

SECTION A – NEWS

PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS

Sixth PAAT Programme Committee Meeting

The sixth meeting of the PAAT Programme Committee was convened at WHO Headquarters, Geneva, Switzerland, from 21 to 23 November 2000. The main issues of discussion at the meeting were the deteriorating sleeping sickness situation in many endemic areas, and the recent declaration, by African Heads of State, of their commitment to eradicate the tsetse fly from Africa, beginning in 2001. The responsibility for this is vested in the Secretary General of the OAU and delegated to the Inter-African Bureau for Animal Resources (IBAR), which is in the process of drawing up a Concept Note for a Pan-African Tsetse Eradication Campaign (PATEC).

Sleeping sickness

The meeting noted with great concern that epidemics of sleeping sickness were continuing at high levels in Sudan, Democratic Republic of Congo, and Angola. WHO also warned that several of the historical foci in West Africa, that had been dormant for years, are now showing signs of disease resurgence. Particular reference was made to Nigeria and Ghana.

To address this situation WHO are establishing a coordinated network for disease surveillance and control. The main elements of this programme will include enhanced epidemiological surveillance, a drug resistance network and the development of an effective information system to link national and regional actions.

The WHO-based Tropical Diseases Research programme is to include sleeping sickness as one of its priority activities. This will ensure more money for research into the disease over the next five years. Emphasis will be given to simplifying existing diagnostic techniques for use in the field, and for differentiating between first- and second-stage infections, and to determining optimal drug combinations and the search for new drugs.

The Committee welcomed the news that, following protracted negotiations with WHO, the drug companies concerned are prepared to ensure sufficient stocks of the drugs needed to treat the disease. To facilitate this, WHO have undertaken to calculate the doses required on an annual and medium-term basis.

Trypanosomiasis and poverty in Africa: donor attitudes

Committee members expressed their concern over the low levels of donor representation at the Geneva meeting, particularly in regard to the international and multi-donor agencies such as the EU, World Bank, IFAD, African Development Bank and UNDP. The structure, content and purpose of the Committee Meeting should be reviewed and revised to stimulate greater interest, attendance and participation of donors. The Chairman and Secretariat should explore with the EC the possibility of holding a special meeting/workshop to raise the awareness of governments and donors to the scale and intensity of the trypanosomiasis problem.

To meet donor objectives, sleeping sickness in particular, and trypanosomiasis in general, should be portrayed more strongly in terms of impact on development and

poverty. The PAAT Secretariat was urged to seek funding to extend the current economic studies to include socio-economic and human welfare impacts, and to raise public awareness of the problem.

Pan-African Tsetse Eradication Campaign

This new initiative was endorsed, with the recommendation that the Concept Note, concerning implementation in priority areas, be released to the PAAT community via PAAT-L at the earliest opportunity for further discussion, comment and development.

The Secretariat, through involvement of the support group, should raise public awareness of the tsetse and trypanosomiasis situation and the roles of PAAT and PATEC in its resolution. It was suggested that the PATEC title be revised to PATTEC to include disease as well as vector eradication.

Quality control and assurance of drugs for animal trypanosomiasis

For some time the Committee has expressed concern over the quality and lack of controls on drugs used for animal trypanosomiasis. The FAO Regional Office for Africa has announced that the University of Strathclyde has been contracted to provide a service for the analysis and assessment of quality of diminazene products. Protocols for this analysis are being established. National services wishing to make use of this facility should contact George Chizyuka at the Regional Office in Accra (George.Chizyuka@fao.org).

Economic analysis of tsetse impact and control in priority areas of West Africa

This study, based on the use of GIS information derived from the PAAT-IS, will test the economic viability and justification for tsetse control over infested areas on a small, medium and large scale. Poverty, socio-economic impact, land use and political commitment should be included in order to attract donor funds.

Other matters

Other matters brought to the attention of the Meeting included a progress report on the FITCA programme, the GFAR initiative to support trypanosomiasis research (see separate news item below), and the Pan-Africa SIT Forum.

Action was agreed on consultation with NRI to ensure completion of the FAO/WHO GIS databases and their public availability; on the finalisation of position papers; and on the increased use of French on the PAAT-L through selective translation.

WORLD HEALTH ORGANISATION

The WHO Programme for Surveillance and Control of African Trypanosomiasis has five main objectives: (i) to coordinate the sleeping sickness network and ensure sustainability of field activities; (ii) to enhance existing epidemiological systems; (iii) to extend the treatment and drug resistance network; (iv) to foster inter-agency collaboration; and (v) to develop information systems and training activities.

For further details, contact: Dr J. Jannin, WHO, 1211 Geneva 21, Switzerland (janninj@who.ch).

DFID FUNDS TO SUPPORT FAO INVESTIGATIONS INTO TRYPANOSOMIASIS

FAO is to include a PAAT component in the joint DFID/FAO Poverty Livestock Programme. The activities to be pursued will include: investigation of the impact of tsetse and trypanosomiasis in terms of poverty through an analysis of data available from the WHO and FAO databases, agricultural statistics, position papers and country reports; definition of scenarios for disease and vector control at the sub-continental scale; and examination of ways in which to establish the institutional and policy framework needed to ensure sustainable large-scale control based on international collaboration and secure public-private partnerships.

GFAR SUPPORT FOR TRYPANOSOMIASIS RESEARCH

The Global Forum for Agricultural Research (GFAR) has given its support to a proposal aimed not only at strengthening research into trypanosomiasis at various levels but at also providing a link between common problems in Africa and Latin America. The framework for this project has been agreed and a definitive document is being drafted.

The GFAR is not in itself a funding body but provides the focal point for the interaction of research scientists and institutes with donors. The criterion on which research proposals are judged acceptable is that they must be seen as essential to alleviating constraints in developing countries.

For further details, contact Dr E. Camus at: CIRAD-EMVT, Campus de Baillarguet, B.P. 5035, 3402 Montpellier Cedex 1, France (emmanuel.camus@cirad.fr).

WORKSHOPS AND TRAINING COURSE

ICPTV Workshops

A workshop on 'Environmental monitoring approaches and methods' will be held in conjunction with the ISCTRC, in Ouagadougou, Burkina Faso, from 1 to 5 October 2001. A further workshop is to be held on the subject of 'Integrated vector control including the synergistic use of drugs and bait technologies for the control of trypanosomiasis and tick-borne diseases'.

For further details contact: Mark Eisler, ICPTV Coordinator (m.eisler@cgiar.org).

CIRDES Training Course

A theoretical and practical training course on 'The diagnosis and control of haemoparasitoses of livestock and their vectors' will be held, in French, at CIRDES, Bobo-Dioulasso, Burkina Faso, from 5 to 17 November 2001. The number of participants is limited to 15 and the last date for application is 5 October 2001.

For further information, please contact: Dr Marc Desquesnes, 01 B.P. 454 Bobo-Dioulasso, 01 Burkina Faso (fax (226) 97 23 20; e-mail m.desquesnes@fasonet.bf) or Dr Rasmané Ganaba, 01 B.P. 454 Bobo-Dioulasso, 01 Burkina Faso (cirdes@ird.bf).

NEW PUBLICATION

A new French-language 'Manual for the Control of Sleeping Sickness' in six parts has recently been published jointly by the Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale and the Institut de Recherches pour le Développement (see this issue of *TTIQ*: no. 11732). The two main authors of the manual are Dr Laurent Penchenier (lt.penchenier@infonie.fr) and Dr Claude Laveissière (trypoceac@camnet.cm).

It is available free from OCEAC, B.P. 288, Yaoundé, Cameroon (fax (00-237) 23 00 61; e-mail trypoceac@camnet.cm or oceac@camnet.cm).

NZI TRAP WEB SITE

A new web site at <http://informatics.icipe.org/nzi/index.htm> containing practical information on the use of the Nzi trap for tsetse and biting flies is now available through the informatics web server of the International Centre of Insect Physiology and Ecology in Nairobi, Kenya. A publication on the research leading up to the development of the trap is in preparation, and will be submitted to a journal this year. In the interim, I have prepared this web site to provide resources for people who are interested in the practical aspects of using the trap. ICIPE has kindly agreed to host the site.

Steve Mihok

SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

- 11726 **Duvallet, G., 2000.** La maladie du sommeil, encore et toujours. . . [Sleeping sickness, a continuing story. . .] *Médecine tropicale*, **60** (2): 135-136.

Laboratoire de Zoogéographie, Université Paul Valéry-Montpellier III, 34199 Montpellier Cedex 5, France. [gerard.duvallet@univ-montp3.fr]

This editorial discusses the current status of sleeping sickness due to *Trypanosoma brucei gambiense* in West and Central Africa. Some 300,000 new cases are reported each year and 55 million people are estimated to be at risk in 36 countries. Disease control strategies and some major advances in research are briefly described. It is concluded that the present situation is not acceptable and it is time that sleeping sickness became a disease of the past.

- 11727 **Gastellu-Etchegorry, M. and Legros, D., 1999.** Maladie du sommeil: danger indifférence! [Sleeping sickness: the danger is indifference!] *Médecine tropicale*, **59** (4): 347-348.

Service Médical de Médecins Sans Frontières, 8 rue Saint-Sabin, 75544 Paris Cedex 11, France.

The problem of sleeping sickness (due to *Trypanosoma brucei gambiense*) is described. While its resurgence is due to politics, economics and war, lack of money and of safe and effective drugs for treatment is a serious problem which needs urgent action.

- 11728 **Jannin, J., 2000.** Actualités de la trypanosomiase humaine. [Current situation of human trypanosomiasis.] *Médecine tropicale*, **60** (2, Suppl.): 56S-57S.

Service des Maladies Transmissibles/Surveillance et Action, WHO, Geneva, Switzerland.

This article briefly describes the initiatives taken by various organisations and countries since 1984 to tackle the upsurge of HAT in Central and West Africa. These include WHO, OCCGE, OCEAC, PAAT, the French and Belgian governments, the EU and the national programmes of the affected countries. WHO's Programme of surveillance and control of sleeping sickness has two strategic axes: the coordination of surveillance and control activities; and the formation of a network of all field and institutional personnel involved. The five objectives of the programme are described.

- 11729 **Laveissière, C., Grébaut, P., Herder, S. and Penchenier, L., 2000.** *Les glossines vectrices de la trypanosomiase humaine africaine.* [The tsetse vectors of human African trypanosomiasis.] Yaoundé, Cameroon; OCEAC/IRD. 246 pp.

Laveissière: OCEAC, B.P. 288, Yaoundé, Cameroon. [trypoceac@camnet.cm]

At a time when the prevalence of sleeping sickness has never been so high since the colonial period, at a time when integrated control campaigns are urgently needed, this book aims to bring to students and young researchers the basic knowledge necessary for developing coherent and effective research programmes. Its objective is not to give an exhaustive analysis of the literature but rather to provide a synthesis of current knowledge on the insect, its biology, its role as vector and the methods for its control. The contents are as follows: Introduction; Morphology; Identification of species; Internal anatomy, physiology and genetics; Study techniques; The life of the insect (behaviour, distribution, reproduction, feeding, population studies); Medical importance (vectorial capacity, reservoirs, epidemiology of HAT); Vector control (parasitology and/or entomology?; eradication or reduction?, requirements of vector control, non-pesticidal techniques, chemical control, treatment of livestock, traps and trapping methods); Control campaigns (examples of Vavoua and Sinfra, Côte d'Ivoire, and of Uganda); Conclusion; Glossary; Construction of traps; Bibliography; Index. The text is illustrated with many line drawings and black and white photographs.

11730 **Laveissière, C. and Penchenier, L., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 2 Stratégies.* [Manual of sleeping sickness control in Central and West Africa: volume 2 Strategies.] Yaoundé, Cameroon; OCEAC/IRD. 42 pp. (See also **24**: no. 11732.)

This volume of the manual begins by giving definitions of the terms used in this and the following volumes (sleeping sickness suspects, at-risk and endemic areas, foci, case detection, diagnosis, medical prospection, mobile teams, primary health care, surveillance); distinctive features of HAT and its control; the objectives and imperatives of control; constraints (financial, logistic, training, organisation; human beliefs and behaviours); general organisation (timing, coordination, participants, training, equipment and operation); strategies (identification of affected areas – strategies and consequences, decontamination of the human reservoir, vector control, screening or screening+diagnosis, treatment of patients); information/education/communication; primary health care and HAT control.

11731 **Nieuwenhove, S. van, 2000.** *Gambiense sleeping sickness: re-emerging and soon untreatable?* *Bulletin of the World Health Organization*, **78** (11): 1283.

Trypanosomiasis Control, WHO Regional Office for Africa, P.O. Box 1899, Kinshasa 1, Democratic Republic of Congo. [OMS-DRC@MAF.ORG]

This editorial discusses the problems of sleeping sickness treatment and draws attention to the paper by Pépin *et al.* (see *TTIQ*, **24**: no. 11769). Although eflornithine is the only registered drug that can cure melarsoprol-refractory sleeping sickness, its currently recommended intravenous regimen is unfeasible in rural areas. One of the main objectives of WHO's new Sleeping Sickness Treatment and Drug Resistance Network is to make pentamidine, suramin, melarsoprol, eflornithine and nifurtimox available and

financially accessible to governmental and non-governmental organisations. In view of the present dramatic resurgence of the disease, this initiative must not fail.

11732 **Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale/Institut de Recherches pour le Développement, 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 1 Généralités; volume 2 Stratégies; volume 3 Dépistage; volume 4 Diagnostic; volume 5 Lutte antivectorielle; volume 6 Traitement.* [Manual of sleeping sickness control in Central and West Africa: volume 1 General; volume 2 Strategies; volume 3 Case detection; volume 4 Diagnosis; volume 5 Vector control; volume 6 Treatment.] Yaoundé, Cameroon; OCEAC/IRD.

