, suggests an overall prevalence considerably higher than 6.3%. In Timbéri, where the prevalence in 1978 had been 3%, four villages were surveyed. Only 3 cases were found out of 955 people tested (prevalence 0.3%). In Ranga, where the prevalence in 1978 had been 17.2%, 32 new cases were parasitologically confirmed out of 1404 persons tested (prevalence 2.3%). Considerable variation was seen between the seven villages visited. Entomological surveys in Tapol focus found very low dry-season populations of *Glossina f. fuscipes* (0.2-9 apparent density per trap) using biconical traps but higher apparent densities (11-62) using pyramidal traps. In an attempt at tsetse control, 77 blue screens were placed in the villages but were not a technical success. In addition to these three foci, 16 villages in Moïssala focus were surveyed. Of 2947 people tested, 176 were CATT positive or uncertain, 2 positive by lymph gland aspiration and 17 by mAEC.

6468 **Wéry, M., 1990.** Les lents progrès du contrôle de la maladie du sommeil. [Slow progress in the control of sleeping sickness.] *Annales de Parasitologie humaine et comparée*, **65** (Suppl. 1): 89-93.

Institut de Médecine Tropicale, 155 Nationalestraat, B-2000 Antwerp, Belgium.

For almost a century, the same methods have been used to try to control the foci of *Trypanosoma brucei gambiense* trypanosomiasis. Technical improve-ments are restricted to (1) the introduction of serological diagnosis, bringing a marked gain in sensitivity as compared to lymphnode palpation, (2) new parasite concentration methods for corroborating the diagnosis,

and (3) the design of simpler efficient tsetse traps. However, none of these methods, simple though they are, is easily applied in the field conditions where *T. b. gambiense* is transmitted. Much progress has been made in the last few years in understanding the molecular biology of the trypanosome, but this has not yet resulted in any striking improvement in active case detection or in the treatment of patients and healthy carriers.
Author's abstract

(b) PATHOLOGY AND IMMUNOLOGY
(c) TREATMENT

6. animal trypanosomiasis

(a) SURVEY AND DISTRIBUTION

[See also **13**: no. 6446].

6469 **Gueye, A., Mbengue, M. and Diouf, A., 1989.** Tiques et hémoparasitoses du bétail au Sénégal. IV. La zone sud-soudanienne. [Ticks and haemoparasitic infections of livestock in Senegal. IV. South-Sudanian zone.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (4): 517-528.

ISRA-LNERV, Département de Recherches sur les Productions et la Santé Animales, B.P. 2057, Dakar-Hann, Senegal.

Of 200 each of cattle, sheep and goats, only one sheep and two goats were found to be infected with trypanosomes (*Trypanosoma vivax, T. congolense*).

6470 **Otesile, E.B., 1990.** Survival and infectivity of *Trypanosoma brucei* in refrigerated pig blood. *Veterinary Parasitology*, **36** (3-4): 333-336.

Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.

T. brucei parasites survived for 72 h or longer in refrigerated pig blood. The survival period was directly proportional to the initial parasite concentration of the sample. Infectivity of the parasites declined faster than survival, being less than 1 per 10^5 motile organisms at 72 h. The stage of infection in the pig (early *v*. late) did not appear to influence subsequent survival periods or infectivity of the parasites *in vitro*.

Author's abstract

(b) PATHOLOGY AND IMMUNOLOGY

6471 **Adeyemo, O., Oyejide, A. and Agbedana, O., 1990.** Plasma testosterone in *Trypanosoma congolense*-infected and *Trypanosoma brucei*-infected West African dwarf rams. *Animal Reproduction Science*, **22** (1): 21-26.

Departments of Veterinary Anatomy (Adeyemo), Veterinary Pathology (Oyejide) and Chemical Pathology (Agbedana), University of Ibadan, Ibadan, Nigeria.

To investigate the testicular endocrine changes associated with mixed trypanosome infection, rams of the West African dwarf (WAD) breed were inoculated with *T. congolense* and *T. brucei*. Serum testosterone concentrations were determined weeks pre- and post-infection, and after subsequent treatment of rams with Berenil. Testosterone concentration (22.6 □ 0.2 ng/ml) showed a progressive decline from 5 weeks post-infection to 0.6 □ 0.1 ng/ml by the 10th week in the surviving rams. After Berenil treatment, testosterone level rose only slightly to 1.1 □ 0.1 ng/ml 5 weeks

post-treatment. The study shows that testicular endocrine activity is altered during trypanosomiasis. The restoration of testicular endocrine function after recovery of rams from chronic mixed trypanosome infection is slow.
Authors' abstract

6472 **Agu, W.E. and Bajeh, Z.T., 1986.** An outbreak of fatal *Trypanosoma brucei brucei* infection of pigs in Benue State of Nigeria. *Tropical Veterinarian*, **4** (1-2): 25-28.
NITR, Vom, Plateau State, Nigeria.
An outbreak of porcine trypanosomiasis characterised by anorexia, emaciation, anaemia and death within 1-3 months was reported and subsequently investigated in Mkar, Gboko, Benue State, Nigeria. *T. b. brucei* was isolated from one of the pigs as the causative agent. The *T. b. brucei* isolated from this case caused remarkable loss of weight as well as decreased PCV in Large White piglets inoculated intramuscularly with the parasites. The experimentally infected piglets died 2 months after patent infection. It was concluded that *T. b. brucei* in pigs could be of much economic importance.
Authors' abstract

