

SECTION A – NEWS

MEETING REPORT

Global Forum for Agricultural Research

The Global Forum for Agricultural Research (GFAR) was held in Dresden, Germany, from 21 to 23 May 2000, with the theme: Strengthening Partnership in Agricultural Research for Development in the context of Globalisation. The conference was attended by, among others, representatives of UN agencies, the EU, international organisations and foundations, CGIAR, NARs, NGOs, farmers' organisations, the private sector and national governments. The PAAT Secretariat was represented by Prof. A.A. Ilemobade, PAAT Support Group adviser on Field Programme Support, who took along some flyers and publications of PAAT which were used to great effect in informing participants of PAAT's activities and focus.

Dr Adama Traore, President of CORAF (Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles), presented a proposal entitled 'Global initiative to exploit biotechnology and animal genetic resources for the improvement of livestock productivity through control of trypanosomiasis' which had been agreed by a group that met initially at Montpellier in January 2000. He drew attention to the global presence of trypanosomiasis (Africa, Asia and South America) and the need for concerted action through global initiatives to combat the disease and its vectors. He referred to partnerships that have been fostered over the years, the role of different players including PAAT in the promotion of innovative partnerships, and the need to enlarge and build upon existing partnerships. He then commended the proposal to GFAR as worthy of support for global focus and promotion if the agenda for poverty eradication, food security and sustainable management and conservation of natural resources is to be achieved. At the end of a lively discussion, the proposal was accepted and recommended as meriting support. It was made clear that GFAR is not a funding agency, but rather a platform for sharing information and facilitating innovative partnerships. The significance of GFAR support will need to be ascertained from the GFAR Secretariat.

The conference afforded the opportunity to Prof. Ilemobade to discuss with Dr Philip Viallate (DG VIII, EU) the proposed West and Central Africa project; a modified concept note was still awaited from OAU/IBAR. He also exchanged views with a delegation from Nigeria led by Alhaji Umoru Alkaleri, Permanent Secretary of the Ministry of Agriculture and Natural Resources, and Dr O. Oloko, Director, Agricultural Research, on Nigeria's newly approved UTF programme which will be implemented by FAO and whose component on animal and plant pests will include tsetse and trypanosomiasis control.

Apart from Prof. Ilemobade, Dr Traore and some staff of ILRI, there was a conspicuous absence of participants from Africa, Asia or Latin America working on or interested in trypanosomiasis. The business of the Conference was dominated by crops, and other areas including livestock, fisheries and forestry were given only scant attention. The hope was expressed that future business of GFAR would correct this trend.

At the end of the conference, a draft Dresden Declaration was drawn up which was agreed upon in principle, but needed further editorial amendments.

WORLD HEALTH ORGANISATION

Sleeping Sickness Treatment and Drug Resistance Network

The Steering Committee of this Network, made up of representatives of the Swiss Tropical Institute, the Institute of Tropical Medicine, Antwerp, the Centers for Disease Control (USA) and Médecins sans Frontières, met for the third time from 28 to 31 May 2000 in Bruges, Belgium. The Drugs working group reviewed the available stocks of eflornithine, melarsoprol and suramin, and Dr Jean-Pierre Helenport (WHO/MSF consultant) reported on meetings he had had to try to find a manufacturer able to ensure production of eflornithine. The Research group presented preliminary estimates for the setting-up of two serum banks in Basel and Antwerp. The Surveillance group submitted details of the drug-resistance surveillance system.

For more information, and to obtain a report of the meeting, contact Dr Jean Jannin, OMS/CDS/CSR/EDC, WHO, 20 Avenue Appia, CH-1211 Geneva, Switzerland (tel. 41 22 791 3779; fax 41 22 791 4878; e-mail janninj@who.ch).

Regional Workshop on HAT Surveillance in Central Africa

The Second Regional Workshop on Sleeping Sickness Surveillance Networks in Central Africa was organised by the WHO HAT Surveillance Support Office in Yaoundé, Cameroon, from 12 to 15 June 2000, in collaboration with the Swiss Tropical Institute. This meeting provided an opportunity for the 20 participants from the nine central African countries covered by the Office (Angola, Cameroon, Central African Republic, Congo P.R., Congo D.R., Côte d'Ivoire, Equatorial Guinea, Sudan and Uganda) to review progress in HAT mapping. Since 1996, 2980 sleeping sickness endemic villages have been georeferenced and 24 endemic foci have been partially mapped. The GIS data and indicators used by each national programme were also discussed.

For more information, contact Pierre Lucas, OMS/CDS/CSR/EDC, Bureau d'Appui à la Surveillance de la Maladie du Sommeil en Afrique Centrale, B.P. 155, Yaoundé, Cameroon (tel. 237 70 15 79; fax 237 23 00 61; e-mail lucaswho@camnet.cm). See also <http://www.cm.refer.org/trypinfo/> (French language web site of the Support Office).

Kit for epidemiological surveillance of sleeping sickness

The Sleeping Sickness Surveillance Support Office, Yaoundé, is currently developing a kit which comprises all the materials for epidemiological surveillance needed for a survey team in the field. In particular, it includes a GPS with a spare set of batteries, forms for village surveys (300) and forms for surveillance and follow-up of patients. This kit will be tested and distributed from the last quarter of 2000.

All enquiries should be addressed to the Support Office at Yaoundé (see above).

CURRENT RESEARCH

Joint FAO/IAEA Division Co-ordinated Research Projects

Automation in tsetse fly mass-rearing for use in SIT programmes (D4.20.06)

Several stages in the mass production of tsetse have been addressed so far. Progress has been good in the automated stocking of production cages, where it is now possible to emerge flies under controlled conditions into production cages to give the desired female to male ratio of 4:1 with less than 0.5% females remaining in the un-emerged pupae, for *Glossina austeni*, *G. fuscipes fuscipes*, *G. brevipalpis* and *G. pallidipes*. This system eliminates manual handling of adult flies for sex separation for purposes of mass rearing and release. The protocol, which requires pupae to be collected daily and incubated and emerged under carefully controlled conditions, has been distributed to participating centres.

Work is now under way on controlling the emergence of the males, which remain after emergence of the females, by manipulating the holding temperature to allow synchronous emergence, and on chill holding of the adult males in preparation for release. At 15°C pupae can be stored up to 3 days without affecting the emergence rate, survival without blood and mating behaviour of males.

Work on an improved system to handle cages for feeding is progressing well. A first fully automated prototype tsetse production unit (TPU1) proved to be too complicated and a second prototype (TPU2) is now undergoing trials and shows good promise of reducing the effort of cage handling by approximately ten-fold. The system holds 63 large cages on a single trolley that can be moved to feed all the cages simultaneously and then returned to the larval collecting unit. In a third prototype (TPU3), blood is moved to the flies while the cage holding system is stationary.

Other work has looked at the handling factors affecting flight ability of irradiated males, increasing cage holding density by the use of inserts, energy saving and blood decontamination.

Improved attractants for enhancing the efficiency of tsetse fly suppression operations and barrier systems used in tsetse control/eradication campaigns (D4.20.08)

This project aims at alleviating the shortcomings in attractants for a number of important tsetse species where the standard odours used for *Glossina morsitans* and *G. pallidipes* are poor or ineffective, and in general to try to improve attractant effectiveness for entomological monitoring, tsetse population suppression and barrier maintenance.

Molecules stereo-isomerically related to known natural tsetse kairomones have been synthesised and tested in laboratory experiments and field trials, and an effort has been made to identify locally available inexpensive sources of visual and chemical attractants.

Among the odours tested in the coastal region of Kenya for *G. austeni*, *G. pallidipes* and *G. brevipalpis*, octyl formate and decyl formate proved attractive. Preliminary studies revealed that racemic octenol increased the capture rate of *G. brevipalpis* males. Coconut oil increased the capture rate of *G. austeni* and *G. pallidipes*.

In preliminary field studies using electrified grids close to pyramidal traps on Buvuma islands, Lake Victoria, Uganda, both decyl formate and racemic octenol

significantly increased the number of attracted (but not trapped) female *G. fuscipes fuscipes*. Alternative trap designs with different odour combinations will be explored with the aim of increasing the trap entry rate.

Plant secondary products (essential oils) evoked responses by the antennal chemoreceptors of *G. brevipalpis* and *G. pallidipes*, and preliminary wind tunnel experiments indicated that some also evoked behavioural responses from tsetse.

A lighter and less expensive leg panel for trapping *G. austeni* was developed; it is made from a wire framework and royal blue polyethylene which holds the sticky substance for more than 3 months.

Gas-chromatographic and mass-spectrometric studies suggested that linoleic acid-containing vegetable oils might be used as low-cost octenol sources in field traps.

For more information on the activities of the Joint FAO/IAEA Division, contact the Insect and Pest Control Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria (tel. +43-1-2600-21628; fax +43-1-26007; e-mail J.Hendrichs@iaea.org) or the Entomology Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, A-2444 Seibersdorf, Austria (tel. +43-1-2600 28402; fax +43-1-2600 28 222; e-mail A.Robinson@iaea.org). See also <http://www.iaea.org/programmes/nafa/d4/index.html>.

FELLOWSHIP

Post-doctoral position available at ICP/TROP, Brussels, Belgium

A post-doctoral position is available at the Research Unit for Tropical Diseases (TROP) of the Christian de Duve Institute of Cellular Pathology (ICP) in Brussels, Belgium. Topics studied in ICP/TROP include: (i) the identification and characterisation of potential drug targets and the rational design of drugs for sleeping sickness, Chagas' disease and leishmaniasis; (ii) the biogenesis of the glycosome, a microbody involved in the glycolytic pathway of the Trypanosomatidae; and (iii) the study of the enzymes of the pentose-phosphate pathway in trypanosomatids.

The ICP is an international institute for biomedical research, located on the campus of the Medical Faculty of the Université Catholique de Louvain (UCL) in Brussels. It houses more than 300 people of which some 250 are directly involved in research. Detailed information is available at <http://www.icp.ucl.ac.be:8080/>.

The ICP's post-doctoral fellowship programme aims at young scientists who have a Ph.D., MD or equivalent degree and are preferably not older than 33 years of age. Fellowships are awarded for one year with a one-year renewable option. Candidates are selected, according to scientific excellence, by an ICP committee which meets twice a year in February and September.

Information about ICP fellowships and how to apply is available at <http://www.icp.ucl.ac.be:8080/fellowship.html>. Further information can also be obtained from Fred Oppendoes, ICP/TROP, UCL, Avenue Hippocrate 74-75, B-1200 Brussels, Belgium (tel. +32-2-764.74.39; fax +32-2-762.68.53; e-mail oppendoes@trop.ucl.ac.be; <http://www.icp.ucl.ac.be/~opperd/trop.html>) to whom applications should be sent.

SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

- 11451 **Bouteille, B. and Dumas, M., 1999.** La trypanosomose humaine africaine: les défis à relever pour une maladie réémergente. [Human African trypanosomiasis: the challenges raised by this re-emergent disease.] *Médecine tropicale*, **59** (Suppl. 2): 20-24.

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

The re-emergence of human African trypanosomiasis is considered, with emphasis on the epidemic situation in Congo D.R. and Angola, where civil war has disrupted control programmes for many years. The challenges of measuring accurately the present extent of HAT, reorganising control programmes, diagnosing the disease and its stage, and treating patients with effective, non-toxic drugs are discussed.

- 11452 **Campbell, K., 1999.** Remote sensing and GIS decision support tools: applications for wildlife and range management in tsetse control areas. *In*: Grant, I.F. and Sear, C.B. (eds), *Decision tools for sustainable development* (Chatham, UK; Natural Resources Institute), pp. 181-209.

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

There is a growing awareness amongst both the international donor community and national land use managers of the need to monitor the impacts of tsetse control operations and subsequent rural development, from both environmental and socioeconomic perspectives. This chapter examines: the nature of the problem; remote sensing and GIS as decision support tools (low level aerial survey; satellite remote sensing; ground surveys; global positioning systems; GIS; and academic tools); and information management.

- 11453 **Joubert, J.J., Schutte, C.H.J., Ions, D. and Fripp, P.J., 1999.** Sir David Bruce (1855-1931): the discoverer of the nagana parasite. *Southern African Journal of Epidemiology and Infection*, **14** (3): 67-72.

Department of Medical Microbiology, Faculty of Medicine, University of Stellenbosch, Sabie, South Africa.

A history of Surgeon-Major David Bruce is presented. After isolating the bacterium causing brucellosis in 1884, Bruce and his wife Mary discovered in 1895 that the causative agent of nagana was *Trypanosoma brucei* and showed that it was transmitted through the bite of tsetse flies. While studying the agent responsible for sleeping sickness, Bruce came to realise that a subspecies of *T. brucei*, *T. b. rhodesiense*, was responsible for Rhodesian sleeping sickness.

- 11454 **Kristjanson, P., Rowlands, J., Swallow, B., Kruska, R., Leeuw, P. de and Nagda, S., 1999.** *Using the economic surplus model to measure potential returns to international livestock research: the case of trypanosomiasis vaccine research.* Nairobi, Kenya; ILRI (ILRI Impact Assessment Series no. 4). vi + 30 pp.

A methodology building on an earlier approach to measuring agricultural research returns (Alston *et al.* 1995) was developed. A herd model (to measure the potential size impact of GIS and to predict where this impact is likely to be felt) and the economic surplus model (to estimate some of the costs of trypanosomiasis in Africa, the potential benefits of controlling it, and potential returns to vaccine research) were integrated. This approach, which uses field data and GIS analysis to determine where and how much impact research will have on livestock productivity, requires much data and the type of information that is still scarce in many developing countries.

- 11455 **Mattioli, R.C., Belem, A.M.G., Ki-Zerbo, A. and Thiry, E.E., 1998.** Liveweight and killing out percentage of some wild animal species of the Nazinga game ranch (Burkina Faso) infested by tsetse flies. *Tropical Animal Health and Production*, **30** (2): 137-140.

Mattioli: ITC, P.M.B. 14, Banjul, Gambia. [raf.mattioli@commit.gm]

This study reports liveweights (LW) and killing out percentage (KOP, ratio between cold carcass weight after evisceration and LW) of six species of wild ungulates reared in the Nazinga ranch in the mid-south of Burkina Faso, an area heavily infested with *Glossina morsitans submorsitans* and *G. tachinoides*. Data were collected from March to June 1988 and March to July 1989 on 149 warthogs, 66 oribis, 44 Grimm's duikers, 34 roan antelopes, 27 bushbucks and 18 hartebeests. Warthogs showed a low slaughtering productivity (KOP 45.5%) compared to domestic pigs (reported KOP 70%) but this was due to the difference in computing this value. In the other wild animal species studied, KOP was comparable to that of N'Dama cattle (52%) and seems to confirm Bousquet's hypothesis (1982) that meat production in the Nazinga game ranch is feasible.

- 11456 **Reid, R.S., Kruska, R.L., Deichmann, U., Thornton, P.K. and Leak, S.G.A., 2000.** Human population growth and the extinction of the tsetse fly. *Agriculture Ecosystems & Environment*, **77** (3): 227-236.

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

Agricultural expansion is a major cause of biodiversity loss worldwide. In Africa, biologists have observed that the populations of some tsetse species, which transmit human and livestock trypanosomiasis, decline or disappear as human populations grow and farmers clear fly habitat for cultivation. The available information concerning human and tsetse populations was synthesised and a model was developed to estimate the future effect of human populations on tsetse populations. A spatial GIS model was developed to estimate future impacts using a combination of fine-resolution human population data for the years 1960, 1980, 2000, 2020 and 2040, field data on the relationships between human

and tsetse population densities, and the distribution of different types of tsetse fly. By 2040, many of the 23 species of tsetse fly will begin to disappear and the area of land infested and the number of people in contact with the flies will also decline. However, none of the species of tsetse will be under threat of extinction by human agricultural activities in the near term. An area of Africa larger than Europe will remain infested by tsetse and under threat of trypanosomiasis for the foreseeable future.

11457 **Reid, R.S., Kruska, R.L., Muthui, N., Taye, A., Wotton, S., Wilson, C.J. and Woudyalew Mulatu, 2000.** Land-use and land-cover dynamics in response to changes in climatic, biological and socio-political forces: the case of southwestern Ethiopia. *Landscape Ecology*, **15** (4): 339-355.

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

Few studies of land-use/land-cover change provide an integrated assessment of the driving forces and consequences of change, particularly in Africa. Our objectives were to determine how driving forces at different scales change over time, how these forces affect the dynamics and patterns of land use/land cover, and how land-use/land-cover change affects ecological properties at the landscape scale. To accomplish these objectives, we first developed a way to identify the causes and consequences of change at a landscape scale by integrating tools from ecology and the social sciences, and then applied these methods to a case study in Ghibe Valley, southwestern Ethiopia. Maps of land-use/land-cover change were created from aerial photography and Landsat TM imagery for the period 1957-1993. A method called 'ecological time lines' was developed to elicit landscape-scale explanations for changes from long-term residents. Cropland expanded at twice the speed recently (1987-1993) than two decades ago (1957-1973), but also contracted rapidly between 1973 and 1987. Rapid land-use/land-cover change was caused by the combined effects of drought and migration, changes in settlement and land tenure policy, and changes in the severity of trypanosomiasis in livestock. The scale of the causes and consequences of land-use/land-cover change varied from local to sub-national (regional) to international, and the links between causes and consequences crossed scales. At the landscape scale, each cause affected the location and pattern of land use/land cover differently. The contraction of cropland increased grass biomass and cover, woody plant cover, the frequency and extent of savanna burning, and the abundance of wildlife. With recent control of the tsetse fly, these ecological changes are being reversed. These complex patterns are discussed in the context of scaling issues and current conceptual models of land-use/land-cover change.

