

SECTION A – NEWS

PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS (PAAT)

Report of the Third Meeting of the Programme Committee

The main objectives of the third meeting of the Programme Committee, which was convened at WHO headquarters in Geneva from 19 to 21 November 1997, were to provide advice and guidance to the Programme Committee on priority areas for further research, to make recommendations on key policy and technical issues through the presentation of position papers and to coordinate and prioritise disease control activities in Africa for a more effective delivery in the context of human welfare and food security through more productive mixed crop-livestock systems.

The Secretariat members presented their **progress reports**, and matters arising from the Management Planning Workshop held in Montpellier in April 1997 (see *TTIQ*, **20** (2)) and from the ISCTRC/Advisory Group Coordinators meeting in Maputo (see **20** (4)) were discussed. WHO reported that an information system has been developed using geo-referenced maps of human sleeping sickness incidences. Difficulties with communication in West Africa are still prevalent. However, all FAO country representatives have an e-mail facility. In addition, WHO has distributed 16 computers with e-mail facility in the region. Nevertheless, it was felt that resources should be made available to improve communications, particularly in West Africa. Similarly, it was felt that assistance should be provided for Advisory Group Coordinators in West and Central Africa to attend meetings. The compilation of a resource inventory has been hampered by a poor response rate and it should be stressed that providing information is a two-way process for scientists and should be advantageous for both parties involved. A questionnaire sent to all tsetse-infested countries yielded more than a 60% response. FAO reported that the field guide on trypanosomiasis is being revised and will be published in English and French in 1998. It was noted that funding of the Pesticide Resistance Reference Centre has been discontinued.

Lists of **research priorities**, ranked according to importance, have been compiled by the Advisory Group Coordinators (mostly researchers or policy makers) and by the FAO Liaison Officers of Eastern and Southern Africa (mostly implementers of control activities). It was recommended that the FAO Liaison Officers of Western and Central Africa prepare a similar list. These research priorities mostly concern animal trypanosomiasis, since it is difficult to prepare a list of research priorities for human trypanosomiasis. The Secretariat will combine the three lists into a single one, without ranking of the items according to importance, and taking into account common themes as well as the recommendations of the ISCTRC meeting. This list will be made available to the donor community.

PAAT has commissioned a number of **position papers** to provide policy and strategy directives for various controversial or insufficiently researched subjects. Those produced so far have succeeded in elucidating the subject or in provoking debate. However, it was felt that other authors should be invited to contribute to these 'working papers' in order to provide a more objective approach and to broaden the subjects to include all techniques. By including other authors and covering opposing views in a

discussion section, a revised paper can be endorsed (and published) as a PAAT position paper.

During the meeting a position paper on *privatisation of tsetse control* was presented by Dr G. Lako. It was noted that tsetse control is primarily a community problem not directly benefiting the individual farmer and therefore complicating privatisation. However, some aspects of tsetse control could be privatised. The meeting suggested including aspects of training, commercialisation and intellectual property, and aspects of the privatisation of human sleeping sickness should also be mentioned.

It was suggested that Dr B. Swallow's position paper on the *impact of trypanosomiasis on African agriculture* (see *TTIQ*, 20 (4)) should include more locations, extrapolate beyond case studies and include some geographic information system applications.

The **ISCTRC** and **PAAT** complement each other and wish to move forward together. ISCTRC is an ideal forum for field workers and scientists to present their results and share their experiences, thus promoting PAAT within the African scientific community, but it was felt that collaboration between ISCTRC and PAAT could be strengthened.

A presentation by Prof. Dr I. Maudlin identified the shortcomings of present tsetse control activities and pointed the way forward to autonomous trypanosomiasis control, using the example of the highly successful Chagas disease control campaign in South America (Southern Cone Initiative). It was stressed that integrated disease control, identification of geographic priority areas, scientific consensus, political promotion, public awareness, self reliance and community participation will all play an important role if tsetse and trypanosomiasis control is to emulate the success of the SCI.

The PAAT should suggest topics for **workshops** to refine the research priorities and assist in the organisation of thematic meetings. Donors stressed that on-farm research assisting field projects, strengthening the researcher-farmer linkage and promotion of a participatory approach are some of the objectives of funding agencies. A workshop should be organised to stimulate the integrated approach to rural development including integration of vector/parasite control. Attention should be focused on household resources security and peri-urban production systems.

Anticipated projects dealing with trypanosomiasis

The Farming In Tsetse Control Areas of Eastern Africa (FITCA) project will start in 1998, focusing on food security and poverty alleviation in Uganda, Tanzania, Kenya and Ethiopia. The control of human and animal trypanosomiasis will feature prominently within the project. The EDF will provide ecu 20 million over a four-year period, and OAU/IBAR will coordinate the project. At present, strategy papers have been developed for three of the countries. It is anticipated that a similar project will be initiated in West Africa.

Mr U. Feldmann (Joint FAO/IAEA Division) highlighted the success of the tsetse eradication programme in Zanzibar (see item below) and explained the concept of integrated area-wide insect pest management approaches. He suggested that the option of tsetse eradication be retained wherever feasible and justifiable and gave a briefing on the phased, conditional approach regarding the integrated sterile insect technique (SIT) programme in the Southern Rift Valley of Ethiopia. At present the project is budgeted to cost US\$ 43.8 million for the eradication of *Glossina pallidipes* from an area of 25,000 km² over a ten-year period. The Programme Committee expressed concerns over the economic and technical feasibility of the proposed project and questioned the justification for eradicating tsetse

from the Southern Rift Valley. Two EDF and IFAD representatives requested the PAAT Secretariat to examine the situation in more detail in order to provide further advice and guidance as to its suitability for funding.

Information system development

Development of the FAO/PAAT information system was initiated. This will consist of three components: a resource inventory, a knowledge base and a geographic information system (GIS); these will strengthen the role of PAAT as an advisory body to national governments and international donors. Funding has been provided by DFID for a Technical Officer to develop the system during the next two years at FAO, Rome. It was decided that an inventory of field stations and training opportunities be compiled.