6473 **Agyemang, K., Dwinger, R.H., Jeannin, P., Leperre, P., Grieve, A.S., Bah, M.L. and Little, D.A., 1990.** Biological and economic impact of trypanosome infections on milk production in N'Dama cattle managed under village conditions in The Gambia. *Animal Production*, **50** (3): 383-389.
ITC, P.M.B. 14, Banjul, Gambia.
Over a 3-year period, productivity characteristics and criteria of trypanosomiasis incidence and severity have been monitored by monthly examination of individual N'Dama cattle in villages in The Gambia. From this database, 60 lactating cows in which *Trypanosoma congolense* or *T. vivax* had been detected on blood examination (group 1) were compared with 50 cows which had not been found infected with trypanosomes during the monitoring period (group 2). The latter were selected on the basis of comparability of age and stage of lactation to those of group 1 for examining the effect of trypanosome infections on the quantity of milk extracted for human consumption, and on the growth of their sucking calves. Data from a 6- to 7-month period were examined in the analysis. The quantity of daily milk extracted during the first month of infection (group 1) decreased by proportionately 0.25 in comparison to the amount extracted during the preceding month when parasites were not detected. The corresponding figure in the uninfected controls (group 2) was 0.02. The mean daily milk extracted for human consumption from uninfected cows during a 6-month period was proportionately 0.26 higher than the mean for the infected cows. Growth rates of calves sucking infected and uninfected dams were similar. These observations indicate that infection with pathogenic trypanosomes of

lactating N'Dama cattle causes a reduction in milk production. In economic terms, it was estimated that the decline in milk extracted for human consumption due to trypanosome infections amounted to an average of £1 per month per cow.
Authors' abstract

6474 **Anene, B.M. and Omamegbe, J.O., 1984.** Abortion associated with *Trypanosoma brucei* infection in an Alsatian bitch. A case report. *Tropical Veterinarian*, **2** (4): 211-213.
Veterinary Teaching Hospital (Anene) and Department of Veterinary Surgery and Obstetrics (Omamegbe), University of Nigeria, Nsukka, Nigeria.
A case of abortion probably due to *T. brucei* infection is reported in an Alsatian bitch. The pyrexia, severe anaemia and heavy parasitaemia observed 4 days after the abortion and the hypoglycaemia and tissue invasion associated with trypanosomiasis (singly or in combination) may have played various roles in the pathogenesis of the abortion. This present finding suggests that trypanosomiasis could pose serious problems for dog breeding in endemic areas.
Authors' abstract

6475 **Emeribe, A.O., Anosa, V.O., Inyang, A.L. and Essien, E.M., 1990.** Platelet aggregation inhibition in *Trypanosoma vivax* infection of sheep. *Central African Journal of Medicine*, **36** (1): 1-4.
Department of Haematology, College of Medical Sciences, University of Calabar, Calabar, Nigeria; Departments of Veterinary Pathology (Anosa), Pharmacology (Inyang) and Haematology (Essien), University of Ibadan, Ibadan, Nigeria.
We have investigated *in vitro* platelet aggregation in platelet rich plasma (PRP) from *Trypanosoma vivax*-infected and control sheep using the dual channel Payton Aggregometer. Final concentrations of the following inducing agents were used: 1.2 μmol ADP, 6.2 μg collagen, 1.2 μg ristocetin and 1 unit thrombin. There was a significantly reduced aggregation of platelets from infected sheep (43.4 □ 1.1% at week 3 post-infection when compared with control sheep PRP: 95.0 □ 1.0%; $P < 0.001$) using ADP. Similar differences were obtained with the other inducing agents. Preliminary ^{14}C-5HT uptake and release studies showed that there was a difference in the uptake of label between platelets from infected (18.6%) and control (28.4%) sheep. However, when release was induced, comparable results were obtained for both infected and control sheep platelets. It is concluded that the degree of aggregation inhibition varies directly with the level of parasitaemia.
Authors' abstract

6476 **Grootenhuis, J.G., Dwinger, R.H., Dolan, R.B., Moloo, S.K. and Murray, M., 1990.** Susceptibility of African buffalo and Boran cattle to *Trypanosoma congolense* transmitted by

Glossina morsitans centralis. *Veterinary Parasitology*, **35** (3): 219-231.
National Veterinary Research Centre, KARI, P.O. Kabete, Kenya; ITC, P.M.B. 14, Banjul, Gambia; P.O. Box 24437, Nairobi, Kenya; ILRAD, P.O. Box 30709, Nairobi, Kenya; Department of Veterinary Medicine, University of Glasgow, Bearsden Road, Glasgow G61 1QH, UK.
Four African buffalo (*Syncerus caffer*) and four Boran cattle (*Bos indicus*) were each exposed to the bites of 10 tsetse flies infected with *T. congolense*. Although both groups of animals became infected, the buffalo showed no clinical signs of trypanosomiasis while the cattle suffered from the disease characterised by pronounced skin reactions, high parasitaemia and severe anaemia. The prepatent periods in the buffalo varied from 18 to 27 days in comparison with 11 to 14 days in the cattle. In the buffalo, skin reactions were only detectable by histological examination of skin biopsies, the peak of parasitaemia was at least a hundredfold below that in cattle and after 54 days parasites were no longer detected. In contrast, the cattle had a continuous high parasitaemia until they were treated with a trypanocidal drug 60 days after infection. Neutralising antibody to metacyclic trypanosomes appeared in the buffalo during the prepatent period, 15-20 days after infection, whereas in cattle neutralising antibody was not detected until 10 days after the first peak of the parasitaemia, 25-30 days after infection.
Authors' abstract

6477 **Igbokwe, I.O., 1989.** Dyserythropoiesis in animal trypanosomosis. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (3): 423-429.
Department of Veterinary Pathology, University of Maiduguri, Maiduguri, Nigeria.
Haemolysis is the most prominent pathogenic cause of the anaemia in trypanosomosis. Haemolytic anaemias are normally accompanied by increased erythropoiesis, reticulocyte response and increase in the mean corpuscular volume of circulating erythrocytes. In trypanosomosis, the anaemia is accompanied by inadequate erythropoiesis. This is suggested by suboptimal reticulocyte response in infected rodents, little or no reticulocyte response in infected ruminants and weak erythrogenic capacity of infected sheep plasma in mice. The mean corpuscular volume increases in the acute phase reaching a peak at 3-4 weeks after infection and drops to normal or below

normal in the chronic phase, suggesting that erythropoiesis moderately increases in the acute phase but wanes and becomes completely depressed as the disease progresses into the chronic phase. The causes of the dyserythropoiesis are meanwhile not clear but may be found to be associated with erythroid injury, depressed erythropoietin synthesis and bioactivity or depressed haemoglobin synthesis or their interplay. Extensive studies in these areas are still necessary.
Author's abstract