11458 **Wang Sonnè, 1999.** Approche historique des quinze premières années de la lutte contre la maladie du sommeil dans le Mbam, 1921-1935. [Historical approach to 15 years of sleeping sickness control in Mbam, 1921-1935.] *Bulletin de Liaison et de Documentation de l'OCEAC*, **32** (3): 20-27.

Laboratoire de Recherches sur les Trypanosomiasés, OCEAC, B.P. 288, Yaoundé, Cameroon.

At the end of the 1960s a resurgence of sleeping sickness was observed in certain historic foci in Cameroon. One of them was Bafia, in the Mbam region, 120 km to the

north of Yaoundé. Doctors, entomologists and other biologists intervened immediately to control the outbreak. However, with hindsight, the question arises whether it would be possible to contain and permanently eradicate the disease in this type of 'historic' focus without knowing the places, dates and precise circumstances in which the epidemic erupted and the means used in order to control it. The present study covers the time from the discovery of the first cases by Dr Jamot in 1921 to the efforts undertaken to curb the disease completely and extend control operations beyond the right bank of the Mbam river in 1935. These fifteen years are divided into three stages: the alarm (1921-1924), the 'trial and error' stage (1924-1926) and the realisation of the gravity of the disease and the efforts to contain it not only at the centre of the focus but also outside the area (1926-1935). The study is based on first-hand reports drawn from the archives of the 'Pères du Saint-Esprit' at Chevilly-La-Rue to the south of Paris, the Centre des Archives d'Outre-Mer in Aix-En-Provence, the Archives de l'Institut de Médecine Tropicale du Service de Santé des Armées, Parc du Pharo, Marseille, and the Archives Nationales de Yaoundé, and on oral first-hand information from many informants living mainly in the Mbam area.

11459 **Welburn, S.C., Fevre, E. and Coleman, P., 1999.** Sleeping sickness rediscovered. *Parasitology Today*, **15** (8): 303-305.

Welburn: CTVM, University of Edinburgh, Easter Bush, Roslin, Midlothian EH25 9RG, UK.

This report of the meeting held at the Prince Leopold Institute of Tropical Medicine in Antwerp, Belgium, from 14 to 18 December 1998, outlines the topics covered, under the following headings: control activities (national programmes, international and bilateral agencies and programmes, NGOs); control tools (diagnosis, vector control, treatment and follow-up, public health); research (parasite and vector biology: neuropathology of sleeping sickness, genetic mapping in *Trypanosoma brucei*, resistance gene, new diagnostic methods, VSG); drugs and vaccines; WHO/TDR/CTD Round Table (where do we go from here?).

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

11460 **Adesiyan, S.A., 1998.** Scanning electron microscopy of *Glossina pallidipes* (Diptera: Glossinidae) for systematic studies. *Entomological Society of Nigeria Occasional Publication*, **31**: 123-127.

NITR, Vom, Plateau State, Nigeria.

Two populations of *G. pallidipes* from Uganda and Zimbabwe were studied using scanning electron microscopy (SEM) to investigate further whether taxonomic differences and speciation occur between the two allopatric populations. Two methods were used in

the preparation of specimens for SEM, one for dry hard structures (head), the other for soft tissues (genitalia). Although heads were included, attention was focused on the genital armatures of the males. The results showed no significant differences in the genitalia between the two populations and supported the validity of the view that speciation does not occur between them. The genital armatures of *G. pallidipes* are discussed and recommendations made as to the taxonomic techniques that can be applied to such population studies.

- 11461 **Chen, X.-A., Li, S., Li, C.-B., Zhao, S.-Y. and Aksoy, S., 1999.** Phylogeny of genus *Glossina* (Diptera: Glossinidae) according to ITS2 sequences. *Science in China (C)*, **42** (3): 249-258.

Chen: Institute of Genetics, Fudan University, Shanghai 200433, China.

The ribosomal DNA Internal Transcribed Spacer-2 (ITS-2) region sequences from different *Glossina* species were PCR-amplified and analysed in order to construct a molecular phylogeny for the genus. Trees generated by parsimony confirmed the monophyletic taxonomic placement of the genus *Glossina*, where *fusca* group species formed the deepest branch followed by *morsitans* and *palpalis* groups, respectively. The placement of *G. austeni* by both traditional morphological and biochemical criteria has been contro-versial. Results presented here, based on ITS-2 locus sequence analysis, suggest that *G. austeni* can be placed in a separate subgenus which forms a sister-group relationship with the *morsitans* group species.

- 11462 **Chen, X.-A., Li, C.-B., Zhao, S.-Y. and Aksoy, S., 1999.** Phylogeny of the symbionts of tsetse and the evolutionary relationships with their hosts. *Progress in Natural Science*, **9** (12): 922-928.

Chen: Institute of Genetics, Fudan University, Shanghai 200433, China.

The phylogeny of the primary (P)-symbionts of eight species belonging to the three subgenera of *Glossina* was studied based on their 16S rDNA sequences. The results show that these organisms constitute a distinct lineage within the γ -subdivision of the Proteobacteria and have evolved concordantly with their insect host species, suggesting an evolutionarily ancient association for this symbiosis. Based on their almost identical 16S rDNA sequences, the secondary (S)-endosymbionts from five tsetse species belonging to the three subgenera should be considered as closely related microorganisms. They are members of the family Enterobacteriaceae within the γ -3 subdivision of the Proteobacteria, closely related to enteric bacteria. This high similarity among the S-endosymbionts from different hosts provides strong evidence that the symbiosis acquisition is developed independently by S-endosymbionts of individual tsetse species.

- 11463 **Luo, C., Zhang, J., Luna, C., Strickler, P.M. and Zheng, L., 1999.** Phylogenetic analysis of Toll and related proteins in disease vectors. (Meeting abstract no. 187.) *American Journal of Tropical Medicine and Hygiene*, **61** (3 Suppl.): 229.

Luo: Department of Epidemiology and Public Health, Yale University School of Medicine, 60 College Street, New Haven, CT 06510, USA.

Nine genes encoding proteins with Toll/interleukin-1 receptor domain included one in *Glossina palpalis palpalis*.

- 11464 **Meola, S.M., Pendleton, M.W., Langley, P.A. and Lovering, S.L., 1999.** Ultrastructural localization of unique neurosecretory granules in the corpora cardiaca of the stable fly, *Stomoxys calcitrans*, and the tsetse fly, *Glossina morsitans*. *Journal of Morphology*, **240** (2): 155-168.

Meola: USDA-ARS Food Animal Protection Research Laboratory, College Station, TX 77845, USA. [smeola@acs.tamu.edu]

Ultrastructural analysis of the corpora cardiaca of the stable fly, *S. calcitrans*, and the tsetse fly, *G. morsitans*, revealed the presence of elementary neurosecretory granules (ENG) unique to the intrinsic neurosecretory cells (INC) of these species. In addition to electron-dense spheres, the INC of the corpus cardiacum of *S. calcitrans* contain electron-dense angular granules, either square or rectangular in shape, while the INC of *G. morsitans* contain electron-dense spindle-shaped ENG. The distinctive granules of these INC can be traced within nerves to their sites of storage and release, eliminating the need for labelling with artificial probes. Although the INC of the corpus cardiacum of most species have been found to be fuchsinophilic, neither the INC of *S. calcitrans* nor *G. morsitans* are aldehyde-fuchsinophilic. These peptigenic cells offer neuroendocrinologists a unique opportunity to study the physiology and biochemistry of neurosecretory cells.

- 11465 **Solano, P., La Rocque, S. de, Cuisance, D., Geoffroy, B., Meeus, T. de, Cuny, G. and Duvallet, G., 1999.** Intraspecific variability in natural populations of *Glossina palpalis gambiensis* from West Africa, revealed by genetic and morphometric analyses. *Medical and Veterinary Entomology*, **13** (4): 401-407.

Solano: IRD Santé, B.P. 5045, F-34032 Montpellier Cedex, France. [solano@mpl.orstom.fr]

G. p. gambiensis from West Africa (Senegal and Burkina Faso) were analysed for microsatellite DNA polymorphisms and size of the wings. In the overall sample a strong heterozygote deficiency was found at two polymorphic microsatellite loci. It led to a highly significant value of *F_{is}* (within-sample heterozygote deficit) in the western zone of the Sideradougou area in Burkina Faso. Genetic differentiation was significant on a macro-geographic scale, i.e. between tsetse from Senegal and Burkina Faso. Wing measures also differed between the two countries; flies from Senegal appeared to be smaller. Micro-satellite loci further allowed differentiation of populations of *G. p. gambiensis* trapped on the same hydrographic network a few kilometres apart. The results suggest that further investigations will allow the study of genetic variability of tsetse flies in relation to the dynamics of transmission of human and animal trypanosomoses.

- 11466 Voskamp, K.E., Everaarts, E. and Otter, C.J. den., 1999. Olfactory responses to attractants and repellents in tsetse. *Medical and Veterinary Entomology*, **13** (4): 386-392.

Otter: Department of Animal Physiology, University of Groningen, P.O. Box 14, 9750 AA Haren, Netherlands. [c.j.den.otter@biol.rug.nl]

The aims of this study were to investigate how antennal olfactory cells of tsetse code odour quality and how they are able to discriminate between attractive and repellent odours. For *Glossina pallidipes*, a survey is presented of the cells' responses to attractive (1-octen-3-ol, acetone, 3-methylphenol, carbon dioxide) and repellent stimuli (2-methoxyphenol, acetophenone, lactic acid, naphthalene). In addition, the responses of these cells to binary mixtures and the dose-response curves of 1-octen-3-ol, 3-methylphenol, 2-methoxyphenol and acetophenone are presented. A minority of the cells responded to one attractant or repellent only, whereas the vast majority were excited by more than one of the attractive and/or repellent stimuli. It is proposed that the peripheral olfactory cells of tsetse discriminate between different compounds via an across-fibre pattern coding, in which the cells that specifically code for attractants or repellents may play a substantial role in composing a unique excitation pattern that informs the central nervous system about the specificity of odours.

- 11467 Voskamp, K.E., Goes van Naters, W.M. van der and Otter, C.J. den, 1999. Comparison of single cell sensitivities to attractants in the tsetse *Glossina fuscipes fuscipes*, *G. morsitans morsitans* and *G. pallidipes*. *Medical and Veterinary Entomology*, **13** (4): 460-462.

Otter: Department of Animal Physiology, University of Groningen, P.O. Box 14, 9750 AA Haren, Netherlands. [c.j.den.otter@biol.rug.nl]

The responses of individual olfactory cells in *G. m. morsitans* and *G. f. fuscipes* to the attractants 1-octen-3-ol, acetone, carbon dioxide and phenols have previously been surveyed using the 'surface-contact' technique, the majority of these cells appearing to respond to a single chemical (specialists), a few to more than one (generalists), and a large group to none. Single-cell recordings were also made in *G. pallidipes*. This paper discusses the differences in the numbers and percentages of the various cell types that could be distinguished in samples of antennal olfactory cells in the three species. No differences were seen between the sexes. In *G. f. fuscipes* 64% (137 out of 214) cells responded to the stimuli applied, of which 84% were specialists and 16% generalists; in *G. m. morsitans* 75% (136 out of 182) responded, of which 92% were specialists and 8% generalists; and in *G. pallidipes* 84% (141 out of 168) responded, with almost equal numbers of specialists (47%) and generalists (53%). The relatively large numbers of specialist cells found in *G. f. fuscipes* and *G. m. morsitans*, and the larger proportion of cells not responding to any of the substances used, suggest that we are still unaware of a number of olfactory cues which are important in host-location by these tsetse.

- 11468 Wohlford, D.L., Krafsur, E.S., Griffiths, N.T., Marquez, J.G. and Baker, M.D., 1999. Genetic differentiation of some *Glossina morsitans morsitans* populations. *Medical and Veterinary Entomology*, **13** (4): 377-385.

Krafsur: Department of Entomology, Iowa State University, Ames, IA 50011, USA. [ekrafsur@iastate.edu]

To study the population structure of *G. m. morsitans*, polymerase chain reaction (PCR) and single-strand conformational polymorphism (SSCP) methods were used to estimate mitochondrial DNA diversity at four loci in six natural populations from Zambia, Zimbabwe and Mozambique, and in two laboratory cultures. The Zambian and Zimbabwean samples were from a single fly belt. Four alleles were recorded at *12S* and *16S1*, and five alleles at *16S2* and *COI*. Nucleotide sequencing confirmed their singularities. χ^2 contingency tests showed that allele frequencies differed significantly among populations. Mean allele diversities in populations averaged over loci varied from 0.14 to 0.61. Little loss in haplotype diversity was detected in the laboratory cultures, thereby indicating little inbreeding. Wright's fixation index F_{ST} in the natural populations was 0.088 ± 0.016 , the correlation of haplotypes within populations relative to correlations in the total. A function of its inverse allows an estimate of the mean equivalent number of females exchanged per population per generation, 5.2. No correlation was detected between pairwise genetic distance measures and geographical distances. Drift explains the high degree of differentiation.

- 11469 Zdárek, J., Nachman, R.J. and Denlinger, D.L., 2000. Parturition hormone in the tsetse *Glossina morsitans*: activity in reproductive tissues from other species and response of tsetse to identified neuropeptides and other neuroactive compounds. *Journal of Insect Physiology*, **46** (3): 213-219.

Denlinger: Department of Entomology, Ohio State University, 1735 Neil Avenue, Columbus, OH 43210, USA.

Parturition hormone (PH) activity is present not only in the uterus of the tsetse *G. morsitans* but also in the oviducts of *Bombyx mori* and *Schistocerca gregaria*, as well as the ejaculatory duct of *S. gregaria* males. Activity thus appears to be present in the reproductive ducts of diverse insect taxa. To determine whether any of the common insect neuropeptides are capable of mimicking the effect of PH, 35 identified neuropeptides and analogues were evaluated for PH activity in pregnant neck-ligated *G. morsitans*. Modest PH activity was observed only for high doses of proctolin and a pyrokinin analogue, suggesting that PH is unlikely to be closely related to any of the identified neuropeptides tested. While proctolin was highly effective in stimulating contractions of the *S. gregaria* oviduct, the extract from the *G. morsitans* uterus elicited only a weak response in this bioassay. PH activity was, however, effectively mimicked in *G. morsitans* with an injection of 8 bromo-cyclic GMP, thus suggesting a potential role for this cyclic nucleotide in mediating the PH response. Pregnant females were responsive to PH, other neuropeptides and cyclic nucleotides only when they were neck-ligated. In intact females, the brain can presumably override the stimulation provided by the active compounds.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also 23: nos. 11456, 11489.]

- 11470 **Brunhes, J., Bodo, J.-M., Grébau[lt], P., Penchenier, L. and Simarro, P., 1999.** [*Glossina caliginea* Austen, 1911,] une nouvelle glossine pour la faune de la Guinée Equatoriale (Dipt., Glossinidae). [*G. caliginea*, a new tsetse fly for the fauna of Equatorial Guinea.] *Bulletin de la Société Entomologique de France*, **104** (1): 43-44.

Brunhes: IRD, Centre de Montpellier, 911 avenue Agropolis, F-34032 Montpellier, France.

G. caliginea is reported for the first time in Equatorial Guinea where specimens were captured in Vavoua traps near villages in the Mbini area during an epidemiological survey of human and animal trypanosomiasis. *G. palpalis palpalis* was also caught.

- 11471 **Jarry, M., Gouteux, J.-P. and Khaladi, M., 1999.** Estimation of age-dependent survival rates of female tsetse flies (Diptera: Glossinidae) from ovarian age distributions. *Bulletin of Entomological Research*, **89** (6): 515-521.

Jarry: Laboratoire d'Ecologie Moléculaire, IRD-UPPA, IBEAS, Avenue de l'Université, F-64000 Pau, France. [marc.jarry@univ-pau.fr]

Existing attempts to estimate the survival rate of tsetse flies from ovarian age distributions generally assume that the population is stationary. The fact that the survival rate cannot be dissociated from the growth rate by these methods poses a problem. Under the assumption of a stable age distribution, we propose a maximum likelihood method to estimate the 'apparent survival rate' for three categories of females: nulliparous (β_0), young parous (β_1) and old parous flies (β_2). The rate depends both on 'real survival rates' a_0 , a_1 and a_2 , and a growth rate λ : $\beta_0 = a_0/\lambda$, $\beta_1 = a_1/\lambda$ and $\beta_2 = a_2/\lambda$. We used a matrix model, which can be parameterised if the pupal survival rate and the pupal period are known. Replacing a_0 , a_1 and a_2 by $\beta_0\lambda$, $\beta_1\lambda$ and $\beta_2\lambda$ in the projection matrix, the problem amounts to calculating its dominant eigen-value λ , and hence a_0 , a_1 and a_2 . The application to a field population of *Glossina palpalis gambiensis* in Burkina Faso showed there was a marked difference in survival rate according to age category. The average survival rate increased with age with decreasing variability. The results suggested that sampling (by trapping) may have had an effect on the dynamics of this tsetse population by ageing it artificially. This method may be a useful tool for monitoring tsetse control.