OCEAC, B.P. 288, Yaoundé, Cameroon. [trypoceac@camnet.cm]

This six-part manual on the control of human African trypanosomiasis caused by *Trypanosoma brucei gambiense* is intended to help all those who, whether closely or remotely, have to prepare, manage or carry out control measures against this disease. Although sleeping sickness in sub-Saharan Africa fell into oblivion for several decades, it has never disappeared and is now spreading again through combined sociological, economic and political effects. The long period of neglect has had a disturbing effect on the training of personnel. Young doctors and nursing staff are no longer acquainted with the disease, or have only textbook knowledge, and lack field experience, and few control campaigns have been undertaken since the colonial period. Too few people currently know how to organise a survey, what techniques to use for screening and diagnosis, how to care for sleeping sickness patients and how to eliminate the vector. National or regional control campaigns are now urgently needed to curb the disease or at least reduce its impact. Since the manuals are intended for a wide public, professional and non-professional, the authors have purposely avoided too scientific a vocabulary and style in order to make the manuals accessible to all. However, words in the text in bold print cross-refer to a glossary where readers wishing to deepen their knowledge of a particular subject will find additional information. Other useful details are included in annexes. The manual is illustrated with many line drawings and black and white photographs. For details of the contents of individual volumes, see **24**: nos. 11730, 11733, 11753, 11761, 11762 and 11768.

11733 **Penchenier, L. and Laveissière, C., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 1 Généralités.* [Manual of sleeping sickness control in Central and West Africa: volume 1 General.] Yaoundé, Cameroon; OCEAC/IRD. 66 pp. (See also **24**: no. 11732.)

This volume of the manual gives the historic background to *Trypanosoma brucei gambiense* sleeping sickness; its distribution; details of the parasite (trypanosome species, morphology and life cycle), the vector (tsetse species, biology and ecology), the patient (trypanosome cycle, immune response) and the animal reservoir; disease transmission; and the symptoms.

- 11734 **Rogers, D.J., 2000.** Satellites, space, time and the African trypanosomiasis. *Advances in Parasitology*, **47**: 129-171.

Trypanosomiasis and Land Use in Africa (TALA) Research Group,
Department of Zoology, University of Oxford, South Parks Road, Oxford
OX1 3PS, UK.

The human and animal trypanosomiasis of Africa provide unique challenges to epidemiologists because of the spatial and temporal scales over which variation in transmission takes place. This paper describes how our descriptions of the different components of transmission, from the parasites to the affected hosts, eventually developed to include geographical dimensions. It then briefly mentions two key analytical techniques used in the application of multi-temporal remotely sensed imagery to the interpretation of field data: temporal Fourier analysis for data reduction, and a variety of discriminant analytical techniques to describe the distribution and abundance of vectors and diseases. Satellite data may be used both for biological, process-based models and for statistical descriptions of vector populations and disease transmission. Examples are given of models for *Glossina morsitans* in the Yankari Game Reserve, Nigeria, and in The Gambia. In both sites the satellite derived index of Land Surface Temperature (LST) is the best correlate of monthly mortality rates and is used to drive tsetse population models. The Gambia model is then supplemented with a disease transmission component; the mean infection rates of the vectors and of local cattle are satisfactorily described by the model, as are the seasonal variations of infection in the cattle. High and low spatial resolution satellite data have been used in a number of statistical studies of land cover types and tsetse habitats. In addition multi-temporal data may be related to both the incidence and prevalence of trypanosomiasis. Analysis of past and recent animal and human trypanosomiasis data from south-east Uganda supports the suggestion of the importance of cattle as a reservoir of the human disease in this area: mean infection prevalences in both human and animal hosts rise and fall in a similar fashion over the same range of increasing vegetation index values. Monthly sleeping sickness case data from the districts and counties of south-east Uganda are analysed and often show significant correlation with local LST. Case numbers increase with LST in areas that are relatively cooler than average for this part of Uganda, but decrease with LST in areas that are on average warmer. This indicates different seasonal cycles of risk across the region, and may be related to the differing vectorial roles of the two local tsetse, *G. fuscipes* and *G. pallidipes*. Finally, the increasing pace of change, and the likelihood of new or re-emerging vector-borne diseases, highlight the need for accurate and timely information on habitat changes and the impacts these will have on disease transmission. The next generation of satellites will have significantly more spectral and spatial resolution than the current satellites, and will enable us to refine both statistical and biological predictions of trypanosomiasis and other vector-borne diseases within disease early warning systems.

- 11735 **Swallow, B.M., 2000.** Impacts of trypanosomiasis on African agriculture. *PAAT Technical and Scientific Series*, no. 2: 52 pp. (Rome, Italy; FAO. ISBN 92 5 104413 9.)

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

African animal trypanosomiasis constrains agricultural production in the areas of Africa that hold the continent's greatest potential for expanded agricultural production. Compared with animals kept in trypanosomiasis-free areas, animals kept in areas of moderate risk of trypanosomiasis have lower calving rates, lower milk yields and higher rates of calf mortality; they also require more frequent treatment with preventive and curative doses of trypanocidal drugs. At the herd level, trypanosomiasis reduces milk offtake, live animal offtake and the work efficiency of oxen used for cultivation. Herds of trypanosusceptible livestock can be devastated by sudden exposure to high levels of trypanosomiasis risk. The risk of trypanosomiasis also has an influence on where people decide to live, the way they manage their livestock and the number of animals that they keep. In the tsetse-infested areas as a whole, trypanosomiasis reduces the offtake of meat and milk by at least 50%. In addition, by generally reducing the overall benefits of livestock to farming (through less efficient nutrient cycling, reduced access to animal traction, lower income from milk and meat sales and reduced access to liquid capital), trypanosomiasis reduces yields, area cultivated and the efficiency of resource allocation. It is estimated that a 50% increase in the livestock population would increase the total value of agricultural production by 10%. The potential benefits of trypanosomiasis control thus appear to be highest in areas where there is good potential for integrating livestock into profitable and sustainable mixed crop-livestock farming systems. This conclusion has clear implications for the development and implementation of the PAAT Action Plan.

- 11736 **Thomson, M.C. and Connor, S.J., 2000.** Environmental information systems for the control of arthropod vectors of disease. *Medical and Veterinary Entomology*, **14** (3): 227-244.

Thomson: MALSAT Environmental Information Systems, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

Over the last decade, remote sensing technologies and geographical information systems have moved from the research arena into the hands of vector control specialists. This review explains remote sensing approaches and spatial information technologies used for investigations of arthropod pests and vectors of diseases affecting humans and livestock. Relevant applications are summarised and examples of studies on different vectors are given, including those on the tsetse vector of trypanosomiasis. Methods and their uses are tabulated and discussed, with recommendations for efficiency, caution and progress in this burgeoning field.

- 11737 **Trowbridge, M., McFarland, D., Richer, M., Adeoye, M. and Moore, A., 2000.** Cost-effectiveness of programs for sleeping sickness control. (Meeting abstract no. 417.) *American Journal of Tropical Medicine and Hygiene*, **62** (3, Suppl.): 312.

Trowbridge: Department of International Health, Rollins School of Public Health, Emory University, Atlanta, GA, USA.

A cost-effectiveness analysis was performed using data collected in 1997-1999 during an emergency control programme in Tambura County, Sudan, to compare the utility of screening and treatment at 3-year intervals, 'crisis' intervention after a 9-year period without trypanosomiasis control, and no intervention. Regular screening and treatment was found to be more cost-effective than emergency intervention. Among a population of 50,000, it was estimated that periodic screening and treatment would prevent 4054 sleeping sickness-related deaths during a 9-year period compared with 1092 prevented deaths through emergency intervention. In foci similar to Tambura, sleeping sickness control programmes can be considered good value for money in terms of cost per disability adjusted life year (DALY) averted; this is because this strategy keeps disease prevalence low and identifies patients in the early stage of infection.

11738 **Veeken, H. and Pécoul, B., 2000.** Medicijnen voor 'verwaarloosde ziekten': een bittere pil. [Drugs for 'neglected diseases': a bitter pill.] *Nederlands Tijdschrift voor Geneeskunde*, **144** (26): 1253-1256.

MSF, P.O. Box 10014, 1001 EA Amsterdam, Netherlands.

This paper is a Dutch version of one published in English in *Tropical Medicine and International Health*. For abstract, see *TTIQ*, **23** (4): no. 11599.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

[See also **24**: no. 11729.]

11739 **Cappello, M. and Aksoy, S., 2000.** Tsetse thrombin inhibitor. *Official Gazette of the United States Patent and Trademark Office Patents*, **1232** (2): patent no. US 6036958.

Cappello: Yale University School of Medicine, New Haven, CT 06510, USA.

A potent and specific inhibitor of thrombin is purified from salivary gland extracts of *Glossina morsitans morsitans*. The inhibitor has a molecular weight of 3530 Daltons as determined by laser desorption mass spectroscopy. The inhibitor is useful as an anti-coagulant and an inhibitor of platelet aggregation and in pharmaceutical and immunogenic compositions.

11740 **Dede, P.M., 1999.** Effect of trypanocidal drugs on some aspects of the reproductive biology of female *Glossina palpalis palpalis* (Diptera: Glossinidae). *Revue d'Élevage et de Médecine vétérinaire des Pays tropicaux*, **52** (3-4): 239-243.

Entomology/Parasitology Division, NITR, P.M.B. 03, Vom, Plateau State, Nigeria.

The effects of isometamidium chloride (Samorin) and diminazene aceturate (Berenil) on some aspects of the reproductive biology of female *G. p. palpalis* were investigated. Samorin and Berenil were administered to the flies *in vitro* through a silicone membrane, at 0.14 mg/ml and 0.40 mg/ml respectively, or *in vivo* via the ears of rabbits treated at the recommended prophylactic and therapeutic doses of 1.0 and 3.5 mg/kg respectively. Flies were maintained at $24.5 \pm 0.5^\circ\text{C}$, $80 \pm 5\%$ relative humidity and 6 h photoperiod. Neither drug at the concentrations employed had any significant adverse effect on female survival rate, fecundity or mean puparial weights. In fact, females fed on Berenil at 0.40 mg/ml blood through the membrane had among the best survival rates, fecundities and mean puparial weights of any group except the rabbit-fed controls; also, flies that emerged from pupae deposited by these females were noted to be the most active. The implications of these findings in relation to vector control are highlighted.

11741 **Gooding, R.H., 2000.** Hybridization asymmetries in tsetse (Diptera: Glossinidae): role of maternally inherited factors and the tsetse genome. *Journal of Medical Entomology*, **37** (6): 897-901.

Department of Biological Sciences, University of Alberta, Edmonton, AB, T6G 3E9, Canada. [rgooding@gpu.srv.ualberta.ca]

Among the *morsitans* group of tsetse there are several pairs of taxa in which there is a marked hybridisation asymmetry (HA), i.e. one cross produces significantly more offspring than does the reciprocal cross. To investigate the relative contribution of maternally inherited factors (MIF) and chromosomal factors to HA, three hybrid lines were established in which flies have MIF from one taxon and chromosomes from another. HA was then compared among crosses of the parental taxa and crosses of each parental taxon with the appropriate hybrid line. The results indicate that HA in reciprocal crosses of *Glossina morsitans morsitans* and *G. swynnertoni* and in reciprocal crosses of *G. m. morsitans* and *G. m. centralis* is caused by chromosomal factors, not MIF. Reciprocal crosses of *G. m. centralis* and *G. swynnertoni* do not display HA, and none developed as a result of a novel combination of MIF and tsetse chromosomes.

11742 **Krafsur, E.S., Madsen, M., Wohlford, D.L., Mihok, S. and Griffiths, N.T., 2000.** Population genetics of *Glossina morsitans submorsitans* (Diptera: Glossinidae). *Bulletin of Entomological Research*, **90** (4): 329-335.

Krafsur: Department of Entomology, Iowa State University, Ames, IA 50011-3222, USA.

Breeding structure of *G. m. submorsitans* was evaluated by using genetic markers in mitochondrial DNA where diversity was scored at two loci in five natural populations from The Gambia and two populations in Ethiopia (form *ugandensis*), countries separated by c. 5450 km. Twenty-six haplotype combinations were found, of which 17 were shared among two or more populations. Nine haplotypes were found in The Gambia and 23

haplotypes in Ethiopia. There were 12 unique haplotypes. Only six haplotypes were shared between the two countries. Populations in The Gambia ($h_e = 0.26 \pm 0.04$) showed less than a third of the diversity of populations in Ethiopia ($h_e = 0.84 \pm 0.03$). This suggests recovery from an earlier reduction in population. In a nested analysis of molecular variance of haplotype frequencies, 65% of the variance was due to differences within populations, 34% to differences between populations grouped by country, and only 1% was due to differences among populations within countries. In terms of gene flow, the fixation index $F_{ST} = 0.35$, which leads to an estimate by Wright's island model of less than one reproducing migrant per generation exchanged between the eastern and western *G. m. submorsitans* populations. Nei's genetic similarity measure showed a deep division between Gambian and Ethiopian populations.

11743 **Li, S. and Aksoy, S., 2000.** A family of genes with growth factor and adenosine deaminase similarity are preferentially expressed in the salivary glands of *Glossina m. morsitans*. *Gene*, **252** (1-2): 83-93.

Aksoy: Department of Epidemiology and Public Health, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06510, USA.

A cDNA library constructed from salivary glands of tsetse fly, *G. m. morsitans*, was differentially screened, and two related full-length cDNAs were molecularly characterised: tsetse salivary growth factor, TSGF-1 and TSGF-2. The cDNAs encode for open reading frames (ORFs) of 494 and 506 aa, respectively, and display an overall 45% amino acid identity and 61% similarity to one another. Both genes are preferentially expressed in the salivary glands of male and female adult flies. In addition to salivary glands, both transcripts can be detected from the gut tissue. Only transcripts specific for TSGF-2 are detected in ovary and testis tissues of adults as well as in puparia, while neither gene is expressed during the larval developmental stages. The N-terminal region of both putative proteins contains a hydrophobic sequence with secretory signal peptide characteristics, and analysis of proteins in saliva by Western blot indicates that both are secreted. Western blot analysis indicates that TSGF-1 is synthesised at significantly higher levels than TSGF-2. The deduced protein sequences of both cDNAs display extensive similarities to two other proteins: insect derived growth factor (IDGF) characterised from *Sarcophaga peregrina* with growth-factor activity, and atrial gland specific antigen (AGSA or MDSF) characterised from *Apylasia californica*. In addition to growth factor similarity, all four related proteins share the evolutionarily conserved amino acid residues associated with the enzymatic deamination of adenosine, which is shown here to be present in salivary gland extracts of tsetse. While both genes are present and expressed in *G. m. morsitans* and *G. p. palpalis*, only TSGF-1 is present in *G. austeni*. The molecular characteristics of the cDNAs, their genomic arrangement and their regulation of expression in different fly tissues and species are presented, and the potential role of these proteins in haemostasis and in African trypanosome transmission by different species of tsetse is discussed.