A CD-ROM on human African trypanosomiasis was demonstrated to the meeting. It will be available for distribution by the end of 1998 and will be updated annually. An initiative of the WHO/UNICEF Joint Programme of the Division of Control of Tropical Diseases to apply GIS in the area of public health was demonstrated. In particular, the applications for mapping human sleeping sickness were shown.

The FAO and WHO systems will be compatible and complementary.

Plan of action

Since human sleeping sickness tends to be focal and occurs in epidemics, while animal trypanosomiasis is mostly endemic and diffuse, it was decided to prepare two separate action plans. However, an integrated approach to disease management and rural development is essential, with the focus on mixed crop/livestock systems since tsetse control in these areas will achieve the biggest economic benefits. It was suggested that the evaluation group of the CGIAR should be consulted for advice.

The five-point action plan adopted for the control of *animal trypanosomiasis* includes the need to agree on criteria for prioritising areas for investments in control; support priority setting exercises at the national, regional and continental levels; develop guidelines for control strategies in high, medium and low priority areas; agree on criteria for evaluating investments in control; and develop indicators and means of verification that can be incorporated into monitoring and evaluation systems (see *TTIQ*, 20 (4)).

The action plan for *human trypanosomiasis* control is based on 12 points agreed by representatives of the 16 most endemic countries at a meeting held in Abidjan in May 1996, and includes the establishment of an epidemiological monitoring and information system; extended coordination of control activities; national action plans and standardisation of strategies, methods and protocols; training; development of information, communication and education material; collation and dissemination of documentation; and establishment of reference laboratories.

Other conclusions and recommendations

The Programme Committee should be modified to include additional donors as well as African decision and policy makers. It was also proposed to increase the number of African members functioning as Advisory Group Coordinators and to incorporate the FAO Liaison Officers as active participants in the PAAT structure.

PAAT should be consulted by donors, national governments and international organisations involved in funding and implementation of intervention campaigns, on all aspects of strategy planning, assessment of disease or vector control options, project design and evaluation.

PAAT should start to develop guidelines on available control technologies, highlight their advantages and disadvantages and indicate the criteria to be considered in order to obtain maximum economic benefit.

Efforts should be made to increase the public profile of PAAT. It is proposed to produce a two-page glossy brochure, to be distributed to governments, regional organisations and donors, describing the multilateral initiative, primary objectives, membership, functions, principal activities and services available. In addition, a commentary should be prepared for a renowned scientific journal with a large circulation. Finally, the OAU Council of Ministers should be provided with the recommendations emanating from PAAT.

Amendment to List of Advisory Group Coordinators

Dr G. d'Ieteren has taken over from Dr A. Teale as Coordinator of the Advisory Group on Host Management: *Trypanotolerance; research and development*. He also is at ILRI, P.O. Box 30709, Nairobi, Kenya (tel. 254 2 630743; fax 254 2 631499; e-mail g.dieteren@cgnet.com).

TSETSE CONTROL OPERATIONS

Tsetse eradication on Zanzibar completed

An independent group of experts reviewed the SIT tsetse eradication project on Zanzibar and the tsetse production facility at Tanga, Tanzania, in October 1997 and confirmed the apparent eradication of *Glossina austeni* from Zanzibar and a decline of trypanosome transmission to a negligible level. In spite of intensive entomological monitoring with more than 500 sticky traps, permanently positioned all over Unguja island of Zanzibar, no wild tsetse were found after the reported capture of the last wild fly in September 1996. From more than 1000 cattle in 38 sentinel herds, the incidence of new trypanosome infections declined to less than 0.1% during recent routine parasitological screenings. In 1986, the pre-control prevalence of trypanosomiasis among cattle had ranged between 17 and 25%.

Tsetse eradication activities were initiated on Unguja in 1988 as part of a six-year, c. US\$ 3 million, UNDP/FAO animal disease control programme using pour-on formulations of insecticides for tsetse control. These activities substantially reduced the target tsetse population and, to a large extent, also trypanosome transmission in the north of the island and in parts of the middle belt. In several areas, particularly in and close to Jozani, a protected primary forest in central Unguja, and around Muyuni, an extensive secondary forest in the south, the control methods did not succeed.

In 1994, when UNDP funding was exhausted, the Government and IAEA pursued the UNDP/FAO efforts and, in addition, adopted the area-wide concept of tsetse/trypanosomiasis intervention, targeting the *entire* pest insect population in affected agricultural zones *and* non-agricultural fly habitats. The sterile insect technique was introduced as a complementary method in this integrated campaign. After a year of colony build-up at the Tsetse and Trypanosomiasis Research Institute (TTRI) at Tanga, Tanzania, and of test releases, the operational SIT campaign was initiated in May 1995 using fixed-wing aircraft for even dispersal of sterile males. More than 8.2 million sterile males were released in

weekly flights between 1995 and 1997 (more than 1.8m, 3.7m and 2.7m in 1995, 1996 and 1997, respectively). For this the TTRI fly production plant maintained a membrane-fed *G. austeni* colony of up to one million females (peak of colony size in mid-1996) and produced more than 20 million pupae. The overall costs of the project operations (1994-1997) amount to US\$ 5.5 million, a major part being investments in national expertise and the TTRI facilities, which remain available for future activities.

Following the recommendations of the group of experts, (i) releases of sterile males were discontinued in late December 1997, (ii) measures were taken to pursue entomological surveys and veterinary monitoring for at least 1 and 2 years, respectively, and (iii) an action plan was elaborated to sustain the Tanga fly production facility in the next years. As part of a package for post-tsetse eradication support to agricultural development in Zanzibar, IAEA will foster livestock development for the benefit of smallholder farmers. OAU has officially commended 'the Agency for this excellent achievement' and assured 'OAU support to the Agency's similar projects in Africa'. In collaboration with other partners, FAO/IAEA will pursue efforts to assess and demonstrate the technical and economic feasibility of the integrated area-wide concept and of the SIT component for tsetse and trypanosomosis intervention.