- 11472 **Kappmeier, K. and Nevill, E.M., 1999.** Evaluation of coloured targets for the attraction of *Glossina brevipalpis* and *Glossina austeni* (Diptera: Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research*, **66** (4): 291-305.

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

Studies on the attractiveness of various coloured targets for *G. brevipalpis* and *G. austeni* in South Africa showed black and phthalogen blue (p.blue) combinations to be the most effective for both species. A 2 m wide (all targets 1 m high) black/p.blue/black (colour ratio 1:2:1) conformation caught nearly three times more *G. brevipalpis* and nearly five times more *G. austeni* than a 1.5 m wide black standard control target. For *G. brevipalpis* the black/p.blue/black (1:2:1) target should be at least 2 m wide in order to increase catches significantly while a 1.5-2.0 m wide target is optimal for *G. austeni*. The p.blue section of a 2 m black/p.blue/black target should make up not less than 20% of the total target width for either species. The most effective combination of practical target sizes and colour ratios were a 1.75 m wide black/p.blue/black (1:1.5:1) or 2 m wide target (1.5:1:1.5). Between 61 and 95% of *G. brevipalpis* and 34-90% of *G. austeni* that were attracted, settled first on the black section of black/p.blue targets (> 1 m wide). Further studies revealed that for *G. brevipalpis* only the black parts of the 2 m wide target need to be treated with insecticide, while the entire 1.75 m wide target should be treated. For *G. austeni* the total width of either target should be treated with insecticide since this species readily settles on both blue and black.

11473 **Kappmeier, K. and Nevill, E.M., 1999.** Evaluation of conventional odour attractants for *Glossina brevipalpis* and *Glossina austeni* (Diptera: Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research*, **66** (4): 307-316.

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

The components of the synthetic ox-odour used in Zimbabwe against *G. pallidipes* and *G. morsitans morsitans* were evaluated for the attraction of *G. brevipalpis* and *G. austeni* in South Africa. The Zimbabwe mixture (Zim-mix), which consisted of acetone and a 1:4:8 mixture of 3-*n*-propylphenol, 4-methylphenol and 1-octen-3-ol, increased the catches of *G. brevipalpis* by *c.* 2.1-4.4 times compared to when no odours were used. One of the odour components, namely 3-*n*-propylphenol, did not significantly increase the size of the catches. Acetone was an essential component for *G. brevipalpis*, especially during the warm and wet season when it acted synergistically with high doses of 1-octen-3-ol and 4-methylphenol. The most attractive odour combination for *G. brevipalpis* was 1-octen-3-ol released at 2.3-9.1 mg/h with 4-methylphenol at *c.* 15.5 mg/h and acetone at *c.* 350 mg/h. This combination increased the catches by another 2.3-2.8 times when compared to the Zim-mix and 10.1-12.3 times compared to 'no odour'. None of the odour components was attractive for *G. austeni*. None of the components was repellent for either species.

11474 **Kappmeier, K. and Nevill, E.M., 1999.** Evaluation of a proposed odour-baited target to control the tsetse flies *Glossina brevipalpis* and *Glossina austeni* (Diptera: Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research*, **66** (4): 327-332.

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

The most effective odour attractant for *G. brevipalpis*, namely a combination of octenol released at *c.* 9.1 mg/h, 4-methylphenol released at *c.* 15.5 mg/h and acetone released at *c.* 350 mg/h, when used together with the smallest recommended colour target (as determined in previous studies), namely a 1.75 m wide × 1 m high black/phthalogen-blue/black target, was evaluated for the control of *G. brevipalpis* and *G. austeni*. This combination increased the catches of *G. brevipalpis* by 3.5 fold when compared to the number of those caught on a 1.5 m wide × 1 m high black target baited with a synthetic ox-odour as was used in a trial to control this species in the Hluhluwe-Umfolozì Game Reserve in 1992. There was an indication that odour (olfaction) plays a far more important role in attracting *G. brevipalpis* than does colour (vision). For *G. austeni* visual attraction appears to play the major role as the odours used were relatively unattractive to them. The odour-baited target should, however, attract *G. austeni* in sufficient numbers (visually) to achieve control to the fly.

11475 **Vreysen, M.J.B. and Khamis, I.S., 1999.** Notes on the ecology of a natural *Glossina austeni* (Diptera: Glossinidae) population in the Jozani Forest, Unguja Island of Zanzibar. *Insect Science and its Application*, **19** (2-3): 99-108.

Vreysen: IAEA Project RAF/5/040, c/o Ethiopian Science and Technology Commission, P.O. Box 19917, Addis Ababa, Ethiopia. [estc@telecom.net.et]

Studies were made of *G. austeni* captured with sticky panels during the wet (April), early dry (June) and late dry (September) seasons of 1991 in the northern and central parts of the Jozani forest on the island of Unguja, Zanzibar. The density of the fly population was significantly higher in the northern part of the forest than in the central. Female and male daily catches remained stable in time in the northern area but the density of the male fly population declined significantly in the central area at the end of the dry season. The magnitude of the catch and the sex ratio of the samples were highly affected by the trap site in both locations. Only samples in the central part of the forest were biased towards one of the sexes depending on the season: females outnumbered males in the dry season but catches were distorted in favour of males in the wet season. The age composition of the male flies was independent of locality and season but that of female flies was influenced by the seasons in the central area. The breeding and abortion rates of flies were similar in the two locations during both the wet and dry seasons. The stability of the fly population in terms of density and composition is probably a reflection of the optimal environmental conditions in this primary forest habitat.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **23**: nos. 11474, 11512.]

- 11476 **Krafsur, E.S., 1998.** Sterile insect technique for suppressing and eradicating insect population: 55 years and counting. *Journal of Agricultural Entomology*, **15** (4): 303-317.

Department of Entomology, Iowa State University, Ames, IA 50011, USA.
[ekrafsur@iastate.edu]

The sterile insect technique (SIT) has a long, interesting but controversial history. Criticisms of this areawide approach to insect management are reviewed in general, and specifically with regard to the Mediterranean fruit fly and the screwworm (tsetse is mentioned occasionally). The chief objections include evolutionary responses to SIT, the occurrence of sibling species, the role of weather in causing pest suppression and outbreaks during SIT programmes, and the occurrence of undetected pest populations where eradication has been claimed. Despite the criticisms, it is concluded that SIT is a highly effective and environmentally benign method of insect pest suppression and eradication. It would lend credibility to the efficacy of SIT if sterile mating frequencies were estimated in challenged populations and correlated with target population densities.

- 11477 **Lambert, M.R.K., 1997.** Effects of pesticides on amphibians and reptiles in sub-Saharan Africa. *Reviews of Environmental Contamination and Toxicology*, **150**: 31-73.

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

Effects of pesticides and the residue levels recorded in amphibians and reptiles of sub-Saharan Africa are reviewed. Most references relate to deaths from organochlorine insecticides used against tsetse. DDT treatment at 180 g/ha and endosulfan at ≥ 200 g/ha caused death among snakes, lizards and frogs. Analysis of unpublished data indicated that endosulfan residues accumulated in anurans but were not detected in lizards until after the second of five sequential treatments over a 51-day period. Organochlorine levels in frog and lizard corpses after contact with soil heavily contaminated from pesticide spillage greatly exceeded baseline control values. The use of species as contamination bio-indicators, and the importance of amphibians and reptiles both as a food resource and as a link in food chains enabling accumulated toxic chemicals to enter predators, are discussed.

- 11478 **Okoth, J.O., 1999.** Tsetse and trypanosomiasis control problems in south-east Uganda: past, present and alternative strategies. *Schweizerische Medizinische Wochenschrift*, **129** (31-32): 1091-1098.

Livestock Health Research Institute (LIRI), P.O. Box 96, Tororo, Uganda.

Tsetse and trypanosomiasis due to *Trypanosoma brucei rhodesiense* in south-east Uganda are reviewed. This paper examines why in nearly 100 years no appreciable progress has been made in tsetse and trypanosomiasis control. It points out that tsetse control strategies in the past have relied on sophisticated technologies such as aerial spraying, which are inappropriate to Uganda's economic and environmental situation.

With the vector *Glossina fuscipes fuscipes* being peridomestic and the transmission cycle undoubtedly domestic animal-fly-man, community participation using appropriate technologies such as low-cost traps/targets and integrating farming activity with tsetse control seem to be the most appropriate approach in south-east Uganda. Savings in expenditure on vector control are discussed in the light of diminishing resources.

11479 **Vale, G.A., Mutika, G. and Lovemore, D.F., 1999.** Insecticide-treated cattle for controlling tsetse flies (Diptera: Glossinidae): some questions answered, many posed. *Bulletin of Entomological Research*, **89** (6): 569-578.

Vale: 93 The Chase, Mount Pleasant, Harare, Zimbabwe. [gvale@healthnet.zw]

Bioassays in Zimbabwe with wild-caught *Glossina pallidipes* and *G. morsitans morsitans* showed that formulations of deltamethrin (Decatix, SpotOn and an experimental variant of SpotOn), alphacypermethrin (Renegade) and cyfluthrin (Cylence) applied to oxen at the manufacturers' recommended doses gave knockdowns above 50% for 5-24 days in hot months and 24-55 days at cooler seasons. Within these periods, the average knockdowns were 77-86% with deltamethrin, 74% with alphacypermethrin and 59% with cyfluthrin. None of the insecticides affected the numbers of tsetse attracted to oxen from a distance, the proportion of tsetse that engorged, and the alighting responses on cloth screens. In the hot season most tsetse engorged on the belly. At other times the front legs were preferred, especially in the wet season and for a few months thereafter. Chemical assays indicated that insecticide persisted at greatest concentration on the backs of oxen and least on the legs. Modelling the experimental data suggested that 4-21 annual applications of insecticide in areas > 1000 km² would give good control at least 10 km from the invasion source if the treated cattle contributed at least 50% of tsetse diet. No treatment regime under any diet conditions would give good control near an invasion front. Insecticide at concentrations up to 0.15 ppm occurred in dung from treated oxen for up to 12 days post-treatment. Dead beetles occurred in and near fresh dung.

11480 **Vreysen, M.J.B., Saleh, K.M., Khamis, I.S. and Mramba, F., 1999.** An evaluation of insecticide-impregnated screens against *Glossina austeni* (Diptera: Glossinidae) on Unguja Island of Zanzibar. *Insect Science and its Application*, **19** (1): 75-84.

Vreysen: IAEA Project RAF/5/040, c/o Ethiopian Science and Technology Commission, P.O. Box 19917, Addis Ababa, Ethiopia. [estc@telecom.net.et]

A tsetse-control trial was carried out in a primary forest habitat on Unguja Island of Zanzibar to assess the effect of blue cotton screens impregnated with alphacypermethrin or deltamethrin on a population of *G. austeni*. In November 1991, screens were deployed at densities of 45-70 per km² and the fly population was monitored monthly using sticky panels. Both female and male daily catches during the initial 5 months after screen deployment were similar to the pre-control catches, but the physiological age distribution of female flies shifted significantly towards younger groups. Females were more influenced by the screens than males. After the long rainy season (March to May), the fly

population was very low but increased to pre-control levels by September, 3 months after the flooding of the forest floor. Thereafter, male and female apparent densities decreased, and 78-91% and 98-99% suppression was obtained for males and females, respectively, at the end of the 18-month intervention period (April 1993). While effective control of *G. austeni* using blue cotton screens was shown to be feasible, it required a high deployment density and a long intervention period.

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

[See also 23: 11458, 11493, 11541, 11542.]

11481 **Artzrouni, M. and Gouteux, J.-P., 2000.** *A microsimulation model for the population dynamics of human sleeping sickness.* Pau, France; Université de Pau et de Pays de l'Adour and Centre National de la Recherche Scientifique (Laboratoire de Mathématiques Appliquées ERS 2055, Analyse Non Linéaire et Modélisation 2000/02). 12 pp.

Artzrouni: Department of Applied Mathematics, University of Pau, 64000 Pau, France. [marc.artzrouni@univ-pau.fr]

A microsimulation model of the spread of human sleeping sickness is described. The model focuses on the randomness of epidemic trajectories brought about merely by the random nature of fly bites on humans. There is a high level of variability in the trajectories, primarily due to the small sizes of the populations involved. Although an inverse relationship was expected between probabilities of extinction and the size of an epidemic flare-up, the probabilities of extinction remain surprisingly high even with a serious outbreak. We found as a corollary that in the absence of infected immigrant flies, a low-level endemic occurs with a very small probability. With a stream of one infected fly entering the system every three days, a low-level endemic can be sustained, with less variability. Implications and further subjects of study are briefly discussed.

11482 **Fournet, F., Koné, A., Traoré, S. and Hervouët, J.P., 1999.** Heterogeneity in the risk of sleeping sickness in coffee and cocoa commercial plantations in Ivory Coast. *Medical and Veterinary Entomology*, **13** (3): 333-335.

Fournet: Département des Sciences Humaines Appliquées à la Santé, IPR, 01 B.P. 1500, Bouaké 01, Côte d'Ivoire. [fournet@ird.ci]

Entomological surveys of two commercial coffee/cocoa plantations in the northern part of the Zoukougbeu sleeping sickness focus, 30 km west of Daloa, Côte d'Ivoire, were undertaken. In November 1997, at the end of the short wet season, 28 Vavoua traps, 15 in the Tonykro plantation and 13 in the Siluekro plantation, were used to evaluate human-vector contact with regard to spatial and temporal distribution of the agricultural activities. Only *Glossina palpalis palpalis* was caught, at an average apparent density of 0.3 flies/trap/day. In Tonykro, the apparent density was 0.2 flies/trap/day, while it was

significantly higher in Siluekro where it was 0.4 flies/trap/day. Flies were more abundant close to tracks, but were not more abundant close to plantation workers' settlements. As no human blood meal was identified, human-vector contact seemed to be low and the epidemiological risk of transmission could be considered as nil in the two plantations, despite the survey being done during the harvest period when many people are usually present. These results support the hypothesis that land use has an impact on the distribution of sleeping sickness, small-holder plantations with high human mobility having higher epidemiological risk than commercial plantations, especially those with limited human access.

11483 **Gouteux, J.-P. and Artzrouni, M., 2000.** Persistence et résurgence de la maladie du sommeil à *Trypanosoma brucei gambiense* dans les foyers historiques. Approche biomathématique d'une énigme épidémiologique. [Persistence and resurgence of *T. b. gambiense* sleeping sickness historic foci. A biomathematical approach to an epidemiological enigma.] *Comptes rendus de l'Académie des Sciences, série III (Sciences de la Vie)*, **323** (4): 351-364.

Gouteux: Laboratoire d'Ecologie Moléculaire, IBEAS, Université de Pau et des Pays de l'Adour, F-64000 Pau, France. [jean-paul.gouteux@wanadoo.fr]

Since the end of the 19th century, historic endemic foci of *T. b. gambiense* sleeping sickness have proven very persistent. Using a recently developed model, the authors studied the transmission dynamics of the disease. In order to understand the speed at which the disease spreads or goes to extinction at the beginning of an epidemic outbreak, a new index was introduced: T_0 , the time necessary for the prevalence to be halved or doubled depending on whether the basic reproduction rate of the system (R_0) is less than or more than 1. This five-compartmental mathematical model is briefly described and equations given. For certain realistic parameter values, T_0 can be quite large (> 5 years), corresponding to a persistent low-level endemic. A relatively small shift in parameter values can cause an epidemic upsurge of the disease. The authors in particular examine changes in (1) the relative sizes of human and vector populations, (2) the rate of tsetse blood meals taken on humans, and (3) the virulence of the trypanosome strain with respect to the human population. In this model with an open vector population, the immigration of small numbers of infected tsetse flies is sufficient to maintain a high disease prevalence at equilibrium, and can explain the development of the disease within susceptible populations and its expansion into secondary foci. The model is validated with field data from historic foci in Congo P.R., Côte d'Ivoire and Central African Republic.

11484 **Kazadi, J.-M., Kageruka, P. and Losson, B., 1999.** Influence du nombre de repas sains antérieurs au repas infectieux sur la compétence vectorielle de *Glossina morsitans morsitans* infectée par *Trypanosoma congolense* IL 1180. [Influence of the number of healthy meals prior to an infectious meal on the vectorial competence of *G. m. morsitans* infected with *T. congolense* IL 1180.] *Veterinary Research*, **30** (4): 419-426.