6478 **Ikeme, M.M., Saharee, A.A., Saad, M.Z. and Koran, R., 1984.** Effect of experimental *Trypanosoma evansi* infections in cattle and subsequent response to hemorrhagic septicemia vaccine. *Tropical Veterinarian,* **2** (2): 61-67.
Department of Veterinary Parasitology and Entomology, University of Nigeria, Nsukka, Nigeria; Faculty of Veterinary Medicine, University Pertaniam Malaysia, Serdang, Malaysia; ibid.; ibid.
Antibody response to haemorrhagic septicaemia vaccine (batch 196, Ipoh, Malaysia) was evaluated in groups of cattle previously experimentally infected with *T. evansi*. The response of these animals to live *Pasteurella multocida* (cattle type B) challenge was similarly assessed. The capacity of the infected cattle to mount a humoral response to the vaccine was lower but not significantly different from those of uninfected controls ($P > 0.05$). Trypanocidal therapy of infected cattle with diminazene aceturate did not appreciably improve this ability to mount a humoral response to the vaccine. On subsequent challenge with *P. multocida* the number of animals protected in this group was not significantly different in comparison to the untreated infected and uninfected controls. It was concluded that low parasitaemia and pathogenicity resulting from the carrier state in bovine *T. evansi* trypanosomiasis do not appreciably compromise the ability of infected cattle to mount a humoral immunity to haemorrhagic septicaemia vaccine.
Authors' abstract

6479 **Joshua, R.A., 1984.** Heterophile antibody to red blood cell in domestic chickens infected with *Trypanosoma brucei*. *Tropical Veterinarian*, **2** (1): 54-58.
Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.
Domestic fowls (*Gallus domesticus*) inoculated with fresh bloodstream forms of *T. brucei* developed a chronic infection. Trypanosomes could not be detected in the chicken blood by microscopic examinations but were

readily demonstrated by mouse inoculation. Sera collected from the infected birds agglutinated non-sensitised erythrocytes from rabbit, rat and guinea pig at high titres. No elevated agglutinins were observed to erythrocytes from man, sheep and horse. The antibody is strongly but not completely absorbed by *T. brucei* antigen.
Author's abstract

6480 **Joshua, R.A., 1990.** Association of infectivity, parasitaemia and virulence in a serodeme of *Trypanosoma congolense. Veterinary Parasitology*, **36** (3-4): 303-309. Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria.
Quantitative methods were adopted to study the course of *T. congolense* infection in mice and goats. The ease of initiating infection with a single organism (clone) was found to show a smooth correlation with the virulence of 24 isolates. Virulence of *T. congolense* was found to be directly related to the degree of viability of the parasite but inversely proportional to the capacity of the host to limit parasitaemia. Isolates obtained from the goat in the early stage of the infection were found to be highly infective but moderately virulent; subsequent isolates were of low infectivity and low virulence. Organisms obtained at the terminal stage of the infection were highly virulent. Generally, the highly virulent clones produced rapidly high parasitaemia and mortality in the host. The low-virulence clones were characterised by low parasitaemia but very pronounced remission of trypanosomaemia.
Author's abstract

6481 **Monzón, C.M. and Villavicencio, V.I., 1990.** Serum proteins in guinea-pigs and horses infected with *Trypanosoma evansi* (Steele, 1885). *Veterinary Parasitology*, **36** (3-4): 295-301. Veterinary Diagnostic and Research Centre - CEDIVEF, P.O. Box 292, (3600) Formosa, Argentina; Agriculture Ministry, (3600) Formosa, Argentina.
The serum protein pattern in guinea-pigs infected with *T. evansi* was analysed and compared with those found in horses with either a natural or an experimental infection. In both species, a highly significant decrease in albumin levels and an increase in gamma-globulins were seen, leading to a very low albumin/globulin ratio. No significant differences in total protein levels between healthy and infected animals were registered. Likewise, alpha-globulins were not significantly affected. A decrease in beta-globulins was observed in one horse and in guinea-pigs

with experimental infection, while in horses with natural infections this decrease was not constant. The serum protein patterns in guinea-pigs infected with *T. evansi* appeared similar to those occurring in horses infected with this parasite. Guinea-pigs, therefore, may be useful laboratory models for the study of equine trypanosomosis caused by *T. evansi*.
Authors' abstract

6482 **Moulton, J.E., 1986.** Structural and functional changes in the lymphoid organs of cattle infected with *Trypanosoma congolense*. *Tropical Veterinarian*, **4** (3-4): 97-106. P.O. Box 479, Little River, CA 95456, USA.
Fifteen Boran cattle were inoculated with *T. congolense* and killed at varying post-inoculation days (PID) during a 6-month period. The disease in these animals was characterised by a fluctuating parasitaemia, anaemia and marked changes in the lymphoid organs. The histologic changes in the lymph nodes and spleens were divided into inactive, early active, active and regressive stages. In the early stages the lymph nodes showed hyperplasia of germinal centres and increased numbers of plasma cells in the medullary cords. During the later stages, there was diminution of B- and T-cell dependent areas. Proliferating macrophages accumulated in the medullary sinuses and cords, and plasma cells in the cords became relatively decreased in number. Similar changes occurred in the spleen, with early germinal centre hyperplasia and large numbers of plasma cells in the red pulp cords. Late in infection, macrophages became numerous in the red pulp cords. Histological changes in the haemolymph nodes were similar to those in the spleen. A 2-fold increase in IgG and IgM cells, as observed by immunofluorescence, appeared in the lymph nodes at PID 31. During the final stages of infection (PID 161-182), the IgM staining cells decreased in number, but IgG staining cells remained elevated. As early as PID 8 in the spleen, IgM reacting cells were seen in the periarteriolar lymphatic sheath, and at PID 15, IgM-positive cells were increased in the red pulp of the spleen.
Author's abstract

6483 **Mwangi, D.M., Munyua, W.K. and Nyaga, P.N., 1990.** Immuno-suppression in caprine trypanosomiasis: effects of acute *Trypanosoma congolense* infection on antibody response to *Anthrax* spore vaccine. *Tropical Animal Health and Production*, **22** (2): 95-100.