Coloured brochures and a limited number of copies of a 10 minute video on the project, entitled 'Farewell to Tsetse' (English), are available from: Division of Public Information, IAEA, P.O. Box 100, A-1400 Vienna, Austria. Please specify the video system required (PAL, SECAM or NTSC).

CURRENT RESEARCH

Animal trypanosomosis research at CIRAD-EMVT

CIRAD's Département d'Élevage et de Médecine Vétérinaire (CIRAD-EMVT) has a long tradition of applied research on tsetse and trypanosomoses which began in 1950 with studies on tsetse ecology, biology and distribution. It was in charge of insecticidal ground spraying campaigns between 1960 and 1974 at both local (Cameroon, Central African Republic) and regional levels (Lake Chad Basin), but rapidly promoted safer and more targeted methods (SIT, trapping). In the laboratory, tsetse colonies were set up to study their biology, particularly their reproduction, with the first trials of γ -ray sterilisation and the sterile male technique. This genetic control method was studied in the field in Chad in 1970-1974 and Burkina Faso in 1975-1979, and this led to a larger integrated project in 1980-1984 aimed at eradicating three species of tsetse (*Glossina tachinoides*, *G. palpalis gambiensis* and *G. morsitans submorsitans*) from a 350,000 ha agropastoral area of Burkina Faso using screens in the dry season and sterile male releases in the rainy season.

CIRAD-EMVT set up the Centre de Recherches sur les Trypanosomoses Animales (CRTA) in Bobo-Dioulasso in 1974 in association with GTZ, working on two large-scale programmes, one on trypanosomes and trypanotolerance, the other on SIT and trapping techniques. CIRAD-EMVT continues its close association with the Centre under its new name of CIRDES and also works closely with ILRI in Nairobi and with ORSTOM's laboratories in Bouaké and Yaoundé. It is also a member of the Scientific Environmental Monitoring Group which has since 1986 studied the environmental impact of aerial and ground spraying on the non-target fauna, and has more recently addressed the effects of

tsetse eradication on land-use change and natural resources. Since large-scale tsetse control campaigns are now rare, current emphasis is on clarifying the complexities of the disease (animal and human) at all levels. Data are being collected and analysed on ruminant production systems, new diagnostic tools are being developed and evaluated in the field, and improvements in tsetse trapping methods using olfactory attractants are being sought.

The main research activities on tsetse and trypanosomoses at CIRAD-EMVT (with the collaboration of ORSTOM) can be summarised as follows.

Tsetse flies: breeding of five species/subspecies; tests on new insecticidal compounds and formulations; development of an Expert System for the computer-based identification of tsetse flies; study of tsetse fly chemoreceptors; use of computerised image analysis of wing structure for the ageing of tsetse flies; genetic variability of *G. palpalis* populations –population, biological and epidemiological markers (dispersal, competence and behaviour); mechanical transmission by other biting insects.

Trypanosomes: detection and identification of trypanosomes in the insect and the host (ELISA, DNA probes, PCR); genetic variability of *Trypanosoma congolense* and its significance in epidemiology (pathogenicity, resistance); standardisation and validation of diagnostic tests (antigen and antibody ELISAs); molecular approach to the development of an anti-protease vaccine (congopain).

Tsetse flies/trypanosomes: factors involved in probing/salivation; infection and emission kinetics of *T. congolense* in the saliva of *G. m. morsitans* and *G. tachinoides*; study of the host specificity of *T. congolense* ('savanna', 'riverine forest'), *T. vivax* and *T. brucei* vis-à-vis *G. tachinoides*, *G. p. gambiensis* and *G. m. submorsitans* ('preferential pairs'?).

Tsetse flies/trypanosomes/cattle/land use: evolution of natural and cultivated resources/tsetse habitat/cattle, pioneer front line; tsetse fly presence and risk assessment.

CIRAD-EMVT also carries out training (lectures, certificates, degree courses) in association with other organisations and universities.

For further information, contact CIRAD-EMVT, B.P. 5035, 34032 Montpellier Cedex 1, France (tel. 33 + 4 67 61 58 00).

MEETINGS

FAO/IAEA International Conference on Area-Wide Control of Insect Pests, Integrating the Sterile Insect Technique and Related Nuclear and Other Techniques

This will be held in Penang, Malaysia, from 28 May to 2 June 1998. For more information, contact: Jorge Hendrichs, Joint FAO/IAEA Division, A-2444 Seibersdorf, Austria (tel. 431-2060-21628; fax 431-20607-21628; e-mail J.Hendrichs@iaea.org).

Sixth European Congress of Entomology

This will be held in České Budejovice, Czech Republic, from 23 to 29 August 1998. It will be hosted by the Institute of Entomology of the Czech Academy of Sciences, the University of South Bohemia and the Czech Entomological Society. The programme will include 1-2 days of plenary lectures, 3-4 days of offered papers and posters arranged in specialist symposia, and a 1-day excursion. The registration fee is expected to be US\$ 200 with a 50% reduction for students.

For more details apply to: Dr Tomáš Soldán, Institute of Entomology, Academy of Sciences, 31 Branišovska, 370 05 České Budejovice, Czech Republic (tel. (+42 38) 40822; fax (+42 38) 43625; e-mail soldan@entu.cas.cz).

SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

10255 **Boa, F.Y., 1997.** Les causes de l'échec de la lutte contre les trypanosomiasés humaines africaines et les stratégies pour le futur. [The causes of the failure of human African trypanosomiasis control and the strategies for the future.] *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 115-117.

Département de Neurologie, Faculté de Médecine, Université d'Abidjan, Côte d'Ivoire.

