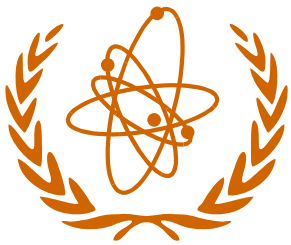
ISSN 0142-193X

TSETSE AND TRYPANOSOMIASIS INFORMATION QUARTERLY

Volume 13
Part 1, 1990
Numbers 6049–6176



DFID

CIRAD
Cirad-emvt

section b - abstracts
1. general (including land use)

6049 **Blair-Rains, A., 1988**. Land use - is orderly development possible? *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 385-391.
Rosebank, Castle Douglas, DG7 1EH, UK.
The control or eradication of tsetse is one of the inputs necessary for the development of some areas in the humid and sub-humid areas of Africa. In spite of the progress which has been made in our understanding of the physical environment, in planning and in undertaking effective control programmes, the implementation of project plans for land use has often been unsatisfactory and the development has been *ad hoc* rather than orderly; the not infrequent result of this type of development is frustration and hardship for individuals and the degradation of the natural resources. Failure to implement land use programmes satisfactorily is sometimes attributed to inadequate resources or to a poorly developed infrastructure but it would also often seem to be the result of not giving sufficient attention to customary land use laws and of a failure to build a consensus of public opinion and support for the proposed development, which may sometimes have to be modified in order to secure this support.
Author's abstract

6050 **Hendy, C.R.C. and Daniels, I.M., 1988**. A model for the estimation of the direct benefits of trypanosomiasis control by tsetse eradication in southern Somalia. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 519-520.
ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, ME4 4TB, UK, and National Tsetse and Trypanosomiasis Control Project, Somalia.
Because trypanosomiasis is only one of many constraints on livestock production, quantification of the benefits of tsetse eradication is difficult. In Somalia, factors assumed to affect these benefits include (1) livestock populations in areas of different intensities of tsetse infestation and management systems, resulting in different exposure to trypanosomiasis, (2) the effects of trypanosomiasis on livestock mortality and productivity, (3) the occurrence of drought and consequential effects on the exposure and susceptibility of animals to trypanosomiasis, (4) the effects of other constraints on future livestock productivity and population growth, and (5) the effects of changes in land use on the extent of tsetse infestation in the absence of tsetse eradication. A computer model was used to assess the relative impact of these assumptions on predicted benefits. Assumptions on the frequency of drought and the future growth of livestock populations were shown to be major determinants of benefits. Predicted benefits derived mainly from cattle (40% of total economic benefits) and camels (50%), and mainly from increased milk outputs (70%). Increased meat production accounted for only 14-17% of benefits, while trypanocidal drug savings contributed 10-17%.
From authors' abstract

6051 **Hendy, C.R.C. and Makin, M.J., 1988**. Land use and development planning associated with trypanosomiasis control. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 425-433.
ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, ME4 4TB, UK.

Land resource appraisal for development planning is of necessity a complex multidisciplinary activity with many components. Development planning and implementation are long-term activities requiring agreement on priorities, strategy and implementation by government departments, private institutions and local people. Trypanosomiasis control especially through large-scale tsetse eradication can, in contrast, be a relatively straightforward task carried out rapidly by a single agency. Often the costs of related development far exceed those of tsetse control, and the benefits may be less certain. Many countries are constrained by lack of necessary staff, institutions and funds to cover the recurrent costs of development. Trypanosomiasis control should ideally be seen as an integrated part of rural development. This may not always be possible, however, in view of the scale and potential benefits of some methods of disease control. Disease control may nevertheless also cause undesirable indirect effects on land use and the environment. It may be necessary in these cases to choose alternative more appropriate disease control methods which can more easily be coordinated with area development.
From authors' abstract

6052 **International Livestock Centre for Africa, 1987**. *ILCA's strategy and long-term plan: a summary*. Addis Ababa, Ethiopia; ILCA. 25 pp.
ILCA, P.O. Box 5689, Addis Ababa, Ethiopia.
ILCA's strategy and plan up to the year 2000 is outlined. The proposed research programme includes trypanotolerance, within which the following major topics are proposed: collection and analysis of data on the productivity of trypanotolerant breeds under varying levels of trypanosomiasis risk; identification of more reliable indicators of trypanosomiasis risk; definition of a selection criterion for trypanotolerance, in order to devise optimum breeding programmes; evaluation of the costs and benefits of selected tsetse control measures, and their interaction with prophylactic drugs; testing of nutritional interventions to improve livestock productivity in tsetse-infested areas; and study of the effects of trypanocidal drugs in order to determine appropriate interventions in areas of medium to high trypanosomiasis risk.

6053 **Organization of African Unity/Scientific, Technical and Research Commission, 1988**. *Nineteenth Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Lomé, Togo, [30 March - 3 April] 1987*. Nairobi; OAU/STRC. OAU/STRC Publication no. 114. 555 pp.
OAU/STRC, P.O. Box 30786, Nairobi, Kenya.
Abstracts and/or bibliographic details of all scientific papers published in the report of this meeting are included in this issue of *TTIQ* (individual item numbers are not given here since most of the issue is devoted to this report). The meeting was divided into sections on: Protozoology, immunology and biochemistry; Human trypanosomiasis; Animal trypanosomiasis; Entomology; *Glossina* control; and Posters. For each section there is a general report and recommendations for future action as well as the text of presented papers. Short reviews of the current activities of various international organisations (OAU/IBAR, WHO, FAO, EEC, ILRAD, ILCA, IAEA, ITC, ICIPE, CEBV, CRTA) and countries

(Burundi, Ethiopia, Nigeria, Uganda, Senegal, Somalia, Tanzania, Kenya, Angola, Gabon, Guinea) are also included, together with some general recommendations.

6054 **Technical Centre for Agricultural and Rural Cooperation (CTA), 1988**. Tackling trypanosomiasis. *Spore*, no. 17: 1-3.
CTA, Postbus 380, 6700 AJ Wageningen, Netherlands.
A general account is given of the problem of trypanosomiasis. The work of ORSTOM and IEMVT/GTZ in developing traps and screens for tsetse control in West and Central Africa is briefly described, as is the use of the sterile insect technique in conjunction with traps by CRTA, and the use of trypanocidal drugs, insecticide-impregnated ear-tags and cattle dips. The research being undertaken on trypanotolerance is also discussed.

6055 **World Health Organization, 1987**. Parasitic diseases. The primary health care approach to the control and prevention of sleeping sickness. *Weekly Epidemiological Record*, **62** (27): 197-200.
WHO, CH-1211 Geneva 27, Switzerland.
The number of cases of African trypanosomiasis diagnosed in nine countries from which data reporting has been the most regular showed a more than two-fold increase (from 5091 to 12,117) between 1976 and 1983. The organisations involved and the funds available for the control of sleeping sickness (either by diagnosis and treatment of infected individuals or by vector control), in Angola, Congo, Equatorial Guinea, Cameroon, Sudan, Uganda and Zaire are considered briefly. In other African countries, surveillance activities are minimal or have stopped because of inadequate facilities, and the absence of reported cases is not indicative of the present status of the disease. The objectives and action plan of the WHO Programme `Primary Health Care Approach towards the Control and Prevention of Sleeping Sickness', launched in 1984, are outlined. To date 17 countries have actively participated in the programme and have defined control strategies most appropriate to the local epidemiological situation. Training, follow-up visits and control manuals were provided through WHO and funds were made available for eight countries.

2. tsetse biology

(a) REARING OF TSETSE FLIES

6056 **Kabore, I. and Bauer, B., 1988**. Elevage à grande échelle de trois espèces de glossines au CRTA de Bobo-Dioulasso. [Large-scale rearing of three tsetse species at CRTA, Bobo-Dioulasso.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 460-462.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
Large colonies of three tsetse species (*Glossina palpalis gambiensis, G. tachinoides* and *G. morsitans submorsitans*) have been established at CRTA since 1979 to produce sterile males for an integrated control campaign in a pastoral zone south of Bobo-Dioulasso, Burkina Faso, comprising approximately 3500 km^2. The flies are fed on membranes with cattle blood obtained from the local abattoir. Prior to use the cattle blood is irradiated with 50-55 krad in a ^{137}Cs source. Supplementation of this diet by feeding on rabbits has been gradually reduced and eventually eliminated. As a result of technical improvements in the

handling of the flies, e.g. the use of large rectangular cages for *G. p. gambiensis* and the use of cold or CO_2 for immobilising the flies for sexing and marking, the amount of work has been considerably reduced. Large heating plates and a better designed storage system have also helped to reduce the work. Consequently, more than 300,000 producing females have been maintained in the CRTA and nearly 1 million sterile males have been released in the field.
Authors' abstract

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

6057 **Gooding, R.H., Rolseth, B.M. and Tarimo Nesbitt, S.A., 1989**. Mapping four loci in *Glossina morsitans submorsitans* Newstead (Diptera: Glossinidae). *Canadian Entomologist*, **121** (9): 823-824.

Department of Entomology, University of Alberta, Edmonton, Alberta, Canada T6G 2E3; ibid.; Department of Zoology, Howard University, Washington, DC 20059, USA.
The objective of the present study was to map the loci for two esterases (*Est-2* and *Est-X*) and the locus for malic dehydrogenase (*Mdh*). Evidence is presented to demonstrate that *Est-2* and *Mdh* are on different autosomes and that *Est-X* is on the X chromosome and is closely linked to a locus influencing sex ratio (*Sr*).
6058 **Jura, W.G.Z.O., 1988**. Morphological and functional changes associated with virus infection in male *Glossina morsitans morsitans* Westwood (Diptera: Glossinidae). *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 363-372.
ICIPE, P.O. Box 30772, Nairobi, Kenya.
Electron-microscope studies on male *G. m. morsitans* with virus-infected hypertrophied salivary glands showed marked enlargement and proliferation of the glandular epithelial cells of the salivary glands and luminal obliteration with masses of virus particles which were detected not only intra- and extracellularly but also within the cellular interstices. Lesions seen in the follicles of the testes of infected flies fell into three categories and depicted progressive degeneration and arrested development and sterility. The virus particles are thus shown to be pathogenic to various tsetse species with possibly an important role in their natural control.
Based on author's abstract

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **13**: no. 6098.]
6059 **Clair, M., 1988**. Données récentes sur la répartition des glossines au Niger, au Burkina Faso et en Côte d'Ivoire. [Recent data on the distribution of tsetse in Niger, Burkina Faso and Côte d'Ivoire.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 345-350.
IEMVT, 10 rue Pierre-Curie, 94704 Maisons-Alfort Cédex, France.
The drought which prevailed in the countries of the Sahel Region in recent years was particularly devastating between 1983 and 1985. In two countries visited recently, it was noted that the density and distribution of tsetse flies had decreased considerably at their northern limit. The prolonged period of these extreme conditions seems to have had a devastating effect on the fly populations not only by affecting them directly but also by reducing the influx of migrants in search of new areas. Tsetse distribution in the Niger is restricted to the Western Region. The 1970 control measures reduced their rate of dispersal which was further reduced during the period under review. *Glossina tachinoides* is restricted to the Niger Valley and two of its tributaries (Tapoa and Mekrou) which border the W. Park. *G. morsitans submorsitans* also is now less abundant than in the past. In Burkina Faso, the eastern provinces bordering Niger are infested by *G. tachinoides* and *G. morsitans submorsitans* which seem to be restricted to the Pendjari Valley and some large tributaries in the game reserves lying between latitudes 11□ and 12□. In Côte d'Ivoire attention is focused on the area of

distribution of some species prevalent in that country based on the UNDP/FAO/GTZ 1980 Project Surveys.
Author's abstract

6060 **Diallo, A. and Karantao, O., 1988**. Etude expérimentale de l'attractivité différentielle des glossines par les pièges biconiques, les écrans et les bovins. Quelques observations relatives à *Glossina morsitans submorsitans* Newstead 1910 (Diptera, Glossinidae). [Experimental study on the differential attractiveness of biconical traps, screens and cattle to tsetse flies. Some observations on *G. m. submorsitans*.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 509-515.
Laboratoire d'Epidémiologie des Affections Parasitaires, Ecole Nationale de Médecine et de Pharmacie, B.P. 1805, Bamako, Mali; Ranch d'Elevage de Bovins N'Dama de Madina-Diassa, B.P. 265, Bamako, Mali.
An experimental study on the differential attractiveness of biconical traps, electric blue screens and N'Dama cattle to *G. m. submorsitans* has been carried out on Madina-Diassa ranch in southern Mali. The latin-square sampling method was used. Preliminary results obtained did not reveal any differences between cow, bull, bull-calf, biconical trap and electric blue screen as regards attractiveness to *G. m. submorsitans*.
Authors' abstract

6061 **Gibson, G. and Brady, J., 1988** A video-analysis of the host-seeking behaviour of tsetse flies in Zimbabwe. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 373-381.
Department of Pure and Applied Biology, Imperial College, Silwood Park, Ascot, SL5 7PY, UK.
The behaviour of free-flying, wild *Glossina pallidipes* and *G. m. morsitans* in relation to host odour plumes was video-recorded in the field in Zimbabwe. Movement of smoke (used as a visible substitute for odour) showed that 15 m downwind of the source the correlation of wind-direction and source-direction is highest on a open airstrip with moderate windspeeds (1-3 m s^{-1}), less high in thick woodland at lower windspeeds (0.5-1.0 m s^{-1}) and lowest in woodland at still lower windspeeds (0.4-0.8 m s^{-1}). The proportion of time the wind-direction pointed within 30□ of the source-direction was 97%, 77% and 51%, respectively. This suggests that slower windspeeds and thicker vegetation may cause a decrease in the range over which host odour attracts tsetse. Flies were videoed as they either entered or left a plume in cross-wind flight. Most flies (80%) leaving odour made large turns (of *c*. 100□), but when entering odour they either did not turn (40%), or turned relatively little (*c*. 70□). There was clear evidence of in-flight sensitivity to wind direction: flies entering odour turned significantly more upwind than downwind, and odour losers turning upwind made significantly larger turns than average.
From authors' abstract

6062 **Green, C.H., 1988**. Analysis of colour as an attractant for *Glossina palpalis*. *In*: OAU/STRC, 1988 (see **13**: no. 6053), 453-459.
TRL, Langford, Bristol BS18 7DU, UK.
To work effectively, screens or targets for tsetse fly control must attract flies, and induce them to make contact with an insecticide-impregnated surface. The present study sets out to analyse the effects of screen colour (spectral reflectivity)

on both initial attraction to screens, and on the tendency to land on them, in *G. p. palpalis*. Three wavelength bands affected initial attraction: blue wavelengths increased attraction, and ultraviolet (UV) and green-yellow-red wavelengths diminished it. The only waveband having an effect on landing behaviour, however, was UV, which induced landing; in screens with little UV reflectivity, most flies circled without landing. Screens for control of *G. palpalis* should be either royal blue with mosquito netting to intercept circling flies, or blue together with a strongly UV-reflecting cloth to induce landing. A different relationship exists between colour and screen-orientated behaviour in *G. palpalis* compared to that described for *morsitans* group flies.
Author's abstract

6063 **Hugh-Jones, M., 1989**. Applications of remote sensing to the identification of the habitats of parasites and disease vectors. *Parasitology Today*, **5** (8): 244-251.
Department of Epidemiology and Community Health, Louisiana State University, Baton Rouge, LA 70803, USA.
The characteristics, uses and limitations of satellite imagery for mapping potential habitats are briefly reviewed. Remote sensing for tsetse control was first used in 1976 to map riparian forests in Mali. The method is more rapid and accurate than aerial photography over large areas. In addition, climatic data on land temperature and humidity, available from some satellite systems, can help to differentiate between potential habitats of *Glossina palpalis* and *G. tachinoides* within riverine forest, since their bioclimatic optima differ. Satellite imagery should help to reveal the true potential for the reoccupation by *G. morsitans* and *G. pallidipes* of woodlands in south-east Tanzania, and could be used in monitoring the advance of savanna tsetse in southern Africa.