Kazadi: Département de Santé Animale, Institut de Médecine Tropicale Prince Léopold, Nationalestraat 155, B-2000 Antwerp 1, Belgium. [jmkazadi@hotmail.com]

The purpose of this work was to assess the influence of several healthy meals (0, 1 and 2) prior to an infectious meal on the vectorial competence of *G. m. morsitans* (Mall). The teneral flies (aged < 32 h) of this line were divided into three groups: those of group A received no meal, those of group B received one healthy meal on day 1, while those of group C were given two consecutive healthy meals on days 1 and 2. All the flies were infected experimentally with *T. congolense* IL 1180 when the maximum age reached 32 h for flies receiving no meal, 56 h for those receiving one healthy meal and 80 h for those receiving two healthy meals. When both sexes were considered, the meso-procyclic and metacyclic indices and the vectorial competence (VC) of the flies receiving no meal were 0.99 ± 0.01 , 0.96 ± 0.02 and 0.95 ± 0.03 , respectively. In the flies which were fed one healthy meal, the respective values were 0.42 ± 0.13 , 0.50 ± 0.01 and 0.21 ± 0.06 , whereas the values for the flies receiving two healthy meals were 0.45 ± 0.11 , 0.29 ± 0.19 and 0.13 ± 0.05 , respectively. The meso-procyclic and metacyclic indices and the VC in both sexes were higher in the flies receiving no meal than in those fed one or two healthy meals. No significant difference in either meso-procyclic index or VC was seen between flies receiving one or two healthy meals. However, the metacyclic index of male flies fed one healthy meal was higher than that of males fed two healthy meals. These results indicate that the number of non-infected meals prior to an infected meal reduces the interaction between *G. m. morsitans* (Mall) and *T. congolense*.

11485 **Masaninga, F. and Mihok, S., 1999.** Host influence on adaptation of *Trypanosoma congolense* metacyclics to vertebrate hosts. *Medical and Veterinary Entomology*, **13** (3): 330-332.

Mihok: 9 Morin Place, Hay River, NT X0E 0R3, Canada. [smihok@yahoo.com]

Blood factors have been shown to influence the establishment of trypanosome infections in tsetse flies. In the present study, the possibility of latent effects resulting from the biochemical milieu at the time of the infective feed was investigated by comparing the outcome of infections initiated in laboratory mice from *Glossina morsitans centralis* infected with *T. congolense* Kilifi clone K60/1 in goat, zebra or eland blood. In a first trial, the prepatent period in mice with infections originating from eland blood was 14.0 ± 0.3 days compared to 11.0 ± 0.5 days for goat blood ($P < 0.001$). Although individual tsetse were confirmed to be extruding metacyclics, less than half the mice developed patent infections (eland protocol $47.4 \pm 3.6\%$; goat protocol $44.3 \pm 10.5\%$; $P = 0.34$). In a second trial, parasitaemia was estimated. Levels were very similar and high in all protocols (goat, eland, zebra), reaching $10^{6.9}$ - $10^{8.4}$ parasites/ml once the parasites became patent between days 8 and 12. Parasitaemias in all groups converged at $c. 10^8$ parasites/ml on day 18. Zebra blood produced the longest prepatent period and the lowest overall level of parasitaemia. In a third trial, all the mice in the zebra protocol survived to day 30, while only 42% and 67% survived in the goat and eland protocols, respectively

(zebra vs. goat $P = 0.005$; zebra vs. eland $P = 0.04$). These differences in virulence of metacyclics derived from a clonal trypanosome fed to tsetse in different host bloods suggest differential expression of genes for certain parasite types at the procyclic stage with consequences at the metacyclic stage.

- 11486 **Moloo, S.K., Kabata, J.M. and Gitire, N.M., 2000.** Study on the mechanical transmission by tsetse fly *Glossina morsitans centralis* of *Trypanosoma vivax*, *T. congolense* or *T. brucei brucei* to goats. *Acta Tropica*, **74** (1): 105-108.

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

Goats housed in tsetse-free conditions were infected with *T. vivax* stock IL 1392, *T. congolense* clone IL 1180 or *T. b. brucei* clone GUTat 3.1 Hungry non-teneral *G. m centralis* were allowed to start feeding on infected goats under laboratory conditions, interrupted and then allowed (mostly within 60 s) to continue feeding on uninfected goats. Mechanical transmission of *T. vivax* from infected to uninfected goats was shown to occur but the transmission rate was only 37.5%. All attempts at direct transmission of *T. congolense* and *T. b. brucei* between goats failed. These results may be due to the high parasitaemias seen in the *T. vivax*-infected goats compared with the low parasitaemias seen in goats infected with the other two species.

- 11487 **Sané, B., Laveissière, C. and Meda, H.A., 2000.** Diversité du régime alimentaire de *Glossina palpalis palpalis* en zone forestière de Côte d'Ivoire: relation avec la prévalence de la trypanosomiase humaine africaine. [Diversity of the diet of *G. p. palpalis* in the forest zone of Côte d'Ivoire: relation to the prevalence of human African trypanosomiasis.] *Tropical Medicine and International Health*, **5** (1): 73-78.

Meda: OCCGE-Centre Muraz, 01 B.P. 153, Bobo Dioulasso, Burkina Faso.
[Vaccino.muraz@fasonet.bf]

The feeding habits of *G. p. palpalis*, the main vector of human African trypanosomiasis in the region, were retrospectively analysed using data collected between 1984 and 1994 in five foci in the forest belt in the mid-west of Côte d'Ivoire. The feeding habits of the vector in these different foci were compared, with the objective of determining if there is any relationship between the feeding pattern of tsetse flies and the prevalence rates of HAT. The feeding pattern was measured using two indices: the conventional index of Shannon and Weaver (Ish) and a new one, the zoophily/anthropophily index (Za), which is an estimate of the ratio of the percentage of animal blood meals divided by the percentage of human blood meals. There was no correlation between tsetse apparent density and prevalence rate. A high Ish and a high Za, indicative of a diversity of host blood meals, were observed in the foci of Vavoua, Zoukougbeu and Sinfra where prevalence rates of HAT were high. Conversely, a low Ish and a low Za, indicative of most blood meals being taken from human hosts, were observed in the hypoendemic areas of Daniafla and Gagnoa. Both indices were highly but not significantly correlated with prevalence rates. The Za index seemed to be more strongly correlated to the disease rate

as compared to the Ish index. The epidemiological significance of these observations is discussed.

- 11488 **Solano, P., La Rocque, S. de, Reifenberg, J.M., Cuisance, D. and Duvallet, G., 1999.** Biodiversité des trypanosomes pathogènes pour le bétail et importance en épidémiologie. [Biodiversity of trypanosomes pathogenic for cattle and epidemiological significance.] *Bulletin de la Société française de Parasitologie*, **17**: 32-42.

Solano: CIRAD-EMVT, Campus de Baillarguet, B.P. 5035, F-34032 Montpellier Cedex 1, France. [solano@mpl.ird.fr]

The application of molecular biological techniques to the characterisation of trypanosomes in cattle is discussed. PCR permits the differentiation of *Trypanosoma congolense* from *T. simiae* and the characterisation of five different 'taxa' within the species *T. congolense*. Epidemiological studies undertaken in Burkina Faso, involving the characterisation of trypanosomes in cattle and tsetse, the identification of the origin of tsetse blood meals, and the precise localisation of captures, are described.

- 11489 **Späth, J., 2000.** Feeding patterns of three sympatric tsetse species (*Glossina* spp.) (Diptera: Glossinidae) in the preforest zone of Côte d'Ivoire. *Acta Tropica*, **75** (1): 109-118.

Sossauer Strasse 49, D-84130 Dingolfing, Germany.

The feeding patterns of *Glossina longipalpis*, *G. medicorum*, *G. palpalis gambiensis* and *G. p. palpalis* are described from natural habitats in central Côte d'Ivoire where these tsetse species occurred sympatrically. Blood-meal identification of tsetse flies revealed that in natural habitats wild ruminants were by far the most frequent source of food for each tsetse species, but there were significant differences between the nutritional spectra of single fly species. *G. p. gambiensis* fed significantly less often on bushbuck and significantly more often on monitor lizard than both *G. longipalpis* and *G. medicorum*. In *G. p. gambiensis* the blood of wild ruminant species was significantly more often found than in *G. p. palpalis*, whereas the latter fed significantly more often on domestic animals. Peridomestic populations of *G. longipalpis* and *G. p. palpalis* fed mostly on domestic pig and therefore had significantly reduced host spectra in comparison to natural populations. The significant differences in feeding patterns among the investigated species, subspecies and populations seem not to depend on species specific feeding preferences. Rather, they can be attributed to microhabitat specialisation of the various tsetse groups and hence mainly to the different availability of hosts. This implies that environmental factors should be taken more into account when analysing and comparing the feeding patterns of tsetse.

- 11490 **Welburn, S.C. and Maudlin, I., 1999.** Tsetse-trypanosome interactions: rites of passage. *Parasitology Today*, **15** (10): 399-403.

Welburn: CTVM, University of Edinburgh, Easter Bush, Roslin, Midlothian EH25 9RG, UK. [sue.welburn@ed.ac.uk]

Trypanosomes that cause sleeping sickness (*Trypanosoma brucei rhodesiense* and *T. b. gambiense*) are entirely dependent on tsetse for their transmission between hosts, but the flies are not easily infected. This situation has not arisen by chance: the tsetse has evolved an efficient defence system against trypanosome invasion. This review, which charts the progress of trypanosomes through the fly and identifies some of the hazards faced by both parasite and fly that affect vector competence of tsetse, has sections entitled: establishment in the tsetse midgut; refractoriness to infection in tsetse; peritrophic matrix, gut enzymes and vector competence; trypanosome death; the basis of refractoriness in tsetse; window of opportunity for maturation; maturation, sex and mortality; human infectivity and maturation.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

11491 **Enyaru, J.C.K., Odiit, M., Winyi-Kaboyo, R., Sebikali, C.G., Matovu, E., Okitoi, D. and Olaho-Mukani, W., 1999.** Evidence for the occurrence of *Trypanosoma brucei rhodesiense* sleeping sickness outside the traditional focus in south-eastern Uganda. *Annals of Tropical Medicine and Parasitology*, **93** (8): 817-822.

Enyaru: Livestock Health Research Institute (LIRI), P.O. Box 96, Tororo, Uganda.

The occurrence of *T. b. rhodesiense* west of the River Nile, in Masindi district in the mid-western part of Uganda, is confirmed. Masindi borders the traditional belt of *T. b. gambiense* infection in the north-west, Gulu in the north and the Democratic Republic of Congo in the west. Of 702 persons tested for sleeping sickness in Masindi, 113 (16%) were positive by CATT. Trypanosomes were observed in samples of CSF from two (0.3%) of the subjects: a 7-year-old girl, who had been ill for 2 weeks and yet was in good general condition, with 3 white blood cells (WBC)/ μl CSF; and a 47-year-old woman who had been ill for 8 months, looked sickly, had 7 WBC/ μl CSF, but was still able to dig in her gardens. Rats and mice inoculated with blood from the two parasitologically confirmed cases became parasitaemic on day 3 post-inoculation, indicating that the parasites were *T. b. rhodesiense*. Isoenzyme analysis revealed that the parasites isolated from one of these confirmed cases belonged to a zymodeme (449) which has not been previously observed among isolates from south-eastern or north-western Uganda. Although the isolate shared PGM2 and ICD3 patterns with *T. b. gambiense* and *T. b. rhodesiense*, respectively, it did not have the SOD3:5 pattern characteristic of *T. b. gambiense*. The spread of *T. b. rhodesiense* beyond its traditional focus and the development of areas where this subspecies and *T. b. gambiense* are co-endemic will complicate the control of sleeping sickness in Uganda; although the CATT is very useful

for the mass screening of populations for *T. b. gambiense*, it is not applicable in the detection of *T. b. rhodesiense*.

- 11492 **Kyambadde, J.W., Enyaru, J.C.K., Matovu, E., Odiit, M. and Carasco, J.F., 2000.** Detection of trypanosomes in suspected sleeping sickness patients in Uganda using the polymerase chain reaction. *Bulletin of the World Health Organization*, **78** (1): 119-124.

Enyaru: Livestock Health Research Institute (LIRI), P.O. Box 96, Tororo, Uganda.

Diagnosis of sleeping sickness is difficult because of the fluctuating levels of parasitaemia encountered in patients. In the present study we found that the PCR demonstrated trypanosome infection in 20 out of 35 (57.1%) blood samples and in 21 out of 34 (61.7%) CSF samples collected from an area endemic for sleeping sickness in north-west Uganda. A total of 14 blood samples and 13 CSF samples that were positive for trypanosomes by double centrifugation were also positive by PCR, demonstrating good concordance between the two methods. However, six (28.6%) of the 21 blood samples that were parasitologically negative were positive by PCR, while eight (38.0%) out of 21 CSF samples that were negative by double centrifugation were positive by PCR. These 14 negative samples could therefore be from sleeping sickness cases even though a positive PCR test is not evidence for the presence of trypanosomes. Furthermore, of these eight CSF samples, four had been designated as early cases, based on the absence of trypanosomes and on a count of ≤ 5 white blood cells (WBC)/ μl . This suggests that some late-stage cases could potentially be missed according to the present criteria, and it is therefore important to perform clinical trials to determine whether these cases could be treated successfully with the first-stage drug alone. The remaining four CSF samples had been classified as late-stage cases, based on a count of > 6 WBC/ μl , even though trypanosomes could not be detected in these samples by either double centrifugation or PCR. A cut-off point of 5 WBC/ μl , which is used as a rule of thumb to stage sleeping sickness patients, seems to leave some late-stage cases undetected since trypanosomes were detected in four CSF samples from suspected cases with < 5 WBC/ μl .

- 11493 **Penchenier, L., Grébaud, P., Ebo'o Eyenga, V., Bodo, J.M., Njiokou, F., Binzouli, J.J., Simarro, P., Soula, G., Herder, S. and Laveissière, C., 1999.** Le foyer de trypanosomose humaine de Campo (Cameroun): historique et situation de l'endemie en 1998. [The Campo human sleeping sickness focus (Cameroon): history and endemic situation in 1998.] *Bulletin de la Société de Pathologie exotique*, **92** (3): 185-190.

Penchenier: OCEAC, B.P. 288, Yaoundé, Cameroon. [pencheni@oceac.orstom.cm]

For the first time in 13 years, the human sleeping sickness focus of Campo, spanning the Cameroon-Equatorial Guinea border, has been surveyed. Screening was carried out in June 1998 simultaneously on both sides of the border. Study of this focus, which has been known, and active, for almost a century, is particularly interesting because there has never

been an epidemic outbreak in this area; though still active, trypanosomiasis is not very manifest there. According to passive screening carried out in recent years, the estimated prevalence ranges between 0.2 and 0.5%. For this screening, 5255 persons were examined on the Cameroonian side of the focus (90.6% of the census population) and 405 in Equatorial Guinea (71.3% of the census population). Serological screening was carried out with the CATT 1.3, which is the CATT generally used in surveys, and with the latex CATT (LiTat 1.3, 1.5 and 1.6). Lymph node fluid from individuals with adenopathy was examined for trypanosomes, and blood of serological suspects was examined by quantitative buffy coat (QBC), mini anion exchange centrifugation (mAEC) and by *in vitro* isolation of trypanosomes (KIVI). Sixteen patients were identified in Cameroon but none in Equatorial Guinea. These results show that the Campo focus is active only on the Cameroonian side, centred on the village of Ipono with a low prevalence (0.3%). The persistence of cases is associated with the presence in Ipono of pigs carrying *Trypanosoma brucei gambiense*, identified during the study. The zymodeme of this strain was found to be the same as that of the human strain isolated in Campo. The epidemiological data collected suggest that concerted medical and entomological action within the village of Ipono could eradicate the disease. During this study, the latex CATT proved to be more cost-effective than the CATT 1.3, achieving a similar result with eight times less work at a lower cost. This remains to be confirmed in a hyperendemic focus.

11494 **Simarro, P.P., Franco, J.R. and Ndong, P., 1999.** Field evaluation of several serological screening tests for sleeping sickness (*T. b. gambiense*). *Bulletin de Liaison et de Documentation de l'OCEAC*, **32** (3): 28-33.

Simarro: Centro Control Tripanosomiasis, Apartado de Correos 560, Bata, Equatorial Guinea. [cidobfun@intnet.gq]

Active case-finding in sleeping sickness control is based on serological screening of the population at risk followed by parasitological testing of suspected individuals. In April 1996, four serological tests were evaluated in Mbini focus, Equatorial Guinea: standard CATT (LiTat 1.3); CATT modified with EDTA on undiluted blood (LiTat 1.3); IFAT on dried blood on Whatman filter paper (LiTat 1.3); and latex card agglutination on blood dilutions (LiTat 1.3, 1.5 and 1.6). Three hundred and forty-three persons living in this focus, with no previous history of sleeping sickness, were screened using these four tests; 318 were considered serologically negative and 25 serologically positive. These 25 individuals were tested by three parasitological methods and the parasite was confirmed in eight of them. Comparing the serological and parasitological results, latex agglutination on blood dilutions showed a very high sensitivity (100%) and specificity (99.4-100%) and was easy to use in the field. The standard CATT had high specificity (96.7%) but lower sensitivity (87.5%), and was also easy to perform. The CATT/EDTA on whole blood showed high sensitivity (100%) but reduced specificity (95.8%). The IFAT on Whatman filter paper gave high specificity (99.7%) but low sensitivity (75%). Seventy-six other individuals with a previous history of trypanosomiasis were also screened; they were not considered for the study, but the prevalence of seropositivity in this group was much higher than that in the general population and suggested an acquired immunity.