Progress in the control of human African trypanosomiasis has generally been far below expectations: there have been some notable successes, such as the eradication of the disease from Senegal and The Gambia, but many failures too. There are several reasons for these. (i) Educational: risks inherent in people's life style (collecting water and firewood, cultivating coffee plantations) can be reduced if people participate actively, including financially, in control measures, but for this to happen they need to understand the relationship between the tsetse fly, its bite and sleeping sickness rather than believing that the disease is inflicted by sorcerers or sent by the gods to punish bad behaviour. (ii) Political: human trypanosomiasis is not always a high priority in health care; also war and political unrest cause disruption notably to health care systems. (iii) Scientific: only four drugs have been developed in 91 years and each has its limitations and adverse side effects, and the prospects of a vaccine recede daily. (iv) Financial: sleeping sickness affects rural African populations, i.e. the poorest people in the poorest countries in the world, and sufficient funds at both national and international levels are not made available. Future strategies in combating this complex disease are outlined; these include rationalisation of health care and more training at all levels, decentralisation of supplies of diagnostic kits and drugs, and regionalisation of control efforts, particularly in epidemics.

10256 **Douati, A., 1997.** Participation des communautés rurales à la lutte contre les trypanosomiasés: méthodologie et expériences. [Participation of rural communities in the control of trypanosomiasis: methodology and experimental operations.] *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 301-309.

Ministère de l'Agriculture et des Ressources Animales, Abidjan, Côte d'Ivoire.

Community participation has several elements. At the top of the hierarchy are conceptual and technological participation at the administrative decision-making level. In general, the beneficiaries (rural communities) are invited to participate financially and/or physically. In Côte d'Ivoire, the first prospective study concerning community participation in animal trypanosomiasis control took place in 1985 and concluded that such

participation was necessary. This was followed by a larger study in 1990-1992 which identified those beneficiaries who would be willing to participate. Five production systems and five possible forms of participation were identified, together with certain measures which would be necessary in support of the planned activities (administrative, legal, financial, media coverage, information dissemination). Two exercises in community participation are described. In the first, an experimental operation in 1990-1992 in the Central region of Côte d'Ivoire, agropastoralists participated physically in the deployment and maintenance of traps and later were asked to contribute financially. The 23 participating farms and ranches were classified according to the quality of their input, and it was found that the most conscientious were family-run farms whose members' life-style depended on the success of the farm. The principle of payment was accepted by 22 of the 23 farms. The second, a pilot operation in the Northern region of Côte d'Ivoire starting in 1994, covered a c. 300 km² area of river valley with villages and camps, occupied by a mixed population of cotton producers and livestock breeders (transhumant, and community and individual sedentary herds, totalling 24,300 head of cattle). After some initial enquiries and training, those villagers who had been chosen participated in the impregnation and positioning of traps and their maintenance and withdrawal under the guidance of the project leader. In 1993-1994, control operations were financed entirely by the technical services of the project; in 1994-1995, participation by villagers led to savings of more than 30%.

10257 **Hendrickx, G., Napala, A., Slingenbergh, J. and Palmer, H.B., 1997.** Facteurs affectant le contrôle de la trypanosomiose au Togo. [Factors affecting the control of trypanosomiasis in Togo.] *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 291-294.*

Hendrickx: GCP-TOG-013-BEL, B.P. 114, Sokodé, Togo.

The response of traditional cattle breeders in Togo to the presence of tsetse flies has been to use trypanotolerant breeds. Now increased demand for animal protein makes additional methods of trypanosomiasis control (drugs, tsetse control) necessary. A rational programme is being elaborated, based on data gathered since 1990 using eighth of a degree grid squares which are helping to clarify different variables influencing the epizootiology of trypanosomiasis. These variables include disease prevalence in cattle and mean PCV of sampled herds, taurine morphology and cattle densities, distribution and abundance of different tsetse species, and the percentage of land used for agriculture. In addition targeted questionnaires were prepared to help understand traditional farming systems. This paper presents and discusses three preliminary maps showing (i) the prevalence of bovine trypanosomiasis in Togo, (ii) the distribution of the taurine phenotype, and (iii) areas of different levels of intervention (veterinary, vector control), based on a combination of the other two maps. Plans for future work are outlined.

10258 **Kamara, D.W., Swallow, B.M., Echessah, P.N. and Curry, J.J., 1997.** Combining quantitative, qualitative and participatory research methods in assessment of the prospects for community-based tsetse control in Busia District, Kenya. *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 310-317.*

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

The prospects for community-based tsetse control are being assessed in Busia District, Kenya, an area in which both humans and livestock are at risk of contracting trypanosomiasis. A combination of quantitative, qualitative and participatory methods is being used in this assessment. The methods used in the first phase of the study in six selected villages included key informant interviews, community profiling exercises including village transect walks and social mapping, focus groups and participant observations, all with the aim of assessing the socio-economic impacts of trypanosomiasis and people's knowledge, attitudes and beliefs about the disease. The information gathered was used to design a process of community education, including posters and drama, to sensitise the community to the disease and its control. Four weeks after this educational event, a household-level survey was administered to 30 randomly selected households in each village to assess their willingness to contribute time and/or money to tsetse control activities. The results from all previous phases of the research were used to select two villages for pilot programmes of community-based tsetse control. Since mid-1994 the villages have been engaged in a participatory process of education and mobilisation for tsetse control. Community committees have been formed and decisions taken at village meetings concerning financial contributions and collection procedures. Actual contributions are now being monitored. Results to date show marked differences between contingent, planned and actual contributions.

10259 **Kamuanga, M., Kaboré, I., Swallow, B., Amsler-Delafosse, S. and Bauer, B., 1997.** Evaluating factors affecting implementation of community-based tsetse control in southern Burkina Faso. Part 1: Use of insecticide impregnated screens. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 318-330.