11744 **Luna, C., Bonizzoni, M., Cheng, Q., Robinson, A.S., Aksoy, S. and Zheng, L., 2000.** Microsatellite polymorphism in the tsetse flies (Diptera: Glossinidae:

Nemorhina). (Meeting abstract no. 361.) *American Journal of Tropical Medicine and Hygiene*, **62** (3, Suppl.): 289.

Luna: Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT 06510, USA.

This study identified 13 polymorphic microsatellite loci from *Glossina palpalis palpalis*. The majority of these markers were shown to amplify corresponding loci from the related species *G. p. gambiensis*, *G. fuscipes* and *G. tachinoides*. Only seven out of 13 loci were amplified from *G. austeni*. Genetic variability was estimated in one field population of *G. p. gambiensis*. The results demonstrated that microsatellite markers could be applied to examine the sub-population structure of tsetse flies.

11745 **Moloo, S.K. and Gooding, R.H., 2000.** Long-term study on the susceptibility to *Trypanosoma congolense* infections and genetics of colonized *Glossina pallidipes* from allopatric populations in Kenya. *Canadian Journal of Zoology*, **78** (7): 1289-1292.

Gooding: Department of Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9, Canada. [rgooding@gpu.srv.ualberta.ca]

Two colonies of *G. pallidipes* originating from the Shimba Hills and Nguruman, Kenya, were examined for their susceptibility to two strains of *T. congolense* and for allele frequencies at eight polymorphic loci. These data were compared with data from earlier studies of these colonies. Overall, the two colonies of *G. pallidipes* were found to have lost, over 3-4 years, most of the genetic and trypanosome-susceptibility characteristics that originally distinguished them.

11746 **Solano, P., La Rocque, S. de, Meeus, T. de, Cuny, G., Duvallet, G. and Cuisance, D., 2000.** Microsatellite DNA markers reveal genetic differentiation among populations of *Glossina palpalis gambiensis* collected in the agropastoral zone of Sideradougou, Burkina Faso. *Insect Molecular Biology*, **9** (4): 433-439.

Solano: IPR, 01 B.P. 1500, Bouaké, Côte d'Ivoire.

Intraspecific genetic variability of *G. p. gambiensis* in the area of Sideradougou, Burkina Faso, was studied using polymorphic microsatellite DNA markers. This genetic study was combined with other epidemiological information on the same tsetse: blood-meal identification, dissection of tsetse and molecular characterisation of the trypanosomes detected. There was significant genetic differentiation among flies caught only a few kilometres apart, within the same riverine habitat. These distinct subpopulations were also differentially infected by trypanosomes. In part of the study area, a Factorial Correspondence Analysis undertaken on the genotypes allowed us to detect a Wahlund effect, suggesting the presence of tsetse originating from different source populations coming from two distinct drainage systems. The apparent structuring

of populations of *G. p. gambiensis* is discussed relative to appropriate strategies to control African trypanosomiasis.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also 24: nos. 11729, 11734, 11756, 11757.]

- 11747 **Gikonyo, N.K., Hassanali, A., Njagi, P.G.N. and Saini, R.K., 2000.** Behaviour of *Glossina morsitans morsitans* Westwood (Diptera: Glossinidae) on waterbuck *Kobus defassa* Ruppel and feeding membranes smeared with waterbuck sebum indicates the presence of allomones. *Acta Tropica*, **77** (3): 295-303.

Hassanali: ICIPE, P.O. Box 30772, Nairobi, Kenya. [ahassanali@icipe.org]

The behavioural responses of caged individual teneral *G. m. morsitans* on waterbuck and ox and on feeding membranes with and without smears of different doses of waterbuck sebum were compared. No significant difference was found in the initial landing behaviour on the two animals, nor on treated and control parts of the membrane. However, the subsequent behaviours of the flies were significantly different. Whereas none of the flies that landed on the ox showed any escape behaviour, more than a third of those that initially landed on waterbuck departed before probing. Similar results were obtained on feeding membranes treated in part with 1.0 or 1.4 mg/cm² of waterbuck sebum. Moreover, flies that landed on waterbuck or its sebum changed probing sites more often and probed significantly longer. The proportions that initiated feeding during the 10 min observation period were also significantly less. Our results suggest the presence of both volatile and non-volatile allomones on waterbuck which would account for low numbers of flies found attracted to and feeding on waterbuck in the wild.

- 11748 **Gouteux, J.-P. and Martin, L., 2000.** Pièges à tsé-tsé en polyéthylène: variation imprévue de l'attraction pour *Glossina fuscipes fuscipes* en République Centrafricaine. [Polyethylene tsetse traps: unexpected variation in attractiveness for *G. f. fuscipes* in the Central African Republic.] *Insect Science and its Application*, **20** (1): 67-72.

Gouteux: IRD, Laboratoire d'Ecologie Moléculaire, IBEAS, Université de Pau (UPPA), avenue de l'Université, F-64000 Pau, France. [jean-paul.gouteux@wanadoo.fr]

The polythene films used in manufacturing bipyramidal tsetse traps in the Central African Republic can exhibit slight variations in colour. Experiments conducted on *G. f. fuscipes* using a new protocol that combines a Latin square design and two competing traps in the same experiment show that a less intensely blue colouring decreases the attractiveness of the trap. The use of polythene for making tsetse traps has many advantages but it is necessary to ensure that its colour is homogeneous.

- 11749 **Hargrove, J.W., 2000.** A theoretical study of the invasion of cleared areas by tsetse flies (Diptera: Glossinidae). *Bulletin of Entomological Research*, **90** (3): 201-209.

Hargrove: c/o Tsetse Control Branch, Box CY52, Causeway, Harare, Zimbabwe. [jhargrove@rttcp.org.zw]

Large-scale eradication campaigns against tsetse flies *Glossina* spp. are giving way to smaller operations aimed at disease and vector containment. There has been little discussion of the effects of these changes in policy. This study estimates the rate at which tsetse re-infect treated areas after the termination of control efforts. Movement is modelled as a diffusion process with a daily root mean square displacement (λ) of 0.2-1 km^{-1/2} and population growth as logistic with a growth rate (r) \leq 1.5% day⁻¹. Invasion fronts move as the product of λ and \sqrt{r} . For $r = 0.75\%$ day⁻¹ a front advances at 2.5 km year⁻¹ for each 100 m increment in λ . If there are 0.001% survivors in 10% of the treated area, the population recovers to within 1% of the carrying capacity (K) within 3 years. If the control area is subject to invasion from all sides, a treated block of 10,000 km² is effectively lost within 2 years, except at the lowest values of λ and r . Cleared areas of 100 km² are lost in a year, as observed in a community-based suppression programme in Kenya. If the treated area is closed to re-invasion, but if there is a block where tsetse survive at 0.0001-0.1% of K , the population recovers within 3-4 years for up to 20 km outside the surviving block. If the surviving flies are more widely spread, re-infection is even more rapid. The deterministic approach used here over-estimates re-invasion rates at low density, but comparisons between control scenarios are still valid. Stochastic modelling would estimate more exactly rates of re-infection at near-zero population densities.

11750 **Kappmeier, K., 2000.** Diurnal activity patterns of *Glossina brevipalpis* and *G. austeni* (Diptera: Glossinidae) in South Africa, with reference to season and meteorological factors. *Onderstepoort Journal of Veterinary Research*, **67** (3): 179-189.

Division of Entomology, Onderstepoort Veterinary Institute, Private Bag X05, ZA-0110 Onderstepoort, South Africa.

Studies on the diurnal and seasonal availability of *G. brevipalpis* and *G. austeni* to stationary targets were conducted in north-eastern KwaZulu-Natal, South Africa. *G. brevipalpis* showed a bimodal, and occasionally trimodal, partly crepuscular cycle. Periods of the availability of flies to stationary, odour-baited targets (here referred to as diurnal 'activity' patterns) were mainly early in the morning and late afternoon until dark, especially at dawn and dusk. The main diurnal activity period was the late afternoon peak, which occurred during the 1-2 h before sunset until dark. The amplitude of the morning and afternoon peaks seemed to be mainly modulated by temperature. This species was also active throughout the remainder of the day, depending on the season. *G. austeni* was day-active and activity seemed to increase with increasing temperature and decreasing relative humidity (RH). The species remained available to targets throughout the day, but during the hottest part of the day the diurnal pattern decreased somewhat, resulting in a U-shaped but still more or less unimodal pattern. The diurnal pattern was strongly modulated by ambient temperature, although seemingly more by a combined temperature-RH effect. Both species' availability to targets ceased after dark, although night activity

was observed on various other occasions. The use of artificial refuges by *G. brevipalpis* and *G. austeni* as a possible means of escaping climatic extremes is briefly discussed and speculated on.

- 11751 **Sigauque, I., Bossche, P. van den, Moiana, M., Jamal, S. and Neves, L., 2000.**
The distribution of tsetse (Diptera: Glossinidae) and bovine trypanosomosis in the Matutuine District, Maputo Province, Mozambique. *Onderstepoort Journal of Veterinary Research*, **67** (3): 167-172.

Sigauque: Direção Nacional de Pecuária, C.P. 1406, Maputo, Mozambique.

A tsetse and bovine trypanosomosis survey was conducted during 1998 and 1999 in the Matutuine District of Maputo Province, Mozambique. A total of 59 *Glossina brevipalpis* and 17 *G. austeni* were captured throughout the district. Survey results suggest that *G. brevipalpis* is mainly concentrated in dense vegetation along the Maputo River and in the wetlands east of the river. *G. austeni*, on the other hand, was captured mainly in dense thickets in drier areas. Both tsetse species are suspected of being vectors of bovine trypanosomosis. Trypanosomosis (75.5% *Trypanosoma congolense*) was diagnosed in 53 cattle (13.9%) from seven sampling sites distributed throughout the district. The prevalence of cattle with anti-trypanosomal antibodies was high (29.9%). The incidence of trypanosomal infections in sentinel cattle was also high. The widespread distribution of bovine trypanosomosis and the high prevalence of infection are likely to have a significant impact on cattle production and, hence, the cattle restocking exercise in the district.

- 11752 **Vreysen, M.J.B., Saleh, K.M., Zhu, Z.-R. and Suleiman, F.W., 2000.**
Responses of *Glossina austeni* to sticky panels and odours. *Medical and Veterinary Entomology*, **14** (3): 283-289.

Vreysen: Kapelstraat 61, B-2490 Balen-Wezel, Belgium.

The responses of male tsetse *G. austeni* towards blue and white sticky legged panels, baited with odour attractants, and towards modified panels were studied in the Jozani forest of Unguja Island, Zanzibar. Increasing the height of the body of a standard panel, from 30 to 60 or 90 cm, increased the catch two-fold. Increasing the height of the legs, from 15 to 60 or 120 cm, or raising the device more than 5 cm above the ground reduced the catch significantly. The legs of the panels were the preferred landing sites of the flies, irrespective of the height of the body of the panel. Acetone (300 mg/h) combined with cow urine (60-130 mg/h) significantly increased the catches 2- to 3-fold during the rainy season, but not during the dry season. Acetone had no effect during the dry season and its effect during the rainy season was less consistent. There was no effect of octenol (2.5-12.5 mg/h) used alone or in combination with acetone. Likewise, the catch did not increase through the addition of cow sebum, pig urine (60-860 mg/h), pig urine combined with acetone and octenol. The observed seasonal differences in the response of *G. austeni* towards odours are discussed in relation to host location strategies.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **24**: nos. 11729, 11736, 11740, 11748, 11749, 11788.]

11753 **Laveissière, C. and Penchenier, L., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 5 Lutte antivectorielle.* [Manual of sleeping sickness control in Central and West Africa: volume 5 Vector control.] Yaoundé, Cameroon; OCEAC/IRD. 104 pp. (See also **24**: no. 11732.)

This volume of the manual concentrates on the practicalities of controlling the tsetse species responsible for transmitting *Trypanosoma brucei gambiense* and is intended for as wide a public as possible, not just specialists, in order that it may be used to inform and educate those most concerned, the village communities. Short introductory sections outline the control strategies, including the requirements and the constraints. The techniques are then described (the principle of trapping, description of screens and traps, use of insecticides on screens and traps, drying after impregnation, maintenance). The protocols for use in the savanna zone, where the epidemiology of HAT is relatively simple, and in the forest zone, where it is much more complex, are given. These include discussions of the choice of method, supervision, recording of data, training, raising the awareness and education of village communities, timing of control operations and deployment of traps, maintenance and reimpregnation, and evaluation of tsetse population reduction. The requirements in other types of foci (mangrove swamps, Les Niayes, towns, those which cross borders between countries) are briefly considered. The final sections describe the logistics and manufacture of traps and screens.

11754 **Makumi, J.N., Stevenson, P. and Green, C.H., 2000.** Control of *Glossina longipennis* (Diptera: Glossinidae) by insecticide-treated targets at Galana Ranch, Kenya, and confirmation of the role of *G. longipennis* as a vector of cattle trypanosomiasis. *Bulletin of Entomological Research*, **90** (5): 397-406.

Makumi: KETRI, P.O. Box 362, Kikuyu, Kenya. [ketri@net2000ke.com]

G. longipennis was studied in Galana Ranch, Kenya, over a 4 year period, in two areas (Tank E and Lali) where the species was abundant and other species were absent or scarce. There was active transmission of trypanosomiasis to cattle in both areas, the parasite species being *Trypanosoma vivax* and *T. congolense*. Mean infection rates of the *G. longipennis* were 1.1% and 0.55% for *T. vivax* and *T. congolense* respectively at Tank E, and 0.88% and 0.15% at Lali. Experimental transmission studies showed that cattle in fly-proof enclosures challenged with wild *G. longipennis* collected from Galana became infected with both trypanosome species. A tsetse control operation in one area (Tank E) using targets impregnated with deltamethrin in an oil formulation reduced the population of *G. longipennis* by 98% over one year, despite evidence of re-invasion. Populations of *G. longipennis* in the other area (Lali) were relatively stable over the whole study period. The effect of tsetse control on the incidence of cattle trypanosomiasis at Tank E was less clear than that on tsetse numbers, probably due to the lack of a sustained reduction in tsetse numbers. However, a significant relationship was demonstrated between fortnightly

incidence measurements and electric net catches of *G. longipennis* at Tank E. A further significant predictor of incidence was rainfall in the previous four to seven weeks. This study confirms the importance of *G. longipennis* as a vector of bovine trypanosomiasis in areas where it is the predominant tsetse present.