- 11495 **Simarro, P.P., Ruiz, J.A., Franco, J.R. and Josenando, T., 1999.** Attitude towards CATT-positive individuals without parasitological confirmation in the African trypanosomiasis (*T. b. gambiense*) focus of Quiçama (Angola). *Tropical Medicine and International Health*, **4** (12): 858-861.

Simarro: Centro Control Tripanosomiasis, Apartado de Correos 560, Bata, Equatorial Guinea. [cidobfun@intnet.gq]

Serologically positive individuals without parasitological confirmation constitute an important problem for trypanosomiasis control programmes since they may remain untreated and serve as reservoirs of infection. In July 1997, in the focus of Quiçama, Angola, 4753 individuals were screened using CATT/*T. b. gambiense* on whole blood. In 102 individuals who were CATT-positive but parasite-negative, CATT titration on serum was performed. Of these, 16 individuals showing an end-titre lower than 1/4 were considered noninfected, according to the results of a previous study of serological status of parasitologically confirmed cases, while 86 individuals with end-titres $\geq 1/4$ were considered to be suspected cases of trypanosomiasis and were followed up every 3 months from July 1997 to July 1998. After one year, 32 individuals whose antibody titres had dropped below 1/4 were considered noninfected, 22 were confirmed by demonstration of parasites, while 17 were further followed up because antibody titres remained $\geq 1/8$ although parasites could not be found. Fifteen individuals did not show up for testing. Following the usual criterion, only parasitologically confirmed cases were treated. However, if it had been decided to treat parasite-negative individuals with a CATT end-titre of $> 1/8$, 22 initially unconfirmed but infected individuals would have been treated earlier, whereas five noninfected individuals would have been treated unnecessarily. CATT titration on diluted serum or plasma could therefore be useful for making therapeutic decisions.

(b) PATHOLOGY AND IMMUNOLOGY

- 11496 **Millogo, A., Nacro, B., Bonkoungou, P., Sanou, M., Traoré, S., Traoré, H. and Tall, F., 1999.** La maladie du sommeil chez l'enfant au Centre hospitalier de Bobo-Dioulasso: à propos de trois observations. [Sleeping-sickness in children at Bobo-Dioulasso Hospital: report of three cases.] *Bulletin de la Société de Pathologie exotique*, **92** (5): 320-322.

Millogo: Service de Médecine Interne, Centre Hospitalier National Souro Sanou, B.P. 676, Bobo-Dioulasso, Burkina Faso.

Three cases of trypanosomiasis in children aged 3 to 13 years are reported. Two of the cases were imported from Côte d'Ivoire and one originated from an old endemic area of the Bobo-Dioulasso region of Burkina Faso. Clinical features were comparable to classical descriptions in adults but neurological findings were dominant. Two children were at the lymphatic stage. Treatment with melarsoprol in two cases and eflornithine in one case led to complete recovery. Active epidemiological surveillance of this zoonosis should be maintained and the devastating pandemic of the beginning of the 20th century should be kept in mind.

- 11497 **Sinha, A., Grace, C., Alston, W.K., Westenfeld, F. and Maguire, J.H., 1999.** African trypanosomiasis in two travelers from the United States. *Clinical Infectious Diseases*, **29** (4): 840-844.

Maguire: Division of Infectious Diseases, Department of Medicine, Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115, USA.

Two recently diagnosed cases involving tourists who went on safari in Tanzania are reported. Review of these and 29 other published cases of the disease in returning US travellers indicates that it is nearly always of the East African form, due to *Trypanosoma brucei rhodesiense*, and that timely and appropriate therapy has resulted in favourable outcomes for most patients.

(c) TREATMENT

[See also **23**: nos. 11495, 11531, 11532, 11538.]

- 11498 **Burri, C., Nkunku, S., Merolle, A., Smith, T., Blum, J., and Brun, R., 1999.** Evaluation in a randomised controlled clinical trial of a new, concise protocol for treatment of *Trypanosoma brucei gambiense* sleeping sickness with melarsoprol. (Meeting abstract no. 81.) *American Journal of Tropical Medicine and Hygiene*, **61** (3 Suppl.): 185.

Burri: Department of Medical Parasitology and Infection Biology, Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland. [christian.burri@unibas.ch]

The clinical efficacy and safety of a novel, concise protocol for the treatment of late-stage *T. b. gambiense* sleeping sickness were compared to those of standard melarsoprol treatment in an open, randomised clinical equivalence trial conducted in 500 patients in Angola. Application of melarsoprol was either (a) following the standard national Angolan protocol of three series of four injections (1.2, 2.4, 3.6 and 3.6 mg/kg body weight/day) interrupted by rest periods of 7 days, total duration 26 days, or (b) according to the new treatment protocol of 10×2.2 mg/kg b.w./day. Parasitological cure 24 h after treatment was 100% in both groups. No significant differences in severe adverse events were seen between the two treatment protocols and moderate adverse events were comparable in the two groups. An increase of skin reactions (dermatitis, urticaria, pruritus) was observed with the new treatment but these could be controlled by treatment interruption and steroid application and remitted completely. Relapse rates up to 18 months were comparable in the two groups. This concise treatment protocol might become a useful alternative to the common lengthy treatment, especially in epidemic situations.

- 11499 **Legros, D., Fournier, C., Gastellu Etchegorry, M., Maiso, F. and Szumilin, E., 1999.** Echecs thérapeutiques du mélarsoleprol parmi des patients traités au stade tardif de trypanosomose humaine africaine à *T. b. gambiense* en Ouganda.

[Therapeutic failure of melarsoprol among patients treated for late stage *T. b. gambiense* human African trypanosomiasis in Uganda.] *Bulletin de la Société de Pathologie exotique*, **92** (3): 171-172.

Legros: Epicentre, P.O. Box 2362, Kampala, Uganda.

The failure rate of melarsoprol after treatment of late stage cases of human African trypanosomiasis is usually under 7%, even though the drug has been used for such treatment over the past 50 years. A melarsoprol treatment failure rate of 26.9% is reported among 428 patients treated in northern Uganda in 1995 and 1996. Whatever its origin, this observation, the first documented in a HAT focus, is alarming, particularly since no second line trypanocidal drug is actually available for the treatment of late-stage HAT. We believe that the current worrying HAT situation in several African countries, and the risk of emergence of other foci of resistance, argue in favour of a greater attention on the part of the scientific community and the pharmaceutical companies being paid to this problem.

11500 **Onyango, J.D., Burri, C. and Brun, R., 2000.** An automated biological assay to determine levels of the trypanocidal drug melarsoprol in biological fluids. *Acta Tropica*, **74** (1): 95-100.

Burri: Department of Medical Parasitology and Infection Biology, Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland. [christian.burri@unibas.ch]

Few functional methods exist for investigating the pharmacokinetic properties of melarsoprol. An automated biological assay, based on the fluorescent dye Alamar blue, was developed for the determination of melarsoprol in biological fluids. To validate the assay, 108 serum and 37 CSF samples were spiked with melarsoprol at concentrations of 17 ng/ml-2.2 µg/ml for serum and 17-92 ng/ml for CSF. The precision (repeatability) expressed as the interday average coefficient of variation was 9.9% for serum and 18.8% for CSF samples over the respective concentration range. The accuracy (measurement for systematic error) of the test was 99.4% for serum and 96.4% for CSF. The assay's limit of quantitation with *Trypanosoma brucei rhodesiense* stock STI 704 BABA was 4 ng/ml for both serum and CSF samples.

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

11501 **Bossche, P. van den, Mudenge, D., Mubanga, J. and Norval, A., 1999.** The parasitological and serological prevalence of tsetse-transmitted bovine trypanosomiasis in the Eastern Caprivi (Caprivi District, Namibia). *Onderstepoort Journal of Veterinary Research*, **66** (2): 103-110.

Bossche: RTTCP, P.O. Box A560, Harare, Zimbabwe. [peterfdb@rttcp.org.zw]

Between August 1995 and June 1997 a survey to determine the distribution of tsetse-transmitted trypanosomosis was conducted in the Eastern Caprivi. A total of 1481 adult cattle was examined at 33 sampling sites. Direct parasitological diagnostic tests (mHCT, Giemsa-stained thick and thin blood smears) were used, and eluted blood spots were screened by ELISA for the presence of anti-trypanosomal antibodies. Tsetse-transmitted trypanosomal infections were detected in 66 animals (4.5%) from 14 different locations (*Trypanosoma vivax* 81.8%, *T. congolense* 16.7% and mixed *T. vivax/T. congolense* 1.5%). Of 1196 blood spots screened for trypanosomal antibodies, only 115 (9.6%) were positive. The parasitological and serological prevalence of trypanosomosis was highest in the Mamili area. Trypanosomosis was virtually absent in the Linyanti/Chobe area, and the target barrier along the Kwando River had significantly reduced the prevalence of trypanosomosis in cattle grazing to the east of it. Survey results suggest that, in the Katima Mulilo area, trypanosomal infections were being acquired when cattle grazed along the Zambezi River. However, no *Glossina morsitans centralis*, the only tsetse species present in the Eastern Caprivi, were trapped in the area, indicating that tsetse have not been able to establish themselves in the Katima Mulilo area, though the trapping methods used have low sensitivity. The parasitological prevalence in a herd, which was positively correlated with the respective prevalence of anti-trypanosomal antibodies, was significantly correlated to the percentage of anaemic animals in that herd. It is concluded that the prevalence of anti-trypanosomal antibodies in a herd can be used not only as an indicator of the extent of infection in a particular herd but also to evaluate and monitor the effectiveness of tsetse control measures.

11502 **Bossche, P. van den, Shumba, W. and Makhambera, P., 2000.** The distribution and epidemiology of bovine trypanosomosis in Malawi. *Veterinary Parasitology*, **88** (3-4): 163-176.

Bossche: RTTCP, P.O. Box A560, Harare, Zimbabwe. [peterfdb@rttcp.org.zw]

A survey to update the distribution and clarify the epidemiology of bovine trypanosomosis in Malawi was conducted between 1995 and 1997 using parasitological and serological (anti-trypanosomal antibody-detection ELISA) diagnostic methods. Trypanosomal infections were detected in cattle sampled adjacent to known tsetse foci. The distribution of cattle with anti-trypanosomal antibodies indicated that the distribution of bovine trypanosomosis was more widespread than the parasitological prevalence data suggested. This is attributed to the seasonal movement of tsetse (mainly *Glossina morsitans morsitans* and *G. pallidipes*) from its prime habitat and the presence of localised foci of *G. brevipalpis*. The odour-baited, insecticide-treated target barriers along the edge of Kasungu National Park and the Nkhotakota Game Reserve appeared to be effective in preventing tsetse from moving outside the game areas and contacting cattle. The ELISA had high sensitivity in detecting *Trypanosoma congolense* infections. In parasitologically negative animals, the average PCV was higher in those that had no anti-trypanosomal

antibodies and decreased with increasing antibody titre. The ELISA proved to be a useful tool in establishing the distribution of bovine trypanosomiasis and clarifying its epidemiology in Malawi.

- 11503 **Clausen, P.-H., Gebreselassie, G., Abditcho, S., Mehlitz, D. and Staak, C., 1998.** Detection of trypanosome DNA in serologically positive but aparasitaemic horses suspected of dourine in Ethiopia. *Tokai Journal of Experimental and Clinical Medicine*, **23** (6): 303-308.

Clausen: Institute for Parasitology and Tropical Veterinary Medicine, Freie Universität Berlin, Königsweg 67, D-14163 Berlin, Germany. [tropvetm@komma.zedat.fu-berlin.de]

A field study of horses was conducted in the province of Bale in the Ethiopian highlands. A rapid questionnaire analysis indicated that dourine (*Trypanosoma equiperdum* infection), known as 'Dirressa', is a major health problem of equines in this area. A total of 121 horses suspected of dourine were examined by clinical, parasitological, serological and DNA-based techniques. Incoordination of hindlegs (76%), swelling of external genitalia (48.8%) and emaciation (39.7%) were the most common clinical signs. Using the haematocrit centrifugation technique (HCT), no trypanosomes were detected in blood, genital washes or tissue fluids. By contrast, trypanosome-specific DNA products were amplified by PCR and subsequently detected by DNA probe hybridisation in blood samples of 29 of 104 horses (27.9%). Overall, 34 of 120 horses (28.3%) were positive by the complement fixation test (CFT) and 51 (42.5%) by ELISA. All horses positive by PCR were serologically positive by CFT and/or ELISA. Positive PCR results were significantly associated with swelling of external genitalia ($P < 0.05$). There is strong evidence, although there was no direct detection of *T. equiperdum*, that dourine is highly prevalent in the area, a finding which is in accordance with earlier reports. It is concluded that this PCR assay provides a very sensitive tool in the diagnosis of active infections of dourine in endemic areas where trypanocidal drug use is common.

- 11504 **Ndoutamia, G., Brahim, B.O., Brahim, A., Djimgang, G., Saboun, M. and Doutoum, A.A., 1999.** La trypanosomose à *Trypanosoma evansi* chez les camelidés au Tchad: facteurs épidémiologiques et influence sur les paramètres hématologiques et protéo-énergétiques. [*T. evansi* infection of camels in Chad: epidemiological factors and effect on some blood components, protein and energy constituents.] *Revue de Médecine vétérinaire*, **150** (11): 899-904.

Ndoutamia: Laboratoire de Recherches Vétérinaires et Zootechniques de Farcha, B.P. 433, N'Djamena, Chad.

The latex agglutination antigen test (Suratex) and parasitological examination of blood smears were used to study the epidemiology of camel trypanosomiasis due to *T. evansi* in all the camel-rearing regions of Chad. Overall prevalence rates of 6.01% and 24.08% were seen for parasitological and serological techniques, respectively. The infection rate varied according to the geographical region and management practices. It was 0% for Zouar (Region I) and Faya-Tigui-Couba (Region II) using parasitological examination, compared with seropositivities of 6% and 10%, respectively. Kalait-

Oumchalouba-Fada (Region III), situated on the borders of the saharan and sahelian zones, had a prevalence of 12.08% by blood smears and 38.04% by Suratex. Biltine (Region IV) and Kanem (Region V) had parasitological prevalences of 12.29% and 8.23%, and serological prevalences of 40.98% and 31.37%, respectively. The prevalence rates were significantly higher ($P < 0.001$) among nomadic camel herds than among sedentary ones. The prevalence was low ($P < 0.001$) among young camels aged 0-4 years, reached its maximum in the 4- to 10-year age group and fell to its lowest level in animals over 10 years old. The survey indicated that *T. evansi* infection has a significant negative effect on the haematological parameters and protein constituents of camels, and therefore on their physiology, thus limiting their productivity.

- 11505 **Ogunbanwo, J.A., 1998.** Sero-prevalence survey for trypanosomiasis using antigen detection enzyme linked immunosorbent assay. *Journal of Parasitic Diseases*, **22** (2): 126-128.

International Centre for Genetic Engineering and Biotechnology, P.O. Box 10504, Aruna Asaf Ali Marg, New Delhi 110067, India.

The antigen-detection ELISA was used to screen 120 serum samples from cattle, all of which were parasitologically negative for trypanosomes, in 14 Local Government Areas of Plateau and Bauchi States of Nigeria. Two (1.6%) were positive for *Trypanosoma brucei* and nine (7.5%) for *T. vivax*, while none was positive for *T. congolense*. The Ag-ELISA test specificities were 98.4% for *T. brucei*, 92.5% for *T. vivax* and 100% for *T. congolense*.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **23**: no. 11504.]

- 11506 **Audu, P.A., Esievo, K.A.N., Mohammed, G., Ajanusi, O.J. and Ibrahim, N.D.G., 1999.** Pathological observations in *Trypanosoma evansi* infected Yankasa sheep. *Journal of Protozoology Research*, **9** (2): 64-70.

Audu: Department of Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria.

The pathology of *T. evansi* infection in Yankasa sheep was studied using an isolate obtained from the blood of an infected camel slaughtered at Kano abattoir, Kano State, Nigeria. Pathological changes affecting various organs were noted, including pale and anaemic carcasses and serious atrophy of adipose tissue. The major gross lesions observed were lymphadenitis, lymphadenopathy and splenomegaly. Histopathological changes in the infected sheep included fatty degeneration involving hepatocytes, erythrophagocytosis and haemosiderosis associated with focal areas of hepatic necrosis in chronic cases. Glomerular necrosis, and necrosis of proximal and distal collecting tubules, mononuclear cell infiltration and congestion were observed in the kidneys of the infected sheep. Other lesions associated with the infection included emphysema, pulmonary congestion and diffuse mononuclear cell infiltration into the lung parenchyma

(pneumonia). There were no significant findings in the organs of the control sheep. These results indicate the susceptibility of Yankasa sheep to the *T. evansi* isolate. Full genetic characterisation of the isolate was, however, not carried out.