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

A programme of tsetse control using traps, screens and 'pour on' insecticides was begun in 1994 in the Sissili agropastoral zone of Burkina Faso following an epidemic of animal trypanosomosis which reduced the cattle population by around 70%. This area has been settled by Fulani pastoralists as part of a government project to increase livestock production. With a view to preparing the community to participate more in the tsetse control programme, a survey of heads of families (a family consists here of two or more households) was undertaken to evaluate their willingness to contribute to tsetse control, as well as the socio-economic factors affecting the amount of resources they were prepared to contribute. The results of a contingent valuation study showed that all 34 households were willing to contribute money, while 28 were also willing to contribute labour. The willingness to contribute financially was linked positively to knowledge of the symptoms of animal trypanosomosis, while willingness to contribute labour was positively associated with the amount of time already devoted to community activities.

10260 **Meirvenne, N. van, Magnus, E. and Büscher, P., 1997.** Prestation de service aux centres de lutte contre la trypanosomiase. [Provision of services to trypanosomiasis control centres.] (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 103-104.

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

The Institute of Tropical Medicine collaborates with TDR, ILRAD [now ILRI] and ITC to provide the following services to trypanosomiasis control centres: (i) Production and distribution of diagnostic test systems (development, evaluation, application and distribution of reagents, accessory materials and small apparatus for field and laboratory diagnosis of human and animal trypanosomiasis); (ii) Serum bank (collection, processing, storage and distribution of documented serum, plasma and CSF samples of trypanosome-infected patients and animals and of trypanosome-free controls); (iii) Cryobank (isolation, cryopreservation and distribution of stocks and clone populations of different species and subspecies of trypanosomes); (iv) Supply of antigen preparations and experimental antisera (production and distribution of various antigen preparations and experimental antisera for research purposes); (v) Analyses on request (execution of various laboratory tests on serum, plasma, CSF and dried blood samples sent by trypanosomiasis control centres); (vi) Training (the laboratory offers facilities for technical training and scientific research); and (vii) Field surveys (assistance to planning, organisation and realisation of field surveys).

10261 **ole-MoiYoi, O.K., Jaye, A.B., Majiwa, P.A.O., Nantulya, V.M. and Masake, R.A., 1997.** Approaches to control of African trypanosomiasis. (Meeting abstract no. 1604.) *FASEB Journal*, **11** (9): A1132.

ole-MoiYoi: IIMCB-A, P.O. Box 30709, Nairobi, Kenya.

African trypanosomiasis continues to be a serious threat to human and animal health in over 10 million km² of sub-Saharan Africa. To control disease, several approaches have been employed, including bush clearance, sterile tsetse male release, chemotherapy and selective animal breeding. Using a variety of markers, the F₂ offspring of trypanosome-resistant and susceptible animals are being tested and the loci linked to resistance identified. Because of difficulties in developing VSG- or invariant surface antigen-based conventional vaccines, an approach that advocates vaccination against disease, rather than organism, is being developed. To this end a cysteine protease, which appears in the circulation of *Trypanosoma congolense*-infected animals as both a zymogen and an active enzyme, has been characterised.

10262 **Olubai, W.A., Echessah, P.N. and Opiyo, E.A., 1997.** Assessment of gross community perception of tsetse, human and animal trypanosomiasis in the Lambwe Valley, Kenya. (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 331-332.

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

A community-based tsetse control programme is more likely to succeed where the community understands the role the tsetse flies play as vectors of trypanosomiasis. Data on the gross community perception of tsetse, human and animal trypanosomiasis have

therefore been collected following interviews with target groups in six villages in the Lambwe Valley. Structured questionnaires were also administered to 180 randomly selected households. Results of discussions with target groups indicated a high level of understanding of tsetse and trypanosomiasis, and 92% of respondents to the questionnaire knew that tsetse bites could result in the transmission of trypanosomiasis. As for constraints to livestock production, trypanosomiasis was the most often mentioned animal disease. This high level of knowledge was attributed to the cyclic nature of epidemics in the region, and thus the experience the residents have had of the disease. It is intended that the findings of the present study will be used in a multi-disciplinary community-based project aimed at controlling trypanosomiasis in the Lambwe Valley.

10263 Organization of African Unity/Scientific, Technical and Research Commission, 1997. *Twenty-third Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Banjul, Gambia, [11-15 September] 1995.* (Edited by J.M. Ndung'u.) Nairobi; OAU/STRC. OAU/STRC Publication no. 118. 348 pp.

OAU/STRC, P.O. Box 30786, Nairobi, Kenya.

The texts and/or abstracts of papers presented at the twenty-third ISCTRC meeting are published under the following headings: Diagnosis; Human trypanosomosis; Animal trypanosomosis; *Glossina* biology; *Glossina* control; Community participation. Introductory sections include reports of relevant work carried out by international organisations (OAU/IBAR, FAO, WHO/TDR, IAEA, ILRI, ITC, ICIPE, CIRDES) and by countries and regional organisations (Angola, Benin, Côte d'Ivoire, OCEAC, Uganda, RTTCP, Togo, Zaire). Summaries of the plenary sessions and of several round table discussions are also given, with recommendations. Abstracts of all presentations published in this report are included in this issue of *TTIQ*.

10264 Touré, S.M., 1997. Causes d'échec dans la lutte contre la trypanosomose animale africaine et stratégie pour le futur. [Causes of failure in African animal trypanosomosis control and strategy for the future.] *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 117-119.*

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

Some of the causes of failure in the control of animal trypanosomiasis are discussed. These may be: (i) Strategic (too large an area, too little money, small national campaigns which fail because of reinvasion from surrounding areas, large-scale campaigns which are not followed up, sustainability not taken into account); (ii) Insufficient up-to-date knowledge (of tsetse distribution, habitat, ecology, species associations, and of the trypanosome involved); (iii) Institutional (lack of training, motivation, planning, and insufficient appreciation of what, how, where and when to take action); (iv) Socio-economic (insufficient level or duration of funding, uncertainties of external assistance, lack of cooperation from rural populations, lack of land use planning, civil war, unfavourable cost:benefit ratio). The strategy proposed for the future includes: (i) A basic concept to aim for; (ii) Possible applications (IPM, favouring high economic potential

development, non-polluting techniques, community participation, evaluation of biological and socio-economic impact); (iii) Implementation (PPI – policy, planning and implementation; national campaigns, coordinated on a regional scale, using modern methods; use of GIS); (iv) Finance; and (v) Coordination (role of OAU/IBAR, FAO, WHO and regional institutions).