CTVM, Easter Bush, Roslin, EH25 9RG, UK; Department of Veterinary Pathology and Microbiology, Faculty of Veterinary Medicine, University of Nairobi, P.O. Box 29053, Nairobi, Kenya; ibid.
T. congolense-infected goats were vaccinated with *Bacillus anthracis* spore vaccine to determine the effect of such infection on the humoral immune response to the vaccine. The anti-anthrax antibody levels were severely depressed in infected goats. When trypanocidal therapy was administered to *T. congolense*-infected goats 14 days after infection they developed antibody levels against *B. anthracis* similar to uninfected controls.
Authors' abstract

6484 **Olubayo, R.O., Grootenhuis, J.G. and Rurangirwa, F.R., 1990.** Susceptibility of African buffalo and Boran cattle to intravenous inoculation with *Trypanosoma congolense* bloodstream forms. *Tropical Medicine and Parasitology*, **41** (2): 181-184.

National Veterinary Research Centre, KARI, P.O. Box Kabete, Kenya; ibid.; Small Ruminant Collaborative Research Support Programme, Nairobi, Kenya.
This study compares the susceptibility of African buffalo (*Syncerus caffer*) and Boran cattle (*Bos indicus*) to intravenous infection with *T. congolense* bloodstream forms. The trypanosomes multiplied in the buffaloes and the Boran and reached levels of detectable parasitaemia 4 days after infection in the Boran and 10 days after infection in the buffalo. The cattle developed severe anaemia and had to be treated 60 days after infection to save them from dying whereas the buffaloes did not develop any signs of anaemia and did not require treatment. The Boran cattle showed high levels of parasitaemia persisting throughout the experimental period with some fluctuations. The parasitaemia in the buffaloes reached a peak of 5 ∃ 10^3/ml, 100 fold below the maximum level in cattle, it was intermittent and by the end of the experimental period (60 days) three out of four buffaloes had eliminated the parasites from circulation. Neutralising antibodies were detected at the time of peak parasitaemia or soon after the first peak parasitaemia in buffaloes whereas in the Boran cattle neutralising antibody could not be detected until after several peaks of parasitaemia. Neutralising antibody persisted in both Boran and buffaloes until the end of the experimental period.
Authors' abstract

6485 **Opasina, B.A., 1985.** Relationship between anaemia and parasitaemia in sheep naturally infected with *Trypanosoma vivax* in southwest Nigeria. *Tropical Veterinarian*, **3** (1-4): 79-82. ILCA, c/o IITA, P.M.B. 5320, Ibadan, Nigeria.
T. vivax was diagnosed from 20 of 45 (44.4%) West African dwarf sheep suspected of clinical trypanosomiasis on ILCA's farm at Fasola in southwest Nigeria. The infection represented 11.8% of the total sheep on the station. Varying levels of parasitaemia and anaemia were observed among the trypano-some-positive animals. There was a very significant correlation ($r = 0.76$) between PCV, the measure of the degree of anaemia, and the degree of parasitaemia. Also, there was a significant difference ($P < 0.01$) in the mean PCV and haemoglobin concentration in sheep that were positive and negative for trypanosomes. The haematological values appeared to be affected, in both trypanosome-positive and trypanosome-negative groups, by another anaemia-inducing parasite, *Babesia motasi*. Author's abstract

(c) TRYPANOTOLERANCE
[See also **13**: nos. 6476, 6484.]
6486 **Esievo, K.A.N., Jaye, A., Andrews, J.N., Ukoha, A.I., Alafiatayo, R.A., Eduvie, L.O., Saror, D.I. and Njoku, C.O., 1990.** Electrophoresis of bovine erythrocyte sialic acids: existence of additional band in trypanotolerant Ndama cattle. *Journal of Comparative Pathology*, **102** (4): 357-361. Department of Pathology and Microbiology, Faculty of Veterinary Medicine (Esievo, Jaye, Alafiatayo, Saror, Njoku), Department of Biochemistry (Andrews, Ukoha) and National Animal Production Research Institute (Eduvie), Ahmadu Bello University, Zaria, Nigeria.
Mild acid-hydrolysis of erythrocyte surface sialic acids of the trypano-tolerant Ndama and the trypanosusceptible White/Fulani Zebu breeds of cattle was performed. The cleaved sialic acids from the two breeds of cattle were simultaneously subjected to polyacrylamide gel electrophoresis in the presence of sodium dodecyl sulphate (SDS-PAGE), along with commercial standard N-acetylneuraminic acid (MW 309.28), blank gel and plasma proteins. The cleaved sialic acids migrated in the globulin fractions, as shown by the plasma protein electrophoresis. While the Ndama and the Zebu erythrocytes had one migrating band, each of which coincided with the standard N-acetylneuraminic acid, the Ndama had another trailing band of sialic acid, of an estimated molecular weight of 30 kDa, which may account for the higher erythrocyte

sialic acid con-centrations of the Ndama. This additional band was absent in the Zebu. All these bands were readily reproducible.
Authors' abstract