6064 **Küpper, W., 1988**. The efficiency of various odours in attracting *G. tachinoides* Westwood. Results of 2 years' experiments in northern Côte d'Ivoire. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 407.
GTZ, B.P. 45, Korhogo, Côte d'Ivoire.
Attractants have been shown to be of potentially great importance when using insecticide-impregnated traps or screens in the control of *Glossina* spp. But so far only *G. morsitans morsitans* and *G. pallidipes* in Eastern Africa have been successfully attracted by odours, natural or synthetic. In Côte d'Ivoire, particularly in the north, the riverine species *G. palpalis gambiensis* and *G. tachinoides* play a major role in the transmission of animal trypanosomiasis. Both species are already successfully controlled by impregnated traps in an area of about 12,000 km^2. Through the addition of odours, the efficacy of traps or screens, and therefore the economy of this method, could be further improved. Although over 20 natural and synthetic odours were tested, only the synthetic urine TF 86/05 gave significant catch improvements. At certain times during the two years some of the odours, such as octenol, attracted significantly more *G. tachinoides* than the control, but at other times did not. The problem of correctly dispensing the right amount of odour at all times, independently of temperature, wind and humidity, seems to be critical; in the case of *G. tachinoides*, the nutritional status of the population at the time of the catch is also important.
Author's abstract

6065 **Merot, P., 1988**. Mise en évidence, pour une glossine de sous-genre *Nemorhina*, *Glossina tachinoides*, de l'existence d'attractifs olfactifs. [Identification of olfactory attractants for *G. tachinoides*.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 500-505.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
In order to determine if a tsetse fly of the *palpalis* group, *G. tachinoides*, responds to host odours, field experiments were carried out by CRTA. Blue targets with electrified grids were baited by a stream of air containing host odour. The odour of a man, a pig and a Baoulé cow increased catches significantly relative to the non-baited target. The attractiveness increased with increasing number of cows. Catches were reduced after passage of the odour through a charcoal filter (which passes only the volatile chemicals), showing that CO_2 is not the only olfactory attractant in host odour. Mixtures of phenol derivatives significantly increased ($\exists$ 2) the attractiveness of biconical traps. Experiments are currently being carried out to determine whether these components are the only attractants for *G. tachinoides*. All these experiments show for the first time that tsetse flies of the *palpalis* group are attracted to odours.
Author's abstract

6066 **Omoogun, G.A., Dipeolu, O.O. and Akinboade, O.A., 1988**. Population estimate of *Glossina* species in Egbe area of the derived savanna zone of Nigeria. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 351-359.
NITR, P.M.B. 2077, Kaduna, Nigeria; Department of Veterinary Microbiology and Parasitology, University of Ibadan, Ibadan, Nigeria; ibid.
Egbe area was previously known to contain four species of *Glossina* namely, *G. morsitans submorsitans*, *G. longipalpis*, *G. palpalis* and *G. tachinoides*. Recent observations carried out over three years (1982-85) showed that only the riverine species *G. p. palpalis* and *G. tachinoides* now remain at Egbe. Fly numbers increased in the dry season when concentration along riverine vegetation occurred. The population was estimated using biconical traps and the mark-release-recapture method in the early dry season of 1982 at the junction of the two major rivers (Ofe and Ofili) (i.e. area of highest tsetse concentration). Using the Lincoln Index, *G. p. palpalis* was estimated at 10,125 and *G. tachinoides* at 4,750 within about 1.4 km length of the riverine vegetation. The result agreed well with the relative estimate in the form of yield/trap/day over the same period. The rate of tsetse dispersal showed that a distance of 0.03-0.8 km was covered per day. *G. p. palpalis* exhibited a higher dispersal rate than *G. tachinoides* and male flies a higher rate than females.
From authors' abstract

6067 **Omoogun, G.A., Onyiah, J.A., Dipeolu, O.O. and Akinboade, O.A., 1988**. Predation of tsetse puparia in Egbe in Kwara State, Nigeria. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 463-464.
NITR, P.M.B. 2077, Kaduna, Nigeria; ibid.; Department of Veterinary Microbiology and Parasitology, University of Ibadan, Ibadan, Nigeria; ibid.
By planting known numbers of puparia of *Glossina palpalis palpalis* in the soil in known tsetse-infested areas and making recoveries 30-32 days later, an attempt was made to determine the predation rate of tsetse puparia at Egbe. Natural breeding sites along river banks were utilised in the dry season. In the rainy season artificial sites away from river banks in locations partly protected from

rain were used. A higher predation rate of 66.8% was recorded in the rainy season compared to 12.7% in the dry season. When some puparia were isolated in soil-filled plastic bowls, the predation rate dropped to 10% for the rainy season and 7.5% for the dry season, suggesting a protective effect. As ants were suspected of being the major predators, observations were carried out on the following three most common ant species: *Myrmicaria striata*, *Camponotus perrisi* and *C. vestitus*. Only *M. striata* showed predatory traits similar to the closely related known predatory ant *Pheidole*, the other two species behaving more like scavengers. The observed colony pattern and behaviour of *M. striata* showed that it would be an effective predator of exposed puparia.
Authors' abstract

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE EFFECTS)

[See also **13**: nos. 6050, 6064, 6067.]

6068 **Bossche, P. van den, Hees, J. van and Mortelmans, J., 1988**. Observations on the remanent effect of deltamethrin acaricide liquid on tsetse flies under laboratory conditions. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 422-424.
Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.
The effect of an anti-tick deltamethrin formulation on tsetse flies was tested in the laboratory. Guinea-pigs were dipped in 0.00375% deltamethrin (Decatix) and *Glossina tachinoides* were allowed to feed on them 0, 1, 2, 3, 7, 14 and 21 days after dipping. The main observations can be summarised as follows: (1) the earlier the contact after dip, the more flies die after previously undergoing knock-down (KD); (2) the more hungry the flies, the longer the KD: (3) a dipped guinea-pig displays toxicity to tsetse for at least 3 weeks; (4) female tsetse seem to be less sensitive than male; (5) some tsetse can survive two or three consecutive KD with varying intervals; (6) tsetse undergoing a KD do not fly and are consequently an easy prey to predators; (7) only a few flies feed on a dipped guinea-pig, even when very hungry, although no true repellent or irritant action could be observed; (8) after a KD a mature inseminated fly produces a larva after 15-16 days, a similar non-intoxicated fly after 10-11 days; (9) repeated KD results in a repeated prolongation of the interlarval period.
Based on authors' abstract

6069 **Dagnogo, M., Eouzan, J.P. and Lohuirignon, K., 1988**. Le piégeage comme moyen de lutte contre les glossines: recherche du nombre minimal de supports à l'hectare. [Trapping as a means of controlling tsetse flies: research on the minimum number of traps per hectare.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 408-412.
Dagnogo, Lohuirignon: CEMV, 01 B.P. 2597 Bouaké 01, Côte d'Ivoire; Eouzan: OCCGE/IPR, 01 B.P. 1500 Bouaké 01, Côte d'Ivoire.
In the forest area of Côte d'Ivoire (Daloa region) monoconical traps impregnated with deltamethrin at 300 mg a.i./m^2 were placed around four villages in the Bété area using 1, 2, 4 or 8 traps/ha. With 4 or 8 traps/ha a 99-100% reduction in fly population density was seen on the 9th day, and control was maintained, with a

second impregnation after 4 months, at a high level (93-96% reduction) for 8 months. At 1 trap/ha, results were disappointing (79% reduction after 8 months), while 2 traps/ha gave intermediate results. A trap's effective radius can thus be assumed to be 28 m. During the rainy season, reimpregnation of traps at an interval of 3-4 months is necessary to maintain control at a high level.
Based on authors' abstract

6070 **Douati, A., 1988**. Bilan de quatre années de lutte antiglossinaire aux moyens de pièges et écrans au nord de la Côte d'Ivoire. [Evaluation of a four-year tsetse control programme using screens and traps in the northern region of Côte d'Ivoire.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 506-508.
Projet Ivoiro-Allemand de Lutte contre la Trypanosomiase et les Tsé-tsé, B.P. 45, Korhogo, Côte d'Ivoire.
Since October 1982 screens and insecticide-impregnated traps have been used to control tsetse flies in the northern region of Côte-d'Ivoire. The operation which, to date, covers and area of 12,000 km^2 has recorded an average reduction in the apparent tsetse density per trap per day of about 95%. It represents an essential component of the activities aimed at promoting animal health, particularly control of animal trypanosomiasis. The techniques used are described and future prospects discussed.
Author's abstract

6071 **Hursey, B.S., Whittingham, G.W. and Chadenga, V., 1988**. The integration of insecticidal techniques for the control and eradication of *Glossina morsitans* in north-east Zimbabwe. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 438-452.
Animal Production and Health Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy; Tsetse and Trypanosomiasis Control Branch, P.O. Box 8283, Causeway, Harare, Zimbabwe; ibid.
During 1986, within the context of the EEC-funded Regional Tsetse and Trypanosomiasis Control Project, the Zimbabwe Tsetse Control Branch undertook a large-scale integrated control operation in the north-east of the country using the techniques of selective ground spraying, sequential aerial application, odour-baited and insecticide-treated targets and the treatment of cattle with a residual acaricide. The areas treated consisted of 2882, 3200, 1300 and 2500 km^2 respectively, a total of 9882 km^2. The tsetse infestation is limited to the species *G. morsitans*. Selective ground spraying of known tsetse habitat using 4% DDT aqueous suspension and the aerial application of an endosulfan aerosol have proved very effective. Odour-baited targets, placed at a density of 4 per km^2 and treated regularly with deltamethrin, have resulted in a noticeable and rapid decrease in the *G. morsitans* population. Distributed at 25-30 per km^2 along the border between the target treated area and the aerial spraying block they have formed an effective barrier to reinvasion of the latter. In the extreme eastern section of the operations area, where reinvasion pressures from Mozambique are continuous, some 22,000 head of cattle grazing over 2500 km^2 have been regularly treated with a residual acaricide dip which remains toxic to tsetse for up to 50 days. Regular inspections of these herds for trypanosomiasis indicates that the cattle are effective living targets and that the incidence of disease has decreased markedly over the last 6 months. The logistics of implementing and

integrating these various techniques are discussed and the approximate costs of the operation are given.
Authors' abstract

6072 **Johnstone, D.R., Allsopp, R., Cooper, J.F. and Dobson, H., 1988**. Predicted and observed droplet deposition on tsetse flies using a fluorescent [tracer] technique. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 392-406.
Department of Pesticide Application and Management, ODNRI, Porton Down, Salisbury, Wilts, SP4 0JQ, UK.
A non-toxic formulation containing fluorescent tracer was dispersed as an aerosol over savanna woodland in stable air conditions, with only light wind, shortly after sunrise. Droplet deposition on wild-caught tsetse flies, *Glossina morsitans*, was measured by means of a fluorescent tracer technique and compared with the deposit levels predicted from rotary sampler measurements using droplet collection efficiency data for samplers and flies derived from a laboratory wind tunnel study. Good correlation was found between the predicted and observed dose. An additional comparison between a typical spray (measured v.m.d. 27 μm) and an undersized spray (measured v.m.d. 21 μm) suggested that the latter might be significantly more effective as a means of control.
Authors' abstract

6073 **Kangwagye, T.N., Oliaka, J.E. and Baguma, G., 1988**. Trapping of and ground spraying against *Glossina fuscipes* in the control of human trypanosomiasis epidemics in N.W. and S.E. Uganda. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 413-421.
Tsetse Control Department, P.O. Box 7033, Kampala, Uganda.
In the *gambiense* trypanosomiasis epidemic area of Moyo in north-western Uganda 100 monoconical traps impregnated with 1% deltamethrin at 300 mg a.i./trap were laid out in June 1986 along frequently used water points and routes and the edge of drainage lines. The tsetse trapping results show daily averages of from 16.6 to 74.9 *Glossina fuscipes* per trap. In the *rhodesiense* epidemic areas of Jinja and Iganga districts in south-eastern Uganda since September 1985, 290 traps recorded daily averages of 97.48 *G. fuscipes* per trap and monthly reductions in the tsetse catches of between 25 and 70%. Sporadic ground spraying of 3% dieldrin emulsion was undertaken by teams using knapsack sprayers in both regions. Although trapping and ground spraying have both been shown to be effective in reducing *G. fuscipes*, human trypanosomiasis still occurs. Further financial and logistical support is required for the control campaign to be satisfactory.
Based on authors' abstract.