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

10265 **Chigusa, Y., Ohshita, M., Taya, J., Kirinoki, M., Yokoi, H., Kawai, S. and Matsuda, H., 1997.** [Relationship between longevity and body weight in *Glossina morsitans morsitans*.] (In Japanese with English abstract.) *Medical Entomology and Zoology*, **48** (2): 91-96.

Department of Medical Zoology, Dokkyo University School of Medicine, Mibu, Tochigi 321-02, Japan.

The longevity and body weight at each developmental stage of *G. m. morsitans* were examined under the following conditions: temperature $25 \pm 1^\circ\text{C}$, relative humidity $60 \pm 10\%$ and photoperiod 12 h light and 12 h dark. The length of life of male adults ($n = 93$) was 145.9 ± 51.4 days (mean \pm SD), range 9 to 241 days, and that of female adults ($n = 73$) was 131.1 ± 58.3 , range 4 to 208 days. The respective mean body weight was: 1-day-old male puparia, 28.8 mg; 3-week-old male puparia, 25.1 mg; 1-day-old male adults, 20.4 mg. The equivalent weights of females were 29.9, 26.3 and 22.0 mg, respectively. The coefficient of correlation between the body weight of 1-day-old adults and their longevity was 0.005 for males and 0.025 for females, indicating that there was almost no correlation between longevity and body weight.

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

10266 **Krafsur, E.S. and Griffiths, N., 1997.** Genetic variation at structural loci in the *Glossina morsitans* species group. *Biochemical Genetics*, **35** (1-2): 1-11.

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

Gene diversity was investigated in four taxa of tsetse flies including *G. m. morsitans*, *G. m. centralis*, *G. swynnertoni* and *G. pallidipes*. Histochemical tests were performed for 35-46 isozymes. Polymorphic loci were 20% in *G. m. morsitans*, 32% in *G. m. centralis*, 17.6% in *G. swynnertoni* and 26% in *G. pallidipes*. Mean heterozygosities among all loci were 66% in *G. m. morsitans*, 6.0% in *G. m. centralis*, 7.1% in *G. swynnertoni* and 6.8% in *G. pallidipes*. Allozyme gene diversities were considerably less than those reported for many Diptera. The low gene diversities are probably related to small effective population sizes.

- 10267 **Loder, P.M.J., 1997.** Size of blood meals taken by tsetse flies (*Glossina* spp.) (Diptera: Glossinidae) correlates with fat reserves. *Bulletin of Entomological Research*, **87** (5): 547-549.

CAB International, Wallingford OX10 8DE, UK.

The relationship between stored fat and the size of blood meals taken by individual flies was studied in *Glossina morsitans morsitans* in the laboratory and in *G. pallidipes* in the field in Zimbabwe. Only mature male flies were used. The fat contents of all the flies were expressed as the proportion of the dry body weight at death accounted for by the fat reserves held in the fly's body. In both species, blood meal size correlated with the proportional fat contents. The trend of smaller blood meals with higher fat reserves was apparent if the absolute fat levels were used, but the relationship became statistically significant only if the body size of the fly itself was controlled for. Since data from the field indicate that flies with a great range of proportional fat levels approach and feed on hosts, it appears that some sort of feedback mechanism linked to a fly's fat reserves affects the feeding process itself, and not just host-seeking behaviour.

- 10268 **Magiri, E.N., Konji, V.N., Makawiti, D.W. and Midiwo, J., 1995 [1997].** Effect of plant quinones on insect flight muscle mitochondria. *Insect Science and its Application*, **16** (2): 183-189.

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

The effect of four biologically active and naturally occurring plant quinones, namely maesanin, maesaquinone, embelin and juglone, on the respiration of flight muscle mitochondria isolated from the tsetse fly *Glossina morsitans morsitans*, the locust *Schistocerca gregaria* and the cockroach *Periplaneta americana* was investigated. The rate of oxygen consumption by the mitochondria was measured using an oxygen electrode. Maesanin inhibited the mitochondrial electron transport chain at a level before cytochrome C whereas maesaquinone and embelin uncoupled the mitochondria. Juglone inhibited respiration in *G. m. morsitans* mitochondria and uncoupled those of *S. gregaria* and *P. americana*.

- 10269 **Makawiti, D.W., Magiri, E.N. and Konji, V.N., 1997.** Effect of naturally occurring plant quinones on insect flight muscle mitochondrial respiration. (Meeting abstract no. 548.) *FASEB Journal*, **11** (9): A950.

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

For abstract, see **21**: no. 10268.

- 10270 **Robinson, A.S. and Gooding, R.H., 1997.** RAPD-PCR analysis of the genome of *Glossina austeni*. (Abstract only: extended English, shorter French.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 264-265.

Robinson: FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf A-2444, Austria.