6487 **Quéval, R., Pagot, E., Sylla, S. and Maillard, J.C., 1989.** Résistance globulaire des hématies bovines. [Corpuscular resistance of bovine red blood cells.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **42** (3): 437-446.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
Corpuscular resistance of different breeds was analysed by exposing red blood cells of Zebu, Baoulé and Zebu ∃ Baoulé crossbred cattle to different saline concentrations. No significant difference in mean percentage haemolysis was seen between the sexes in any of the breeds. In Zebus, the values for animals with haemoglobin of types AA and AB were significantly different from those of type BB. Comparison of mean % haemolysis between the breeds showed significant differences between Zebus and the other two breeds. Values for Hb type AA Zebus were not significantly different from those of Hb type AA Baoulé, but both these types and the crossbreeds were significantly different from Hb type BB Zebus. (All Baoulé were AA; crossbreeds were AA and AB.) Similar results were seen when the NaCl concentrations corresponding to 50% haemolysis were analysed: Zebus (0.5875 □ 0.010% NaCl) were significantly different from Baoulé (0.5048 □ 0.012%) and crossbreeds (0.5018 □ 0.015%) ($P < 0.001$). These differences can partly explain the less severe anaemia seen in Baoulé cattle infected with trypanosomes.

(d) TREATMENT

6488 **Dolan, R.B., Okech, G., Alushula, H., Mutugi, M., Stevenson, P., Sayer, P.D. and Njogu, A.R., 1990.** Homidium bromide as a chemoprophylactic for cattle trypanosomiasis in Kenya. *Acta Tropica*, **47** (3): 137-144.
KETRI, P.O. Box 362, Kikuyu, Kenya. (Correspondence to Dolan: P.O. Box 24437, Nairobi, Kenya.)
Homidium bromide was used in a strategic chemoprophylactic regime to control trypanosomiasis in Boran cattle in Kenya. Trypanosome infection rates in cattle receiving homidium bromide prophylaxis were compared with those in control cattle which received no prophylaxis but were treated with diminazene aceturate when infected. Homidium bromide was administered twice during the year after which no infections were detected for periods of 19 weeks and 17 weeks respectively. The

drug sensitivity of the infecting trypanosomes is believed to be a major factor in determining the duration of prophylaxis.
Authors' abstract

6489 **Onyeyili, P.A. and Anika, S.M., 1990.** The influence of *Trypanosoma congolense* infection on the disposition kinetics of diminazene aceturate in the dog. *Veterinary Research Communications*, **13** (3): 231-236.

Department of Veterinary Physiology and Pharmacology, University of Nigeria, Nsukka, Nigeria.

Diminazene aceturate was administered intravenously at 3.5 mg/kg body weight to mongrel dogs before and after infection with *T. congolense*. Plasma and urine were collected at varying intervals thereafter and analysed for the compound. The mean area under the concentration-time curve (AUC) of diminazene in healthy dogs was 25.8 h.μg/ml but was significantly increased ($P < 0.05$) to 35.7 h.μg/ml after infection with *T. congolense*. The distribution half-life was significantly reduced ($P < 0.05$) in dogs after infection, being 0.12 h compared to 0.17 h in the same dogs before infection. The mean proportion of the diminazene recovered in the urine of infected dogs (25.1%) was not significantly different from that recovered in the urine of healthy dogs (26.8%). These results indicate that infection with *T. congolense* increases the rate at which diminazene is distributed in the body but that the infection has no marked influence on the urinary excretion of the drug.
Authors' abstract

6490 **Sekoni, V.O., Njoku, C., Saror, D., Sannusi, A., Oyejola, B. and Kumi-Diaka, J., 1990.** Effect of chemotherapy on elevated ejaculation time and deteriorated semen characteristics consequent to bovine trypanosomiasis. *British Veterinary Journal*, **146** (4): 368-373.

National Animal Production Research Institute (Sekoni), Faculty of Veterinary Medicine (Njoku, Saror, Sannusi, Kumi-Diaka) and IAR (Data Analysis Section) (Oyejola), Ahmadu Bello University, P.M.B. 1096, Shika, Zaria, Nigeria.

The effect of the trypanocidal drug Novidium on elevated ejaculation time and deteriorated semen characteristics was studied in Zebu cattle infected with *Trypanosoma vivax* and *T. congolense*. Two groups, comprising six bulls per group, were infected with *T. vivax* or *T. congolense* while three bulls served as controls. Chemotherapy was carried out 12 weeks post-infection on

three bulls from each group, leaving three bulls untreated while three bulls served as uninfected controls. Blood samples from treated bulls were all negative for trypanosomes 3 days post-chemotherapy. The animals also had normal body temperature. As the study progressed, clinical signs associated with trypano-somiasis, such as anaemia and cachexia, disappeared gradually in treated bulls. There was some improvement in semen characteristics of some of the bulls at 10 weeks post-chemotherapy. However, all bulls infected with *T. vivax* or *T. congolense* irrespective of Novidium chemotheraphy still had poor semen characteristics manifested by all or some of the following: decreased volume of semen, oligospermia, azoospermia and elevated incidence of spermatozoa morphological abnormalities. They were thus unsuitable for breeding.
Authors' abstract

7. experimental trypanosomiasis
(a) DIAGNOSTICS
[See also **13**: no. 6515.]