11507 **Ben Romdhane, S., Jemli, M.H., Romdane, M.N., Landolsi, R., Kaabachi, N., Feki, M. and M'Bazaa, A., 1999.** Electrophorèse des protéines sériques chez le dromadaire en Tunisie: application à la trypanosomose à *Trypanosoma evansi*. [Electrophoresis of serum proteins in dromedary camels in Tunisia: application to *T. evansi* infections.] *Revue de Médecine vétérinaire*, **150** (12): 951-956.

Ben Romdhane: Service de Biochimie, Ecole Nationale de Médecine Vétérinaire, 2020 Sidi Thabet, Tunisia.

In order to assess the electrophoretic profiles in dromedary camels (*Camelus dromedarius*) with trypanosomosis due to *T. evansi*, 125 male animals aged 4-7 years from southern Tunisia were used. The animals were divided into three groups: healthy animals serologically negative for *T. evansi* infection (as tested by indirect immunofluorescence), seropositive animals without clinical signs, and seropositive animals with clinical signs. Blood samples were taken from these camels and the sera obtained were analysed for total proteins and their fractions using cellulose acetate electrophoresis. In all the animals, results showed the existence of five protein fractions: albumin, α_1 , α_2 , β , and γ globulins. Hyperprotidemia and increased γ globulins were seen in seropositive animals with and without clinical signs.

11508 **Kadima, K.B., Umar, I.A., Omege, J.J., Igbokwe, I.O., Ibrahim, N.D.G., Gyang, E.O., Saror, D.I. and Esievo, K.A.N., 1999.** Effects of lactose in saline infusion on electrolyte alterations in *Trypanosoma vivax*-infected cattle. *Journal of Clinical Biochemistry and Nutrition*, **27** (1): 27-36.

Esievo: Department of Veterinary Pathology and Microbiology, Ahmadu Bello University, Zaria, Nigeria.

Alteration of serum electrolytes (Na^+ , K^+ , Cl^- , and HCO_3^-) was studied in Zebu cattle experimentally infected with 11.0×10^6 *T. vivax*. Another group of similarly infected cattle was i.v. infused with lactose in normal saline, at a dose rate of 0.5 g/kg body weight as a function of the animal blood volumes of about 6-7% of their body weights. Serum Na^+ and Cl^- concentrations showed significant ($P < 0.05$) increases following decreasing parasitaemia on days 6, 7 and 8 p.i., whereas the greatest drops, resulting in hyponatraemia and hypochloraemia, occurred at the period when parasites were very scant in the blood. The Na^+ and Cl^- returned to normal between days 10 and 13 p.i., coinciding with the second parasitaemic wave. K^+ values showed a nonsignificant decline following the decline of parasitaemia, and rose to normal values thereafter, around the second wave of parasitaemia. The HCO_3^- values were lowest when the parasites became numerous in the blood on day 3 p.i., with a significant ($P < 0.05$) decrease at peak parasitaemia on day 5 p.i. Subsequently, HCO_3^- concentrations increased when parasites became low in number in the peripheral circulation; thereafter, interrupted but significant

($P < 0.05$) increases in HCO_3^- values occurred as the disease progressed. With the i.v. infusion of lactose in normal saline when the disease had been established, evidenced by peak parasitaemia and declining PCV, serum Na^+ and Cl^- remained normal as observed in the first uninfected uninfused group. The variations of K^+ and HCO_3^- showed a similar pattern during the infusion. The values of all four electrolytes were relatively reduced immediately after and during the course of the infusion. The anion gaps were 20-22 mM/l for the uninfected group; 22-25 mM/l on days 3-5 p.i. and 16-19 mM/l on days 6-13 p.i. for the infected, uninfused group, whereas infusion into the infected group produced an anion gap of 18-25 mM/l. The choice of saline as a solvent for lactose and the total infusion volume had no detrimental effect on the host's electrolytes and acid-base status; rather, the infusion ameliorated the aberrations in electrolytes associated with *T. vivax* infection in cattle.

- 11509 **Ogbadoyi, E.O., Ukoha, A.I. and Kyewalabe, E.K., 1999.** Anemia in experimental African trypanosomiasis. *Journal of Protozoology Research*, **9** (2): 55-63.

Ogbadoyi: Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Anaemia was monitored in five goats experimentally infected with *Trypanosoma vivax* by measuring the PCV and the haemoglobin (Hb) level up to 26 days p.i. Parasitaemia and serum free fatty acid (FFA) levels were also estimated. Massive parasitaemia was observed on days 5 and 12 p.i. There was a 45-59% decrease in PCV and a 33-63% decrease in Hb level. The serum FFA level progressively increased throughout the course of infection. Anaemia in the early stages of infection is initiated and maintained by living trypanosomes, the severity of the anaemia depending on the level of parasitaemia. Persistent anaemia as the disease process progresses is caused by factor(s) other than living trypanosomes. It is suggested that erythrocyte haemolysis and erythrophagocytosis are the underlying causes of trypanosomal anaemia.

- 11510 **Osaer, S., Akinbamijo, O.O. and Goossens, B., 2000.** Some biochemical changes following *Trypanosoma congolense* infection in Djallonké ewe lambs and breeding ewes fed on two levels of nutrition. *Acta Tropica*, **75** (2): 229-241.

Osaer: ITC, P.M.B. 14, Banjul, Gambia.

The effects of artificial *T. congolense* infection and dietary level on biochemical changes were observed in 24 ewe lambs (Experiment 1) and 42 breeding ewes (Experiment 2). All animals belonged to the Djallonké breed which is known to be trypanotolerant. For both experiments, there were four treatment combinations, of which two were kept on a restricted diet (L), the other two on an *ad libitum* diet (H). Half of each dietary group was infected with *T. congolense* (LI, HI), while the remainder served as uninfected controls (LC, HC). Artificial *T. congolense* infection took place at the age of 200 ± 7 days in Experiment 1 and at the peak of oestrus in Experiment 2. Irrespective of dietary levels offered, total proteins in lambs and ewes and albumin in lambs declined significantly ($P < 0.001$) post infection. Plasma glucose concentration was reduced by the low dietary level and not by infection. Although plasma urea concentrations were slightly

increased in the infected ewe lambs, adult ewes in the HI group demonstrated significantly increased plasma urea concentrations ($P < 0.05$) due to an interaction between infection and diet. Neither infection nor the imposed diet induced significant changes on plasma creatinine concentrations. Transitory peaks in non-esterified fatty acids (NEFA) and β -hydroxy butyric acid (BHBA) levels in infected ewes on low dietary level indicated temporary changes in the energy metabolism of the host. It was concluded from this study that, in spite of their trypanotolerance, Djallonké lambs and ewes demonstrated an infection effect on host metabolism pattern due to *T. congolense* infection. These changes reflected to some extent trypanosome-induced alteration of the nutrient metabolism, which could not always be negated by dietary supplements. Nutrition, as an independent factor, did confer added benefits against the debilitating effects of trypanosomosis under the conditions of the present study.

11511 Osaer, S., Goossens, B., Eysker, M. and Geerts, S., 2000. The effects of prophylactic anthelmintic treatment on the productivity of traditionally managed Djallonké sheep and West African Dwarf goats kept under high trypanosomosis risk. *Acta Tropica*, **74** (1): 13-24.

Osaer: ITC, P.M.B. 14, Banjul, Gambia.

The effects of a prophylactic anthelmintic intervention on the productivity of village based sheep and goats was studied in an area of high trypanosomosis risk in The Gambia during 2 and 3 years, respectively. In total, 223 sheep and 385 goats from five villages were included. Allocation to treatment groups (treated-control) was randomised by village, based on age and sex. Three treatments with fenbendazole (Panacur 2.5%, 5 mg/kg) per rainy season were applied. Mean nematode egg counts per gram faeces (EPG) of treated groups were significantly reduced by prophylactic anthelmintic treatment, indicating the efficiency of the treatment despite the risk of rapid reinfestation. Weight gain benefits were observed in all age categories (> 6 months) of sheep, but not in goats. Kidding rates were significantly increased while positive, though not statistically significant, trends were observed for other reproductive parameters (litter size, parturition interval) in both goats and sheep. Birth weights of offspring of treated does and ewes were higher ($P < 0.05$) than those of controls. In contrast, growth rates up to 3 months of age were not influenced by the treatment status of the dam. Mortality rates of kids up to the age of 3 months from treated does were significantly lower than those from control does. Mean PCV levels during the rains were significantly higher in treated goats than in controls. The same trend was observed in sheep. In general, there were no interactions between trypanosome infections and effect of anthelmintic treatment, the two factors acting independently. Finally, the live weight productivity index (12-month-old offspring in kg/year/dam) was 24% and 47% higher in treated than in control ewes and does, respectively. It was concluded that, despite the continuous risk of trypanosome infections which have a negative impact on their productivity, anthelmintic treatment had a beneficial effect on both species but most obviously on goats, measured as an increased production and improved health status. A cost-benefit analysis is needed to confirm whether prophylactic anthelmintic treatment can be recommended to farmers to increase their income from small ruminant production. Anthelmintic treatment will certainly optimise trypanotolerance in these breeds.

- 11512 **Rowlands, G.J., Woudyalew Mulatu, Leak, S.G.A., Nagda, S.M. and d'Ieteren, G.D.M., 1999.** Estimating the effects of tsetse control on livestock productivity: a case study in southwest Ethiopia. *Tropical Animal Health and Production*, **31** (5): 279-294.

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

A tsetse control campaign was started in January 1991 using cypermethrin 'pour-on' applied monthly to cattle exposed to high levels of drug-resistant *Trypanosoma congolense* in the Ghibe valley of south-west Ethiopia. In December 1992, a cost-recovery scheme was introduced, and thereafter farmers paid for treatment. An average of 100 village Ethiopian Highland Zebu cattle were monitored monthly from March 1986 to February 1997. Individual animals in this herd were treated with diminazene aceturate at 3.5 mg/kg when trypanosomes were detected and their PCV was less than 26%. Superimposed on this systematic trypanocidal chemotherapy, control of tsetse (*Glossina pallidipes*, *G. morsitans submorsitans*) resulted in average reductions from 1992 to 1996 of 95% and 75% in the mean relative densities of tsetse and biting flies, respectively, and of 63% in the prevalence of trypanosomal infections in cattle. Despite these reductions, there was no significant increase in the body weight of the cows, calving rate or the mean body weight of calves at 12 months of age. There was, however, an average decrease of 57% in calf mortality (including stillbirths) by 12 months of age, an increase of 49% in the ratio of live calves under 12 months of age to cows over 36 months of age, and an increase of 8% in the body weight of adult males.

(c) TRYPANOTOLERANCE

[See also **23**: no. 11453.]

- 11513 **d'Ieteren, G.D.M., Authié, E., Wissocq, N. and Murray, M., 2000.** Resistance to trypanosomes and trypanosomosis. In: Axford, R.F.E., Bishop, S.C., Nicholas, F.W. and Owen, J.B. (eds), *Breeding for disease resistance in farm animals* (Wallingford, UK; CABI Publishing), pp. 195-216.

d'Ieteren: ILRI, P.O. Box 30709, Nairobi, Kenya.

The experimental and field studies reviewed in this chapter are providing the basic tools with which the trypanotolerance trait can be identified and exploited. Comprehensive evaluation of the degree of genetic determination of the different disease resistance traits, their heritability and their genetic correlations with each other and with animal performance traits should allow progress to be made in the development of breeding programmes and policies. This book starts with a section covering principles and methods (DNA markers, genetic maps and the identification of quantitative trait loci; modelling farm animal disease; the immune system; the major histocompatibility complex and its role in disease resistance and immune responsiveness; rodent models of genetic resistance to parasitic infections) and includes chapters on other diseases of farm animals.

(d) TREATMENT

- 11514 **Bossche, P. van den, Doran, M. and Connor, R.J., 2000.** An analysis of trypanocidal drug use in the Eastern Province of Zambia. *Acta Tropica*, **75** (2): 247-258.

Bossche: RTTCP, P.O. Box A560, Harare, Zimbabwe. [petervd@rttcp.org.zw]

As part of the development of a strategy for the control of bovine trypanosomosis in Zambia, a survey was conducted to quantify and qualify the current use of trypanocidal drugs (diminazene aceturate and isometamidium chloride) in a tsetse-controlled and a tsetse-infested area of the Eastern Province. A total of 207 trypanocide users were interviewed. Questions were posed on herd structure, trypanocidal drug preference, treatment strategy, reason for treatment, method of treatment and treatment frequency. The majority of the cattle owners preferred to use diminazene aceturate rather than isometamidium chloride. Both trypanocides were mainly used to treat clinically sick animals (not necessarily infected with trypanosomes) and preference was given to the treatment of oxen and cows. The proportion of animals treated and the frequency of drug application did not differ between the two areas. Hence, in the tsetse-controlled area, a high proportion of the trypanocide treatments was inappropriate. In the tsetse-infested area, on the other hand, the treatment of clinically sick animals significantly reduced the trypanosomosis-related mortality but was insufficient to boost reproduction in cows. Despite the fact that the cattle owners administered most trypanocides themselves, evidence from the survey suggests that most of the farmers did not under-dose with either diminazene aceturate or isometamidium chloride. Moreover, other factors enhancing the development of resistance to trypanocides in trypanosomes were not present in the areas surveyed. Conclusions are drawn on the usefulness of this type of survey in determining appropriate methods to control bovine trypanosomosis.

- 11515 **Gu, Y., Gettinby, G., McKendrick, I., Murray, M., Peregrine, A.S. and Revie, C., 1999.** Development of a decision support system for trypanocidal drug control of bovine trypanosomosis in Africa. *Veterinary Parasitology*, **87** (1): 9-23.

Revie: Department of Information Science, University of Strathclyde, Glasgow G1 1XH, UK.

TrypsChemo is an expert system that attempts to aid the application of veterinary knowledge to disease management. It has been designed to maximise the effectiveness and cost efficiency of the different trypanocidal drug regimens currently available for prophylaxis and treatment of tsetse-transmitted bovine trypanosomosis in Africa. This paper describes the design of TrypsChemo, the properties of the system, and illustrates how it can be used to support decision making for trypanocidal drug control. The system was developed as part of a larger decision support project carried out in association with ILRI and is currently undergoing a structured evaluation by potential users in Africa.

7. EXPERIMENTAL TRYPANOSOMIASIS**(a) DIAGNOSTICS**

[See also **23**: no. 11536.]

- 11516 **Mbati, P.A., Hirumi, K., Inoue, N., Situakibanza, N.H. and Hirumi, H., 1999.** Comparison of PCR with parasitology and serology in the diagnosis of a low virulent strain of *Trypanosoma brucei gambiense* in mice. *Journal of Protozoology Research*, **9** (1): 1-9.

Mbati: Qwa-Qwa Campus, University of the North, Parasitology Research Program, Private Bag X13, Phuthaditjaba 9866, South Africa. [mbati@uniquwa.ac.za]

(b) PATHOLOGY AND IMMUNOLOGY

[See also **23**: nos. 11533, 11566.]

- 11517 **Eckersall, P.D., Rodgers, J., Murray, M. and Kennedy, P.G.E., 1999.** Haptoglobin, the acute phase response and natural human immunity to trypanosomes. (Letter and reply.) *Parasitology Today*, **15** (6): 251-252.

Eckersall: Department of Veterinary Clinical Studies, University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

The letter comments on the article by S. Tomlinson and J. Raper in *Parasitology Today*, **14** (9): 354-359 (see *TTIQ*, **22** (1): 10778). It is followed by the original authors' reply.

- 11518 **Eltayeb, R., Sharafeldin, A., Jaster, R., Bittorf, T., Mix, E. and Bakhiet, M., 2000.** *Trypanosoma brucei brucei* induces interferon- γ expression in rat dorsal root ganglia cells via a tyrosine kinase-dependent pathway. *Journal of Infectious Diseases*, **181** (1): 400-404.

Eltayeb: Division of Infectious Diseases (F-82), Karolinska Institute, Huddinge University Hospital, SE-14186 Huddinge, Sweden.

- 11519 **Girard, M., Ayed, Z., Preux, P.-M., Bouteille, B., Preud'homme, J.-L., Dumas, M. and Jauberteau, M.-O., 2000.** *In vitro* induction of nitric oxide synthase in astrocytes and microglia by *Trypanosoma brucei brucei*. [Mice.] *Parasite Immunology*, **22** (1): 7-12.

Jauberteau: Laboratory of Immunology, University Hospital, 2 avenue Martin Luther King, F-87042 Limoges, France. [jauberte@unilim.fr]

- 11520 **Laurenzi, M.A., Marinucci, E., Chianella, S., Semprevivo, M. and Grassi Zucconi, G., 1999.** Microglial activation in two experimental models of sleep disorders. [*T. brucei*; rats.] (Meeting abstract no. P46.) *Neuroimmunomodulation*, **6** (6): 445.