Recent developments in molecular genetics, including the use of random amplified polymorphic DNA by the polymerase chain reaction (RAPD-PCR) have greatly increased the opportunities for, and the rate of, analysis of poorly known genomes. Here we describe the use of RAPD-PCR to study the genetic relationship of *G. austeni* from several locations in East and South Africa. The current campaign to eradicate *G. austeni* from the island of Zanzibar by SIT is entering its final phase. Although there is strong circumstantial evidence that reinvasion cannot occur, there are at present no tools available to identify the origin of a fly found after completion of the programme. RAPD analysis can help resolve this dilemma. Three populations were analysed, the Seibersdorf colony (established with material collected in Zanzibar in 1969), wild flies trapped this year on Zanzibar and wild flies trapped in the vicinity of Tanga. The latter two samples were preserved in 100% ethanol. In general there were very few differences among the three populations. However, some diagnostic bands could be identified. The similarities in the pattern were surprising. No sex specific bands could be unequivocally identified. The presence of a large number of B chromosomes must not be forgotten in this type of analysis. A second analysis included *G. austeni* from the Hellsgate area, South Africa, a population which has been given a separate taxonomic status, *G. austeni mossurizensis*, and thus would be expected to show significant genetic differences from *G. a. austeni*, the northernmost subspecies. These populations do indeed show some divergence but the level of similarity remains remarkably high. The use of the RAPD-PCR approach to analyse field collected and preserved tsetse flies represents a major step forward in the analysis of important population parameters related to SIT and other methods of control. The facility with which many analyses can be done on a single individual and the variation uncovered by this approach should now enable many basic and applied questions to be addressed.

10271 **Willhoeft, U., 1997.** Fluorescence *in situ* hybridization of ribosomal DNA to mitotic chromosomes of tsetse flies (Diptera: Glossinidae: *Glossina*). *Chromosome Research*, **5** (4): 262-267.

Bernhard-Nocht-Institute for Tropical Medicine, Bernhard-Nocht-Strasse 74, D-20359 Hamburg, Germany.

Ribosomal genes were mapped in *Glossina austeni*, *G. brevipalpis*, *G. fuscipes fuscipes*, *G. morsitans submorsitans*, *G. palpalis palpalis*, *G. pallidipes* and *G. tachinoides* on mitotic chromosomes by fluorescence *in situ* hybridisation (FISH) using *Drosophila hydei* genomic clones that contain the 28S ribosomal DNA. In all species except *G. brevipalpis*, the ribosomal genes were located on the long arm of autosome L₁. The Y chromosomes of *G. pallidipes* and *G. p. palpalis* showed additional hybridisation signals. Supernumerary chromosomes were found in *G. austeni*, *G. brevipalpis* and *G. pallidipes*. The C-banding pattern obtained by *in situ* hybridisation was compared with Giemsa C-banding patterns that were published previously. The karyotype of *G. brevipalpis* was found to differ from that of other *Glossina* species, with either two or three FISH signals being obtained with a ribosomal probe, depending on the individual analysed. The rDNA

genes are the first physically mapped markers in tsetse flies and will be useful for mapping approaches.

- 10272 **Zdárek, J. and Denlinger, D.L., 1997.** Species variation in the response of tsetse flies (*Glossina* spp.; Diptera: Glossinidae) to parturition hormone. *European Journal of Entomology*, **94** (3): 381-383.

Zdárek: Institute of Organic Chemistry and Biochemistry, Academy of Sciences of the Czech Republic, Flemingovo nám. 2, 166 10 Praha 6, Czech Republic.

Parturition hormone, present in the uterus of several species of *Glossina*, causes expulsion of the uterine contents in neck-ligated, pregnant females of *G. morsitans*, thus eliciting either parturition or abortion. Uteri of all six tsetse species tested (*G. morsitans*, *G. austeni*, *G. brevipalpis*, *G. palpalis*, *G. fuscipes*, *G. pallidipes*) contained parturition hormone activity, and neck-ligated females of *G. morsitans*, *G. austeni*, *G. palpalis* and *G. pallidipes* all responded to the hormone by giving birth. Though uterine extracts of both *G. brevipalpis* and *G. fuscipes* also contained parturition hormone activity, females of these species failed to respond to a hormone injection in our assay system. This suggests that additional or alternative regulatory mechanisms are involved in regulating parturition in certain species.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **21**: no. 10267.]

- 10273 **Hargrove, J.W., 1997.** Modelling tsetse population changes on Antelope Island. (Extended English abstract only.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 255-256.

IPMI Tsetse Project, c/o Tsetse Control, P.O. Box CY52, Harare, Zimbabwe.

The Antelope Island experiment ran from October 1979 to early 1984. To date there has been only one description of the results and that was limited to the simplest description required to establish the important practical principle that odour-baited targets could be used for the effective control of *Glossina morsitans morsitans* and *G. pallidipes*. In principle the data should have provided a unique set of about 220 sequential weekly estimates of marked and absolute population levels, probabilities of capture and of recapture, survival probabilities and birth rates, which could provide valuable insights into the relationship between flyround and trap catches, on the one hand, and absolute numbers present on the other. Unfortunately, serious theoretical problems have led to great delays in providing the full set of results which can be used to provide the basis for a general dynamic model of the population. These problems are discussed. The experiment was performed in seven different stages, using different sampling methods (flyrounds, daily or weekly marking). More male *G. m. morsitans* were always captured than females, although there was little difference for *G. pallidipes*. There was a marked seasonal change in catches with a peak in August-September (end of cool dry season) and a trough in

February (end of hot wet season). The estimated probability of survival shows annual fluctuations overlain by a general overall decrease with time as the population was put under increasing pressure due to the deployment of first traps and then targets. The probability of recapture showed an even clearer trend in this regard, which appears to be due to changes in the lifetime expectancy with season. Plots of estimated survival probability against maximum temperature show that this can be an important factor, and also show that there is a measurable decrease in survival probability due to the intervention of the experimenter, particularly when the targets were deployed. They also show that the females always have a higher survival probability than the males. The numbers of births are more difficult to estimate and this proves to be a major stumbling block to the effective modelling of the population.

10274 **Hay, S.I., Packer, M.J. and Rogers, D.J., 1997.** The impact of remote sensing on the study and control of invertebrate intermediate hosts and vectors for disease. *International Journal of Remote Sensing*, **18** (14): 2899-2930.