6074 **Laveissière, C., Couret, D. and Hervouet, J.-P., 1988**. Les communautés rurales et la lutte contre la trypanosomiase humaine en Côte d'Ivoire. [Rural communities and human trypanosomiasis control in Côte d'Ivoire.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 472-478.
IPR/OCCGE, B.P. 1500, Bouaké, Côte d'Ivoire.
In forest areas, the spread of sleeping sickness is favoured by the ubiquitous nature of the vectors, the dispersion of the population of which 75% live in plantation camps, by continuous movement and constant contact between man and tsetse flies. Furthermore, medical surveys are conducted only on a small

fraction of the most affected population, the immigrants. At present, trapping applied by rural communities themselves appears to be the only method of bringing about rapid vector control. The population must first be made aware of the problems connected with the disease and its control methods, and the equipment must be simple and easy to install and maintain. One of the greatest advantages of this protocol is to leave the medical team free to visit 90% or more of the people and quickly treat the human reservoir. In the Vavoua focus in Côte d'Ivoire, 15,600 blue screens impregnated with deltamethrin (150 mg/m^2) were distributed to 363 farmers (representing over 7500 people) to treat 451 coffee and cocoa plantations covering an area between 1 and 20 ha. In less that 6 days, 8600 ha were protected at an annual average cost of 1940 F.CFA/ha (2000 F/person) during the first year (300 F/ha (250 F/person) during the second year for the purchase of insecticide).
From authors' abstract

6075 **Lee, C.W. and Torr, S.J., 1988**. Prospects for an integrated approach to tsetse control. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 485-492.
Aerosol Technology Unit, Imperial College, Silwood Park, Ascot, Berks, UK; ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, ME4 4TB, UK.
A critical review is made of various tsetse control techniques that utilise insecticides, with special reference to operations that ODNRI have been involved with in East and southern Africa. Ground and aerial spraying are particularly susceptible to reinvasion of the control area and both are subject to seasonal, climatic constraints. In addition, ground spraying is hampered by logistical problems, the high cost of the technique if pyrethroids are used, and the lack of suitably experienced staff. Aerial spraying, which has to be carried out by contractors, is less effective in areas of broken terrain or unsuitable climatic conditions. Odour-baited targets offer a technique that withstands reinvasion and is less subject to seasonal constraints, but at present has several logistical problems. The various techniques could be advantageously integrated so that they complement one another and are suited to the control situation. It is suggested that targets offer a means of protecting aerial-sprayed areas from reinvasion. However, the targets should be deployed well before the commencement of spraying to provide an adequate period for the targets to operate. Ground spraying is a less effective means of protecting aerial-sprayed areas. Some of the logistical problems of odour-baited targets could be overcome by using helicopters to deploy and service them.
Authors' abstract

6076 **Mawuena, K., 1988**. L'utilisation des pièges et écrans imprégnés d'insecticide pour la lutte contre la trypanosomiase animale: résultats préliminaires. [Use of insecticide-impregnated screens and traps for the control of animal trypanosomiasis: preliminary results.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 467-471.
CREAT, B.P. 27, Agou-Gare, Kloto, Togo.
Screens and traps impregnated with deltamethrin were used near CREAT, Avetonou, Togo, to control *Glossina palpalis* and *G. tachinoides* in the River Sio forest gallery area. An experimental herd of local trypanotolerant cattle was kept in the area to evaluate the control effect, while a control herd was kept in an area without screens and traps. 22 biconical traps were placed in 2.2 km of forest

gallery while 16 screens were placed in a 32 ha area of pasture interspersed with mango and orange plantations. Animals found to be infected with trypanosomiasis in monthly tests were treated with 3.5 mg/kg diminazene aceturate (both herds). Preliminary results over the 12-month trial were very satisfactory: tsetse population density in the treated area fell from 4.6 to 0.1 flies/trap/day and the incidence of trypanosomiasis in the experimental herd fell from 13.5% to 1.6%. Productivity in the herd also improved: no cases of abortion or calf mortality were recorded and the rate of parturition increased.
From author's abstract

6077 **Oladunmade, M.A., Feldmann, H.U., Dengwat, L., Onah, J. and Ndams, I.S., 1988**. The use of the insecticide impregnated targets. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 466.
BICOT, P.O. Box 76, Vom, Nigeria.
Insecticide-impregnated blue cotton targets have proved an effective means of controlling populations of both *Glossina p. palpalis* and *G. tachinoides*, even under wet season conditions. Their combined use with biconical traps has reduced *G. p. palpalis* populations to a lower level than would have been achieved with biconical traps alone prior to sterile male releases. Targets impregnated with 0.05% a.i. delthamethrin appeared to be more efficient and cost effective than ground-spraying 4% dieldrin in forming a barrier to prevent *G. p. palpalis* reinfesting a cleared zone. The fact that marked sterile young female *G. p. palpalis* released from outside the barrier zone could not be recaptured within the area under the sterile male influence shows the effectiveness of the target barrier. The reduction of a heavy *G. tachinoides* population to a non-detectable level within 8 weeks using the targets consequently caused the break in transmission of animal trypanosomiasis within the vicinity of a grazing reserve.
Authors' abstract

6078 **Opiyo, E.A., Dolan, R.B., Njogu, A.R., Sayer, P.D. and Mgutu, S.P., 1988**. Tsetse control on Galana ranch. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 434-437.
KETRI, P.O. Box 362, Kikuyu, Kenya.
Deltamethrin-impregnated odour-baited targets have been used successfully as tsetse control devices in Zimbabwe. A trial using similar methods is currently being undertaken on Galana ranch in Kenya. The control site is a stretch along the Galana river with an area of 25 km^2, infested with four species of tsetse: *Glossina pallidipes, G. austeni, G. longipennis* and *G. brevipalpis*. Targets at a density of five per km^2 were installed and baited with acetone and octenol. They were sprayed with deltamethrin at 0.1% concentration and thereafter at 0.05% at 3 monthly intervals. An untreated area adjacent to the control site to the east and west was used to monitor natural tsetse population changes. The density of flies was assessed one month before the installation of targets and thereafter at 3 weekly intervals by biconical traps. Reductions in fly numbers were observed immediately after installation of targets. The transect in the centre of the study area has remained free of tsetse for more than 10 months as measured by the trap catches. Transects at the edge of the study area had some flies. This was interpreted to be possible invasion from adjacent untreated areas. There also has been general reduction in trap catches in adjoining untreated areas for a

considerable distance; it is not certain whether this is due to the effect of targets or not.
Authors' abstract

6079 **Tamboura, I., Merot, P., Cuisance, D., Politzar, H., Kourouma, B., Gidel, R., Bauer, G., Kabore, I., Some, J., Traore, A.N. and Paulin, C., 1988**. Lutte intégrée contre trois espèces de glossines dans la zone pastorale de Sideradougou, Burkina Faso. [An integrated campaign against three tsetse species in the pastoral zone of Sideradougou, Burkina Faso.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 479-484.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
An eradication campaign against three tsetse species (*Glossina palpalis gambiensis, G. tachinoides*, and *G. morsitans submorsitans*) was conducted by the CRTA, Bobo-Dioulasso, in a pastoral zone of 3500 km^2 situated near Sideradougou. The work was divided into two phases. During the preliminary phase from 1981-82 more than 600 km of roads were constructed. An entomological survey allowed the establishment of a distribution map for the different tsetse species and determination of their relative densities. The tsetse campaign began in 1983 and finished at the end of 1984. Two methods were used alternately, according to season. The use of insecticide-impregnated screens in the dry season resulted in a 90% population reduction. 850,000 sterile males were subsequently released during the rainy season. This area, from which tsetse have been eradicated by a combination of the two methods, and which is protected from reinvasion by barriers of trap and screens, is now being fully utilised.
Authors' abstract

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

[See also **13**: nos. 6127, 6146, 6147.]

6080 **Agbede, R.I.S., 1988**. Occurrence of *Trypanosoma theileri*, *T. vivax* in the gut and haemolymph of *Rhipicephalus sulcatus* (Newman, 1908) ticks and their possible epizootiological significance in Nigeria. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 252-255.
Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria.
Ticks collected from Mokwa cattle ranch, an area endemic for tsetse and trypanosomes, showed, on gut smear examination, parasites that looked like *T. theileri* and *T. vivax* trypomastigotes, the latter being suggested by the size (18-31 μm) and blunt ends.

6081 **Dwinger, R.H., Rawlings, P., Jeannin, P. and Grieve, A.S., 1988**. Experimental infection of N'Dama cattle with trypanosomes using *Glossina palpalis gambiensis* caught in the wild. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 246-250.
ITC, P.M.B. 14, Banjul, Gambia.
In an investigation of the ability of infected tsetse to transmit trypanosomes to uninfected trypanotolerant cattle, *G. p. gambiensis* were captured in the field, transferred singly into numbered small cages and allowed to feed on six uninfected N'Dama cattle. Following a completed feed, the tsetse were dissected

and infection in the proboscis or the gut was recorded. Each animal was bitten by between 5 and 64 tsetse; three of the cattle were bitten by a single infected insect, and three by two infected tsetse each. Only two of the cattle became infected: one animal by *Trypanosoma congolense* following exposure to a single infected tsetse, the other by *T. vivax* and *T. congolense* after exposure to two infected flies. These findings suggest that N'Dama cattle can become infected with trypanosomes through the bite of a single infected tsetse fly. However, it should also be noted that only two (possibly three) of the nine infected tsetse transmitted the parasites successfully.
From authors' abstract

6082 **Gough, A.J.E., Hall, D.R., Beevor, P., Cork, A., Bursell, E. and Vale, G.A., 1988**. Attractants for tsetse from cattle urine. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 493-499.
Gough, Bursell: TRL, Langford House, Langford, Bristol BS18 7DU, UK; Hall, Beevor, Cork: ODNRI, Central Avenue, Chatham Maritime, Chatham, Kent, ME4 4TB, UK; Vale: Tsetse and Trypanosomiasis Control Branch, Department of Veterinary Services, P.O. Box 8283, Causeway, Harare, Zimbabwe.
Cattle urine has been shown to be attractive to the Zimbabwean species of tsetse, particularly *Glossina pallidipes*. The phenolic fraction has been shown to account for most of this attractiveness and eight components have been identified from this fraction. Two of these phenols, 4-methylphenol and 3-n-propylphenol, in the appropriate proportions were shown to be as attractive as the total mixture. Catches of *G. pallidipes* in F3 traps already baited with acetone and 1-octen-3-ol can be increased by up to six times. Two electrophysiologically active components of the neutral fraction of buffalo urine were isolated and shown to be active towards *G. morsitans* in a laboratory bioassay. These were identified as carotenoid metabolites and the synthetic compounds are being tested in the field.
Authors' abstract

6083 **Kiafouka, D., 1988**. *Trypanosoma* du groupe *brucei* chez le bovin trypanotolérant en zone enzootique d'un foyer actif de la trypanosomiase humaine en République Populaire du Congo. [*Trypanosoma brucei* sspp. found in trypanotolerant cattle in an enzootic zone with an active focus of human trypanosomiasis in Congo.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 145-147.
Centre de Recherches Vétérinaires et Zootechniques, B.P. 235, Brazzaville, Congo.
T. brucei sspp. was diagnosed in 1.48% out of a total of 135 trypanotolerant cattle from eight herds. In this region, *palpalis* group tsetse were found to be infected with pathogenic trypanosomes, including *T. congolense*, *T. vivax* and *T. brucei* sspp. *T. b. gambiense* was found to be responsible for human trypanosomiasis, *T. congolense* frequently infected cattle, horses, sheep, pigs and dogs in the region, whilst *T. vivax* was isolated only from cattle. *T. brucei* was, however, isolated from a sheep in a village focus. The existence of *T. brucei* sspp., which can attack the CNS, in trypanotolerant cattle in this active sleeping sickness focus suggests the need for awareness that such cattle may be reservoir hosts of this disease.
From author's abstract

6084 **Leak, S., Awuome, K., Dufferra, W., Dumont, O., Feron, A., Jeannin, P., Mahamat, B., Mawuena, K., Minengu, M., Mulungo, M., Nankodaba, G., Ordner, G., Sheria, M., Tikubet, G., Tsotsi, E., Toure, M. and Yangari, G., 1988**. Determination of tsetse challenge and its relationship with trypanosome prevalence in livestock within the African Trypanotolerant Livestock Network. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 542-547.
Leak, Feron: ILRAD, P.O. Box 30709, Nairobi, Kenya; Awuome: Direction Régionale du Développement Rural, Région Centrale, Ministère du Développement Rural, Togo; Dufferra, Tikubet: Ghibe Valley Site, ILCA, Ethiopia; Dumont, Jeannin, Ordner, Yangari: OGAPROV, Moanda, Gabon; Mahamat, Nankodaba, Toure: SODEPRA/GTZ/ILCA Joint Project, Boundiali, Côte d'Ivoire; Mawuena: CREAT, Avétonou, Togo; Minengu: Développement Progres Populaire, Idiofa, Zaire; Mulungo, Sheria: Kolo and Mushie Ranches, Compagnie J. Van Lancker, Zaire; Tsotsi: Veterinary Department, Kenya.
Tsetse challenge has been estimated at eleven sites within the African Trypanotolerant Livestock Network. Three factors have been studied: (1) tsetse relative density, determined from biconical trap catches; (2) trypanosome infection rates in tsetse, determined by dissection of proboscides, salivary glands and midguts; and (3) the proportion of feeds taken by these tsetse on livestock, determined by ELISA analysis of residual blood meals. The product of these three factors will give an index of tsetse challenge. As insufficient blood meals have so far been analysed, tsetse challenge is presented here as the product of factors (1) and (2) only. These challenge estimates can be related to trypanosome prevalences in livestock groups at the sites. A within-site comparison can reveal a significant relationship.
From authors' abstract

6085 **Mehlitz, D., 1988**. Animal reservoir hosts of sleeping sickness: an overview. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 213-219.
Bernhard-Nocht-Institut, Bernhard-Nocht-Strasse 74, D-2000 Hamberg 4, Federal Republic of Germany, and LRU, Monrovia, Liberia.
Current knowledge on animal reservoir hosts and their significance for the epidemiology of sleeping sickness due to *Trypanosoma brucei rhodesiense* and *T. b. gambiense* is reviewed. Criteria for the identification of the two *T. brucei* subspecies are given and problems of diagnosis and isolation of *T. brucei* infective to man are stressed. The zoonotic character of the *T. b. rhodesiense* disease is re-emphasised, and progress in epidemiological research on the known or potential domestic and wild animal reservoir hosts of *T. b. gambiense* or of *T. brucei* infective to man in West and Central Africa is considered in particular. The significance of non-human hosts in control of the two forms of sleeping sickness is discussed.
Author's abstract

6086 **Rawlings, P. and Snow, W.F., 1988.** Estimating trypanosomiasis challenge: problems experienced in developing a comprehensive approach in The Gambia. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 360-362.
ITC, P.M.B. 14, Banjul, Gambia.
Risk of trypanosomiasis infection to livestock involves factors related to tsetse, trypanosomes and the mammalian host. It is often estimated, simply, as the product of the relative abundance of tsetse and the infection rate in the flies.

However, in recent studies, including those at ITC in The Gambia, this measure of challenge has not correlated well with data on trypanosomiasis incidence in cattle. The reasons why the simple measure of challenge does not relate to disease incidence are discussed with reference to the problems of sampling tsetse including the use of traps compared with fly-rounds, the relationship between fly habitats and cattle grazing grounds, daily activity cycles of tsetse and the feeding preferences of different species of tsetse. Models of trypanosomiasis challenge which take these factors into account will lead to a better understanding of the epidemiology of trypanosomiasis and the evaluation of which factors of tsetse ecology may serve as indicators of challenge.
Authors' abstract

6087 **Snow, W.F., Dukes, P. and Rawlings, P., 1988**. High incidences of *Trypanosoma simiae* obscuring the composition of trypanosome infections observed in tsetse: a neglected problem. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 239-245.
Snow, Rawlings: ITC, P.M.B. 14, Banjul, Gambia; Dukes: TRL, Langford House, Bristol BS18 7DU, UK.
Trypanosoma (Nannomonas) simiae cannot be readily distinguished from *T. (N.) congolense* in tsetse and, as a result, has been overlooked in assessing tsetse infection rates. Three `case histories' from the literature and the experience of the authors are presented referring to work in Nigeria, Kenya and, most recently, The Gambia. These support the view that *T. simiae* is a widespread and common infection in tsetse, particularly in populations of *G. morsitans* group flies which take a large proportion of their feeds from warthogs or bushpigs. *T. simiae* is reported for the first time from The Gambia where it comprised 70-80% of *Nannomonas* infections in *G. m. submorsitans* in one area. The importance of accurate identification of infections in tsetse, particularly in relation to studies of challenge to livestock, is stressed.
Authors' abstract

5. human trypanosomiasis

(a) SURVEILLANCE

6088 **Avode, G., Bouteille, B., Pestre-Alexandre, M., Dumas, M., Gbaguidi, C., Lawson, G. and Darde, M.L., 1988**. Enquête clinique et sérologique de la trypanosomiase africaine dans la Province de l'Atacora au nord du Benin. [Serological and clinical study of African trypanosomiasis in the Province of Atacora in northern Benin.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 158-167.
Avode, Pestre-Alexandre, Dumas, Darde: Institut de Neurologie Tropicale, Faculté de Médecine, 2 rue du Docteur Marcland, 87025 Limoges Cédex, France; Bouteille, Pestre-Alexandre, Darde: Service de Parasitologie, CHU Dupuytren, 2 avenue Alexis Carrel, 87042 Limoges Cédex, France; Gbaguidi, Lawson: Service des Grandes Endémies et Direction Provinciale de la Santé, Natitingou, Benin.
The northern province of Benin, Atacora, is a wooded savanna region with a previously dormant focus of sleeping sickness as well as animal trypanosomiasis.