6491 **Isharaza, W.K. and Meirvenne, N. van, 1990.** Variant-specific trypanolytic antibodies in sera from patients infected with *Trypanosoma brucei rhodesiense*. *Bulletin of the World Health Organization*, **68** (1): 33-37.
UTRO, P.O. Box 96, Tororo, Uganda; Serological Laboratory, Prince Leopold Institute for Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.
Twelve previously cloned VATs of *T. b. rhodesiense* were selected for immunolysis tests against 85 sera from *T. b. rhodesiense* patients in Busoga, Uganda. One variant, ETat 1/1, reacted with 59 out of 65 sera that contained detectable lytic antibodies. ETat 1/1 in combination with two other variants, ETat 1/14 and Utat 1/1, covered all the seropositive sera; other VATs showed varying degrees of reactivity. The results suggest that sera from *T. b. rhodesiense* patients contain easily detectable VAT-specific antibodies and that their corresponding antigens might be used in the preparation of serodiagnostic reagents for the disease.
From authors' abstract

6492 **Olaho-Mukani, W., Winter, P., Dörflinger, W., Hörchner, F. and Ahmed, J.S., 1990.** Application of luminol-dependent chemi-luminescence to assay opsonizing antibodies to procyclic forms of *Trypanosoma congolense* in the sera of dogs experimentally infected with heterologous stocks. *Tropical Medicine and Parasitology*, **41** (2): 213-216.

KETRI, P.O. Box 362, Kikuyu, Kenya; Institut für Parasitologie und Tropenveterinärmedizin, Freie Universität Berlin, Königsweg 65, D-1000 Berlin 37, Federal Republic of Germany; ibid.; ibid.; ibid.

6493 **Viseshakul, N. and Panyim, S., 1990.** Specific DNA probe for the sensitive detection of *Trypanosoma evansi*. *Southeast Asian Journal of Tropical Medicine and Public Health*, **21** (1): 21-27. Department of Biochemistry, Faculty of Science, Mahidol University, Rama VI Road, Bangkok 10400, Thailand.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **13**: nos. 6480, 6481, 6545.]

6494 **Anosa, V.O., 1983.** Mammalian blood cells in health and in trypano-somiasis. [*T. brucei, T. vivax*; mice.] *Tropical Veterinarian*, **1** (4): 177-199.

Department of Veterinary Pathology, University of Ibadan, Ibadan, Nigeria.

6495 **Bakhiet, M., Olsson, T., Meide, P. van der and Kristensson, K., 1990.** Depletion of $CD8^+$ T cells suppresses growth of *Trypanosoma brucei brucei* and interferon-gamma production in infected rats. *Clinical and Experimental Immunology*, **81** (2): 195-199.

Departments of Neurology (Bakhiet, Olsson) and Cellular Neuropathology (Meide), Karolinska Institute, Huddinge Hospital, Huddinge, S-141 86 Sweden; Kristensson: TNO Primate Centre, Rijswiik, Netherlands. (Correspondence to Olsson.)

6496 **Borowy, N.K., Sternberg, J.M., Schreiber, D., Nonnengasser, C. and Overath, P., 1990.** Suppressive macrophages occurring in murine *Trypanosoma brucei* infection inhibit T-cell responses *in vivo* and *in vitro*. *Parasite Immunology*, **12** (3): 233-246.

Max-Planck-Institut für Biologie, Correnssstrasse 38, D-7400 Tübingen, Federal Republic of Germany.

6497 **Hublart, M., Tetaert, D., Croix, D., Boutignon, F., Degand, P. and Boersma, A., 1990.** Gonadotropic dysfunction produced by *Trypano-soma brucei brucei* in the rat. *Acta Tropica*, **47** (3): 177-184.

Hublart, Tetaert, Boutignon, Degand, Boersma: Unité INSERM no. 16, Place de Verdun, 59045 Lille Cédex, France; Croix: Unité INSERM no. 156, Place de Verdun, Lille, France. (Correspondence to Boersma.)

6498 **Luckins, A.G., Hopkins, J., Rae, P.F. and Ross, C.A., 1990.** Stability of metacyclic variable antigen types (M-VATs) during the early stages of infection with *Trypanosoma*

congolense. [Rabbits, sheep.] *Acta Tropica*, **47** (3): 129-136.

Luckins, Rae, Ross: CTVM, Easter Bush, Roslin, Midlothian EH25 9RG, UK; Hopkins: Department of Pathology, R(D)SVS, University of Edinburgh, Summerhall, Edinburgh, UK.

6499 **Reinitz, D.M. and Mansfield, J.M., 1990.** T-cell-independent and T-cell-dependent B-cell responses to exposed variant surface glycoprotein epitopes in trypanosome-infected mice. [*T. b. rhodesiense*.] *Infection and Immunity*, **58** (7): 2337-2342.

Department of Veterinary Science, University of Wisconsin- Madison, 1655 Linden Drive, Madison, WI53706, USA. (Corres-pondence to Mansfield.)

(c) CHEMOTHERAPEUTICS

6500 **Arowolo, R.O.A. and Eyre, P., 1984.** Pharmacological interactions of three trypanocidal drugs with selected autonomic and autacoid mediator substances. *Tropical Veterinarian*, **2** (2): 68-75.

Department of Veterinary Physiology and Pharmacology, University of Ibadan, Ibadan, Nigeria; Department of Biomedical Sciences, University of Guelph, Guelph, Ontario, Canada.

Using the isolated bovine pulmonary tissue, the effects of Berenil, Samorin and Novidium on the pharmacological responses of histamine, serotonin, bradykinin, adrenaline, carbachol and some prostaglandins were investigated with the objective of shedding some light on the mechanisms of trypanocidal toxicities within the host. Results showed that the trypanocides possessed both anticholinergic and antihistaminic effects. While Berenil enhanced serotonin and adrenaline responses, and inhibited bradykinin and prostaglandins, Novidium and Samorin inhibited serotonin and adrenaline and potentiated bradykinin and the prostaglandins. The implication of this result in trypanosomiasis treatment is discussed.

Authors' abstract

6501 **Ashall, F., Angliker, H. and Shaw, E., 1990.** Lysis of trypanosomes by peptidyl fluoromethyl ketones. [*T. brucei*.] *Biochemical and Bio-physical Research Communications*, **170** (2): 923-929.

Department of Pure and Applied Biology, Imperial College of Science, Technology and Medicine, Prince Consort Road, South Kensington, London SW7 2BB, UK; Friedrich Miescher Institut, P.O. Box 2543, CH-4002 Basel, Switzerland; ibid.