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

[See also 24: nos. 11729, 11734, 11745-11747, 11810, 11812.]

11755 **La Rocque, S. de, Bengaly, Z., Michel, J.F., Solano, P., Sidibe, I. and Cuisance, D., 1999.** Importance des interfaces spatiales et temporelles entre les bovins et les glossines dans la transmission de la trypanosomose animale en Afrique de l'Ouest. [Importance of spatial and temporal contacts between cattle and tsetse flies in the transmission of trypanosomiasis in West Africa.] *Revue d'Élevage et de Médecine vétérinaire des Pays tropicaux*, **52** (3-4): 215-222.

CIRDES, B.P. 454, 01 Bobo-Dioulasso, Burkina Faso.

A risk assessment study of trypanosomiasis transmission was carried out over a period of 2 years in the agropastoral zone of Sideradougou, Burkina Faso using sentinel herds from two different farming systems. The monthly incidences of infections were measured in relation to the movements of herds, their watering practices and their contacts with riparian tsetse flies (*Glossina tachinoides* and *G. palpalis gambiensis*). In Nakaka, a Fulani breeders' village 4 km away from the river, trypanosomes are transmitted during the dry season at permanent watering places inside the gallery forest. In the rainy season, the tsetse flies disperse through the savanna and infect cattle even in the village. In Pefrou, a group of farmers' settlements, herds consist mainly of draught cattle. Animals from settlements located near the hydrographic network drink in the river and are regularly infected all the year long, though incidences of infection are higher during the rainy season and the beginning of the dry season when tsetse flies are most abundant. On the other hand, herds from settlements further away (3 km) from the hydrographic network are watered from wells and do not frequent tsetse habitats. In this agricultural system, tsetse flies do not disperse even in the rainy season and incidences in these herds are almost nil. These results show the importance of spatial and temporal contacts between cattle and tsetse flies in the epidemiology of trypanosomiasis in West Africa.

11756 **Moloo, S.K., Sabwa, C.L. and Baylis, M., 2000.** Feeding behaviour of *Glossina pallidipes* and *G. morsitans centralis* on Boran cattle infected with *Trypanosoma congolense* or *T. vivax* under laboratory conditions. *Medical and Veterinary Entomology*, **14** (3): 290-299.

Baylis: Compton Laboratory, Institute for Animal Health, Compton, Newbury RG20 7NN, UK.

In field studies, tsetse flies feed more successfully on cattle infected with *T. congolense* than on cattle infected with *T. vivax* or uninfected cattle. Here we describe the

first laboratory investigation of this phenomenon. In the first experiment, caged *G. pallidipes* were fed for 1 and 5 min on a Boran steer infected with *T. congolense* clone IL 1180 and on an uninfected steer. Feeding success was recorded in this way five times over several weeks. The same protocol was subsequently used in three additional experiments with the following combinations: *G. pallidipes* and a steer infected with *T. vivax* stock IL 3913, *G. morsitans centralis* and a steer infected with *T. congolense*, and *G. m. centralis* and a steer infected with *T. vivax*. The four experiments were replicated once, making eight experiments in total. In three experiments there was increased tsetse feeding success, measured at 1 min, after a steer became infected (*T. congolense*, two experiments and *T. vivax*, one experiment). Analysis of all data combined found no significant differences in tsetse feeding success on the different groups of cattle prior to infection, but after infection tsetse feeding success was significantly greater on the infected cattle ($P < 0.001$). *T. congolense* infection led to a greater increase in tsetse feeding success than *T. vivax* infection. The increase in feeding success was not related to changes in the level of anaemia, skin surface temperature or parasitaemia. A possible explanation is the effects of trypanosome infection on cutaneous vasodilation and/or blood clotting in infected cattle. When allowed to feed for 5 min, nearly all tsetse engorged successfully and effects of cattle infection on feeding success were not found.

11757 **Sané, B., Laveissière, C. and Méda, H.A., 2000.** Répartition spatiale et préférences trophiques de *Glossina palpalis palpalis* dans le foyer forestier de Zoukougbeu (Côte d'Ivoire). Implications épidémiologiques. [Spatial distribution and bloodmeal preferences of *G. p. palpalis* in the forest focus of Zoukougbeu, Côte d'Ivoire. Epidemiological consequences.] *Parasite*, **7** (3): 241-244.

Sané: IPR, OCCGE, B.P. 1500, Bouaké 01, Côte d'Ivoire.

In the *Trypanosoma brucei gambiense* sleeping sickness focus of Zoukougbeu, Côte d'Ivoire, in the plantation areas which are favourable for disease transmission, more than a quarter of the tsetse flies collected were found to have fed on domestic pigs. The sites where captured *G. p. palpalis* had fed on these animals were concordant with the sites where sleeping sickness patients were present. This suggests that in Zoukougbeu, but perhaps also in other HAT foci, pigs could play a more active role in disease transmission than generally thought, allowing the parasite to spread widely via the tsetse flies.

11758 **Torr, S.J. and Mangwiro, T.N.C., 2000.** Interactions between cattle and biting flies: effects on the feeding rate of tsetse. *Medical and Veterinary Entomology*, **14** (4): 400-409.

Torr: NRI, University of Greenwich, Central Avenue, Chatham Maritime, Chatham ME4 4TB, UK. [s.torr@greenwich.ac.uk]

In Zimbabwe, studies were made of the effect of host behaviour on the feeding success of *Glossina pallidipes* and *G. morsitans morsitans* attracted to cattle of different age and sex. The mean feeding rates for male and female *G. pallidipes* attracted to oxen were 60% and 58%, respectively, compared to 33% and 53% for male and female *G. m. morsitans*. The feeding rate of *G. pallidipes* varied between oxen and was inversely

correlated with a host's rate of defensive leg movements, which, in turn, was positively correlated with the density of *Stomoxys* spp. caught in the vicinity of the host. Tsetse were significantly less successful in feeding from young cattle. For *G. pallidipes*, the feeding rate on calves (< 6 months) was 11%, whereas for male and female *G. m. morsitans* the rates were 12% and 20%, respectively. Significantly lower feeding rates were apparent for cattle aged up to 2 years, when the feeding rate for *G. pallidipes* (31%) was still significantly less than that on mature oxen (68%). Feeding rates for *G. pallidipes* on adult female cattle were lower than those on oxen (45% vs. 61%). The lower feeding rates in young animals were attributed to higher rates of defensive movements, suggesting that such movements reduce their risk of contracting trypanosomiasis.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

[See also 24: nos. 11734, 11737.]

- 11759 **Bédât-Millet, A.L., Charpentier, S., Monge-Strauss, M.F. and Woimant, F., 2000.** Forme psychiatrique de trypanosomiase africaine: illustration des difficultés diagnostiques, [intérêt du traitement au difluorométhylornithine] et apport de l'imagerie par résonance magnétique. [Psychiatric presentation of human African trypanosomiasis: overview of diagnostic pitfalls, importance of difluoromethylornithine treatment and contribution of magnetic resonance imaging.] *Revue neurologique*, **156** (5): 505-509.

Bédât-Millet: Service de Neurologie, Hôpital Charles Nicolle, F-76031 Rouen Cedex, France.

The case is reported of a West African man, resident in France for 4 years, who developed HAT caused by *Trypanosoma brucei gambiense*. The disease was misdiagnosed and untreated for several years because the clinical presentation was limited to psychiatric disorders and biological confirmation was difficult. Polysomnographic recordings demonstrated alterations typical of HAT. Difluoromethylornithine (eflornithine) was effective at this late stage of the disease. Magnetic resonance imaging showed brain oedema with demyelination and associated brain atrophy and abnormal signals in the brainstem and thalamus, both implicated in the sleep-wake cycle.

- 11760 **Jamonneau, V., Truc, P., Garcia, A., Magnus, E. and Büscher, P., 2000.** Preliminary evaluation of LATEX/*T. b. gambiense* and alternative versions of CATT/*T. b. gambiense* for the serodiagnosis of human African trypanosomiasis of a population at risk in Côte d'Ivoire: considerations for mass-screening. *Acta Tropica*, **76** (2): 175-183.

Jamonneau: Laboratoire de Génétique des Parasites et Vecteurs, OCCGE/IPR, 01 B.P. 1500 Bouaké, Côte d'Ivoire.

A study was conducted to compare the classical card agglutination test for trypanosomiasis (CATT)/*T. b. gambiense* with CATT-EDTA and LATEX/*T. b. gambiense* as alternative field tests for serodiagnosis of human African trypanosomiasis. The tests were performed on freshly collected blood in an endemic and a low prevalence area in Côte d'Ivoire. The diagnostic performance of each test was assessed using the quantitative buffy coat technique as the parasitological reference, and immune trypanolysis as the serological reference test. CATT-EDTA on 10 µl and LATEX/*T. b. gambiense* on blood diluted 1:4 detected all parasitologically confirmed cases with good specificity (94.6% and 98.1%, respectively) and yielded better results than the classical CATT (one false negative and 92.5% specific). However, when immune trypanolysis data and feasibility are taken into account, the classical CATT remains the test of choice for mass screening under the given field conditions.

11761 **Laveissière, C. and Penchenier, L., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 3 Dépistage.* [Manual of sleeping sickness control in Central and West Africa: volume 3 Case detection.] Yaoundé, Cameroon; OCEAC/IRD. 76 pp. (See also **24**: no. 11732.)

This volume of the manual is particularly intended for all health care personnel who are in charge of operations to detect suspected cases of *Trypanosoma brucei gambiense* infection. The techniques and procedures to be followed to see an operation of serological surveillance through to a successful conclusion are given. Detailed information is included on the micro-CATT, the CATT on whole blood, the CATT on plasma or serum, the Latex CATT, lymph node palpation, the problem of false positives and false negatives, and on how to carry out a census of a population at risk of sleeping sickness.

11762 **Penchenier, L. and Laveissière, C., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 4 Diagnostic.* [Manual of sleeping sickness control in Central and West Africa: volume 4 Diagnosis.] Yaoundé, Cameroon; OCEAC/IRD. 73 pp. (See also **24**: no. 11732.)

This volume of the manual is intended for health professionals, doctors and nurses, who are or will be responsible for the diagnosis of *Trypanosoma brucei gambiense* sleeping sickness. Details are given of how to use the principal techniques (examination of lymph node aspirate, examination of blood films, concentration of trypanosomes by centrifugation (microhaematocrit centrifugation technique, quantitative buffy coat technique), concentration by filtration (mini-anion exchange centrifugation technique) and trypanosome culture. The protocols to be followed by mobile teams are described (personnel, logistics, preparations and programme planning, course of the survey) as well as those for clinics. The follow-up of serological suspects, use of epidemiological questionnaires and costs of concentration methods are also discussed.

11763 **Penchenier, L., Simo, G., Grébaud, P., Nkinin, S., Laveissière, C. and Herder, S., 2000.** Diagnosis of human trypanosomiasis, due to *Trypanosoma brucei gambiense* in central Africa, by the polymerase chain reaction. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **94** (4): 392-394.

Penchenier: Haïtz Aspian, 889 chemin d'Ostalpea, 64210 Ahètze, France.
[lt.penchenier@infonie.fr]

During a mass screening of sleeping sickness conducted in 1998 and 1999, and involving 27,932 persons in Cameroon and the Central African Republic, the polymerase chain reaction (PCR) on whole blood was tested for the diagnosis of human African trypanosomiasis due to *T. b. gambiense*. The 1858 samples obtained were from four groups: 155 infected patients, 1432 serological suspects detected by CATT, 222 negative controls living in the prospected area (negative with CATT and parasitological methods), and 49 negative controls (by CATT and parasitological methods) who were unexposed to the disease (Europeans). The technique of DNA extraction used made it possible to preserve the blood samples in the field. The primers used were specific for *T. brucei* s.l. Only 1 patient was PCR-negative, and 3 of the negative controls, exposed to the disease, were PCR-positive. Among the 1432 serological suspects, only 50 were PCR-positive. During the 6-month follow-up after the surveys, the 3 negative controls, who were initially positive by PCR, were found to be negative. These initial positive PCR results are unlikely to have been due to a cross-reaction with *T. b. brucei*, which is non-pathogenic for man, but are more likely to have resulted from a mislabelling of sample tubes. All control individuals, exposed or not to the disease, were negative by PCR. The PCR-negative patient was possibly a registration error. Among 50 PCR-positive serological suspects, 39 were re-examined. Five were found to be positive by KIVI, representing an increase in patients of almost 13%. At the end of the study, 160 patients were diagnosed, of which 159 were PCR-positive (99.4%). Moreover, the PCR made it possible to reduce the number of suspects to be re-examined (50 instead of 1432, a reduction of 96.5%).

11764 **Raffenot, D., Rogeaux, O., Goer, B. de, Doche, C. and Tous, J., 2000.** Mononucléose infectieuse ou maladie du sommeil? [Infectious mononucleosis or sleeping sickness?] *Annales de Biologie clinique*, **58** (1): 94-96.

Raffenot: Laboratoire de Biologie, Centre Hospitalier, B.P. 1125, F-73011 Chambéry, France.

11765 **Truc, P. and Cuny, G., 2000.** Apport de la biologie moléculaire à l'identification des trypanosomes responsables de la trypanosomiase humaine africaine ou maladie du sommeil. [Role of molecular biology in the identification of trypanosomes responsible for human African trypanosomiasis or sleeping sickness.] *Médecine tropicale*, **60** (2): 115-119.