A recent report of new cases of sleeping sickness in this focus prompted us to undertake a serological and clinical survey, reported here. Out of 99 people clinically examined, 98 were normal, while 43 of the 92 sera tested were serologically positive. Thirty-five had IgG antibodies detected by both IFAT and ELISA; one was positive by IFAT and CATT; one was positive by ELISA and CATT; 4 were positive by IFAT only; one by ELISA only; and 2 by CATT only. Eight of the sera had IgM antibodies detected by both IFAT and ELISA. The results are discussed. An epidemiological survey (clinical, parasitological and immunological) is being undertaken in the province.
Authors' abstract

6089 **Simarro, P.P., Sima, F.O. and Vilalta, M.M., 1988**. Situation actuelle de la maladie du sommeil dans les foyers historiques de Guinée Equatoriale. [Epidemiology of sleeping sickness in Equatorial Guinea.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 196-204.
Centro Control de la Tripanosomiasis, Bata, Equatorial Guinea.
Intense surveillance between 1942 and 1967 resulted in a steady decline in the number of new cases of sleeping sickness diagnosed in the country. Slackening of surveillance in the 1970s, however, led to a resurgence of the disease in the historical foci as evidenced by the presentation of patients at hospitals in these foci. The gravity of the situation led the health authorities to set up a centre for trypanosomiasis control (CCT) in Bata in 1985, charged with planning and implementing a control strategy for the whole country. After a year of work, 30,609 people have been examined and 391 new cases found and treated. Kogo and Mbini are typical endemic foci with a sleeping sickness prevalence of less than 1%, with cases mainly in the late stage. Luba focus has an overall prevalence of 4%, in some places reaching more than 25%, with a large number of cases in the early stage of the disease, possibly heralding an epidemic. Riaba focus is least affected.

(b) PATHOLOGY AND IMMUNOLOGY

6090 **Mbulamberi, D.B., 1988**. A clinical analysis of 3151 cases of Rhodesian sleeping sickness treated in south eastern Uganda, during the year 1985. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 188-195.
National Sleeping Sickness Programme, P.O. Box 1241, Jinja, Uganda.
The political and economic upheavals which started in Uganda in 1971 caused a breakdown of both tsetse and sleeping sickness surveillance and control, resulting in an epidemic in 1976 which still persists, particularly in south-eastern Uganda. This paper presents a statistical review of the situation in south-eastern Uganda since 1976 and then clinically analyses 3151 out of the 3517 cases of the disease treated in the same area in 1985. The most commonly presenting symptoms included fever, headache, body weakness, pain in the neck, backache, joint pains, loss of appetite and excessive sleeping during the day. 19% had trypanosomal chancre. 86.7% were in the early stage of the disease. The 20-29 year age group had the highest occurrence of cases (20.9%); overall, 52.5% of cases were males, and the sex distribution of cases was similar in all age groups. Only minor complications arose from treatment with suramin and melarsoprol, and reactive encephalopathy was not common. The overall case fatality rate was 0.8%.

6091 **Postema, P.T.E., Groote Veldman, R., Docter, R., Krenning, E.P.,**

Raadt, P. de, Lamberts, S.W.J. and Heinnemann, G., 1988. Involvement of the endocrine system in human African trypanosomiasis. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 174-175.
WHO, 1211 Geveva 27, Switzerland.
To investigate if endocrine abnormalities are present in humans suffering from African trypanosomiasis, serum analysis was performed in 63 acute and advanced stage patients in Daloa, Côte d'Ivoire. Serum was tested for the following parameters: total thyroxine (TT4), triiodothyronine resin uptake (T3U), free thyroxine index (FT41), total triiodothyronine (TT3), total reverse triiodothyronine (rT3), thyrotrophin (TSH), prolactin (PRL) and cortisol (CRT). TSH was normal in virtually all patients. Although TT4 was low in some patients, this was not due to decreased thyroid function, but to diminished serum thyroxine binding capacity, because FT41 was normal in most instances. This fact combined with the great number of patients with low TT3 and high rT3 values points to a severe state of illness (low T3-syndrome). Serum prolactin concentrations were elevated in a number of patients in all groups. The number of patients with low cortisol levels in unexpectedly high and the degree of hypocortisolism in often dramatic (range: 2.4-63.3 nM). It is not known to date whether this adrenal insufficiency is caused by peripheral and/or central mechanisms. It is obvious that, in some patients, life is endangered by the degree of adrenal insufficiency. Early recognition of such patients in relation to adequate cortisol substitution is mandatory.
From authors' abstract and conclusions

(c) TREATMENT

6092 **Bales, J.D., 1988**. The treatment of Rhodesian sleeping sickness: a review of 46 cases. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 155.
c/o KETRI, Kisumu, Kenya.
Forty-six cases of human African trypanosomiasis (Rhodesian type) treated since November 1983 at the Human Treatment Facility of the Kenya Trypanosomiasis Research Institute (KETRI) at Alupe, Kenya, are reviewed. Forty cases were late stage, CNS disease, with six early stage, peripheral disease. Thirty-eight patients were Kenyans from the Lambwe Valley, an endemic focus, and eight were Ugandans. There were 27 males and 19 females. Three late-stage cases have relapsed since therapy with suramin and melarsoprol and have been treated with DFMO. Five died either before (2), during (2) or after (1) therapy with melarsoprol. The two that died during therapy with melarsoprol are considered to represent toxic encephalopathy.
Author's abstract

6093 **Doua, F., Boa, F.Y., Sanon, S.R., Miezan, T.W., Raadt, P. de and Konian, K., 1988**. Traitement actuel des trypanosomiases humaines africaines: résultats observés chez 450 patients atteints de T.H.A. à *Trypanosoma brucei gambiense* dans le foyer de Daloa - Côte d'Ivoire. [Current treatment of human African trypanosomiasis: results obtained with 450 *T. b. gambiense* patients in the Daloa focus, Côte d'Ivoire.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 180-187.

Doua, Sanon, Miezan: Projet de Recherches Cliniques sur la Trypanosomiase, B.P. 1425, Daloa, Côte d'Ivoire; Boa: Service de Neurologie, CHU Cocody, Abidjan, Côte d'Ivoire; Raadt: Trypanosomiasis and Leishmaniasis Unit, Parasitic Diseases, WHO, 1211 Geneva 27, Switzerland; Konian: Direction de la Santé pour le Sud, Abidjan, Côte d'Ivoire.
Between January 1983 and December 1985, 450 *T. b. gambiense* patients were treated in the Daloa Focus, Côte d'Ivoire. They were aged between 4 months and 74 years, and 58.67% of them were males whilst 41.33% were females. 87.34% of the patients were at the advanced stage of the disease compared to only 12.66% in the initial stage. Melarsoprol was used to treat all the patients and DFMO was administered to 10 patients who had relapsed following treatment with melarsoprol or were resistant to this drug. Among the patients treated with melarsoprol, 7.11% developed arsenical encephalopathy and 3.14% of them died. The rate of relapse following treatment with melarsoprol was 5.11% while none of the 10 patients treated with DFMO had a relapse. Furthermore, the secondary effects observed during treatment with DFMO were all reversed either through a reduction of the dose or discontinuation.
Authors' abstract

6094 **Maes, L. and Hamers, R., 1988**. Immunological assay methods for the monitoring of trypanocidal drugs: ELISA methods for measuring melarsoprol levels in serum. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 142.
Instituut voor Moleculaire Biologie, 65 Paardenstraat, B-1640 St Genesius Rode, Belgium.
The use of the arsenical trypanocidal drug melarsoprol for the chemotherapeutic treatment of human trypanosomiasis is accompanied by a number of lethal encephalopathies. The proper administration of the drug is complicated by individual differences in host response. An ELISA method has been developed for measuring the melarsoprol levels in human sera. In addition to drug monitoring, enabling a more appropriate treatment, this method should facilitate pharmacokinetic and metabolic studies. The ELISA method allows for the measurement of melarsoprol at the 10 ng/ml level. Alternative antisera, which are currently being prepared, will also be useful for the detection of metabolites and other arsenicals which are being used in animal trials.
Authors' abstract

6095 **Schechter, P.J. and Sjoerdsma, A., 1988**. Eflornithine treatment of *gambiense* sleeping sickness. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 156-157.
Merrell Dow Research Institute, 16 rue d'Ankara, 67084 Strasbourg, France and Cincinnati, OH 45215, USA.
Eflornithine (DFMO), a selective enzyme-activated inhibitor of polyamine biosynthesis, has been shown to be curative in laboratory animals infected with various *Trypanosoma* species. DFMO has been administered as monotherapy, either intravenously, orally or by both routes, to 150 patients with *T. b. gambiense* trypanosomiasis. Daily doses ranged from 200-500 mg/kg for 2-10 weeks. 145 patients had late-stage disease, many at a terminal stage, and 132 of these had previously been treated with 1-4 full courses of organic arsenical therapy. In each of the 143 cases where evaluation was possible, DFMO treatment resulted in

disappearance of trypanosomes (when present prior to treatment), decreased CSF white blood cell counts (for late-stage cases) and rapid, dramatic amelioration of clinical signs and symptoms. Side-effects included diarrhoea, abdominal pain and anaemia, all reversible upon stopping or decreasing DFMO doses. Thirteen patients died during or shortly after discontinuing treatment. Seven patients relapsed (or were reinfected) within 10 weeks to 10.5 months after treatment. Several cases followed for more than 24 months after treatment remain in good health with no evidence of relapse and are considered cured. Thus, DFMO represents a new, effective and safe treatment for early and late-stage sleeping sickness, including cases refractory to arsenical therapy.
Authors' abstract

6. animal trypanosomiasis
(a) SURVEY AND DISTRIBUTION

[See also **13**: no. 6101.]

6096 **Bauer, B., Compaore, P., Kabore, I., Kourouma, B., Mattausch, M., Some, J. and Tamboura, I., 1988**. Epidemiological survey in the pastoral zone of Sideradougou, Burkina Faso, after tsetse eradication. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 332-333.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
Almost 2 years after tsetse eradication, more than 300 cattle aged 6-12 months were earmarked and parasitologically examined by HCT and the capillary concentration technique. Parasitological examinations were repeated at monthly intervals. For comparison, more than 300 cattle of the same age, grazing in areas of different tsetse densities, were examined in the same manner. The results so far obtained indicate that there are no more cyclically transmitted trypanosomes within the pastoral zone of Sideradougou. In contrast, infections with *Trypanosoma congolense* and *T. brucei* were frequently found in the cattle grazing in tsetse-infested areas.
Authors' abstract

6097 **Ikede, B.O., Reynolds, L., Ogunsanmi, A.O., Fawumi, M.K., Ekwuruke, J.O. and Taiwo, V.O., 1988**. The epizootiology of bovine trypanosomiasis in the derived savannah zone of Nigeria - a preliminary report. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 289-294.

Ikede, Ogunsanmi, Fawumi, Taiwo: Department of Veterinary Pathology, University of Ibadan, Ibadan, Nigeria; Reynolds, Ekwuruke: ILCA Humid Zone Programme, P.M.B. 5320, Ibadan, Nigeria.
The derived savanna zone in Nigeria harbours agro-pastoralists throughout the year and nomadic herders during the dry season. The zone's vast potential for livestock production has been largely neglected due to its presumed high incidence of tsetse and trypanosomiasis. Between February 1986 and March

1987, we examined several settled and semi-settled herds of mainly Zebu cattle in Ogun, Oyo, Ondo, Bendel and Kwara States, mostly in the derived savanna zone. Altogether 757 animals were bled in the rainy season and 768 during the dry season, making a total of 1525 in 95 herds. Standard parasitological and entomological methods were used to determine the prevalence of trypanosomiasis and tsetse respectively. The disease and its vector were found to be relatively insignificant in the herds studied in Ogun and Bendel States (2.7 and 6.7% infection rates respectively). Infection rates were higher in herds in Kwara (17.3%), Oyo (19.4%) and Ondo (28.2%) States. *Trypanosoma congolense* was more common than *T. vivax*, while *T. brucei* was not detected. *Glossina palpalis* and *G. tachinoides* were the only tsetse encountered. The overall infection rate was higher in the wet season than in the dry season. It is concluded that the role of trypanosomiasis in limiting livestock production in the derived savanna zone has been exaggerated. Intensive commercial cattle production with Zebu breeds would seem a viable proposition in most of the area studied.
Authors' abstract

6098 **Joshua, R.A. and Shanthikutmar, S., 1989**. Naturally occurring trypanosomiasis in some cattle herds around the Jos Plateau of Nigeria. *Bulletin of Animal Health and Production in Africa*, **37** (1): 95-96.
Department of Veterinary Medicine, University of Ibadan, Ibadan, Nigeria; Veterinary Teaching Hospital, Jos, Nigeria.
A survey of trypanosome infection in three cattle herds in the Jos Plateau, an area generally presumed to be free of tsetse flies and consequently of trypanosomiasis, was undertaken during a two-year period. In all, 323 cattle were examined; 31 blood samples (9.6%) were found to be infected with trypanosomes: 15 with *Trypanosoma vivax*, 11 with *T. congolense* and 5 with *T. brucei*. Twenty infected *Glossina palpalis* and 11 infected *G. tachinoides* were caught in the vicinity of one herd. Suitable tsetse breeding conditions were provided by a slow-running stream.

6099 **Kiafouka, D., 1988**. Cas d'infestation naturelle par *Trypanosoma congolense* chez une truie gestante de race Large White en République Populaire du Congo. [A case of natural infection with *T. congolense* in a Large White pregnant sow in Congo.] (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 251.
Centre de Recherches Vétérinaires et Zootechniques, B.P. 235, Brazzaville, Congo.
A case of natural infection with *T. congolense* in a pregnant sow of the Large White breed in a forest area around Brazzaville is described. The conditions which probably contributed to the manifestation of the disease in this animal are discussed. The infection was suppressed by isometamidium hydrochloride. Sporadic outbreaks of *T. congolense* in domestic animals are quite common in several foci in the territory in areas limited by narrow forest galleries. Improved sanitary conditions coupled with periodic veterinary control would help to limit animal trypanosomiasis in the country.
Author's abstract

6100 **Stratford, M.B., 1988**. The cattle trypanosomiasis situation in Zanzibar. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 334-335.
FAO Livestock Development Project, URT/81/017, Zanzibar, Tanzania.