6502 **Atilola, M.A.O. and Arowolo, R.O.A., 1983.** Effects of diminazene aceturate on the recovery period from thiopental anaesthesia in the dog: a preliminary report. *Tropical Veterinarian*, **1** (1): 38-40.
Department of Veterinary Surgery and Reproduction (Atilola) and Department of Veterinary Physiology and Pharmacology (Arowolo), University of Ibadan, Ibadan, Nigeria. (Correspondence to Arowolo.)
Ten adult mongrel dogs were pre-medicated with atropine sulphate 0.04 mg/kg bodyweight and anaesthetised with a 5% thiopental solution, 22 mg/kg b.w. intravenously, and the recovery periods noted. A 7% diminazene aceturate (Berenil) solution was injected intramuscularly at the dose rate of 3.5 mg/kg b.w., and the dogs anaesthetised at 2 and 24 h after diminazene administration. The result indicated that diminazene prolonged recovery from thiopental anaesthesia 2 and 24 h after diminazene injection. The factors which may contribute to the barbiturate's enhanced anaesthesia by diminazene are discussed.
Authors' abstract

6503 **Bacchi, C.J., Nathan, H.C., Livingston, T., Valladares, G., Saric, M., Sayer, P.D., Njogu, A.R. and Clarkson, A.B., 1990.** Differential susceptibility to DL-α-difluoromethylornithine in clinical isolates of *Trypanosoma brucei rhodesiense*. *Antimicrobial Agents and Chemo-therapy*, **34** (6): 1183-1188.
Bacchi, Nathan, Livingston, Valladares: Haskins Laboratories and Department of Biology, Pace University, New York, NY 10038, USA; Saric, Clarkson: Department of Medical and Molecular Parasitology, New York University Medical Center, New York, NY 10016, USA; Sayer, Njogu: KETRI, Muguga, Kenya.

6504 **Heath, E., 1986.** Alpha-chlorohydrin is not trypanocidal. [*T. b. brucei, T. vivax*; mice.] *Tropical Veterinarian*, **4** (3-4): 153-157.

Department of Veterinary Biosciences, University of Illinois, 2001 South Lincoln Avenue, Urbana, IL 61801, USA.

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Departments of Biological Sciences (Okanla, Akinyanju) and Chemistry (Owoyale), University of Ilorin, P.M.B. 1515, Ilorin, Kwara State, Nigeria.

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Department of Biological Sciences, University of Salford, Salford M5 4WT, UK.

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Departments of Pharmacology, and Epidemiology and Public Health and Developmental Therapeutics Program, Comprehensive Cancer Center (Shyam, Divo, Sartorelli), and MacArthur Center for Molecular Parasitology (Penketh, Divo, Patton, Sartorelli), Yale University School of Medicine, New Haven, CT 06510, USA.

6508 **Toulmé, J.J., Verspieren, P., Boiziau, C., Loreau, N., Cazenave, C. and Thuong, N.T., 1990.** Les oligonucléotides antisens: outils de génétique moléculaire et agents thérapeutiques. [Antisense oligo-nucleotides: from tools in molecular genetics to therapeutic agents.] [*T. brucei*.] *Annales de Parasitologie humaine et comparée*, **65** (Suppl. 1): 11-14.

Laboratoire de Biophysique, INSERM U201, CRNS UA481, Muséum National d'Histoire Naturelle, 43 rue Cuvier, 75005 Paris, France; ibid.; ibid.; ibid.; ibid.; Centre de Biophysique Moléculaire, CNRS, 45076 Orléans Cedex, France.

6509 **Zweygarth, E. and Kaminsky, R., 1990.** Evaluation of an arsenical compound (RM 110, mel Cy, Cymelarsan$^{\varepsilon}$) against susceptible and drug-resistant *Trypanosoma brucei brucei* and *T. b. evansi*. [Mice.] *Tropical Medicine and Parasitology*, **41** (2): 208-212.

KETRI, P.O. Box 362, Kikuyu, Kenya; ILRAD, P.O. Box 30709, Nairobi, Kenya.

8. trypanosome research

(a) CULTIVATION OF TRYPANOSOMES

6510 **Mhando, P.J., Yanagi, T., Fukuma, T., Nakazawa, S. and Kanbara, H., 1987.** Studies of cells derived from brain and muscles of new born mouse in supporting the growth of bloodstream forms of trypanosomes. [*T. b. gambiense*.] *Tropical Medicine*, **29** (1): 27-36.

Department of Protozoology, Institute of Tropical Medicine, Nagasaki University, 12-4 Sakamoto-machi, Nagasaki 852, Japan.

6511 **Stiles, J.K., Wallbanks, K.R. and Molyneux, D.H., 1990.** Meta-cyclogenesis of *Trypanosoma vivax in vitro*: attachment to chitosan gel. *Annals of Tropical Medicine and Parasitology*, **84** (2): 197-200.

Department of Biological Sciences, University of Salford, Salford M5 4WT, UK.

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

6512 **Fasogbon, A.I., Knowles, G. and Gardiner, P.R., 1990.** A comparison of the isoenzymes of *Trypanosoma (Duttonella) vivax* isolates from East and West Africa. *International Journal for Parasitology*, **20** (3): 389-394.

ILRAD, P.O. Box 30709, Nairobi, Kenya. (Correspondence to Gardiner.)

6513 **Godfrey, D.G., Baker, R.D., Rickman, L.R. and Mehlitz, D., 1990.** The distribution, relationships and identification of enzymic variants within the subgenus *Trypanozoon*. (Review.) *Advances in Parasit-ology*, **29**: 1-74.