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The use of molecular biology in the identification of *Trypanosoma brucei* subspecies is described. Techniques discussed include multi-locus enzyme electrophoresis (MLEE), the polymerase chain reaction (PCR), restriction fragment length polymorphism (RFLP), random amplification of polymorphic DNA (RAPD) and pulsed field gel electrophoresis (PFGE).

(b) PATHOLOGY AND IMMUNOLOGY

[See **24**: no. 11798.]

(c) TREATMENT

[See also **24**: nos. 11731, 11737, 11738, 11800.]

11766 **Barrett, M.P., 2000.** Problems for the chemotherapy of human African trypanosomiasis. (Review.) *Current Opinion in Infectious Diseases*, **13** (6): 647-651.

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Problems associated with the current therapies of sleeping sickness include toxicity, resistance and a lack of a guaranteed supply. However, no new formulations are close to gaining a licence for clinical use and relatively few compounds have been shown to be effective in experimental systems. Many potentially good biochemical targets for drugs have been identified. Some of these have been validated and lead compounds have been developed. However, the biology of trypanosomes means that various pharmacological demands must be met in developing new trypanocides for clinical use. Foremost among these problems is the blood-brain barrier, across which trypanocides must cross to reach parasites in the cerebrospinal fluid. The principal problem, however, relates not to biological difficulties, which are technically surmountable, but to economics. Put simply, most representatives of the pharmaceutical industry believe that selling drugs to the victims of sleeping sickness will not yield sufficient income to justify expenses needed for the development of novel reagents. Only when this economic barrier can be lowered will new drugs emerge for use against sleeping sickness.

11767 **Keiser, J., Ericsson, O. and Burri, C., 2000.** Investigations of the metabolites of the trypanocidal drug melarsoprol. *Clinical Pharmacology & Therapeutics*, **67** (5): 478-488.

Burri: Department of Medical Parasitology and Infection Biology, Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland.

Melarsoprol remains the first-choice drug for human trypanosomiasis. To contribute to the sparse pharmacological data and to understand better the cause of the frequent serious adverse reactions, we investigated the metabolism of this 50-year-old organo-arsenical compound using blood and CSF from five patients with *Trypanosoma brucei gambiense* infection. The half-life of melarsoprol determined by HPLC was < 1 h compared with 35 h determined by bioassay and atomic absorption spectroscopy, indicating the existence of active metabolites. One metabolite, melarsen oxide, was identified by ultraviolet HPLC after incubation of melarsoprol with microsomes. The maximum plasma concentration of melarsen oxide was reached 15 min after administration; the clearance was 21.5 ml/min/kg and the half-life of free melarsen oxide

was 3.9 h. Either melarsen oxide or a yet-undiscovered active metabolite is irreversibly bound to proteins, as shown by ultrafiltration, precipitation experiments, and atomic absorption spectroscopy. Because of the poor pharmaceutical properties of melarsoprol, the therapeutic potential of melarsen oxide was investigated. In a rodent model of acute infection, 20 of 20 mice were cured (0.1-1.0 mg/kg i.v. or 2.2 mg/kg i.p.). In a rodent model of CNS infection, five of six mice survived for more than 180 days (5 mg/kg i.v.), indicating a sufficient melarsen oxide penetration across the blood-brain barrier. Since the prospects for the future of trypanosomiasis treatment are deplorable, investigations on the improvement of the use of the old drugs are required. The results of this study may build a basis for further research on the cause of severe adverse reactions.

- 11768 **Penchenier, L., Sanou, S.J.R. and Laveissière, C., 2000.** *Manuel de lutte contre la maladie du sommeil en Afrique centrale et occidentale: volume 6 Traitement.* [Manual of sleeping sickness control in Central and West Africa: volume 6 Treatment.] Yaoundé, Cameroon; OCEAC/IRD. 47 pp. (See also **24**: no. 11732.)

This final volume of the manual is intended for doctors and nursing staff who are or will be responsible for the treatment of *Trypanosoma brucei gambiense* sleeping sickness patients. It includes the theory as well as the practice of treatment and discusses the determination of the phase of the disease (lumbar puncture, examination of CSF, criteria), case notes, medicinal preparation (treatment for intestinal parasites and malaria, vitamin and iron therapy and protein-rich diet, prevention of infections and convulsions, corticotherapy), specific treatment (history, mode of action of drugs, treatment with pentamidine, with melarsoprol and with difluoromethylornithine (eflornithine), including details of pharmacokinetics, cost and production (1999), dosage and mode of administration, side effects) and post-treatment follow-up. An annexe on other drugs which may be used is included.

- 11769 **Pépin, J., Khonde, N., Maiso, F., Doua, F., Jaffar, S., Ngampo, S., Mpia, B., Mbulamberi, D. and Kuzoe, F., 2000.** Short-course eflornithine in Gambian trypanosomiasis: a multicentre randomized controlled trial. *Bulletin of the World Health Organization*, **78** (11): 1284-1295.

Pépin: Centre de Santé Internationale, Université de Sherbrooke, 3001 12^{ème} Avenue Nord, Sherbrooke, PQ, J1H 5N4, Canada. [jpepin01@courrier.usherb.ca]

A randomised controlled trial was conducted to determine whether 7 days of intravenous eflornithine (100 mg/kg every 6 h) was as effective as the standard 14-day regimen in the treatment of late-stage *Trypanosoma brucei gambiense* trypanosomiasis. A total of 321 patients (274 new cases, 47 relapsing cases) were randomised at four participating centres in Congo P.R., Côte d'Ivoire, Congo D.R. and Uganda to one of these treatment regimens and followed up for 2 years. Six patients died during treatment, one of whom was on the 7-day regimen, whereas the other five had been on the 14-day regimen ($P = 0.2$). The response to eflornithine differed markedly between Uganda and other countries. Among new cases in Uganda, the 2-year probability of cure was 73% on the

14-day course compared with 62% on the 7-day regimen (hazard ratio (HR) for treatment failure, 7-day v. 14-day regimen, 1.45; 95% confidence interval (CI): 0.7-3.1; $P = 0.3$). Among new cases in Côte d'Ivoire, Congo P.R. and Congo D.R. combined, the 2-year probability of cure was 97% on the 14-day course compared with 86.5% on the 7-day regimen (HR for treatment failure, 7-day v. 14-day, 6.72; 95% (CI): 1.5-31.0; $P = 0.003$). Among relapsing cases in all four countries, the 2-year probability of cure was 94% with 7 days and 100% with 14 days of treatment. Factors associated with a higher risk of treatment failure were: a positive lymph node aspirate (HR 4.1; 95% CI: 1.8-9.4), a CSF white cell count $\geq 100/\text{mm}^3$ (HR 3.5; 95% CI: 1.1-10.9), being treated in Uganda (HR 2.9; 95% CI: 1.4-5.9) and CSF trypanosomes (HR 1.9; 95% CI: 0.9-4.1). Being stuporous on admission was associated with a lower risk of treatment failure (HR 0.18; 95% CI: 0.02-1.4) as was increasing age (HR 0.977; 95% CI: 0.95-1.0, for each additional year of age). It is concluded that the 7-day course of eflornithine is an effective treatment of relapsing cases of Gambian trypanosomiasis. For new cases, a 7-day course is inferior to the standard 14-day regimen and cannot be recommended.

11770 **Simon, F., 1999.** Le melarsoprol. [Melarsoprol.] *Médecine tropicale*, **59** (4): 331-332.

The use of melarsoprol for the treatment of advanced stage human African trypanosomiasis is briefly described, including its pharmacological characteristics, its dangers (principally encephalopathy), an absolute contra-indication (pregnancy, although it can be used in certain circumstances) and recent findings (principally the development of resistance).

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

[See also **24**: nos. 11734, 11751, 11788.]

11771 **Basagoudanavar, S.H., Rao, J.R., Omanwar, S., Singh, R.K. and Butchaiah, G., 1998.** Sensitive polymerase chain reaction for detection of *Trypanosoma evansi* in camels (*Camelus dromedarius*). *Journal of Parasitic Diseases*, **22** (1): 40-43.

Division of Parasitology, National Biotechnology Centre, Indian Veterinary Research Institute, Izatnagar 243 122, U.P., India.

The detection of *T. evansi* in dromedary camels using a PCR technique is described. The assay used synthetic oligonucleotide primers targeted to a repetitive nuclear DNA sequence of *T. evansi*. Blood samples collected in 10 μl quantities by vein puncture were allowed to clot and then boiled prior to use for DNA amplification. Blood samples were also examined microscopically and by HCT. The PCR method was sufficiently sensitive to detect ≈ 0.5 ng of template DNA. The test gave a positive reaction in 3 of 20 camels which were negative by microscopic examination and HCT.

- 11772 **Desquesnes, M., Michel, J.F., La Rocque, S. de, Solano, P., Millogo, L., Bengaly, Z. and Sidibe, I., 1999.** Enquête parasitologique et sérologique (ELISA-indirect) sur les trypanosomoses des bovins dans la zone de Sideradougou, Burkina Faso. [Parasitological and serological (indirect-ELISA) survey on bovine trypanosomosis in Sideradougou area, Burkina Faso.] *Revue d'Élevage et de Médecine vétérinaire des Pays tropicaux*, **52** (3-4): 223-232.

CIRDES, B.P. 454, 01 Bobo-Dioulasso, Burkina Faso.

A parasitological and serological survey of bovine trypanosomosis was carried out in the northern sector of the Sideradougou area, Burkina Faso, in November-December 1997. One thousand cattle were sampled by stratified random sampling. Age and breed of animals and the nature and date of the last trypanocidal treatment were recorded. Parasitological examinations were carried out by the buffy coat technique, PCV values were recorded, and indirect-ELISAs were carried out using soluble antigens of *Trypanosoma vivax*, *T. brucei* or *T. congolense* (savanna type). Parasitological examinations showed 5.3% positive samples, dominated by *T. congolense*. Serological tests indicated a seroprevalence of 81.7% ($\pm 2.4\%$) for the three species combined. A mean annual incidence of 52% ($\pm 11\%$) was estimated. The scores of positivity indicated sero-prevalences per species of 79% for *T. vivax*, 3% for *T. brucei* and 28% for *T. congolense*. In this enzootic situation, parasitological diagnosis was not very sensitive but, used in conjunction with the PCV, gave an estimate of trypanosomosis of 15%. Cattle trypanosomosis remains a major concern in the study area. The enzootic situation is dominated by *T. vivax* infections with high prevalence and clinical impact due to *T. congolense*. The data generated by this survey will be integrated into a GIS set up in the area for the evaluation of trypanosome risk.

- 11773 **Ogunsanmi, A.O., Ikeda, B.O. and Akpavie, S.O., 2000.** Effects of management, season, vegetation zone and breed on the prevalence of bovine trypanosomiasis in southwestern Nigeria. *Israel Journal of Veterinary Medicine*, **55** (2): 69-73.

Ogunsanmi: Department of Wildlife and Fisheries Management, University of Ibadan, Ibadan, Nigeria.

The prevalence of trypanosomiasis in 853 animals from 65 cattle herds kept under modern and traditional management systems in the Ondo, Delta, Edo and Kwara States of Nigeria was determined. The herds were located either in the rain forest or the derived savanna zones, which are the two ecological zones of Nigeria. A comparison of trypanosome infection rates in abattoir blood samples with those of resident herds in these zones was also carried out. The results indicated that sedentary management of cattle is associated with a reduced trypanosome infection rate as compared to the semi-sedentary type of management. The infection rates in sedentary and semi-sedentary herds were 9.8% and 42.8%, respectively, while the rates in the rain forest and derived savanna were 6.6% and 19.9%, respectively. The lower infection rates in the rain forest were attributed to increasing human activity reducing the habitat of the vector. The high infection rate in the derived savanna was influenced by proximity to the *Glossina morsitans* belt as well as

to an increasing density of animals and grazing activities. The infection rate of N'Dama cattle was lower than that of Muturu, Keteku and Zebu breeds. The predominant species of trypanosomes found in this survey were *Trypanosoma congolense* and *T. vivax*, while *G. palpalis* and *G. morsitans* were the only tsetse species trapped. None of the tsetse was positive for trypanosomes.

- 11774 **Rebeski, D.E., Winger, E.M., Robinson, M.M., Gabler, C.M.G., Dwinger, R.H. and Crowther, J.R., 2000.** Evaluation of antigen-coating procedures of enzyme-linked immunosorbent assay method for detection of trypanosomal antibodies. *Veterinary Parasitology*, **90** (1-2): 1-13.

Rebeski: Animal Production Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

Research was undertaken to improve the antigen-coating step of the indirect ELISA method. Polystyrene 96-well plates were precoated with antigenically stable crude trypanosomal antigens (*Trypanosoma congolense*), air dried and sealed before being packed in plastic bags with silica gel desiccant packets. Plates stored at +4°C and +37°C provided an assay performance which was superior to that of plates freshly coated with antigens from a frozen stock. Antigen-precoated plates consistently proved stable after storage up to +50°C for at least 1 year. The accuracy of the assay was not affected, i.e. trypanosomal antibody-positive sera were clearly discriminated from trypanosomal antibody-negative sera. In contrast, lyophilised trypanosomal antigens lacked stability on storage at +37°C for longer than 1 month. It was concluded that the routine use of antigen-precoated polystyrene plates for the enzyme immunoassay technique will contribute to improved assay robustness at an acceptable diagnostic proficiency. The modified coating procedure will also provide an improved quality assurance and standardisation procedure for the assay, which is required to allow the reliable detection of trypanosomal antibodies and comparison of data from different laboratories.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **24**: nos. 11735, 11787.]

- 11775 **Chaudhary, Z.I. and Iqbal, J., 2000.** Incidence, biochemical and haematological alterations induced by natural trypanosomiasis in racing dromedary camels. *Acta Tropica*, **77** (2): 209-213.

Chaudhary: Veterinary Laboratories, Agriculture Guidance Section, Abu Dhabi Municipality, P.O. Box 10829, Bani Yas, Abu Dhabi, United Arab Emirates.