Prevalence, distribution and general epidemiological features of cattle (EAZ) trypanosomiasis on Zanzibar Island, Tanzania, have been estimated by bloodsmear during two main surveys in 1985-86. During the first survey 503 cattle were sampled randomly over the road network of Zanzibar. This survey identified three isolated foci of infection. The second survey identified the border of the endemic trypanosomiasis areas. Out of 1881 cattle samples, 325 (19%) were found infected with *Trypanosoma congolense*. The results showed that the three main foci of infection were not isolated. A 30 km long band (5-10 km width) of endemic cattle trypanosomiasis from north-west to south-east of the island has been identified. Epidemiological data on cattle trypanosomiasis showed not significant difference in prevalence of infection in age or breed groups. A significant difference was observed between prevalence of infection in males (28%) and females (18%). In an endemic area, a group of 100 cattle was bloodsmeared and positive animals treated every month with diminazene aceturate for one year. Results of this monthly survey showed an increase in reinfection rate during the hot dry season (January-March). In November 1986, prevalence of infection was 27%. A blanket treatment with diminazene aceturate did not change the prevalence of infection when cattle were rechecked 6 weeks later in a group of 70 cattle where the prevalence was 64%. Isometamidium treatment (1 mg/kg) offered protection for two months.
Author's abstract

(b) PATHOLOGY AND IMMUNOLOGY

[See also **13**: no. 6159.]

6101 **Clausen, P.H., Hörchner, F., Schillinger, D., Röttcher, D., Nantulya, V.M. and Musoke, A.J., 1988**. IgG- and IgM-antibody responses in camels experimentally infected with *Trypanosoma evansi*. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 151.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso; Institut für Parasitologie und Tropenveterinärmedizin, Freie-Universität, Berlin, Federal Republic of Germany; Chemotherapy of Trypanosomiasis Project (GTZ), Veterinary Research Laboratory, Kabete, Kenya; ibid.; ILRAD, P.O. Box 30709, Nairobi, Kenya; ibid.
The effectiveness of curative trypanocidal drug treatment in *T. evansi*-infected camels (*Camelus dromedarius*) was evaluated by semi-quantitative estimation of IgG- and IgM-antibody responses in serum and cerebrospinal fluid (CFS). Thirteen camels were infected with suramin- and melarsoprol-sensitive clones of *T. evansi* (KETRI 2443). Ten were treated 8 weeks after infection, five with suramin and five with melarsoprol. Three camels served as positive controls. Samples of blood and CSF were taken regularly from all animals. Camel IgG and IgM were isolated by DEAE 52 and Sepharose 6 B chromatography and purified by SDS-polyacrylamide gel electrophoresis. Antisera to IgG and IgM were prepared in rabbits. Parasitaemia was monitored and IgG and IgM antibody levels were determined by micro-ELISA using crude trypanosomal antigen. Subinoculation in mice revealed parasites in the CSF of infected camels before treatment. Treatment with melarsoprol appeared to clear the parasites and no

relapse infections occurred. Suramin, which presumably has no trypanocidal activity in the CNS, also appeared to provide an effective cure, although one relapse infection in the suramin-treated group was detected by mouse inoculation, but parasites were never observed in the camel's bloodstream. High IgG and IgM antitrypanosomal antibody levels were detected 9-13 days after infection. IgM levels declined after treatment. This suggests that analysis of IgG- and IgM-antibody levels by ELISA could provide a useful tool for diagnosis of trypanosomiasis in camels.
Authors' abstract

6102 **Coulibaly, L., Diarrasouba, d'Ieteren, G., Itty, P., Maehl, H., Mahamat, B., Nagda, S., Paling, R., Rarieya, M., Schuetterle, A., Thorpe, W. and Trail, J., 1988**. Effect of endemic diseases including trypanosomiasis on the blood packed cell volume of livestock in northern Côte d'Ivoire. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 552-555.
Coulibaly, Diarrasouba, Mahamat, Schuetterle: SODEPRA/ GTZ/ILCA Joint Project, Boundiali, Côte d'Ivoire; d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.
Data on PCV, trypanosome infections and other anaemia-producing pathogens in cattle maintained in village herds in northern Côte d'Ivoire have been analysed for the two years January 1984 to December 1985. The effect of trypanosome infection on PCV was found to be increased by internal but not by blood parasites. The effect of trypanosome infection on PCV increased progressively as the strongyle egg burden increased. In contrast, trypanosomes and the blood parasite *Theileria* spp. affected PCV independently. Stronglye egg burden affected the PCV of cattle of all age groups to a similar degree. In contrast, *Theileria* spp. depressed the PCV of pre-weaners but only marginally affected the other age groups.
From authors' abstract

6103 **Defly, A., Awuome, K., Bokovi, K., d'Ieteren, G., Grundler, F., Handlos, M., Itty, P., Maehl, H., Morkramer, G., Nagda, S., Rarieya, M., Thorpe, W. and Trail, J., 1988.** Effect of trypanosome infection on livestock health and production traits in two areas of Togo. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 526-529.
Defly, Grundler, Morkramer: CREAT, B.P. 27, Agou-Gare, Togo; Awuome, Bokovi, Handlos: Direction Régionale du Développement Rural, Région Centrale, Ministère du Développement Rural, Togo; d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya.
The prevalence, species and intensity of trypanosome infection found in different livestock species, breeds, age groups and management systems are reported for cattle and sheep in the Avétonou area and for sheep and goats in the Sokode area. The effect of these trypanosome infections on health and production traits in cattle are evaluated. Trypanosome prevalence in cattle was more than twice that in sheep kept in the same area; there was no difference between sheep and goats. N'Dama and Race Locale had similar prevalence levels within both ranch and village management systems. *Trypanosoma vivax* type infections accounted for about 90% of total trypanosome infections in cattle (no differences between breeds or management systems). However, intensity of *T. vivax* infections was

higher in village than in ranch cattle. Trypanosome infection in the cow during gestation or lactation significantly depressed her PCV. Average PCV in pre-weaner calves was only affected by infections occurring in the calf. PCVs were significantly lower in village than in ranch cattle but there were no marked breed differences. Trypanosome infections in the cow did not affect parturition weight nor calf birth weight, but higher PCVs were associated with higher weights. Calving intervals were slightly longer in parasitaemic cows and, as PCV increased, calving interval shortened. Cow and pre-weaner mortality was twice as high in village as in ranch cattle.
Authors' abstract

6104 **d'Ieteren, G., Awuome, K., Bokovi, K., Chema, S., Coulibaly, L., Defly, A., Dumont, P., Feron, A., Grundler, G., Handlos, M., Itty, P., Jeannin, P., Maehl, H., Maloo, S., Morkramer, G., Mulungo, M., Nagda, S., Ordner, G., Paling, R., Rarieya, M., Schuetterle, A., Sheria, M., Thorpe, W., Trail, J. and Yangari, G., 1988**. Genetic and environmental factors affecting the epizootiology and pathogenesis of trypanosomiasis in livestock at eight sites within the African Trypanotolerant Livestock Network. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 275-281.
d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Awuome, Bokovi, Handlos: Direction Régionale du Développement Rural, Région Centrale, Ministère du Développement Rural, Togo; Chema, Maloo: Veterinary Department, Kenya; Coulibaly, Schuetterle: SODEPRA/ GTZ/CIPEA Joint Project, Boundiali, Côte d'Ivoire; Defly, Grundler, Morkramer: CREAT, Avétonou, Togo; Dumont, Jeannin, Ordner, Yangari: OGAPROV, Moanda, Gabon; Feron, Mulungo, Sheria: Mushie and Kolo Ranches, Compagnie J. Van Lancker, Zaire; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.
The influence of livestock species, breed, animal age and lactational status on the prevalence, species and intensity of trypanosome infection in livestock was estimated at eight sites in West, Central and East Africa. The sites are OGAPROV (Gabon), Avetonou and Sokode (Togo), Boundiali and Tengrela (Côte d'Ivoire), Muhaka (Kenya) and Kolo and Mushie (Zaire). The effect of trypanosome infections on PCV of cattle was estimated for four characters (average PCV during gestation, PCV at parturition, average PCV pre-weaning and PCV at weaning) at each of three sites, Boundiali, Mushie and Avetonou. The results demonstrated the consistency of PCV depression for each of the characters at the three sites. Frequency of trypanosome infection rather than trypanosome species determined the PCV response at the one site, Mushie, where the comparison could be made. The effects of trypanosome infections on livestock viability, reproductive performance and liveweights are also reported.
Authors' abstract

6105 **Feron, A., d'Ieteren, G., Itty, P., Maehl, H., Mulungo, M., Nagda, S., Paling, R., Rarieya, M., Sheria, M., Thorpe, W. and Trail, J., 1988**. Can PCV be used as an indicator of trypanosomiasis and production level in cattle? *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 534-537.

Feron, Mulungo, Sheria: Kolo and Mushie Ranches, Compagnie J. Van Lancker, Zaire; d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.
Data from N'Dama cattle exposed and not exposed to trypanosomiasis while maintained under the same system of management on two ranches in Zaire were analysed to estimate the importance of factors influencing blood PCV and to investigate possible relationships between PCV and reproductive and liveweight performance. Trypanosome infection during gestation significantly depressed average PCV during that period and also during the subsequent lactation period, while infection during lactation depressed average PCV in the lactation. The effect of repeated infection appeared cumulative. The stress of suckling a calf also significantly depressed PCV. Calf PCV level was depressed by infections in the calf, but not by infections in the dam. Cows with the lowest PCVs tended to have poorest reproductive performance levels and weaning weights both under and free from trypanosomiasis risk. Calf PCV pre-weaning was also positively correlated with calf weaning weight. These preliminary results suggest that PCV may be a useful indicator of trypanosomiasis infection and of livestock performance.
Authors' abstract

6106 **Grundler, G.H.M., 1988**. Testicular lesions in bulls infected with *Trypanosoma congolense*. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 301.
CREAT, B.P. 7518, Lomé, Togo.
Considerable reproduction disorders in *T. vivax*- and *T. congolense*-infected male and female cattle have been reported in recent years. Several authors describe significant reduction of semen quality in bulls due to trypanosomiasis. In order to confirm this observation and to find its pathogenesis, five West African Shorthorn bulls were infected with *T. congolense*. A histological study of the testicles and epididymis was carried out 15 weeks post-infection. In all animals interstitial orchitis, atrophy and calcification of the seminiferous tubular epithelium were found. Systematic diagnosis and early treatment of trypanosomiasis in steers are recommended as prophylactic measures.
Author's abstract

6107 **Kalu, A.U., Ikwuegbu, O.A. and Ogbonnah, G.A., 1989**. Serum protein and electrolyte levels during trypanosome infection and following treatment in the West African dwarf goat. *Bulletin of Animal Health and Production in Africa*, **37** (1): 41-45.
Veterinary and Livestock Studies Division, NITR, Vom, Plateau State, Nigeria; Biochemistry Division, National Veterinary Research Institute, Vom, Plateau State, Nigeria; ibid.
Serum protein and electrolyte concentrations were monitored in East African dwarf goats undergoing experimentally-induced trypanosomiasis (*Trypanosoma vivax* infection) and following administration of trypanocides (Berenil, Samorin and Novidium). Total serum protein, albumin and albumin/globulin ratio decreased significantly ($P < 0.05$) within 4 weeks of patent trypanosomiasis. Globulin fractions increased by 11.51% from a pre-infection level of 39.81 g l^{-1} during the same period. In untreated animals, progressive hypoproteinaemia (18.52% of initial value) was associated with losses in albumin concentration.

Calcium and chloride levels increased as the disease progressed but differences were significant only for changes in calcium concentration. Chemotherapy reversed the effect of the infection by the third or fourth week of drug administration. However, Novidium was more efficient than Berenil or Samorin in modulating the effect of *T. vivax* infections on the serum constituents of caprine hosts.
Authors' abstract

6108 **Mawuena, K., 1988**. Trypanosomiase des moutons et chèvres de race naine Djallonké des régions Sud-Guinéennes au Togo. [Trypano-somiasis in sheep and goats of the dwarf Djallonké breed in the South-Guinean regions of Togo.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 321-330.
CREAT, B.P. 27, Agou-Gare, Togo.
Trypanosomiasis infection was studied in 2689 small ruminants (1038 sheep and 1651 goats) of the Djallonké dwarf breed found in the humid and tsetse-infested South-Guinean regions of south-west Togo. It was established that, although trypanotolerant, the animals can only survive in highly infested areas to the detriment of their health since, in the infested areas, the disease results in anaemia, retarded growth in the young and loss of weight especially in cases of frequent and high parasitaemia which is often seen in *Trypanosoma vivax* infection. Males seem to tolerate the infection better than females. Parasitaemia is more frequent and more serious in young animals aged between 7 months and 2.5 years. The disease seems to be more chronic and more cryptic in animals aged over 3 years. Fertility in the Djallonké breed is not affected by the infection: gestation takes place normally, and no cases of abortion were recorded even in cases where parasitaemia was high during the gestation period. Parturition was also normal and there was no mortality.
Author's abstract

6109 **Mulungo, M., d'Ieteren, G., Feron, A., Itty, P., Maehl, M., Nagda, S., Paling, R., Rarieya, M., Thorpe, W. and Trail, J., 1988**. Trypanosomiasis in N'Dama cattle in Zaire and its effects on their health and production. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 530-533.
Mulungo, Feron: Kolo and Mushie Ranches, Compagnie J. Van Lancker, Zaire; d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.
The prevalence, species and intensity of trypanosome infections over a 3 year period are reported for N'Dama cattle managed on Mushie Ranch, Zaire. The effects of the trypanosome infections on blood PCV, reproductive performance and liveweights are presented. Cows and calves showed similar mean monthly trypanosome prevalences and a common pattern of infection during the study period. Cows had more *Trypanosoma congolense* than *T. vivax* infections while their calves had more *T. vivax* than *T. congolense* infections. The *vivax*:*congolense* ratio decreased with age at all network sites. The mean PCV of uninfected N'Dama cows in Mushie was 35.2%. These cows showed a 3-5% depression of PCV caused by one *T. congolense* or *T. vivax* infection and a 10-11% depression caused by two or more trypanosome infections. These results suggest that there is no marked difference in the pathogenicity of *T. congolense* and *T. vivax* infections in terms of PCV depression, and that the frequency of

infections is more important than the species of trypanosome. Cow weight at parturition was not significantly depressed by trypanosome infection suffered during gestation. However, trypanosome infection during the last 6 months of gestation did significantly reduce calf birth weight, with the greater effect resulting from infections in the dam during the last 3 months of gestation.
From authors' abstract

6110 **Ordner, G., d'Ieteren, G., Dumont, P., Itty, P., Jeannin, P., Maehl, H., Nagda, S., Paling, R., Rarieya, M., Thorpe, W., Trail, J. and Yangari, G., 1988**. Comparative performance of trypanotolerant and more susceptible cattle breeds exposed to trypanosomiasis in Gabon. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 538-541.

Ordner, Dumont, Jeannin, Yangari: OGAPROV, Moanda, Gabon; d'Iteteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.