TRL, Department of Veterinary Medicine, University of Bristol, Langford, Bristol BS18 7DU, UK; Centre for Operational Research and Applied Statistics, University of Salford, Salford M5 4WT, UK; Department of Parasitology, TDRC, P.O. Box 71769, Ndola, Zambia; Abteilung für Veterinärmedizin, Bernhard-Nocht-Institut für Schiffs- und Tropenkrankheiten, Bernhard-Nocht-Strasse 74, 2 Hamburg 4, Federal Republic of Germany.

This survey of isoenzyme characteristics (supported by DNA characteristics) suggests that present forms of *Trypanozoon* may have evolved in the Lake Victoria region as the busoga strain group, associated with one kind of rhodesian trypanosomiasis. From busoga developed

zambezi, also associated with a (less acute) rhodesian type of disease, and sindo, kiboko and kakumbi strain groups which seem to be associated only with animals. Busoga spread also westwards where it evolved into bouaflé from which arose *Trypanosoma brucei gambiense* and *T. evansi*. It is doubtful whether the human infective forms in East Africa merit subspecific status distinct from the three non-human infective strains there.

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TRL, Department of Veterinary Medicine, University of Bristol, Langford, Bristol BS18 7DU, UK.

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KETRI, P.O. Box 362, Kikuyu, Kenya; Department of Pathology, School of Veterinary Science, University of Bristol, Langford, Bristol BS18 7DU, UK. (Correspondence to Gibson.)

(c) LIFE CYCLE, MORPHOLOGY, BIOCHEMICAL AND MOLECULAR STUDIES

6516 **Balber, A.E., 1990.** The pellicle and the membrane of the flagellum, flagellar adhesion zone, and flagellar pocket: functionally discrete surface domains of the bloodstream form of African trypanosomes. (Review.) *Critical Reviews in Immunology*, **10** (3): 177-201.
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Walter and Eliza Hall Institute of Medical Research, Post Office, Royal Melbourne Hospital, Melbourne, Victoria, Australia; Intercampus Program in Molecular Parasitology, School of Pharmacy, University of California at San Francisco, San Francisco, CA 94143-1204, USA; ibid. Mottram also: Wellcome Unit of Molecular Parasitology, Institute of Genetics, University of Glasgow, Glasgow G11 5JS, UK. (Correspondence to Agabian.)

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[Incl. *T. brucei*.] *Parasitology Today*, **6** (9): 299-302.
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Department of Microbiology and Immunology, P.O. Box 3010, Duke University School of Medicine, Durham, NC 27710, USA.

6520 **Chung, H.-M.M., Shea, C., Fields, S., Taub, R.N., Ploeg, L.H.T. van der and Tse, D.B., 1990.** Architectural organization in the interphase nucleus of the protozoan *Trypanosoma brucei*: location of telomeres and mini-chromosomes. *EMBO Journal*, **9** (8): 2611-2619.
Department of Genetics and Development (Chung, Ploeg) and Department of Medicine, College of Physicians and Surgeons (Fields, Taub), Columbia University, New York, NY 10032, USA; Shea: Department of Brain and Cognitive Science, MIT, Cambridge, MA 02139, USA; Tse: Laboratory of Lymphocyte Cell Biology, Department of Medicine, North Shore University Hospital and Cornell University Medical College, Manhasset, NY 11030, USA. (Correspondence to Ploeg.)

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Departments of Pathology (Eakin, Bouvier, Sakanari, McKerrow) and Pharmaceutical Chemistry (Eakin, Craik), University of California, San Francisco, CA 94143, USA. (Correspondence to McKerrow.)

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Departments of Microbiology and Immunology (Ghoda, Coffino), Hormone Research (Phillips), Anatomy (Bass), Pharmaceutical Chemistry, School of Pharmacy (Wang), and Medicine, School of Medicine (Coffino), University of California, San Francisco, CA 94143, USA. (Correspondence to Coffino at Department of Microbiology.)

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Department of Biochemistry, Schools of Medicine and Dentistry, University of Alabama at Birmingham, AL 35294, USA. (Correspondence to Hajduk.)

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Division of Tropical Medicine, School of Public Health (Lee), Department of Pediatrics (Deckelbaum) and Department of Genetics and Development (Ploeg), Columbia University, 701 West 168th Street, New York 10032, USA; Bihain: Department of Physiology, Louisiana State University Medical Center, New Orleans, LA 70112, USA; Russell: Department of

Pathology, New York University Medical Center, New York, NY 10016, USA. (Correspondence to Ploeg.)

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Department of Genetics and Development (Ploeg) and Division of Tropical Medicine, School of Public Health (other authors), Columbia University, New York, NY 10032, USA.

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Division of Tropical Medicine, School of Public Health (Lee), and Department of Genetics and Development (Polvere, Ploeg), Columbia University, 630 West 168th Street, New York, NY 10032, USA.

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Intercampus Program, Molecular Parasitology, University of California, San Francisco and Berkeley, Laurel Heights Campus, San Francisco, CA 94143-1204, USA. (Correspondence to Agabian.)

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Intercampus Program in Molecular Parasitology, School of Pharmacy, University of California, Laurel Heights, San Francisco, CA 94143-1204, USA. (Correspondence to Agabian.)

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Department of Biological and Molecular Sciences, University of Stirling, Stirling FK9 4LA, UK; Wellcome Unit of Molecular Parasitology, Institute of Genetics, University of Glasgow, Church Street, Glasgow G11 5JS, UK; Laboratory for Biochemical Parasitology, Department of Zoology, University of Glasgow, Glasgow G12 8QQ, UK.

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Département de Biologie Moléculaire, Université Libre de Bruxelles, 67 rue des Chevaux, B-1640 Rhode St Genèse, Belgium.

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Department of Biochemistry (Reddy, Donelson) and Howard Hughes Medical Institute (Donelson), University of Iowa, Iowa City, IA 52242, USA; Hall: Department of Immunology, Division of Communicable Diseases and

Immunology, Walter Reed Army Institute of Research, Washington, DC 20307, USA.

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