In this study, a trypanosomiasis incidence of 10.67% was observed in 150 racing camels using Suratex (latex agglutination). A significant decrease ($P < 0.05$) in red blood cells, haemoglobin, PCV and lymphocytes was observed, while a significant increase ($P < 0.05$) in white blood cells and neutrophils was noted in trypanosomiasis-positive samples. The blood chemistry parameters indicated that there was a significant decrease ($P < 0.05$) in iron and albumin, but no significant alteration was observed in alkaline phosphatase

(ALP), alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyltransferase (GGT), lactic dehydrogenase (LDH), urea, total protein, calcium, creatinine, phosphorus and magnesium.

- 11776 **Espinoza, E., Primera, G. and Gonzalez, N., 2000.** Influencia del *Trypanosoma vivax* sobre los valores de transaminasas en cabras criollas. Nota técnica. [Influence the *T. vivax* on transaminase values in creole goats. Technical note.] *Revista Científica, Facultad de Ciencias Veterinarias, Universidad del Zulia*, **10** (5): 372-375.

Espinoza: FONAIAP Guarico, Apartado 14, Calabozo, Edo Guarico, Venezuela.

Serum levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were studied in goats for 5 weeks before and 5 weeks after infection with *T. vivax* (TvIIV) using commercial colorimetric kits. In the case of AST, the difference in levels between infected and uninfected goats was not significant. In the case of ALT, there was a significant difference ($P < 0.01$) in the levels pre- and post-infection.

- 11777 **Haroun, E.M., Magzoub, M., Mahmoud, O.M., Al-Qarawi, A.A., Al-Hawas, A.M. and Omer, O.H., 2000.** Some clinico-pathological aspects of experimental *Trypanosoma evansi* infection in Najdi camels (*Camelus dromedarius*). *Journal of Camel Practice and Research*, **7** (1): 101-106.

Haroun: Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, King Saud University, P.O. Box 1482 Buriedah, Qassim, Saudi Arabia.

Experimental infection of Najdi camels with 6 or 10 million *T. evansi* produced microcytic normochromic anaemia, neutrophilia and lymphocytosis. The activity of the serum enzymes aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactic dehydrogenase (LDH) and gamma-glutamyltransferase (GGT) increased after infection. The initial increase was generally concurrent with parasitaemia. Infection also resulted in an increase in globulin concentration and a decrease in albumin and glucose concentrations. The main histopathological changes were focal fatty changes in the liver.

- 11778 **Holmes, P.H., Katunguka-Rwakishaya, E., Bennison, J.J., Wassink, G.J. and Parkins, J.J., 2000.** Impact of nutrition on the pathophysiology of bovine trypanosomiasis. *Parasitology*, **120** (Suppl.): S73-S85.

Holmes: University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

Trypanosomiasis is a major veterinary problem over much of sub-Saharan Africa and is frequently associated with undernutrition. There is growing evidence that nutrition can have a profound effect on the pathophysiological features of animal trypanosomiasis. These features include anaemia, pyrexia, body weight changes, reduced feed intake and

diminished productivity including reduced draught work output, milk yield and reproductive capacity. Anaemia is a principal characteristic of trypanosomiasis and the rate at which it develops is influenced by both protein and energy intakes. Pyrexia is associated with increased energy demands for maintenance which is ultimately manifested by reductions in voluntary activity levels and productivity. Weight changes in trypanosomiasis are markedly influenced by the levels of protein intake. High intakes allow infected animals to grow at the same rate as uninfected controls, providing energy intake is adequate, whilst low energy levels can exacerbate the adverse effects of trypanosomiasis on body weight. Reductions in feed intake are less apparent in animals which are provided with high-protein diets and, where intake is limited by the disease, animals will often exhibit preferential selection of higher quality browse. Further studies are required to evaluate the minimum levels of protein and energy supplementation required to ameliorate the adverse effect of trypanosomiasis, the nature and quality of protein supplement to achieve these benefits and the influence these have on digestive physiology.

11779 **Kadima, K.B., Gyang, E.O., Saror, D.I. and Esievo, K.A.N., 2000.** Serum biochemical values of *Trypanosoma vivax*-infected cattle and the effects of lactose in saline infusion. *Veterinarski Arhiv*, **70** (2): 67-74.

Kadima: Veterinary Teaching Hospital, Ahmadu Bello University, Zaria, Nigeria.

Experiments were carried out on 12 young zebu cattle (*Bos indicus*) aged from 12 to 18 months, divided into 3 groups of 4 animals (A controls, B infected, C infected and lactose-infused). Following experimental infection with the Samaru strain of *T. vivax*, parasitaemia and serum biochemical values (bilirubin, glucose, blood urea nitrogen (BUN) and aspartate serum transaminase (AST)) were monitored in all groups. The strain of *T. vivax* used caused an acute infection, with parasites appearing in the circulation on day 2 p.i. and peaking on day 5 p.i. After disappearing from circulation on day 7 p.i., parasites reappeared, with a second peak occurring on day 13 p.i. In the group infused with lactose, parasitaemia persisted without apparent remission until day 13 p.i. when the experiment was terminated. The effects of *T. vivax* on biochemical values of infected animals (group B) indicated significant increases ($P < 0.05$) in serum glucose and bilirubin levels following the first peak of parasitaemia, while serum BUN and AST showed significantly ($P < 0.05$) lower levels after the first peak of parasitaemia, remaining low thereafter until the end of the experiment. This situation was ascribed to possible cellular or organ damage following the peak parasitaemia earlier observed. Lactose in saline infusion at peak parasitaemia in group C animals caused normal values of serum glucose and bilirubin, but significantly ($P < 0.05$) lower values of serum BUN and AST. This is indicative of low-level tissue and cellular damage, or probably haemodilution arising from the infusion of lactose in saline.

11780 **Khang'mate, A.B., Lahlou-Kassi, A., Bakana, B.M. and Kahungu, M., 2000.** Performance de reproduction des bovins N'Dama dans le diocèse d'Idiofa au Congo.] [Reproduction performance of N'Dama cattle in the Idiofa diocese of the Congo.] *Revue de Médecine vétérinaire*, **151** (6): 511-516.

Khang'mate: c/o Soeurs de Saint-André, 4 chaussée de Tournai, boîte no. 1, B-7520 Ramegnies-Chin, Belgium.

The reproductive performance of N'Dama cows reared under a traditional management system in the central herds of Idiofa diocese in the west of Congo D.R. was evaluated at the end of a study period lasting 6 consecutive years. The age at first calving was 40 months. The mean calving rate with free mating was 70% with the distribution of births showing a peak in April corresponding to mating in July (dry season) and a dip in August (dry season) corresponding to mating in November (the wettest month). The length of gestation was 285 ± 10 days, the mean calving interval was 408 ± 76 days and the interval between calving and conception was 120 days, the last varying according to the rank of the calving, the herd and the month of first calving. These results constitute baseline data for different strategies for improving the productivity of N'Dama cattle in this environment using modern animal reproduction biotechnologies.

11781 **Njiru, Z.K., Olaho-Mukani, W., Khaemba, B.M., Ochieng, R.S. and Ndung'u, J.M., 2000.** Haematological and serological changes during acute *Trypanosoma evansi* infection in dromedary camels (*Camelus dromedarius*). *Journal of Camel Practice and Research*, **7** (1): 113-116.

Njiru: KETRI, P.O. Box 362, Kikuyu, Kenya. [ketri@net2000ke.com]

In order to study the pathological effects of acute *T. evansi* infection in camels, haematological and serological parameters were assessed in five experimentally infected camels. The role of these parameters in immunosuppression and sudden death in sick camels was also investigated. Following infection, there was a massive leukocytosis characterised by lymphocytosis, neutrophilia and a mild eosinophilia. Monocyte, basophil and PCV changes were negligible. There was a significant reduction ($P < 0.05$) in haemolytic complement and an increase in complement fixing antibodies. The changes observed were restored to pre-infection levels after curative treatment with melarsomine (Cymelarsan) at a dose of 0.25 mg/kg body weight, i.m. These findings suggest that the activation of haemolytic complement observed during acute infection may be a major factor contributing to death in camels infected with trypanosomiasis.

11782 **Omeke, B.C.O. and Igboeli, G., 2000.** Disruption of spermatogenesis in boars sub-clinically infected with *Trypanosoma brucei brucei*. *Animal Reproduction Science*, **63** (3-4): 197-204.

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

Data from 14 crossbred (Landrace \times Large White) boars aged 10-12 months were used to investigate the effects of sub-clinical infection with *T. b. brucei* strain Y58/98 on specific germ cells, Sertoli cells and spermatogenesis. Boars were divided into three groups. Groups A and B (5 animals each) were infected intraperitoneally with 2.8×10^6 trypanosomes per animal, while group C consisted of 4 intact controls. At stable sub-

clinical trypanosomiasis, boars in groups A and B together with two of the controls were weighed, scrotal circumferences were measured and animals were castrated on days 56 and 84 post-infection, respectively. Testes were weighed and a portion of each was processed for histomorphometric assessment while another portion was used to determine gonadal sperm reserves by haemocytometry. Crude cells were converted to true cells. Sub-clinical trypanosomiasis was characterised by low live and testes weights, reduced scrotal circumference, scanty parasitaemia peaks at long intervals and decreased libido. Histomorphometry of animals infected with *T. b. brucei* revealed seminiferous tubular distortion, denudation and/or degeneration of germ cells and Sertoli cells leading to disruption of spermatogenesis. Spermatids and young primary spermatocytes were most prone to, while Sertoli cells and spermatogonia were least affected by, sub-clinical trypanosomiasis. There was evidence of regeneration of germ cells from precursor stem cells, resulting in slightly increased gonadal sperm reserves as the p.i. period increased. Consequently, infected boars may not attain original fertility levels. It was concluded that boars in tropical regions that harbour endemic disease should be maintained under prophylactic conditions.

- 11783 **Onah, D.N., Hopkins, J. and Luckins, A.G., 2000.** Effects of the depletion of CD8⁺ T cells and monocytes on the proliferative responses of peripheral blood leucocytes from *Trypanosoma evansi*-infected sheep. *Veterinary Parasitology*, **92** (1): 25-35.

Onah: Department of Parasitology, Miyazaki Medical College, Kiyotake, Miyazaki, 889-1692, Japan.

Sheep peripheral blood mononuclear cells and those depleted of CD8⁺ T cells and/or monocytes were stimulated with polyclonal mitogens and specific antigens, and analysed by means of a cell proliferation assay procedure to examine whether these cell populations are involved in *T. evansi*-induced immunosuppression. The removal of CD8⁺ T cells failed to normalise the proliferative responses of peripheral blood mononuclear cells from infected sheep to concanavalin A stimulation, while the depletion of monocytes resulted in full and enhanced response, showing that macrophages are mainly responsible for the suppression. Although the depletion of CD8⁺ T cells, monocytes or both restored the responses of the cells to lipopolysaccharide stimulation, the responsiveness of the undepleted cells to this mitogen was significantly higher from day 24 p.i. ($P < 0.01$). The results are discussed in relation to currently known mechanisms of depressed lymphocyte proliferation in tsetse-transmitted African trypanosome infections.

- 11784 **Roa, N., Tamasaukas, R., Fuenmayor, C., Soler, L., Ordonez, R. and Aguirre, A., 1999.** Concentración de progesterona plasmática (P4) en hembras ovinas gestantes estabuladas reaccionantes a *Trypanosoma vivax*. [Plasma progesterone concentration (P4) in stabled pregnant ewes reacting to *T. vivax*.] *Revista Científica, Facultad de Ciencias Veterinarias, Universidad del Zulia*, **9** (5): 395-398.

Roa: Instituto de Investigaciones Zootécnicas, CENIAP-FONAIAP, Maracay, Edo Aragua, Venezuela.

Plasma progesterone (P4) concentrations were determined in 19 West African Dwarf ewes at service, during gestation and in the first week after parturition in an experimental flock in Venezuela, using an ELISA. The quantitative buffy coat technique (QBC) and indirect immunofluorescence (IFI) were used to investigate the incidence of *T. vivax*. The mean values of P4 varied between 4.89 and 18.8 ng/ml, with a minimum value of 0.5 ng/ml at the moment of oestrus and a maximum of 25 ng/ml during gestation. The ewes produced six single lambs, 10 sets of twins and one of triplets; two ewes did not produce lambs because of embryonic absorption. The general P4 curve obtained was characteristic of pregnant ewes. *T. vivax* incidence was 43.7% by QBC and 32.6% by IFI; infection was endemic with intermittent peaks. There was no significant correlation between *T. vivax* incidence and reproductive response, although there was a tendency for low P4 levels in infected ewes and in the two ewes losing their pregnancies.

- 11785 **Stefano, H. de, Gonzalez, B., Boada-Sucre, A., Avellaneda, A., Godoy, S. and Soto, H., 1999.** Efecto de la infección con *Trypanosoma vivax* sobre la calidad espermática de toros Siboney. [Effect of *T. vivax* infection on semen quality of Siboney bulls.] *Revista Científica, Facultad de Ciencias Veterinarias, Universidad del Zulia*, **9** (5): 411-417.

Stefano: IDECYT-CEBIV, Universidad Nacional Experimental Simon Rodriguez, Apartado 1204, Caracas, Venezuela.

The effect of experimental infection with *T. vivax* on the semen quality of crossbred Siboney bulls (3/8 *Bos taurus*, 5/8 *Bos indicus*) was studied. Four bulls were inoculated i.v. with 10⁶ trypanosomes/ml and two bulls were kept as controls. Semen was examined before and after infection, and data were gathered on the animals' body weight, scrotal circumference, haematocrit level, parasitaemia and body temperature. Over a period of 18 weeks, infected animals showed recurrent parasitaemia, anaemia, anorexia, lethargy, loss of balance, weakness and fever. A deterioration in the quality of the semen was seen, with an increase in sperm abnormalities, and a decrease in viability and concentration.

(c) TRYPANOTOLERANCE

[See **24**: no. 11792.]

(d) TREATMENT

[See also **24**: no. 11740.]

- 11786 **Afewerk, Y., Clausen, P.H., Abebe, G., Tilahun, G. and Mehlitz, D., 2000.** Multiple-drug resistant *Trypanosoma congolense* populations in village cattle of Metekel district, north-west Ethiopia. *Acta Tropica*, **76** (3): 231-238.

Clausen: Institute for Parasitology and Tropical Veterinary Medicine, Freie Universität Berlin, Königsweg 67, D-14163 Berlin, Germany.