The influence of breed and animal age on the prevalence, species and intensity of trypanosome infection and the effects of these infections on the blood PCV of N'Dama, Nguni and crossbred cattle are reported. The effects of trypanosome infection, PCV level and lactational status on reproductive performance and liveweight of N'Dama cattle are presented and the mortalities of different breeds exposed to trypanosomiasis risk are compared. Trypanosome prevalence averaged 8.8% for N'Dama, 25.9% for the susceptible Nguni, 16.5% for crossbreds. There was no marked difference between age groups. The relative frequency of *Trypanosoma congolense* type infections was markedly lower in Nguni than in all others, and was significantly higher in cows than in calves. Parasitaemia scores were higher in Nguni. Mean PCV was lower in infected cows (30.5 for Nguni, 33.3 for the N'Dama Okouma strain). Lactating cows had a lower PCV than dry cows. Two or more trypanosome infections reduced the calving rate in N'Dama cows by one third. PCV levels reflected reproductive performance. Calf weaning weight was depressed by 8.8% when the dam was infected during the year prior to parturition. Cow mortality in Nguni was four times higher compared to the other breed groups; pre-weaner mortality was over two times higher in calves with 75% or more Nguni genes as compared to N'Dama.
From authors' abstract

6111 **Schuetterle, A., Coulibaly, L., Diarrasouba, I., d'Ieteren, G., Itty, P., Konin, N., Maehl, H., Mahamat, B., Nagda, S., Paling, R., Rarieya, M., Thorpe, W. and Trail, J., 1988**. Effect of trypanosome infection on livestock health and production traits in northern Côte d'Ivoire. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 521-525.

Schuetterle, Coulibaly, Diarrasouba, Konin, Mahamat: SODEPRA/GTZ/ILCA Joint Project, Boundiali, Côte d'Ivoire; d'Ieteren, Itty, Maehl, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.

The prevalence, species and intensity of trypanosome infection found in different livestock species (cattle and sheep), breeds (N'Dama, Baoulé, Zebu and crossbred cattle; Djallonké and crossbred sheep), and age groups, and the effect of these infections on health and production traits were estimated in northern Côte d'Ivoire. Trypanosome prevalence was higher in cattle (N'Dama) than in sheep

(Djallonké), and highest in the more susceptible breed groups of both species. *Trypanosoma vivax* was more common than *T. congolense* in sheep, while *T. brucei* was the least common species in both cattle and sheep. The relative frequency of *T. vivax* infections decreased as the animals became older. In both cattle and sheep, trypanosome infection during gestation, and during lactation, significantly depressed average PCV. Djallonké ewes with low PCV pre-weaning had longer lambing intervals than those with high PCV.
Based on authors' abstract

6112 **Vos, G.J., Moloo, S.K. and Gardiner, P.R., 1988**. Immunity to *Trypanosoma vivax* infections in goats. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 150.
ILRAD, P.O. Box 30709, Nairobi, Kenya.
Immunity to a tsetse-delivered challenge of *T. brucei* or *T. congolense* can be induced in goats. The methodology - infection of goats following the bite of infected tsetse and subsequent chemotherapy of the initial infection - has been repeated in attempts to induce immunity to a stock and clone of *T. vivax*. Goats were infected with *T. vivax* stock IL 2133 or with clone IL 2710 and either treated with Berenil (10 mg/kg) or allowed to undergo chronic infection and self-cure. Only two out of 12 goats resisted subsequent homologous challenge. All goats were then treated and rechallenged. Three out of four goats infected with clone IL 2710 resisted challenge but goats infected with stock IL 2133 did not. It is suggested that the low number of metacyclics transmitted by tsetse, and therefore the low antigenic stimulus, could be responsible for the erratic induction in goats of immunity to *T. vivax*.
From authors' abstract

6113 **Waitumbi, J.N. and Connor, R.J., 1988**. A comparison of the haematocrit level and parasitaemia among camel dams, calves and yearlings living in a camel trypanosomiasis endemic area of Marsabit District, eastern Kenya. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 331.
KETRI, P.O. Box 362, Kikuyu, Kenya; May & Baker, P.O. Box 30104, Nairobi, Kenya.
A weekly determination of the haematocrit level and examination for the presence of trypanosomes in a traditionally managed group of camels comprising 20 dams, 20 calves and 20 yearlings revealed a remarkable difference over a period of 4 months. While the majority of the calves (70%) were in poor condition and had low levels of haematocrit (below 0.24 l/l), no trypanosomes were demonstrated. The majority of the yearlings (76%) were in good condition and had high haematocrit levels (greater than 0.25 l/l). The remaining 24% that demonstrated low haematocrit levels were clinically ill and trypanosomes were invariably detected. The dams showed a different picture: 57% were in poor condition and also showed low haematocrit levels but only 25% were infected with parasites. A comparison of the above results with those of camels owned by an institution revealed a similar picture except in calves where only 15% had a low haematocrit level.
Authors' abstract

(c) TRYPANOTOLERANCE

[See also **13**: nos. 6108, 6109, 6110, 6125.]
6114 **Agyemang, K., Jeannin, P., Grieve, A.S. and Dwinger, R.H., 1988**. Milk production of N'Dama cattle kept under village conditions in The Gambia. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 234-238.
ITC, P.M.B. 14, Banjul, Gambia.
Preliminary results of a study of the milking potential of N'Dama cattle kept under traditional village production systems in low to medium tsetse challenge areas in The Gambia indicated that, in addition to providing sufficient milk for her calf to reach an average weight of 60 g, the N'Dama cow can provide 310 kg of milk for human consumption during 10 months of lactation
6115 **Bauer, J., Pohlit, H., Kabore, I. and Bauer, B., 1988**. Are trypanotolerant cattle less frequently bitten by tsetse flies? (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 465.
CRTA, B.P. 454, Bobo-Dioulasso, Burkina Faso.
The possibility that tsetse flies can distinguish between individual cattle and that this could play an important role in trypanotolerance was investigated. We released teneral flies of two tsetse species (*Glossina morsitans submorsitans*, *G. palpalis gambiensis*) in a fly-proof stable in the presence of pairs of bovines (Zebu, Baoulé). Two hours later the flies were recaptured and the origin of the bloodmeal was determined. Large, statistically significant differences in the feeding preference occurred. However, these results varied considerably from one day to another. Yet double feeding was observed in only about 3% of the flies. Thus, minor, non-obvious changes in the experimental design may lead to extremely different results. Such may be the case also in the field. We are still attempting to detect and define such changes in the experimental design.

However, a non-mechanistic, stochastic model of infection could be envisaged. In another set of experiments the rate of blood uptake was compared between three fly species (*G. m. submorsitans*, *G. p. gambiensis*, *G. tachinoides*) kept in cages and between several bovines. Only minor differences were observed.
Authors' abstract

6116 **Dolan, R.B., Njogu, A.R., Sayer, P.D., Okech, G. and Alushula, H., 1988**. Trypanotolerance in East Africa: the Orma Boran breeding and selection programme. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 314-318.
KETRI, P.O. Box 362, Kikuyu, Kenya.
Initial studies, under both field and laboratory conditions, showed that Orma Boran cattle, reared by the Orma tribe, were less susceptible to trypanosomiasis that ranch-bred improved Kenya Borans. In October 1983 breeding herds of these two Boran types were established on Galana Ranch in Kenya with the aim of providing comparative data on animals born and reared in the same environment and selecting for increased trypanotolerance and beef production. Production records to include all aspects of fertility and growth are collected. The two herds are maintained in a tsetse-infested area of the ranch and blood is examined for trypanosomes fortnightly and PCV estimated. The first three years' results indicate that the Orma Boran, under continuous trypanosomiasis challenge, have lower infection rates than the improved Boran and both pre- and post-weaning mortality are significantly less in the Orma Boran. To combine selection for trypanotolerance and growth rate, bulls for breeding are selected on the basis of their post-weaning growth rate under continuous field challenge, with trypanosomiasis treatment administered only when the PCV falls to a critical level.
Authors' abstract

6117 **Hoste, C. and Shaw, A.P.M., 1988**. Les échanges internationaux de bovins trypanotolérants en Afrique occidentale: bilan et perspectives d'avenir. [International exchanges of trypanotolerant cattle in West and Central Africa: evaluation and future prospects.] (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 319-320.
c/o FAO Representative, B.P. 25400, Ouagadougou, Burkina Faso; Veterinary Epidemiology and Economics Research Unit, University of Reading, P.O. Box 236, Early Gate, Reading RG6 2AT, UK.
A survey was carried out from 1985-1986 in nineteen countries in West and Central Africa to assess the technical and economic prospects of import/export operations regarding trypanotolerant cattle; evaluate the supply/demand of trypanotolerant cattle; and study sanitary and customs regulations governing the movement of animals and/or the genetic material. The population of trypanotolerant cattle is estimated at approximately 9.6 million head, half of which is N'Dama. Approximately 35,000 head of trypanotolerant cattle have been exchanged on the international markets since the beginning of the century, 18,000 of which were exchanged in the 1980s. Evaluation of the supply and demand of trypanotolerant cattle is a relatively difficult exercise since demand is related to the rate of consumption of animal protein as well as the development policies in force which, in turn, are dependent upon existing projects and availability of funds. Supply, on the other hand, depends not only on the desire to export but

also on a better understanding of the organisation and production factors of the national livestock industry in order to ensure that the country does not jeopardise its development programmes with excessive imports.
From authors' abstract

6118 **Jeannin, P., Dwinger, R.H., Agyemang, K. and Grieve, A.S., 1988**. Epidemiological investigations on N'Dama cattle in The Gambia. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 222-233.
ITC, P.M.B. 14, Banjul, Gambia.

In November 1985 an epidemiological survey was initiated in four Gambian villages to monitor and to evaluate health and productivity of N'Dama cattle whilst exposed to different levels of trypanosomiasis risk under traditional village management. The villages of Gunjur and Pirang were in *Glossina palpalis gambiensis* challenge areas while Keneba and Nioro Jattaba villages were in areas infested with *G. morsitans submorsitans*. The overall means for trypanosome prevalence in cattle were 2.9, 1.0, 0.4 and 1.1% in Keneba, Nioro Jattaba, Gunjur and Pirang, respectively. Results indicated a marked seasonal effect on both trypanosome prevalence, PCV values and average bodyweights. During 1986 this seasonal effect was particularly marked in the *G. morsitans* areas where rainfall was poor. The trypanosome prevalence in all age groups of cattle was found to be higher in the *G. morsitans* areas than in the *G. palpalis* areas. This coincided with lower PCV values and lower average bodyweights. Trypanosome infection and season had the most depressive effect on PCV levels. Preliminary data on production traits gave estimated productivity indices of 24 and 21 kg per 100 kg cow bodyweight in Gunjur and Keneba respectively.
From authors' abstract

6119 **Maehl, H., Coulibaly, L., Defly, A., d'Ieteren, G., Dumont, P., Feron, A., Grundler, G., Itty, P., Jeannin, P., Leak, S., Morkramer, G., Mulungo, M., Nagda, S., Ordner, G., Paling, R., Rarieya, M., Schuetterle, A., Sheria, M., Thorpe, W., Trail, J. and Yangari, G., 1988**. Health and performance of trypanotolerant cattle breeds exposed to quantified trypanosomiasis risk at five sites within the African Trypanotolerant Livestock Network. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 548-551.
Maehl, d'Ieteren, Itty, Nagda, Rarieya, Thorpe, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Coulibaly, Schuetterle: SODEPRA/GTZ/ILCA Joint Project, Boundiali, Côte d'Ivoire; Defly, Grundler, Morkramer: CREAT, Avétonou, Togo; Dumont, Jeannin, Ordner, Yangari: OGAPROV, Moanda, Gabon; Feron, Mulungo, Sheria: Kolo and Mushie Ranches, Compagnie J. Van Lancker, Zaire; Leak, Paling: ILRAD, P.O. Box 30709, Nairobi, Kenya.
Monthly recording of tsetse populations and the health and performance traits of one or more trypanotolerant cattle breeds (N'Dama, Baoulé and Race Locale) was carried out during at least a two year period at each of five sites in West and Central Africa between 1983 and 1986. Trypanosomiasis risk varied from zero to relatively high (about 10% point prevalence). Initial results showed that trypanosome infection caused a marked drop in PCVs but had only relatively small effects on performance levels. This would confirm the relatively high degree of trypanotolerance possessed by these breeds.
From authors' abstract

6120 **Paling, R.W., Moloo, S.K. and Scott, J.R., 1988**. The relationship between parasitaemia and anaemia in N'Dama and Zebu cattle following four sequential challenges with *Glossina morsitans centralis* infected with *Trypanosoma congolense*. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 256-264.
ILRAD, P.O. Box 30709, Nairobi, Kenya.
Eight N'Dama (*Bos taurus*) of Gambian origin, obtained through intrauterine implantation of embryos into Boran (*B. indicus*) female cattle in Nairobi, Kenya, were challenged at the age of 13 months by eight bites of *G. m. centralis* infected with *T. congolense*. The infections were terminated after 164 days by treatment with Berenil. The animals were thereafter sequentially challenged three more times by the same method, each time with a *T. congolense* clone belonging to different serodemes. On each occasion, the animals were treated with Berenil before the next challenge. A group of eight, age-matched Boran cattle was also similarly challenged four times. However, 77% of the infections in the Boran required treatment before the end of the observation period to prevent death. All Boran cattle were then given Berenil treatment at the same time as the N'Dama. On the second and subsequent challenges an additional group of eight trypanosome naive Boran was included in order to determine the comparative virulence of each of the *T. congolense* clones. Observations were made on the development and control of parasitaemia and anaemia. The N'Dama demonstrated a capacity to control anaemia, a capacity which improved following each of the subsequent challenges and which was not related to an improvement in the parasite control nor to a difference in virulence of the *T. congolense* clones. This phenomenon was not observed in the Boran cattle. It is concluded that under controlled experimental conditions the mean PCV of an animal within a group of

age-matched N'Dama, measured during primary infection with *T. congolense*, might serve as a selection criterion for trypanotolerance.
Authors' abstract

6121 **Pohlit, H., 1988**. Research on trypanotolerance: a personal point of view. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 288.
CRTA, B.P. 753, Bobo-Dioulasso, Burkina Faso.
Research on the genetics of trypanotolerance has as a goal the acceleration of the rate of the selection process for resistance. Counteracting whatever natural selection may still exist, are the decrease in selection strength caused by medication and, consequently, the increased cross-breeding with non-resistant races. There are markers (physiological and genetic) for trypanotolerance, it is true, but breeding success through corresponding selection does not seem to result. Heterosis and pleiotropy may be responsible for this. These two phenomena as well as the resistant/sensitive status of an animal should become visible in at least one subunit of the trypanotolerance phenomenon if viewed as a chain of mechanisms. Controlled infection experiments in stables are compared with field experiments. As a variation of the chain-of-mechanisms model a stochastic model may be more appropriate for the extreme conditions in field selection experiments. In any case heterosis and pleiotropy will have to be analysed experimentally in order to advance. This, however, requires experimentation in the sense of quantitative genetics with populations, new lines and races.
Author's abstract

(d) TREATMENT

[See also **13**: nos. 6101, 6107.]