Laurenzi: Department of Cell Biology, Faculty of Biological Sciences, University of Perugia, 06100 Perugia, Italy.

- 11521 **Nyakundi, J.N. and Pentreath, V.W., 1999.** Preliminary observations on the intestinal pathology of mice infected with *Trypanosoma brucei brucei*. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **93** (6): 628-630.

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

- 11522 **Quan, N., Mhlanga, J.D.M., Whiteside, M.B., McCoy, A.N., Kristensson, K. and Herkenham, M., 1999.** Chronic overexpression of proinflammatory cytokines and histopathology in the brains of rats infected with *Trypanosoma brucei*. *Journal of Comparative Neurology*, **414** (1): 114-130.

Herkenham: Section on Functional Neuroanatomy, National Institute of Mental Health, Building 36, Room 2D15, Bethesda, MD 20892-4070, USA.

- 11523 **Radwanska, M., Magez, S., Michel, A., Stijlemans, B., Geuskens, M. and Pays, E., 2000.** Comparative analysis of antibody responses against HSP60, invariant surface glycoprotein 70, and variant surface glycoprotein reveals a complex antigen-specific pattern of immunoglobulin isotype switching during infection by *Trypanosoma brucei*. [Mice.] *Infection and Immunity*, **68** (2): 848-860.

Radwanska: Laboratory of Molecular Parasitology, IBMM, Free University of Brussels, 12 rue des Professeurs Jeener et Brachet, B-6041 Gosselies, Belgium.

- 11524 **Seed, J.R. and Black, S.J., 1999.** A revised arithmetic model of long slender to short stumpy transformation in the African trypanosomes. [*T. brucei*; mice.] *Journal of Parasitology*, **85** (5): 850-854.

Seed: Department of Epidemiology, School of Public Health, McGavran Greenberg Hall, University of North Carolina, Chapel Hill, NC 27599-7400, USA.

- 11525 **Sharafeldin, A., Eltayeb, R., Pashenkov, M. and Bakhiet, M., 2000.** Chemokines are produced in the brain early during the course of experimental African trypanosomiasis. [*T. b. brucei*; rats.] *Journal of Neuroimmunology*, **103** (2): 165-170.

Sharafeldin: Division of Infectious Diseases (F-82), Karolinska Institute, Huddinge University Hospital, SE-14186 Huddinge, Sweden.

(c) CHEMOTHERAPEUTICS

[See also **23**: nos. 11547, 11553, 11556, 11563, 11566, 11570, 11572.]

- 11526 **Barrett, M.P., Fairlamb, A.H., Rousseau, B., Chauvière, G. and Périé, J., 2000.** Uptake of the nitroimidazole drug meglazol by African trypanosomes. [*T. brucei*.] *Biochemical Pharmacology*, **59** (6): 615-620.

Barrett: Division of Infection and Immunity, Institute of Biomedical and Life Sciences, University of Glasgow, Glasgow G12 8QQ, UK.

- 11527 **Caffrey, C.R., Scory, S., Ruppel, A., McKerrow, J.H. and Steverding, D., 1999.** Cysteine proteinase inhibitors as chemotherapy of African sleeping sickness. (Meeting abstract no. 1295.) *FASEB Journal*, **13** (7 Suppl.): A1557.

Caffrey: Department of Pathology, University of California, San Francisco, CA, USA.

- 11528 **Croft, S.L., 1999.** Antiparasitic agents: challenges of sleeping sickness, hopes for malaria. (Editorial review.) *Current Opinion in Infectious Diseases*, **12** (6): 557-558.

Department of Infectious and Tropical Diseases, LSHTM, University of London, Keppel Street, London WC1E 7HT, UK.

- 11529 **Fagbenro-Beyioku, A.F., Otigbuo, I.N., Ikeji-Ogwude, R.N. and Thomas, B.N., 1999.** Trypanocidal potentials of metronidazole and chloroquine in *Trypanosoma vivax* infection. [Mice.] (Meeting abstract no. 732.) *American Journal of Tropical Medicine and Hygiene*, **61** (3 Suppl.): 454.

Fagbenro-Beyioku: Tropical Diseases Research Laboratory, Department of Medical Microbiology and Parasitology, College of Medicine, University of Lagos, Lagos, Nigeria.

- 11530 **Gomes-Cardoso, L., Echevarria, A., Aguiar-Alves, F., Jansen, A.M. and Leon, L.L., 1999.** Amidine derivatives are highly effective against *Trypanosoma evansi* trypomastigotes. *Microbios*, **100** (397): 181-187.

Leon: Departamento de Imunologia, Instituto Oswaldo Cruz, Rio de Janeiro, RJ, Brazil.

- 11531 **Keiser, J. and Burri, C., 1999.** Investigations on the metabolism of the trypanocidal drug melarsoprol. [Melarsen oxide; mice.] (Meeting abstract no. 729.) *American Journal of Tropical Medicine and Hygiene*, **61** (3 Suppl.): 453.

Keiser: Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland.

- 11532 **Keiser, J. and Burri, C., 2000.** Physico-chemical properties of the trypanocidal drug melarsoprol. *Acta Tropica*, **74** (1): 101-104.

Burri: Department of Medical Parasitology and Infection Biology, Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland. [christian.burri@unibas.ch]

The protein binding, the coefficient of partition between water and *n*-octanol (*P*) and the dissociation constant (pK_b) of melarsoprol and melarsen oxide (one of its suggested metabolites) were studied. The average value of *P* for melarsen oxide was determined as 8.4 while that of melarsoprol was calculated to be approximately 160. Values of total serum protein binding of 79% and 72%, albumin binding of 79% and 46% and α -1-acid glycoprotein binding of 70% and 37% for melarsoprol and melarsen oxide, respectively, were calculated. The pK_b was 9.2 for melarsoprol and 9.5 for melarsen oxide. Both compounds are in the medium protein binding range of 50-85% which, together with the ionisation constant, may explain the small fraction of the drug which is available to add to the concentration gradient which drives distribution into the CSF. Elucidation of the metabolic pathway and more detailed pharmacokinetic studies of melarsoprol are recommended.

- 11533 **Kennedy, P.G.E., 1999.** The pathogenesis and modulation of the post-treatment reactive encephalopathy in a mouse model of human African trypanosomiasis. [*T. b. brucei*.] *Journal of Neuroimmunology*, **100** (1-2): 36-41.

Glasgow University Department of Neurology, Southern General Hospital, South Glasgow University Hospitals NHS Trust, Glasgow G51 4TF, UK.

- 11534 **Kondo, K., Horie, M., Murayama, M., Suzuki, T. and Toyoda, M., 1999.** [Determination of residual isometamidium in cattle tissues and milk by HPLC.] (In Japanese with English summary.) *Journal of the Food Hygienic Society of Japan*, **40** (3): 211-217.

National Institute of Health Sciences, 1-18-1 Kamiyoga, Setagaya-ku, Tokyo 158-8501, Japan.

- 11535 **Matovu, E., Mäser, P., Enyaru, J.C.K. and Kaminsky, R., 1999.** Drug resistance in Ugandan trypanosomes. [*T. b. gambiense*, *T. b. rhodesiense*.] (Meeting abstract.) *Schweizerische Medizinische Wochenschrift*, **129** (31-32): 1128.

Matovu: Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland.

- 11536 **Mbati, P.A., Hirumi, K., Inoue, N., Situakibanza, N.H. and Hirumi, H., 1999.** Towards developing a diagnostic regimen for the treatment follow-up of *Trypanosoma brucei gambiense*. [Mice; melarsoprol.] *Korean Journal of Parasitology*, **37** (4): 289-292.

Mbati: Qwa-Qwa Campus, University of the North, Parasitology Research Program, Private Bag X13, Phuthaditjaba 9866, South Africa. [mbati@uniqwa.ac.za]

- 11537 **Nichols, A.C., Yielding, K.L. and Agbe, S.A.O., 2000.** A chlorodiazirine analog of pentamidine with anti-trypanosomal activity. [*T. brucei*.] *Journal of Parasitology*, **86** (1): 177-180.

Nichols: Department of Chemistry, University of Alabama, Florence, AL 35632, USA.

- 11538 **Quan, N., Mhlanga, J.D.M., Whiteside, M.B., Kristensson, K. and Herkenham, M., 2000.** Chronic sodium salicylate treatment exacerbates brain neurodegeneration in rats infected with *Trypanosoma brucei*. *Neuroscience*, **96** (1): 181-194.

Herkenham: Section on Functional Neuroanatomy, National Institutes of Mental Health, Building 36, Room 2D15, Bethesda, MD 20892-4070, USA.

- 11539 **Susperregui, J., Bayle, M., Lain, G., Giroud, C., Baltz, T. and Délérís, G., 1999.** Synthesis and evaluation of the *in vivo* trypanocidal activity of water soluble organotin compounds. [*T. equiperdum*; mice.] *European Journal of Medicinal Chemistry*, **34** (7-8): 617-623.

Délérís: Laboratoire de Chimie Bio-Organique, Université de Victor Ségalen Bordeaux 2, 146 rue Léo Saignat, F-33076 Bordeaux, France.

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

[See also **23**: no. 11488.]

- 11540 **Biteau, N., Bringaud, F., Gibson, W., Truc, P. and Baltz, T., 2000.** Characterization of *Trypanozoon* isolates using a repeated coding sequence and microsatellite markers. *Molecular and Biochemical Parasitology*, **105** (2): 185-201.

Biteau: Laboratoire de Parasitologie Moléculaire, UPRESA-5016 CNRS, Université Victor Ségalen de Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux Cedex, France.

A repeated DNA coding sequence and eleven new microsatellites identified within the *Trypanozoon* genome were analysed. Ninety-seven isolates belonging to *Trypanosoma evansi*, *T. equiperdum*, *T. brucei brucei*, *T. b. rhodesiense* and *T. b. gambiense* were compared. The results revealed a great heterogeneity of the genotypes related to the repeated coding sequence and five microsatellites, some of which showed a high degree of poly-morphism. The data allowed definition of group-specific genotypes or alleles; in particular, it was shown that one specific pattern clearly segregates *T. b. gambiense* group 1.

- 11541 **Eshita, Y., Majiwa, P.A.O., Urakawa, T., Inoue, N., Hirumi, K., Yanagi, T., Yoneda, Y., Hara, T., Higuchi, T., Fukuma, T. and Hirumi, H., 1998.** The application of molecular biological tools to epidemiology of African trypanosomiasis. *Tokai Journal of Experimental and Clinical Medicine*, **23** (6): 401-411.

Eshita: Department of Parasitology, Kurume University School of Medicine, 67 Asahi-machi, Kurume-shi, Fukuoka 830-0011, Japan. [yeshita@med.kurume-u.ac.jp]

Molecular karyotypes of strains and subspecies of the *Trypanosoma brucei* complex were analysed by pulsed-field gel electrophoresis (PFGE) in the 45-2000 kb range. Distinctive differences were found in intermediate and mini-chromosomes among the strains and even between two strains derived from the same clone. Cluster analysis placed five strains of *T. b. brucei* in one cluster, the *T. b. rhodesiense* strain relatively close, the two *T. b. gambiense* strains further away, and a sixth *T. b. brucei* strain between the two *T. b. gambiense* strains. In another study, the nucleotide sequences of ribosomal DNAs of a number of strains of different *Trypanosoma* species were compared by PCR. The data suggested that the four types of *T. congolense* should be classified as individual species and that *T. evansi* should be regarded as a subspecies of *T. brucei*. The use of other molecular biological tools for phylogenetic classification and studying the molecular epidemiology of African trypanosomiasis is reviewed.

- 11542 **Hide, G., 1998.** Evolutionary relationships among the African trypanosomes: implications for the epidemiology and generation of human sleeping sickness epidemics. In: Coombs, G.H., Vickerman, K., Sleigh, M.A. and Warren, A. (eds), *Evolutionary relationships among Protozoa* (Dordrecht, Netherlands; Kluwer Academic Publishers; Systematics Association Special Volume Series no. 56), pp. 213-227.

Wellcome Unit of Molecular Parasitology, Anderson College, University of Glasgow, Glasgow G11 6NU, UK.

A system is described where restriction fragment length polymorphism analysis of repetitive DNA sequences is used to determine the evolutionary relationships among the *Trypanosoma brucei* complex. Subjects reviewed include the genetic diversity of *T. brucei* strains, the origin of human infectivity, the composition of strains circulating during a sleeping sickness epidemic, the stability of strains over time, the contribution of genetic exchange to diversity in trypanosome populations, the contribution of animal reservoirs to human epidemics, the genotypic composition of strains circulating in an individual animal, and the diversity of strains in endemic as compared with epidemic areas. A model for the origins and maintenance of human sleeping sickness foci and epidemics is proposed. The importance of an evolutionary approach to the identification of trypanosome strains to facilitate an understanding of the epidemiology, population genetics and origins of human sleeping sickness is highlighted.

- 11543 **Stevens, J.R. and Gibson, W., 1999.** The molecular evolution of trypanosomes. (Review.) *Parasitology Today*, **15** (11): 432-437.

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

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

- 11544 **Acosta-Serrano, A., Cole, R.N., Mehlert, A., Lee, M.G.-S., Ferguson, M.A.J. and Englund, P.T., 1999.** The procyclin repertoire of *Trypanosoma brucei*: identification and structural characterization of the Glu-Pro-rich polypeptides. *Journal of Biological Chemistry*, **274** (42): 29763-29771.

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

- 11545 **Baeschlin, D.K., Chaperon, A.R., Green, L.G., Hahn, M.G., Ince, S.J. and Ley, S.V., 2000.** 1,2-diacetals in synthesis: total synthesis of a glycosyl-phosphatidylinositol anchor of *Trypanosoma brucei*. *Chemistry – A European Journal*, **6** (1): 172-186.

Ley: Department of Chemistry, University of Cambridge, Lensfield Road, Cambridge CB2 1EW, UK. [svl1000@cam.ac.uk]

- 11546 **Bakker, B.M., Mensonides, F.I.C., Teusink, B., Hoek, P. van, Michels, P.A.M. and Westerhoff, H.V., 2000.** Compartmentation protects trypanosomes from the dangerous design of glycolysis. [*T. brucei*.] *Proceedings of the National Academy of Sciences of the United States of America*, **97** (5): 2087-2092.

Westerhoff: Molecular Cell Physiology, BioCentrum Amsterdam, Vrije Universiteit, De Boelelaan 1087, NL-1081 HV Amsterdam, Netherlands.

- 11547 **Bakker, B.M., Westerhoff, H.V., Opperdoes, F.R. and Michels, P.A.M., 2000.** Metabolic control analysis of glycolysis in trypanosomes as an approach to improve selectivity and effectiveness of drugs. [*T. brucei.*] *Molecular and Biochemical Parasitology*, **106** (1): 1-10.

Michels: Research Unit for Tropical Diseases, Christian de Duve Institute of Cellular Pathology, Université Catholique de Louvain, ICP-TROP 74.39, Avenue Hippocrate 74, B-1200 Brussels, Belgium.

- 11548 **Berberof, M., Vanhamme, L., Alexandre, S., Lips, S., Tebabi, P. and Pays, E., 2000.** A single-stranded DNA-binding protein shared by telomeric repeats, the variant surface glycoprotein transcription promoter and the procyclin transcription terminator of *Trypanosoma brucei*. *Nucleic Acids Research*, **28** (2): 597-604.

Pays: Laboratoire de Parasitologie Moléculaire, IBMM, Université Libre de Bruxelles, 12 rue des Professeurs Jeener et Brachet, B-6041 Gosselies, Belgium. [epays@dbm.ulb.ac.be]

- 11549 **Cardoso de Almeida, M.L., Geuskens, M. and Pays, E., 1999.** Cell lysis induces redistribution of the GPI-anchored variant surface glycoprotein on both faces of the plasma membrane of *Trypanosoma brucei*. *Journal of Cell Science*, **112** (23): 4461-4473.

Cardoso de Almeida: Laboratory of Molecular Parasitology, Free University of Brussels, 67 rue des Chevaux, B-1640 Rhode St Genèse, Belgium. [mlcalmei@alize.ulb.ac.be]

- 11550 **Catisti, R., Uyemura, S.A., Docampo, R. and Vercesi, A.E., 2000.** Calcium mobilization by arachidonic acid in trypanosomatids. [Incl. *T. brucei.*] *Molecular and Biochemical Parasitology*, **105** (2): 261-271.

Vercesi: Laboratory of Molecular Parasitology, Department of Pathobiology, University of Illinois, 2001 South Lincoln Avenue, Urbana, IL 61802, USA.

- 11551 **Dilbeck, V., Berberof, M., Cauwenberge, A. van, Alexandre, H. and Pays, E., 1999.** Characterization of a coiled coil protein present in the basal body of *Trypanosoma brucei*. *Journal of Cell Science*, **112** (24): 4687-4694.

Pays: Laboratory of Molecular Parasitology, Free University of Brussels, 67 rue des Chevaux, B-1640 Rhode St Genèse, Belgium.