Investigations were carried out to determine the prophylactic activity of isometamidium chloride in village populations of cattle naturally infected with trypanosomes in Metekel district, north-west Ethiopia. In a cross-sectional study in March 1997, 484 randomly selected cattle from four villages were examined for trypanosome infections by the dark ground/phase contrast buffy coat technique (BCT). The trypanosome prevalence was 17.2%. *T. congolense* was the dominant species, accounting for 47.6% of the overall infections. Fifty parasitaemic cattle from two villages were treated with isometamidium chloride (Trypamidium) at a prophylactic dose of 1.0 mg/kg body weight (b.w.) and thereafter monitored on a monthly basis for parasitaemia. Trypanosomes were detected in six cattle within 1 month and in 18 cattle within 2 months of treatment. Twenty-three percent (6/26) of cattle infected with *T. congolense* at the time of treatment were detected parasitaemic with this trypanosome species 1 month after treatment. Mice were infected with three *T. congolense* isolates obtained from cattle which were detected parasitaemic within 1 or 2 months after isometamidium treatment. The mice were subsequently treated with ranges of doses of isometamidium chloride or diminazene aceturate (Berenil) and thereafter monitored for parasitaemia for a period of 60 days. Isometamidium chloride at doses of 0.5-4.0 mg/kg b.w. and diminazene aceturate at doses of 3.5-28.0 mg/kg b.w. failed to cure *T. congolense* infections in any of the animals. Three clones were derived from one of the isolates; each clone expressed high levels of resistance to both trypanocides when tested in mice. Based on these results it is concluded that the prophylactic activity of isometamidium is greatly reduced for some of the *T. congolense* populations present in the area, and in addition there is resistance to diminazene aceturate in this trypanosome species.

11787 **Bawa, E.K., Ogwu, D., Sekoni, V.O., Oyedipe, E.O., Esievo, K.A.N. and Kambai, J.E., 2000.** Effects of *Trypanosoma vivax* on pregnancy of Yankasa sheep and the results of homidium chloride chemotherapy. *Theriogenology*, **54** (7): 1033-1040.

Bawa: National Animal Production Research Institute, Ahmadu Bello University, P.M.B. 1096, Zaria, Nigeria.

Three groups of pregnant Yankasa ewes, made up of six ewes in each group, were assigned at random to first, second and third trimester of pregnancy studies. The ewes were experimentally infected with *T. vivax* to study the effects of the infection on pregnancy and the results of homidium chloride (Novidium) chemotherapy. Three pregnant uninfected ewes served as controls. Fourteen days p.i., the ewes in each trimester study were paired by weight and assigned to two groups of three ewes each. One group was treated with Novidium while the other group remained untreated. Of the three ewes in each group, one ewe was killed humanely at 21 days p.i. and another at the end of the trimester period. In the first trimester, a ewe with partial foetal resorption was observed among the untreated ewes. Foetal death *in utero* and expulsion of an autolysed fetus was observed among the treated ewes. In the second trimester, abortion and almost complete foetal resorption were observed among the untreated ewes. Foetal death *in utero* and expulsion of an autolysed foetus was observed among the treated ewes. In the third trimester, abortions were observed among the untreated ewes. Abortion of a live foetus and a case of dystocia were observed among the treated ewes. Ewes in the second and

third trimesters of pregnancy were more susceptible to the infection, with ewes in the third trimester being most susceptible, as measured by the number of abortions and death of ewes. Foetuses from the untreated ewes in the three trimesters of pregnancy were lower in body weights than the foetuses from the treated ewes. The uninfected control ewes carried the pregnancies to term. Novidium chemotherapy at 14 days p.i. was not beneficial in ameliorating the pathogenicity of *T. vivax* infection on pregnancy in Yankasa ewes. *T. vivax* infection of only 14 days was enough to cause irreversible pathology in Yankasa foetuses, evidenced by death of foetuses *in utero*, dystocia and abortions irrespective of Novidium chemotherapy.

- 11788 **Bossche, P. van den, Chigoma, D. and Shumba, W., 2000.** The decline of anti-trypanosomal antibody levels in cattle after treatment with trypanocidal drugs and in the absence of tsetse challenge. *Acta Tropica*, **77** (3): 263-270.

Bossche: Prince Leopold Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium. [pvdbossche@itg.be]

The decline of anti-trypanosomal antibody levels in cattle after treatment with trypanocidal drugs was investigated using an anti-trypanosomal antibody-detection enzyme-linked immunosorbent assay (ELISA). The decline of antibody levels differed between experimental animals but went through two phases. During the first 5 months after trypanocidal drug treatment, the decline was rapid with a monthly average decline of 10% of the average percentage positivity during the treatment. Between months 6 and 13 after treatment, the monthly average decline was only 3.6% of the average percentage positivity at the moment of treatment. It took a total of 13 months for all the experimental animals to become seronegative. The usefulness of the anti-trypanosomal antibody-detection ELISA in the monitoring of tsetse control operations is discussed.

- 11789 **Stevenson, P., Okech, G., Mwendia, C. and Sones, K.R., 2000.** Comparison of the isometamidium-based trypanocidal drugs Samorin[®] and Veridium[®] in cattle under field conditions at Nguruman, Kenya. *Acta Tropica*, **77** (2): 195-201.

Sones: StockWatch Ltd, P.O. Box 24720, Nairobi, Kenya. [ksones@net2000ke.com]

The trypanocidal activity of two commercially available isometamidium-based products, Samorin (Merial, USA) and Veridium (Sanofi Santé Nutrition Animale, France), used at a dose rate of 0.5 mg/kg body weight, was compared in a field trial involving groups of approximately 30 zebu cattle in a trypanosomiasis endemic part of south-western Kenya. The trial took place between April 1997 and March 1998 during a time of higher than normal rainfall that resulted in periods of high trypanosome challenge. The trial consisted of five consecutive prophylactic cycles, each of approximately 10 weeks duration. It was demonstrated that there was no significant difference in the prophylactic activity of the two products, and no significant difference between the relative activity of three different batches of Veridium used during the course of the trial. There was some evidence that drug-resistant strains of trypanosomes may have been present, but it was concluded that isometamidium is still an effective trypanocidal drug in this location.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

[See also **24**: no. 11828.]

- 11790 **Ghorui, S.K. and Srivastava, R.V.N., 2000.** Indirect fluorescent antibody test and antibody capture assay in detection of *Trypanosoma evansi* infection in rabbit. *International Journal of Animal Sciences*, **15** (1): 5-8.

Division of Parasitology, Indian Veterinary Research Institute, Izatnagar, Bareilly 243 122, India.

(b) PATHOLOGY AND IMMUNOLOGY

- 11791 **Gobert, A.P., Daulouède, S., Lepoivre, M., Boucher, J.L., Bouteille, B., Buguet, A., Cespuglio, R., Veyret, B. and Vincendeau, P., 2000.** L-arginine availability modulates local nitric oxide production and parasite killing in experimental trypanosomiasis. [*T. b. brucei*; mice.] *Infection and Immunity*, **68** (8): 4653-4657.

Vincendeau: Laboratoire de Parasitologie, Université de Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux Cedex, France.

- 11792 **Iraqi, F., Clapcott, S.J., Kumari, P., Haley, C.S., Kemp, S.J. and Teale, A.J., 2000.** Fine mapping of trypanosomiasis resistance loci in murine advanced intercross lines. [*T. congolense*.] *Mammalian Genome*, **11** (8): 645-648.

Teale: University of Stirling, Stirling FK9 4LA, UK.

- 11793 **John, M.C., Nedunchellian, S., Venkataraman, K.S. and Sundararaj, A., 1999.** Pathology of *Trypanosoma evansi* infection in guinea pigs. *Cheiron*: **28** (1-2): 40-42.

Department of Preventive Medicine, Madras Veterinary College, Chennai 600 007, India.

- 11794 **Juyal, P.D., Singla, L.D. and Saxena, H.M., 1998.** *In vivo* activity of human serum against *Trypanosoma evansi* infection in Swiss albino mice. *Journal of Parasitic Diseases*, **22** (1): 67-68.

Department of Veterinary Parasitology, College of Veterinary Sciences, Punjab Agricultural University, Ludhiana-141004, India.

- 11795 **Kaushik, R.S., Uzonna, J.E., Zhang, Y., Gordon, J.R. and Tabel, H., 2000.** Innate resistance to experimental African trypanosomiasis: differences in cytokine (TNF- α , IL-6, IL-10 and IL-12) production by bone marrow-derived

macrophages from resistant and susceptible mice. [*T. brucei*, *T. congolense*.] *Cytokine*, **12** (7): 1024-1034.

Tabel: Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK, S7N 5B4, Canada.

- 11796 **Namangala, B., Brys, L., Magez, S., Baetselier, P. de and Beschin, A., 2000.** *Trypanosoma brucei brucei* infection impairs MHC class II antigen presentation capacity of macrophages. [Mice.] *Parasite Immunology*, **22** (7): 361-370.

Beschin: Cellular Immunology Unit, Department of Immunology, Parasitology and Ultrastructure, Flemish Interuniversity Institute for Biotechnology, Free University of Brussels, Paardenstraat 65, B-1640 Sint Genesius Rode, Belgium.

- 11797 **Portela, M.P.M., Raper, J. and Tomlinson, S., 2000.** An investigation into the mechanism of trypanosome lysis by human serum factors. [*T. brucei*.] *Molecular and Biochemical Parasitology*, **110** (2): 273-282.

Tomlinson: Department of Microbiology and Immunology, Medical University of South Carolina, BSB201, 173 Ashley Avenue, Charleston, SC 29425, USA.

- 11798 **Vincendeau, P., Lesthelle, S., Bertazzo, A., Okomo-Assoumou, M.C., Allegri, G. and Costa, C.V.L., 1999.** Importance of L-tryptophan metabolism in trypanosomiasis. [*T. brucei*.] *Advances in Experimental Medicine and Biology*, **467** (Tryptophan, serotonin and melatonin: basic aspects and applications): 525-531.

Vincendeau: Laboratoire de Parasitologie, Université Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux, France. [Philippe.Vincendeau@parasito.u-bordeaux2.fr]

- 11799 **Xie, J., Shen, Y.-L., Li, X.-R. and Wang, Z.-K., 2000.** [MTT colorimetric assay for quantifying the trypanocidal activity of human serum.] [*T. evansi*.] (In Chinese with English summary.) *Chinese Journal of Zoonoses*, **16** (1): 66-67.

College of Veterinary Medicine, Nanjing Agricultural University, Nanjing 210095, China.

(c) CHEMOTHERAPEUTICS

[See also **24**: nos. 11814, 11825.]

- 11800 **Bouteille, B. and Chauvière, G., 1999.** Implication du megalol dans la chimiothérapie des trypanosomoses. [Use of megalol in the chemotherapy of the trypanosomiasis.] *Médecine tropicale*, **59** (4): 321-330.

Institut d'Epidémiologie Neurologique et de Neurologie Tropicale, Faculté de Médecine, Université de Limoges, 2 rue du Docteur Marcland, 87025 Limoges Cedex, France.

The use of megazol to treat trypanosomiasis is reviewed. After an account of the current situation with regard to chemotherapy of trypanosomiasis, and the use of other nitroimidazoles, the following aspects of megazol are discussed: the influence of structural modifications on its activity; its mode of action; its biological activity; tolerance; and pharmacokinetics. It is concluded that it is worth developing it further, in particular for the treatment of human African trypanosomiasis.

- 11801 **Chowdhury, S.F., Villamor, V.B., Guerrero, R.H., Leal, I., Brun, R., Croft S.L., Goodman, J.M., Maes, L., Ruiz-Perez, L.M., Pacanowska, D.G. and Gilbert, I.H., 1999.** Design, synthesis, and evaluation of inhibitors of trypanosomal and leishmanial dihydrofolate reductase. [Incl. *T. b. rhodesiense*.] *Journal of Medicinal Chemistry*, **42** (21): 4300-4312.

Welsh School of Pharmacy, Cardiff University, Redwood Building, King Edward VII Avenue, Cardiff CF10 3XF, UK.

- 11802 **Datta, S., 1999.** Understanding the characteristics of a good anti-infective drug target. [*T. brucei*.] *Journal of Parasitic Diseases*, **23** (2): 139-140.

AstraZeneca R and D Bangalore, 277 T. Chowdiah Road, Bangalore-560003, India.

- 11803 **Ferguson, M.A.J., 2000.** Glycosylphosphatidylinositol biosynthesis validated as a drug target for African sleeping sickness. [*T. brucei*.] *Proceedings of the National Academy of Sciences of the United States of America*, **97** (20): 10673-10675.

Division of Molecular Parasitology and Biological Chemistry, Wellcome Trust Biocentre, University of Dundee, Dundee DD1 5EH, UK.

- 11804 **Joshi, S.S. and Bhoop, S., 2000.** Evaluation of chemotherapeutic and chemoprophylactic efficacy of certain drugs against experimental *T. evansi* infection in albino rats. *Pashudhan*, **15** (7): 5.

- 11805 **Khan, M.O.F., Austin, S.E., Chan, C., Yin, H., Marks, D., Vaghjiani, S.N., Kendrick, H., Yardley, V., Croft, S.L. and Douglas, K.T., 2000.** Use of an additional hydrophobic binding site, the Z site, in the rational drug design of a new class of stronger trypanothione reductase inhibitor, quaternary alkyl-ammonium phenothiazines. [Incl. *T. brucei*.] *Journal of Medicinal Chemistry*, **43** (16): 3148-3156.

Douglas: School of Pharmacy and Pharmaceutical Sciences, University of Manchester, Oxford Road, Manchester M13 9PL, UK.

- 11806 **Loiseau, P.M., Lubert, P. and Wolf, J.-G., 2000.** Contribution of dithiol ligands to *in vitro* and *in vivo* trypanocidal activities of dithiaarsanes and investigation of ligand exchange in an aqueous solution. [*T. b. brucei*; mice.] *Antimicrobial Agents and Chemotherapy*, **44** (11): 2954-2961.