6122 **Fluck, D.J. and Hopkins, J.S., 1988**. Chemotherapy and chemoprophylaxis of bovine trypanosomiasis with liposomal trypanocides. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 302-313.
Department of Physiology, University of Zimbabwe, P.O. Box MP 167, Harare, Zimbabwe; ODA, Eland House, Stag Place, London SW1E 5DH, UK.
In a 12-month field trial, the activity and toxicity of liposomal Berenil, Novidium and Samorin were assessed in cattle in an area of high trypanosomiasis risk in the Zambezi Valley and their performance compared with the equivalent commercial formulations. Liposomal Berenil provided sufficient prophylactic activity for significant reduction of the incidence of early reinfection and without induction of reduced drug sensitivity. Prophylaxis was obtained from both free and liposomal Novidium but considerable variation in the extent of protection was observed. Preliminary results indicate a higher incidence of delayed early reinfections and of long-term protection after treatment with the liposomal drug. Prophylaxis for up to 11 months was provided by both free and liposomal Samorin although first infections were found at 4 months (free Samorin) and at 6 months (liposomal Samorin). Subsequent reinfections occurred 4-7 months after retreatment. In a further series of experiments on tissue reaction to free and liposomal Samorin, both intramuscular and subcutaneous injections of the liposomal drug were well tolerated even at high doses. Weight gains of young cattle maintained on liposomal drugs were satisfactory. Clinical manifestations of acute systemic toxicity have been absent throughout.

From authors' abstract

6123 **Maloo, S., Chema, S., Connor, R., Durkin, J., Kimotho, P., Maehl, H., Mukendi, F., Murray, M., Rarieya, M. and Trail, J., 1988**. Efficacy of chemoprophylaxis for East African Zebu cattle exposed to trypanosomiasis in village herds in Kenya. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 282-287.

Maloo, Chema, Mukendi: Veterinary Department, P.O. Box 204, Mariakani, Kenya; Connor, Kimotho: May and Baker, Nairobi, Kenya; Durkin: ILCA, P.O. Box 5689, Addis Ababa, Ethiopia; Maehl, Rarieya, Trail: ILCA, P.O. Box 46847, Nairobi, Kenya; Murray: Glasgow University Veterinary School, Bearsden Road, Bearsden, Glasgow G61 1QH, UK.

The efficacy of chemoprophylaxis for the control of trypanosomiasis was studied on some 700 head of East African Zebu cattle maintained in village herds in a tsetse-infested area at Muhaka, Coast Province of Kenya. This preliminary study of trypanocidal drug usage in Muhaka villages, covering a two-year period, showed that their use reduced detectable parasitaemias by 39%; increased average PCVs of non-parasitaemic animals by 0.4 percentage points; increased the daily liveweight gain of post-weaners from 42 to 82 g; and increased the daily liveweight gain of adults from minus 3 to 14 g. The beneficial effect of trypanocidal drugs appeard to decline gradually during the 3 months following treatments. When parasitaemias occurred, the affected animals suffered a 4.5 percentage point drop in PCV; the daily liveweight gain of post-weaners dropped from 75 to 18 g; and the daily liveweight loss of adults increased from 7 to 44 g. When all data are available from Muhaka, the effects of trypanocidal drug usage on the other important traits of viability and reproductive performance will allow assessment of influences on economic productivity.

Authors' abstract

6124 **Shönefeld, A. and Röttcher, D., 1988**. Drug sensitivity study in cattle with *Trypanosoma vivax* isolated from Kenya and Somalia. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 295.

Veterinary Research Laboratory, Chemotryps Project, P.O. Box 29231, Nairobi, Kenya.

The drug profile is described of seven *T. vivax* isolates from Kenya and Somalia. Therapeutic dosages of several commercially available trypanocidal drugs failed. The results point to multiple drug resistance of *T. vivax*, geographically widely distributed along the East African coast. The isolates were resistant to the recommended doses of isometamidium, homidium and quinapyramine. The prophylactic activity of isometamidium, when tested against one of the isolates, was absent. All were, however, sensitive to diminazene aceturate, even when quinapyramine was not effective.

Authors' abstract

6125 **Tall, O., Toure, O., Diarra, B. and Sanogo, Y., 1988**. Epidémiologie de la trypanosomiase chez les veaux N'Dama dans un milieu fortement infesté de glossines (Ranch de Madina-Diassa, Mali) et propositions de traitements pour améliorer la survie. [Epidemiology of trypano-somiasis in N'Dama calves in a highly tsetse infested area (Madina-Diassa Ranch, Mali) and proposals for treatment to improve survival.] (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 220-221.

Laboratoire Central Vétérinaire, B.P. 2295, Bamako, Mali.
The purpose of this study was to provide information on the epidemiology of trypanosomiasis in a trypanotolerant breed of calves and to recommend a protocol for treatment in order to improve their survival. 100 N'Dama calves were investigated parasitologically from birth to 12 months. Those animals found to be positive were treated with Berenil and re-exposed to infection. Another batch of 18 calves were treated fortnightly with Trypamidium. The period from 0-3 months proved to be critical in the life of the calves because of the very high rate of infection (45%) and large-scale mortality due to trypanosomiasis infection (more than 40% of total mortality). Serological examination showed that maternal immunity, transmitted through the colostrum, was ineffective and antibodies produced as a result of active immune response were observed only towards the fifth month. Under these conditions, chemotherapy using Trypamidium would be appropriate during the first 6 months.
From authors' abstract

7. experimental trypanosomiasis

(a) DIAGNOSTICS

6126 **Bajyana Songa, E. and Hamers, R., 1988**. Antigen repertoires and the use of an improved card agglutination test in the detection of *T. evansi* infection. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 141.
Instituut voor Moleculaire Biologie, 65 Paardenstraat, B-1640 St Genesius Rode, Belgium.

6127 **Kageruka, P., Eldirdiri, B., Le Ray, D. and Mortelmans, J., 1988**. Comparative study of the activity of human and baboon serum on salivarian African pathogenic trypanosomes. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 148.
Department of Veterinary Medicine (Kageruka, Mortelmans) and Laboratory of Protozoology (Eldirdiri, Le Ray), Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.
The serum incubation and infectivity test (SIIT) was used during the course of studies on the animal reservoir host of *Trypanosoma brucei gambiense* in West and Central Africa. *T. b. gambiense* was found to be consistently resistant to human and baboon sera, *T. b. brucei* and *T. b. equiperdum* were sensitive, while *T. b. rhodesiense* showed a variable response. *T. vivax* and *T. congolense* were resistant, indicating that SIIT is valuable only for distinguishing *Trypanozoon* subspecies.

6128 **Oliveira, T.C.G. de, Sogayar, R. and Salata, E., l989.** Estudo sorológico de infecçoes experimentais por *Trypanosoma evansi*, em cobaias. [Studies on the serological diagnosis of experimental infection with *T. evansi* in guinea-pigs.] *Revista do Instituto de Medicina tropical de Sao Paulo*, **31** (2): 95-99.
Departamento de Parasitologia, IB/UNESP, Campus de Botucatu, CEP 18610 Botucatu, SP, Brazil.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **13**: no. 6159.]

6129 **Bouteille, B., Darde, M.L., Pestre-Alexandre, M., Dumas, M., Breton, J.C., Nicolas, J.A. and Catanzano, G., 1988.** Evolution des modifications du liquide céphalo-rachidien au cours de la trypanosomiase expérimentale du mouton. [CSF study in experimental trypanosomiasis in sheep.] [*T. b. brucei*.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 168-172.

Institut de Neurologie Tropicale (all authors), Service de Parasitologie-Mycologie (Bouteille, Darde, Pestre-Alexandre), Service de Biochimie (Breton) and Service d'Anatomopathologie (Catanzano), Faculté de Médecine, rue du Docteur Marcland, 87025 Limoges Cédex, France; Nicolas: Laboratoire Départemental, rue du Docteur Larrey, 87000 Limoges, France.

6130 **Goodwin, L., 1989.** Complexities of trypanosome infections: a citation classic commentary on `The pathology of African trypanosomiasis' by Goodwin, L.G. (*Transactions of the Royal Society of Tropical Medicine and Hygiene,* **64**: 797-817, 1970). *Current Contents (Life Sciences),* **32** (39): 12.

Wellcome Trust Film Unit, 183 Euston Road, London NW1 2BP, UK.

6131 **Oka, M., Nagasawa, H., Ito, Y. and Himeno, K., 1989**. Granulocyte-macrophage colony-stimulating activity in the serum of mice stimulated with homogenates of *Trypanosoma gambiense*. *Clinical and Experimental Immunology*, **78** (2): 285-291.

Department of Parasitology, School of Medicine, University of Tokushima, Kuramoto-cho 3, Tokushima 770, Japan.

(c) CHEMOTHERAPEUTICS

6132 **Akanji, M.A. and Ngaha, E.O., 1989**. Effect of repeated administration of Berenil on urinary enzyme excretion with corresponding tissue pattern in rats. *Pharmacology and Toxicology*, **64**: 272-275.

Biochemistry Department, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria; Biochemistry Department, Obafemi Awolowo University, Ile-Ile, Nigeria.

6133 **Bafort, J.M., 1988**. D,L α-difluoromethylornithine resistance in experimental *Trypanosoma b. rhodesiense*. (Abstract only.) [Mice.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 173.

RUCA, Microbiology and Immunology, University of Antwerp, Groenenborgerlaan 171, B-2020 Antwerp, Belgium.

6134 **Boid, R., Jones, T.W. and Payne, R.C., 1989**. Malic enzyme type VII isoenzyme as an indicator of suramin resistance in *Trypanosoma evansi*. [Mice.] *Experimental Parasitology*, **69** (4): 317-323.

CTVM, Easter Bush, Roslin, Midlothian, EH25 9RG, UK; ibid.; Balitvet, Jalan R.E. Martadinata 32, P.O. Box 52, Bogor, Java, Indonesia.

6135 **Desmecht, D., Mortelmans, J. and Kageruka, P., 1988**. Chemotherapy of *Trypanosoma congolense* infection with Ronidasole administered orally. (Abstract only.) [Rats.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 336.

Veterinary Department Division of Animal Health, Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.

6136 **Nyeko, J.H.P., Golder, T.K., Otieno, L.H. and Ssenyonga, G.S.Z., 1989**. *Trypanosoma congolense*: drug resistance during cyclical transmissions in tsetse flies and syringe passages in mice. [*G. m. morsitans*.] *Experimental Parasitology*, **69** (4): 357-362.

Tsetse Control Department, P.O. Box 7033, Kampala, Uganda; ICIPE, P.O. Box 30772, Nairobi, Kenya; ibid.; Department of Veterinary Parasitology and Microbiology, Faculty of Veterinary Medicine, Makerere University, P.O. Box 7062, Kampala, Uganda.

6137 **Sayer, P.D., Onyango, J.D., Gould, S.S., Waitumbi, J.N., Raseroka, B.H., Akol, G.W.O., Ndungu, J.M. and Njogu, A.R., 1988**. Treatment of African trypanosomiasis with combinations of drugs with special reference to suramin and nitroimidazoles. [*T. b. brucei*, *T. b. rhodesiense*; mice, vervet monkeys.] *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 205-210.

KETRI, P.O. Box 362, Kikuyu, Kenya.

6138 **Silayo, R.S., 1988**. On curative and prophylactic effects of diminazene aceturate against *Trypanosoma congolense* and *T. brucei*. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 265-274.

Department of Veterinary Microbiology and Parasitology, Sokoine University of Agriculture, P.O. Box 3019, Morogoro, Tanzania.

The present studies in rabbits confirmed those of some earlier workers in finding that diminazene aceturate treatment of *T. congolense* at 8-10 days post-infection (a time when chancre size is maximal) did not always effect cure, while earlier or later treatment was successful. Diminazene aceturate was found to have less than 6 h prophylactic effect against *T. congolense* even at 14 mg/kg.

6139 **Sones, K.R., Njogu, A.R. and Holmes, P.H., 1988**. A comparison of tests in cattle and mice for assessing sensitivity of *T. congolense* to Samorin (isometamidium chloride). *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 337-342.

RMB Animal Health Ltd, Dagenham, Essex, RM10 7XS, UK; KETRI, P.O. Box 362, Kikuya, Kenya; Glasgow University Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

The sensitivities of three strains of *Trypanosoma congolense* to Samorin (isometamidium chloride) were tested in cattle and mice, with the objective of evaluating the mouse-sensitivity test as a means of predicting the Samorin-sensitivity of *T. congolense* in cattle. Comparison of ED_{80} (effective dose 80%) and CD_{80} (curative dose 80%) values for mice with minimum curative dose values for cattle demonstrated a wide variation between strains, with mice requiring from one to more than 100 times the cattle dose. It is concluded that care should be exercised in extrapolating the results of a mouse-sensitivity test to cattle. Although a mouse test may give a broad indication of whether a strain is sensitive or resistant, it cannot be used to predict curative doses for cattle.

From authors' abstract

6140 **Waithaka, H.K., Borowy, N.K., Gettinby, G., Scott, J. and Hirumi, H., 1988**. Trypanocidal drug screening on *Trypanosoma* (*Duttonella*) *vivax in vitro*. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 296-300.

Waithaka: KETRI, P.O. Box 362, Kikuyu, Kenya; Borowy, Scott, Hirumi: ILRAD, P.O. Box 30709, Nairobi, Kenya; Gettinby: University of Strathclyde, Glasgow G1 1XQ, UK.

6141 **Willson, M., Zine, K., Klaébé, A., Périé, J.J. and Baltz, T., 1989**. Anti-trypanosomal compounds. Part II. Novel amidinium sulfinic compounds and phosphorylated heterocycles as antitrypanosomal agents. [*T. equiperdum*; mice.] *European Journal of Medicinal Chemistry*, **24** (6): 623-625.
Groupe de Chimie Organique Biologique, CNRS UA454 and UA470, Université Paul-Sabatier, 118 route de Narbonne, 31062 Toulouse Cédex, France; ibid.; ibid.; ibid.; Laboratoire d'Immunologie et Biologie Parasitaire, Université de Bordeaux, 148 rue Léo-Saignant, 33076 Bordeaux Cédex, France. (Correspondence to Périé.)

8. trypanosome research

(a) CULTIVATION OF TRYPANOSOMES

6142 **Black, S. and Vandeweerd, V., 1989**. Serum lipoproteins are required for multiplication of *Trypanosoma brucei brucei* under axenic culture conditions. *Molecular and Biochemical Parasitology*, **37** (1): 65-72.
ILRAD, P.O. Box 30709, Nairobi, Kenya; Institute of Tropical Medicine, Laboratory of Serology, Kronenburgstraat 25, B-2000 Antwerp, Belgium.

6143 **Nicolas, J.A., Bosgiraud, C., Labrousse, F., Bouteille, B. and Dubost, G., 1988**. *In vitro* cultures of *Trypanosoma brucei* on fibroblastic choroid plexus cells. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 149.
Nicolas, Bosgiraud, Dubost: Laboratoire Départemental Vétérinaire, rue de Docteur Larrey, 87000 Limoges, France; Nicolas, Labrousse, Bouteille: Institut de Neurologie Tropicale, Faculté de Médecine, 2 rue du Docteur Marcland, 87025 Limoges Cédex, France; Bouteille: Service de Parasitologie, CHU Dupuytren, avenue Alexis Carrel, 87042 Limoges Cédex, France.

6144 **Vandeweerd, V. and Black, S.J., 1989**. Serum lipoprotein and *Trypanosoma brucei brucei* interactions *in vitro*. *Molecular and Biochemical Parasitology*, **37** (2): 201-211.
Institute of Tropical Medicine, Laboratory for Serology, Kronenburgstraat 25, B-2000 Antwerp, Belgium; Department of Microbiology, Ohio State University, 484 West 12th Avenue, 376 Biological Sciences Building, Columbus, OH 43210-1214, USA. (Correspondence to Black.)