- 11552 **Duszenko, M., Kang, X.-D., Böhme, U., Hömke, R. and Lehner, M., 1999.** *In vitro* translation in a cell-free system from *Trypanosoma brucei* yields glycosylated and glycosylphosphatidylinositol-anchored proteins. *European Journal of Biochemistry*, **266** (3): 789-797.

Duszenko: Physiologisch-chemisches Institut, University of Tübingen, Hoppe-Seyler-Strasse 4, D-72076 Tübingen, Germany. [michael.duszenko@uni-tuebingen.de]

- 11553 **Ekanem, J.T., 1997.** Inhibitory effect of hydroxyurea on bloodstream form of *Trypanosoma brucei*. *Nigerian Journal of Pure and Applied Science*, **12**: 489-493.

Department of Biochemistry, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria. [jtekanem@unilorin.edu.ng]

- 11554 **Ekanem, J.T., 1997.** Studies on nucleic acid precursors: paucity of cytidine triphosphate in *Trypanosoma brucei*. *Nigerian Journal of Pure and Applied Science*, **12**: 568-572.

Department of Biochemistry, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria. [jtekanem@unilorin.edu.ng]

- 11555 **Estévez, A.M., Thiemann, O.H., Alfonzo, J.D. and Simpson, L., 1999.** T7 RNA polymerase-driven transcription in mitochondria of *Leishmania tarentolae* and *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **103** (2): 251-259.

Simpson: Howard Hughes Medical Institute, UCLA School of Medicine, 6780 MacDonald Building, Los Angeles, CA 90095-1662, USA.

- 11556 **Ferguson, M.A.J., Brimacombe, J.S., Brown, J.R., Crossman, A., Dix, A., Field, R.A., Güther, M.L.S., Milne, K.G., Sharma, D.K. and Smith, T.K., 1999.** The GPI biosynthetic pathway as a therapeutic target for African sleeping sickness. [*T. brucei*.] (Review.) *Biochimica et Biophysica Acta*, **1455** (2-3): 327-340.

Ferguson: Division of Molecular Parasitology and Biological Chemistry, Department of Biochemistry, University of Dundee, Dundee DD1 5EH, UK. [majferguson@bad.dundee.ac.uk]

- 11557 **Field, H., Sherwin, T., Smith, A.C., Gull, K. and Field, M.C., 2000.** Cell-cycle and developmental regulation of TbRAB31 localisation, a GTP-locked Rab protein from *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **106** (1): 21-35. (See also correction in **107** (2): 329-330.)

Field: Wellcome Trust Laboratories for Molecular Parasitology, Department of Biochemistry, Imperial College of Science, Technology and Medicine, Exhibition Road, London SW7 2AY, UK.

- 11558 **Fukai, Y., Amino, H., Hirawake, H., Yabu, Y., Ohta, N., Minagawa, N., Sakajo, S., Yoshimoto, A., Nagai, K., Takamiya, S., Kojima, S. and Kita,**

K., 1999. Functional expression of the ascofuranone-sensitive *Trypanosoma brucei brucei* alternative oxidase in the cytoplasmic membrane of *Escherichia coli*. *Comparative Biochemistry and Physiology (C)*, **124** (2): 141-148.

Kita: Department of Biomedical Chemistry, Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan.

- 11559 **Graham, S.V., Terry, S. and Barry, J.D., 1999.** A structural and transcription pattern for variant surface glycoprotein gene expression sites used in metacyclic stage *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **103** (2): 141-154.

Barry: Wellcome Centre for Molecular Parasitology, Anderson College, University of Glasgow, 56 Dumbarton Road, Glasgow G11 6NU, UK.

- 11560 **Gull, K., 1999.** The cytoskeleton of trypanosomatid parasites. [Mainly *T. brucei*.] (Review.) *Annual Review of Microbiology*, **53**: 629-655.

Gull: School of Biological Sciences, University of Manchester, Manchester M13 9PT, UK. [K.Gull@man.ac.uk]

- 11561 **Ismaili, N., Pérez-Morga, D., Walsh, P., Cadogan, M., Pays, A., Tebabi, P. and Pays, E., 2000.** Characterization of a *Trypanosoma brucei* SR domain-containing protein bearing homology to *cis*-spliceosomal U1 70 kDa proteins. *Molecular and Biochemical Parasitology*, **106** (1): 109-120.

Pays: Laboratoire de Parasitologie Moléculaire, IBMM-ULB, 12 rue des Professeurs Jeener et Brachet, B-6041 Gosselies, Belgium.

- 11562 **Kolb, V., Amann, F., Schmidt, R.R. and Duszenko, M., 1999.** Specific inhibition of an α -galactosyltransferase from *Trypanosoma brucei* by synthetic substrate analogues. *Glycoconjugate Journal*, **16** (9): 537-544.

Duszenko: Physiologisch-chemisches Institut der Universität Tübingen, Hoppe-Seyler-Strasse 4, D-72076 Tübingen, Germany.

- 11563 **Koning, H.P. de, MacLeod, A., Barrett, M.P., Cover, B. and Jarvis, S.M., 2000.** Further evidence for a link between melarsoprol resistance and P2 transporter function in African trypanosomes. [*T. brucei*; mice.] *Molecular and Biochemical Parasitology*, **106** (1): 181-185.

Jarvis: Research School of Biosciences, University of Kent, Canterbury CT2 7NJ, UK.

- 11564 **Koning, H.P. de, Watson, C.J., Sutcliffe, L. and Jarvis, S.M., 2000.** Differential regulation of nucleoside and nucleobase transporters in *Crithidia fasciculata* and *Trypanosoma brucei brucei*. *Molecular and Biochemical Parasitology*, **106** (1): 93-107.

Koning: Division of Infection and Immunity, Institute of Biomedical and Life Sciences, University of Glasgow, Joseph Black Building, Glasgow G12 8QQ, UK.

- 11565 **Kort, M. de, Ebrahimi, E., Wijsman, E.R., Marel, G.A. van der and Boom, J.H. van, 1999.** Synthesis of oligodeoxynucleotides containing 5-(β -D-glycopyranosyloxymethyl)-2'-deoxyuridine, a modified nucleoside in the DNA of *Trypanosoma brucei*. *European Journal of Organic Chemistry*, **1999** (9): 2337-2344.

Boom: Leiden Institute of Chemistry, Gorlaeus Laboratories, University of Leiden, P.O. Box 9502, NL-2300 RA Leiden, Netherlands. [j.boom@chem.leidenuniv.nl]

- 11566 **Krieger, S., Schwarz, W., Ariyanayagam, M.R., Fairlamb, A.H., Krauth-Siegel, R.L. and Clayton, C., 2000.** Trypanosomes lacking trypanothione reductase are avirulent and show increased sensitivity to oxidative stress. [*T. brucei*.] *Molecular Microbiology*, **35** (3): 542-552.

Clayton: Zentrum für Molekulare Biologie, Universität Heidelberg, Im Neuenheimer Feld 282, D-69120 Heidelberg, Germany.

- 11567 **Maga, J.A. and LeBowitz, J.H., 1999.** Unravelling the kinetoplastid paraflagellar rod. [Incl. *T. brucei*.] (Review.) *Trends in Cell Biology*, **9** (10): 409-413.

LeBowitz: Department of Biochemistry, Purdue University, West Lafayette, IN 47907, USA. [lebowitz@biochem.purdue.edu]

- 11568 **Mair, G., Shi, H.-F., Li, H.-J., Djikeng, A., Aviles, H.O., Bishop, J.R., Falcone, F.H., Gavrilescu, C., Montgomery, J.L., Santori, M.I., Stern, L.S., Wang, Z.-F., Ullu, E. and Tschudi, C., 2000.** A new twist in trypanosome RNA metabolism: *cis*-splicing of pre-mRNA. [Incl. *T. brucei*.] *RNA*, **6** (2): 163-169.

Tschudi: Department of Internal Medicine, LCI 805, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06520, USA. [christian.tschudi@yale.edu]

- 11569 **Marché, S., Michels, P.A.M. and Opperdoes, F.R., 2000.** Comparative study of *Leishmania mexicana* and *Trypanosoma brucei* NAD-dependent glycerol-3-phosphate dehydrogenase. *Molecular and Biochemical Parasitology*, **106** (1): 83-91.

Opperdoes: Research Unit for Tropical Diseases, Christian de Duve Institute of Cellular Pathology, Université Catholique de Louvain, ICP-TROP 74.39, Avenue Hippocrate 74, B-1200 Brussels, Belgium.

- 11570 **Mäser, P. and Kaminsky, R., 1997.** The mechanisms of drug resistance in *Trypanosoma brucei* spp. (Review.) *Recent Research Developments in Antimicrobial Agents and Chemotherapy*, **2**: 113-125.

Kaminsky: Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland.

- 11571 **McManus, M.T., Adler, B.K., Pollard, V.W. and Hajduk, S.L., 2000.** *Trypanosoma brucei* guide RNA poly(U) tail formation is stabilized by cognate mRNA. *Molecular and Cellular Biology*, **20** (3): 883-891.

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

- 11572 **Naula, C., Gong, K., Shalaby, T., Schaub, R., Zoraghi, R. and Seebeck, T., 1999.** cAMP signaling in *Trypanosoma brucei*: a new target for new trypanocidal drugs? (Meeting abstract.) *Schweizerische Medizinische Wochenschrift*, **129** (31-32): 1119.

Naula: Institut für Allgemeine Mikrobiologie, Universität Bern, Baltzerstrasse 4, CH-3012 Bern, Switzerland.

- 11573 **Nolan, D.P., Jackson, D.G., Biggs, M.J., Brabazon, E.D., Pays, A., Laethem, F. van, Paturiaux-Hanocq, F., Elliot, J.F., Voorheis, H.P. and Pays, E., 2000.** Characterization of a novel alanine-rich protein located in surface microdomains in *Trypanosoma brucei*. *Journal of Biological Chemistry*, **275** (6): 4072-4080.

Nolan: Laboratory of Molecular Parasitology, Institute of Molecular Biology and Medicine, Free University of Brussels, 12 rue des Professeurs Jeener et Brachet, B-6041 Gosselies, Belgium. [dnolan@dbm.ulb.ac.be]

- 11574 **Nolan, D.P., Rolin, S., Rodriguez, J.R., Abbeele, J. van den and Pays, E., 2000.** Slender and stumpy bloodstream forms of *Trypanosoma brucei* display a differential response to extracellular acidic and proteolytic stress. *European Journal of Biochemistry*, **267** (1): 18-27.

Nolan: Laboratory of Molecular Parasitology, ULB-IBMM, 12 rue des Professeurs Jeener et Brachet, B-6041 Gosselies, Belgium. [dnolan@dbm.ulb.ac.be]

- 11575 **Obungu, V.H., Kiaira, J.K., Olembo, N.K. and Njogu, M.R., 1999.** Pathways of glucose catabolism in procyclic *Trypanosoma congolense*. *Indian Journal of Biochemistry and Biophysics*, **36** (5): 305-311.

Kiaira: Department of Biochemistry, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.

- 11576 **Pelletier, M., Miller, M.M. and Read, L.K., 2000.** RNA-binding properties of the mitochondrial Y-box protein RBP16. [*T. brucei.*] *Nucleic Acids Research*, **28** (5): 1266-1275.

Read: Department of Microbiology, Center for Microbial Pathogenesis, School of Medicine, State University of New York, 138 Farber Hall, Buffalo, NY 14214, USA.

- 11577 **Ploubidou, A., Robinson, D.R., Docherty, R.C., Ogbadoyi, E.O. and Gull, K., 1999.** Evidence for novel cell cycle checkpoints in trypanosomes: kinetoplast segregation and cytokinesis in the absence of mitosis. [*T. brucei.*] *Journal of Cell Science*, **112** (24): 4641-4650.

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

- 11578 **Rangarajan, D., Harvey, T.I. and Barry, J.D., 2000.** Characterisation of the loci encoding the glutamic acid and alanine rich protein of *Trypanosoma congolense*. *Molecular and Biochemical Parasitology*, **105** (2): 281-290.

Barry: Wellcome Centre for Molecular Parasitology, Anderson College, University of Glasgow, 56 Dumbarton Road, Glasgow G11 6NU, UK.

- 11579 **Rudenko, G., 1999.** Genes involved in phenotypic and antigenic variation in African trypanosomes and malaria. [*T. brucei.*] *Current Opinion in Microbiology*, **2** (6): 651-656.

Rudenko: Department of Zoology, Wellcome Trust Centre for Epidemiology of Infectious Diseases, University of Oxford, South Parks Road, Oxford OX1 3FY, UK.

- 11580 **Saas, J., Ziegelbauer, K., Haeseler, A. von, Fast, B. and Boshart, M., 2000.** A developmentally regulated aconitase related to iron-regulatory protein-1 is localized in the cytoplasm and in the mitochondrion of *Trypanosoma brucei*. *Journal of Biological Chemistry*, **275** (4): 2745-2755.

Boshart: AG Molekulare Zellbiologie, Institut für Molekularbiologie und Biochimie, Freie Universität Berlin, Hindenburgdamm 27, D-12203 Berlin, Germany. [boshart@ukbf.fu-berlin.de]

- 11581 **Sanchez, M.A., Ullman, B., Landfear, S.M. and Carter, N.S., 1999.** Cloning and functional expression of a gene encoding a P1 type nucleoside transporter from *Trypanosoma brucei*. *Journal of Biological Chemistry*, **274** (42): 30244-30249.

Sanchez: Department of Molecular Microbiology and Immunology, Oregon Health Sciences University, 3181 S.W. Sam Jackson Park Road, Portland, OR 97201-3098, USA.

- 11582 **Steverding, D., 2000.** The transferrin receptor of *Trypanosoma brucei*. (Review.) *Parasitology International*, **48** (3): 191-198.

Abteilung Parasitologie, Hygiene-Institut der Ruprecht-Karls-Universität, Im Neuenheimer Feld 324, D-69120 Heidelberg, Germany.

- 11583 **Tachado, S.D., Mazhari-Tabrizi, R. and Schofield, L., 1999.** Specificity in signal transduction among glycosylphosphatidylinositols of *Plasmodium falciparum*, *Trypanosoma brucei*, *Trypanosoma cruzi* and *Leishmania* spp. *Parasite Immunology*, **21** (12): 609-617.

Schofield: Walter and Eliza Hall Institute of Medical Research, Post Office, Royal Melbourne Hospital, Parkville 3050 Victoria, Australia.

- 11584 **Turrens, J., 1999.** More differences in energy metabolism between Trypanosomatidae. [Incl. *T. brucei*.] (Letter and reply.) *Parasitology Today*, **15** (8): 346-348.

Department of Biomedical Sciences, University of Southern Alabama, UCOM 6000, Mobile, AL 36688, USA.

The letter comments on the article by A.G.M. Tielens and J.J. van Hellemond in *Parasitology Today*, **14** (7): 265-271 (see *TTIQ*, **22** (1): 10815). It is followed by the original authors' reply.

- 11585 **Vanderheyden, N., Wong, J. and Docampo, R., 2000.** A pyruvate-proton symport and an H⁺-ATPase regulate the intracellular pH of *Trypanosoma brucei* at different stages of its life cycle. *Biochemical Journal*, **346** (1): 53-62. (See also correction in **347** (3): 887.)

Docampo: Laboratory of Molecular Parasitology, Department of Pathobiology, College of Veterinary Medicine, University of Illinois, 2001 S. Lincoln Avenue, Urbana, IL 61802, USA.

- 11586 **Yao, Y., Huang, L., Krutchinsky, A., Wong, M.-L., Standing, K.G., Burlingame, A.L. and Wang, C.C., 1999.** Structural and functional characterizations of the proteasome-activating protein PA26 from *Trypanosoma brucei*. *Journal of Biological Chemistry*, **274** (48): 33921-33930.

Wang: Department of Pharmaceutical Chemistry, Howard Hughes Medical Institute, University of California, San Francisco, CA 94143-0446, USA.

- 11587 **Yao, Y., Toth, C.R., Huang, L., Wong, M.-L., Dias, P., Burlingame, A.L., Coffino, P. and Wang, C.C., 1999.** α 5 subunit in *Trypanosoma brucei*

proteasome can self-assemble to form a cylinder of four stacked heptamer rings. *Biochemical Journal*, **344** (2): 349-358.

Wang: Department of Pharmaceutical Chemistry, Howard Hughes Medical Institute, University of California, San Francisco, CA 94143-0446, USA.

- 11588 **Zitzmann, N., Mehlert, A., Carroue, S., Rudd, P.M. and Ferguson, M.A.J., 2000.** Protein structure controls the processing of the *N*-linked oligosaccharides and glycosylphosphatidylinositol glycans of variant surface glycoproteins expressed in bloodstream form *Trypanosoma brucei*. *Glycobiology*, **10** (3): 243-249. (See also correction in **10** (7): v.)

Ferguson: Division of Molecular Parasitology and Biological Chemistry, Department of Biochemistry, University of Dundee, Wellcome Trust Building, Dundee DD1 5EH, UK.