Loiseau: Biologie et Contrôle des Organismes Parasites, UPRES-EA 398, Université de Paris-Sud, F-92290 Châtenay-Malabry, France. [Philippe. Loiseau@cep.u-psud.fr]

- 11807 **Morty, R.E., Troeberg, L., Powers, J.C., Ono, S., Lonsdale-Eccles, J.D. and Coetzer, T.H.T., 2000.** Characterisation of the antitrypanosomal activity of peptidyl α -aminoalkyl phosphonate diphenyl esters. [*T. b. brucei*; mice.] *Biochemical Pharmacology*, **60** (10): 1497-1504.

Coetzer: School of Molecular and Cellular Biosciences: Biochemistry, University of Natal, Private Bag X01, ZA-3209 Scottsville, South Africa.

- 11808 **Troeberg, L., Chen, X.-W., Flaherty, T.M., Morty, R.E., Cheng, M.-S., Hua, H.-M., Springer, C., McKerrow, J.H., Kenyon, G.L., Lonsdale-Eccles, J.D., Coetzer, T.H.T. and Cohen, F.E., 2000.** Chalcone, acyl hydrazide, and related amides kill cultured *Trypanosoma brucei brucei*. [Mice.] *Molecular Medicine*, **6** (8): 660-669.

Coetzer: Department of Cellular and Molecular Pharmacology, University of California, San Francisco, CA 94143-0446, USA.

- 11809 **Werbovetz, K.A., 2000.** Target-based drug discovery for malaria, leishmaniasis, and trypanosomiasis. (Review.) *Current Medicinal Chemistry*, **7** (8): 835-860.

Department of Parasitology, Division of Experimental Therapeutics, Walter Reed Army Institute of Research, Washington, DC 20307, USA.

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

- 11810 **Hide, G., Tilley, A., Welburn, S.C., Maudlin, I. and Tait, A., 2000.** *Trypanosoma brucei*: identification of trypanosomes with genotypic similarity to human infective isolates in tsetse isolated from a region free of human sleeping sickness. *Experimental Parasitology*, **96** (2): 67-74.

Hide: Centre for Molecular Epidemiology and Ecology, Division of Biological Sciences, School of Environmental and Life Sciences, University of Salford, Salford M5 4WT, UK.

In previous work, we have developed a molecular method that defines genotypes of *T. brucei* and allows distinction of the human-infective subspecies *T. b. rhodesiense* from the non-human-infective *T. b. brucei* without recourse to measurement of resistance to lysis by human serum. Using this approach, we are also able to determine the geographical range of specific genotypes associated with a particular focus. In this study, we have characterised *T. brucei* isolates collected from tsetse in a region where human sleeping sickness has never been reported and which is some 500 km from the Busoga sleeping sickness focus of Uganda. We show that some of the trypanosome isolates taken from tsetse in this region have considerable genotypic similarity to trypanosomes from the Busoga focus, demonstrating a surprisingly wide dispersal of these trypanosome genotypes. Furthermore, the similarity of these genotypes to human-infective trypanosomes in the Busoga focus suggests the possible circulation of human-infective trypanosomes in this location. We also demonstrate that the genetic diversity in trypanosomes isolated from tsetse is significantly higher than that in those isolated from humans, confirming other studies that show that there exists a significant restriction in the range of genotypes that can be transmitted to humans.

11811 **Stevens, J.R. and Gibson, W.C., 1999.** The evolution of pathogenic trypanosomes. [Incl. *T. brucei*.] *Cadernos de Saude Publica*, **15** (4): 673-684.

School of Biological Sciences, University of Exeter, Exeter EX4 4PS, UK.

11812 **Tibayrenc, M., 1999.** Toward an integrated genetic epidemiology of parasitic protozoa and other pathogens. *Annual Review of Genetics*, **33**: 449-477.

Centre d'Etudes sur le Polymorphisme des Microorganismes (CEPM), Unité Mixte de Recherche no. 9926, CNRS/IRD, Centre IRD de Montpellier, B.P. 5045, 34032 Montpellier Cedex 1, France.

The objective of this paper is to evaluate the effect of the genetic diversity of the host, the pathogen and the vector on the transmission and pathogenicity of infectious diseases, including those caused by African trypanosomes. The question of whether pathogenic microorganisms are clonal or sexual is discussed. It is recommended that research in different fields relevant to genetic epidemiology should be better coordinated.

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

11813 **Bastin, P., Ellis, K., Kohl, L. and Gull, K., 2000.** Flagellum ontogeny in trypanosomes studied via an inherited and regulated RNA interference system. [*T. brucei*.] *Journal of Cell Science*, **113** (18): 3321-3328.

Bastin: School of Biological Sciences, University of Manchester, 2.205 Stopford Building, Oxford Road, Manchester M13 9PT, UK.

- 11814 **Bressi, J.C., Choe, J., Hough, M.T., Buckner, F.S., Voorhis, W.C. van, Verlinde, C.L.M.J., Hol, W.G.J. and Gelb, M.H., 2000.** Adenosine analogues as inhibitors of *Trypanosoma brucei* phosphoglycerate kinase: elucidation of a novel binding mode for a 2-amino-N6-substituted adenosine. *Journal of Medicinal Chemistry*, **43** (22): 4135-4150.

Gelb: Department of Chemistry, University of Washington, Seattle, WA 98195, USA. [gelb@chem.washington.edu]

- 11815 **Buckner, F.S., Nguyen, L.N., Joubert, B.M. and Matsuda, S.P.T., 2000.** Cloning and heterologous expression of the *Trypanosoma brucei* lanosterol synthase gene. *Molecular and Biochemical Parasitology*, **110** (2): 399-403.

Buckner: Department of Medicine, University of Washington, P.O. Box 357185, Seattle, WA 98195, USA.

- 11816 **Buckner, F.S., Yokoyama, K., Nguyen, L., Grewal, A., Erdjument-Bromage, H., Tempst, P., Strickland, C.L., Xiao, L., Voorhis, W.C. van and Gelb, M.H., 2000.** Cloning, heterologous expression, and distinct substrate specificity of protein farnesyltransferase from *Trypanosoma brucei*. *Journal of Biological Chemistry*, **275** (29): 21870-21876.

Gelb: Department of Chemistry and Biochemistry, University of Washington, Seattle, WA 98195-1700, USA.

- 11817 **Burgess, M.L.K. and Stuart, K., 2000.** Sequence bias in edited kinetoplastid RNAs. [*T. brucei*.] *RNA*, **6** (11): 1492-1497.

Stuart: Department of Pathobiology, University of Washington, Seattle, WA 98195, USA. [kstuart@u.washington.edu]

- 11818 **Chudzik, D.M., Michels, P.A., Walque, S. de and Hol, W.G.J., 2000.** Structures of type 2 peroxisomal targeting signals in two trypanosomatid aldolases. [Incl. *T. brucei*.] *Journal of Molecular Biology*, **300** (4): 697-707.

Hol: Department of Biological Structure, Biomolecular Structure Center, University of Washington, Seattle, WA 98195-7742, USA.

- 11819 **Coppens, I. and Courtoy, P.J., 2000.** The adaptative mechanisms of *Trypanosoma brucei* for sterol homeostasis in its different life-cycle environments. (Review.) *Annual Review of Microbiology*, **54**: 129-156.

Coppens: Department of Internal Medicine, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06520-8022, USA.

- 11820 **Duffieux, F., Roy, J. van, Michels, P.A.M. and Opperdoes, F.R., 2000.** Molecular characterization of the first two enzymes of the pentose-phosphate pathway of *Trypanosoma brucei*: glucose-6-phosphate dehydrogenase and 6-

phosphogluconolactonase. *Journal of Biological Chemistry*, **275** (36): 27559-27565.

Opperdoes: Research Unit for Tropical Diseases, Christian de Duve Institute of Cellular Pathology, Catholic University of Louvain, Avenue Hippocrate 74, 1200 Brussels, Belgium.

- 11821 **Dunbar, D.A., Chen, A.A., Wormsley, S. and Baserga, S.J., 2000.** The genes for small nucleolar RNAs in *Trypanosoma brucei* are organized in clusters and are transcribed as a polycistronic RNA. *Nucleic Acids Research*, **28** (15): 2855-2861.

Baserga: Department of Therapeutic Radiology, Yale University School of Medicine, HRT 317, 333 Cedar Street, New Haven, CT 06520-8040, USA.

- 11822 **Grams, J., McManus, M.T. and Hajduk, S.L., 2000.** Processing of polycistronic guide RNAs is associated with RNA editing complexes in *Trypanosoma brucei*. *EMBO Journal*, **19** (20): 5525-5532.

Hajduk: Department of Biochemistry and Molecular Genetics, University of Alabama, Birmingham, AL 35294, USA.

- 11823 **Günzl, A., Bindereif, A., Ullu, E. and Tschudi, C., 2000.** Determinants for cap trimethylation of the U2 small nuclear RNA are not conserved between *Trypanosoma brucei* and higher eukaryotic organisms. *Nucleic Acids Research*, **28** (19): 3702-3709.

Günzl: Abteilung Zellbiologie, Zoologisches Institut der Universität Tübingen, Auf der Morgenstelle 28, D-72076 Tübingen, Germany.

- 11824 **Hannaert, V., Brinkmann, H., Nowitzki, U., Lee, J.A., Albert, M.-A., Sensen, C.W., Gaasterland, T., Müller, M., Michels, P. and Martin, W., 2000.** Enolase from *Trypanosoma brucei*, from the amitochondriate protist *Mastigamoeba balamuthi*, and from the chloroplast and cytosol of *Euglena gracilis*: pieces in the evolutionary puzzle of the eukaryotic glycolytic pathway. *Molecular Biology and Evolution*, **17** (7): 989-1000.

Martin: Institut für Botanik, Hienrich-Heine-Universität Düsseldorf, Universitätsstrasse 1, D-40225 Düsseldorf, Germany.

- 11825 **Hasne, M.P. and Barrett, M.P., 2000.** Drug uptake via nutrient transporters in *Trypanosoma brucei*. (Review.) *Journal of Applied Microbiology*, **89** (4): 697-701.

Barrett: Division of Infection and Immunity, IBLS, University of Glasgow, Glasgow G12 8QQ, UK.

- 11826 **Hendriks, E., Deursen, F.J. van, Wilson, J., Sarkar, M., Timms, M. and Matthews, K.R., 2000.** Life-cycle differentiation in *Trypanosoma brucei*: molecules and mutants. *Biochemical Society Transactions*, **28** (5): 531-536.

Matthews: School of Biological Sciences, University of Manchester, 2.205 Stopford Building, Oxford Road, Manchester M13 9PT, UK.

- 11827 **Hunger-Glaser, I., Hemphill, A., Shalaby, T., Hanni, M. and Seebeck, T., 2000.** Nucleoside diphosphate kinase of *Trypanosoma brucei*. *Gene*, **257** (2): 251-257.

Seebeck: Institute of Cell Biology, University of Bern, Baltzerstrasse 4, CH-3012 Bern, Switzerland. [seebeck@imzb.unibe.ch]

- 11828 **Inoue, N., Lluz, A.T., Mori, T., Nagasawa, H., Fujisaki, K. and Mikami, T., 2000.** Novel species specific antigens of *Trypanosoma congolense* and their different localization among life-cycle stages. *Journal of Veterinary Medical Science*, **62** (10): 1041-1045.

Inoue: National Research Center for Protozoan Diseases, Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido 080-8555, Japan.

- 11829 **Jackson, L.K., Brooks, H.B., Osterman, A.L., Goldsmith, E.J. and Phillips, M.A., 2000.** Altering the reaction specificity of eukaryotic ornithine decarboxylase. [*T. brucei*.] *Biochemistry*, **39** (37): 11247-11257.

Phillips: Department of Pharmacology, University of Texas Southwestern Medical Center, 5323 Harry Hines Boulevard, Dallas, TX 75390-9041, USA.

- 11830 **Jiang, D.W., Ingersoll, R., Myler, P.J. and Englund, P.T., 2000.** *Trypanosoma brucei*: four tandemly linked genes for fatty acyl-CoA synthetases. *Experimental Parasitology*, **96** (1): 16-22.

Jiang: Department of Biological Chemistry, Johns Hopkins University School of Medicine, Baltimore, MD 21205, USA.

- 11831 **Jithendran, K.P. and Rao, J.R., 1998.** Concanavalin-A binding sites on *Trypanosoma evansi*. *Journal of Parasitic Diseases*, **22** (1): 21-24.

Division of Parasitology, Indian Veterinary Research Institute, Izatnagar-243122, India.

- 11832 **Kubata, B.K., Duszenko, M., Kabututu, Z., Rawer, M., Szallies, A., Fujimori, K., Inui, T., Nozaki, T., Yamashita, K., Horii, T., Urade, Y. and Hayaishi, O., 2000.** Identification of a novel prostaglandin F_{2α} synthase in *Trypanosoma brucei*. *Journal of Experimental Medicine*, **192** (9): 1327-1337.

Hayaishi: Department of Molecular Behavioral Biology, Osaka Bioscience Institute, 6-2-4 Furuedai, Suita, Osaka 565-0874, Japan. [hayaishi@obi.or.jp]

- 11833 **Leeuwen, F. van, Kieft, R., Cross, M. and Borst, P., 2000.** Tandemly repeated DNA is a target for the partial replacement of thymine by β -D-glucosyl-hydroxymethyluracil in *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **109** (2): 133-145.

Borst: Division of Molecular Biology and Centre of Biomedical Genetics, Netherlands Cancer Institute, Plesmanlaan 121, NL-1066 CX Amsterdam, Netherlands.

- 11834 **Liu, Q., Wang, X.-S., Wang, D.-Z., Lu, M.-M. and Yu, Z.-L., 2000.** [RT-PCR amplification and cloning of HGPR1 gene of *Trypanosoma evansi*.] (In Chinese with English summary.) *Chinese Journal of Veterinary Science*, **20** (3): 254-256.

Military Veterinary Institute, Quartermaster University of PLA, Changchun 130062, China.

- 11835 **Mair, G., Ullu, E. and Tschudi, C., 2000.** Cotranscriptional cap 4 formation on the *Trypanosoma brucei* spliced leader RNA. *Journal of Biological Chemistry*, **275** (37): 28994-28999.

Tschudi: Department of Internal Medicine, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06520-8022, USA.

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