6145 **Yabu, Y., Takayanagi, T. and Sato, S., 1989**. Long-term culture and cloning system for *Trypanosoma brucei gambiense* bloodstream forms in semi-defined medium *in vitro*. *Parasitology Research*, **76** (2): 93-97.
Department of Medical Zoology, Nagoya City University, Medical School, Nagoya 467, Japan.

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

[See also **13**: no. 6126.]

6146 **Gibson, W., 1988**. Identification of trypanosomes in tsetse using species-specific DNA probes. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 143.

University of Bristol, School of Veterinary Science, Langford, Bristol BS18 7DU, UK.

Although mature trypanosome infections can be readily identified at the subgenus level according to their location in the tsetse fly, immature infections, which are more numerous in the field, cannot. We are developing species-specific DNA probes for trypanosomes which can be used directly on material collected from the field. So far we have isolated probes specific for *Trypanosoma brucei*, *T. congolense* and *T. simiae* and tested them against representative stocks of each species. Strong and specific signals can be obtained using 10^2-10^5 whole trypanosomes from culture, blood or tsetse midgut, dotted onto nitrocellulose filters. We are also developing an *in situ* hybridisation method so that individual trypanosomes can be identified under the microscope. This should prove particularly useful for analysing mixed infections and has the added advantage of using non-radioactively labelled probes.

Author's abstract

6147 **Godfrey, D.G., 1988**. The distribution of the zymodemes of trypanosomes infecting man in Africa. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 176-179.

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

During the last few years, workers in this laboratory have determined isoenzyme profiles in numerous stocks of *Trypanozoon* collected from man, animals and tsetse in many areas. As part of an overall study of infraspecific taxonomy, a new method of cladistic analysis was used to ascertain whether the zymodemes (stocks with the same enzyme profiles) fell into particular groupings. Five major clusters appeared, each showing distinct geographical features, as well as some further geographical association with the subclusters seen within the main clusters. This contribution summarises the preliminary observations on the relationships of the clusters to the distribution of the 112 zymodemes, which included 442 stocks, found in man; certain groups of related zymodemes were clearly associated with particular areas.

Author's abstract

6148 **Jenni, L., Richner, S. and Brun, R., 1988**. Characterization of West African trypanosome stocks isolated from man and animals using new technologies. (Abstract only.) *In*: OAU/STRC, 1988 (see **13**: no. 6053), p. 144.
Swiss Tropical Institute, Socinstrasse 57, CH-4051 Basel, Switzerland.
Fourteen isolates from human patients belonged to a homogeneous group of parasites based on DNA analysis, human serum resistance and isoenzyme patterns. The other six isolates, two from humans, two from pigs, one from a dog and one from *Glossina*, showed heterogeneous variations with respect to these parameters.
From authors' abstract

6149 **Mulla, A.F. and Rickman, L.R., 1988**. The isolation of a *Trypanosoma brucei* serodeme from a naturally infected *Glossina morsitans morsitans* in the Luangwa Valley, Zambia and its subsequent characterisation. *In*: OAU/STRC, 1988 (see **13**: no. 6053), pp. 133-140.
Department of Parasitology, TDRC, P.O. Box 71769, Ndola, Zambia.

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

6150 **Agur, Z., Abiri, D. and Ploeg, L.H.T. van der, 1989**. Ordered appearance of antigenic variants of African trypanosomes explained in a mathematical model based on a stochastic switch process and immune-selection against putative switch intermediates. *Proceedings of the National Academy of Sciences of the United States of America*, **86** (23): 9626-9630.

Department of Applied Mathematics, Weizmann Institute of Science, Rehovet 76100, Israel; ibid.; Department of Genetics and Development, College of Physicians and Surgeons, Columbia University, New York, NY 10032, USA.

6151 **Balaban, N., Waithaka, H.K., Njogu, A.R. and Goldman, R., 1989**. Isolation of a subpellicular microtubule protein from *Trypanosoma brucei* that mediates crosslinking of microtubules. *Cell Motility and the Cytoskeleton*, **14** (3): 393-400.

Balaban, Goldman: Department of Membrane Research, Weizmann Institute of Science, Rehovet 76100, Israel; Waithaka, Njogu: KETRI, P.O. Box 362, Kikuyu, Kenya.

6152 **Campbell, D.A., 1989**. Tandemly linked $tRNA^{Gln}$, $tRNA^{Val}$ and $tRNA^{Lys}$ genes in *Trypanosoma brucei*. *Nucleic Acids Research*, **17** (22): 9479.

Department of Microbiology and Immunology, University of California, Los Angeles, CA 90024, USA.

6153 **Campbell, D.A., Suyama, Y. and Simpson, L., 1989**. Genomic organisation of nuclear $tRNA^{Gly}$ and $tRNA^{Leu}$ genes in *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **37** (2): 257-262.

Department of Microbiology and Immunology, UCLA School of Medicine (Campbell) and Department of Biology (Simpson), University of California, Los Angeles, CA 90024, USA; Suyama: Department of Biology, University of Pennsylvania, Philadelphia, PA, USA.

6154 **Clarkson, A.B., Bienen, E.J., Pollakis, G. and Grady, R.W., 1989.** Respiration of bloodstream forms of the parasite *Trypanosoma brucei brucei* is dependent on a plant-like

alternative oxidase. *Journal of Biological Chemistry,* **264** (30): 17770-17776.

Clarkson, Pollakis: Department of Medical and Molecular Parasitology, New York University School of Medicine, New York, NY 10016, USA; Bienen: ILRAD, P.O. Box 30709, Nairobi, Kenya; Grady: Department of Pediatrics, Cornell University Medical Center, New York, NY 10021, USA.

6155 **Clarkson, A.B., Bienen, E.J., Pollakis, G. and Grady, R.W., 1989**. Trypanocidal CoQ analogues: their effect on other mitochondrial systems. [*T. b. brucei*.] *Comparative Biochemistry and Physiology (B),* **94** (2): 245-251.

Department of Medical and Molecular Parasitology, New York University School of Medicine, New York, NY 10016, USA; ibid.; ibid.; Department of Pediatrics, Cornell University Medical Center, New York, NY 10021, USA; Bienen also: ILRAD, P.O. Box 30709, Nairobi, Kenya. (Correspondence to Clarkson, Department of Medical and Molecular Parasitology, New York University Medical Center, 341 East 25th Street, New York, NY 10010, USA.)

6156 **Clayton, C.E. and Mowatt, M.R., 1989.** The procyclic acidic repetitive proteins of *Trypanosoma brucei*: purification and post-translational modification. *Journal of Biological Chemistry,* **264** (25): 15088-15093.

Rockefeller University, New York, NY 10021, USA.

6157 **Colmerauer, M.E.M., Davis, C.E. and Pearson, T.W., 1989**. The trypanosome surface glycoprotein procyclin is expressed only on tsetse fly vector stages of the parasite. [*T. b. brucei*.] *Parasitology Research*, **76** (2): 171-173.

University of California, San Diego, Medical Center, 225 Dickinson Street, San Diego, CA 92103-9981, USA; ibid.; Department of Biochemistry and Microbiology, University of Victoria, Victoria, British Columbia V8W 2Y2, Canada. (Reprint requests to Pearson.)

6158 **Eisenthal, R., Game S. and Holman, G.D., 1989.** Specificity and kinetics of hexose transport in *Trypanosoma brucei. Biochimica et Biophysica Acta,* **985** (1): 81-89.

Department of Biochemistry, 4-West, University of Bath, Bath BA2 7AY, UK.

6159 **Gardiner, P.R., 1989**. Recent studies of the biology of *Trypanosoma vivax*. (Review.) *Advances in Parasitology*, **28**: 229-317.

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

6160 **Gibson, W.C., 1989**. Analysis of a genetic cross between *Trypanosoma brucei rhodesiense* and *T. b. brucei*. *Parasitology*, **99** (3): 391-402.

Department of Pathology, University of Bristol, School of Veterinary Science, Langford, Bristol BS18 7DU, UK.

6161 **Hecker, H., Bender, K., Betschart, B. and Modespacher, U.-P., 1989**. Instability of the nuclear chromatin of procyclic *Trypanosoma brucei brucei*. *Molecular and Biochemical Parasitology*, **37** (2): 225-234.

Swiss Tropical Institute, Postfach, CH-4002 Basel, Switzerland.

6162 **König, E., Delius, H., Carrington, M., Williams, R.O. and Roditi, I., 1989**. Duplication and transcription of procyclin genes in *Trypanosoma brucei*. *Nucleic Acids Research*, **17** (21): 8727-8739.

König, Williams, Roditi: Kernforschungszentrum Karlsruhe, Institut für Genetik und Toxikologie, Postfach 3640, D-7500 Karlsruhe 1, Federal Republic of Germany; Delius: Deutsches Krebsforschungszentrum, Institut für Virusforschung, Heidelberg, Federal Republic of Germany; Carrington: Department of Biochemistry, University of Cambridge, Cambridge CB2 1QW, UK. (Correspondence to Roditi.)

6163 **Marchand, M., Kooystra, U., Wierenga, R.K., Lambeir, A.M., Beeumen, J. van, Opperdoes, F.R. and Michels, P.A.M., 1989.** Glucosephosphate isomerase from *Trypanosoma brucei*. Cloning and characterization of the gene and analysis of the enzyme. *European Journal of Biochemistry*, **184** (2): 455-464.

Marchand, Kooystra, Lambeir, Opperdoes, Michels: International Institute of Cellular and Molecular Pathology, Research Unit for Tropical Diseases, Avenue Hippocrate 74, B-1200 Brussels, Belgium; Wierenga: Laboratory of Chemical Physics, State University Groningen, Belgium; Beeumen: Laboratory of Microbiology and Microbial Genetics, State University Ghent, Belgium.

6164 **Markos, A., Blahusková, A. and Kalous, M., 1989.** Metabolic differentiation of bloodstream forms of *Trypanosoma brucei brucei* into procyclic forms in hemin-depleted medium and in the presence of respiratory inhibitors. *Folia Parasitologica*, **36** (4): 301-306.

Department of Physiology and Developmental Biology, Faculty of Sciences, Charles University, Prague, Czechoslovakia.

6165 **Mottram, J.C., Murphy, W.J. and Agabian, N., 1989**. A transcriptional analysis of the *Trypanosoma brucei hsp 83* gene cluster. *Molecular and Biochemical Parasitology*, **37** (1): 115-128.

Wellcome Unit of Molecular Parasitology, Institute of Genetics, University of Glasgow, Church Street, Glasgow G11 5JS, UK; Department of Microbiology, University of Kansas Medical Center, Kansas City, KS, USA; University of California Intercampus Program in Molecular Parasitology, San Francisco, CA 94143, USA.

6166 **Muhich, M.L., Hsu, M.P. and Boothroyd, J.C., 1989.** Heat-shock disruption of *trans*-splicing in trypanosomes: effect on Hsp70, Hsp85 and tubulin mRNA synthesis. [*T. b. brucei.*] *Gene*, **82** (1): 169-175.

Division of Chemistry 147-75, California Institute of Technology, Pasadena, CA 91125, USA; Department of Microbiology, University of

Iowa, Iowa City, IA 52242, USA; Department of Microbiology and Immunology, Fairchild Science Building, Stanford University School of Medicine, Stanford, CA 94305-5402, USA. (Correspondence to Boothroyd.)

6167 **Pays, E., 1989**. Pseudogenes, chimaeric genes and the timing of antigen variation in African trypanosomes. *Trends in Genetics*, **5** (12): 389-391.

Department of Molecular Biology, University of Brussels, 67 rue des Chevaux, B-1640 Rhode St Genèse, Belgium.

6168 **Roth, C., Bringaud, F., Layden, R.E., Baltz, T. and Eisen, H., 1989**. Active late-appearing variable surface antigen genes in *Trypanosoma equiperdum* are constructed entirely from pseudogenes. *Proceedings of the National Academy of Sciences of the United States of America*, **86** (23): 9375-9379.

Roth, Eisen: Unit of Immunoparasitology, Institut Pasteur, 25 rue du Dr Roux, 75724 Paris Cédex 15, France; Bringaud, Baltz: University of Bordeaux II, Bordeaux, France; Layden, Eisen: Fred Hutchinson Cancer Research Center, 1124 Columbia Street, Seattle, WA 98104, USA. (Reprint requests to Eisen at Seattle address.)

6169 **Rudenko, G., Bishop, D., Gottesdiener, K. and Ploeg, L.H.T. van der, 1989**. Alpha-amanitin resistant transcription of protein coding genes in insect and bloodstream form *Trypanosoma brucei*. *EMBO Journal*, **8** (13): 4259-4263.

Department of Genetics and Development, College of Physicians and Surgeons of Columbia University, 701 West 168th Street, New York, NY 10032, USA.

6170 **Seed, J.R. and Sechelski, J.B., 1989**. Mechanism of long slender (LS) to short stumpy (SS) transformation in the African trypanosomes. [*T. b. gambiense, T. b. rhodesiense*.] *Journal of Protozoology*, **36** (6): 572-577.

University of North Carolina, Department of Parasitology and Laboratory Practice, School of Public Health, Rosenau Hall 201H, Chapel Hill, NC 27514, USA.

6171 **Sherwin, T. and Gull, K., 1989.** The cell division cycle of *Trypanosoma brucei brucei*: timing of event markers and cytoskeletal modulations. *Philosophical Transactions of the Royal Society of London (B),* **323** (1218): 573-588.

Biological Laboratory, University of Kent at Canterbury, Canterbury, Kent, CT2 7NJ, UK; Department of Biochemistry and Molecular Biology, University of Manchester, Manchester M13 9PT, UK.

6172 **Smith, J.L., Levin, J.R. and Agabian, N., 1989.** Molecular characterization of the *Trypanosoma brucei* RNA polymerase I and III largest subunit genes. *Journal of Biological Chemistry,* **264** (30): 18091-18099.

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

6173 **Tait, A., Turner, C.M.R., Le Page, R.W.F. and Wells, J.M., 1989.** Genetic evidence that metacyclic forms of *Trypanosoma brucei* are diploid. *Molecular and Biochemical Parasitology*, **37** (2): 247-255.

Wellcome Unit of Molecular Parasitology, Department of Veterinary Parasitology, Bearsden Road, Glasgow G61 1QH, UK; Department of Zoology, University of Glasgow, Glasgow G12 8QQ,

UK; Department of Pathology, University of Cambridge, Cambridge CB2 1QP, UK; ibid.

6174 **Vickerman, K., 1989.** How trypanosomes evade the immune responses: a citation classic commentary on `On the surface coat and flagellar adhesion in trypanosomes' by Vickerman, K. (*Journal of Cell Science,* **5**: 163-193, 1969). *Current Contents (Life Sciences),* **32** (41): 15. Department of Zoology, University of Glasgow, Glasgow G12 8QQ, UK.

6175 **Vickerman, K., 1989.** Trypanosome sociology and antigenic variation. [*T. brucei*.] *Parasitology*, **99** (Suppl.): S37-S47.
Department of Zoology, University of Glasgow, Glasgow G12 8QQ, UK.

6176 **Wong, S. and Campbell, D.A., 1989**. A polyubiquitin gene from *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **37** (1): 147-150. Department of Microbiology and Immunology, University of California, Los Angeles, CA 90024, USA. (Correspondence to Campbell.)