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

This paper reviews the application of remote sensing to the study and control of invertebrate intermediate hosts and vectors for some of the most prevalent of human diseases worldwide. Examples are also taken from studies involving animal diseases that have considerable adverse effects on human welfare. The current status of remote sensing in epidemiology is assessed and suggestions are made on how, in the future, the two fields might be most profitably combined. Sections include: invertebrate intermediate hosts, remote sensing and disease; disease control; malaria and filariasis; leishmaniasis; onchocerciasis; trypanosomiasis; tickborne disease; schistosomiasis; dracunculiasis.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **21**: nos. 10256, 10258, 10259, 10262, 10268, 10269, 10273, 10274, 10297.]

10275 **Keno, M. and Mengistu, M., 1997.** The control of *Glossina morsitans submorsitans* by the application of deltamethrin 1% pour on to cattle in an area of South Western Ethiopia. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 288-290.

National Tsetse and Trypanosomiasis Control Centre, P.O. Box 113, Bedelle, Ethiopia.

A successful trial using 1% deltamethrin pour-on applied to 2000 cattle was carried out in the Chara area of South Western Ethiopia. Pre-treatment surveys showed an apparent density of *G. m. submorsitans* of 3.3 flies per trap per day and a prevalence of trypanosomiasis of 27.3%. Cattle were in poor health and not responding to drug treatment. The methods and intervals of treatment which noticeably improved the health

of the cattle, appeared to eradicate the tsetse population and reduced the prevalence of trypanosomiasis to a low level, are described. Socio-economic data are also presented and the preliminary results indicate a marked improvement in the productivity of the cattle and of crop production. The results in the treated area are compared to those in an untreated area some 10 km distant.

- 10276 **Patzelt, R.J., Kakaire, D., Katabazi, B. and Mehlitz, D., 1997.** Efficacy of deltamethrin 'Spot On' for control of tsetse flies and trypanosomiasis transmission in Uganda. (Abstract only.) *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 295-296.*

Patzelt: P.O. Box 311, Entebbe, Uganda.

The effect of deltamethrin 'Spot On' on the density and infection rates of tsetse flies, *Glossina fuscipes fuscipes*, and on the prevalence of trypanosome infections in livestock was assessed in Matala Subparish, Mukono District, south-eastern Uganda, an area of secondary rain forest near Lake Victoria. Cattle and pigs account for more than 90% of tsetse bloodmeals and, with *Trypanosoma brucei* being the most common trypanosome species, are thought to play an important role as reservoir host for sleeping sickness. Cattle (120) and pigs (10) all received a curative dose of diminazene aceturate and were then treated with 'Spot On' monthly. From a pre-intervention level of more than 8 flies/trap/ day, the apparent density was reduced by 85% after 4 weeks and gradually reached 0.1. The fly infection rate fell from 3% to nil. Trypanosome prevalence before intervention was 40% in cattle and 80% in pigs; after diminazene and 'Spot On' treatment it fell to less than 3% and 0%, respectively. It is concluded that this is a fast method to reduce tsetse populations and animal infection rates and is suitable for use in focal sleeping sickness epidemics.

- 10277 **Shereni, W., 1997.** Integrated use of bait techniques for tsetse control in Zimbabwe. *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 274-287.*

Tsetse Control, P.O. Box CY 52, Harare, Zimbabwe.

Bait techniques involving the use of insecticide-treated cattle or targets have successfully been used during the last decade in Zimbabwe, either separately or in integrated operations. The containment of the tsetse fly situation in the North Eastern Districts along the border with Mozambique, with no invasion into areas cleared of tsetse, demonstrated how narrow barriers of targets and cattle treated with Decatix (dip) or Spoton (pour-on) can be effectively integrated. Over a quarter of a million cattle, within the tsetse fly belt or in areas adjacent to the tsetse front, are currently under treatment with insecticides over an area of approximately 35,000 km². Tsetse (*Glossina pallidipes*) were eradicated, within 6 months, from an isolated tsetse-infested area south of Chirisa National Park in North Western Zimbabwe, in an integrated operation using targets deployed strategically at the low density of 1 target per km², and the dipping of 20,000 cattle. Control is currently in progress in the mid Zambezi Valley using dipped cattle and targets deployed at 4 per km². Cattle treatment, in the absence of targets, has been used with success in the Honde Valley (North Eastern Zimbabwe). Trypanosomiasis infections in

cattle declined to the level of no detection with parasitological diagnostic techniques 5 months following the introduction of the cattle dipping programme in the Honde Valley area. It was in this area that the dipping of cattle was also demonstrated to be effective against *G. austeni*, which invaded the country from Mozambique in 1992. The cattle treatment programme in the Honde Valley has created a barrier against further invasion. The trypanosomiasis situation in the mid Zambezi Valley (Gutsa, Dande and Muzarabanni Communal Lands) has been influenced by the dynamic changes in the tsetse fly population in the presence or absence of the cattle dipping programme. The treatment of cattle with insecticides has reduced bovine trypanosomiasis infections to an extent that only curative drugs are now being used in Zimbabwe.

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

[See also 21: nos. 10302, 10328.]

10278 **Moloo, S.K., Zwegarth, E., Okumu, I.O. and Sabwa, C.L., 1997.** A comparison of the susceptibility to pathogenic *Trypanosoma* species of *Glossina pallidipes* originating from allopatric populations in Kenya. In: OAU/STRC, 1997 (see 21: no. 10263), pp. 257-263.

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

A colony of *G. pallidipes* which originated from Nguruman, Rift Valley Province, Kenya, was significantly more susceptible to infections with stocks of *Trypanosoma (Nannomonas) congolense*, *T. (N.) simiae* and *T. (Trypanozoon) brucei brucei* than a colony of the same species which originated from Shimba Hills, Coast Province, Kenya. Male *G. pallidipes* from both the colonies were more susceptible to the trypanosome infections than female tsetse. Nevertheless, if the differences in susceptibility of the two *G. pallidipes* colonies to infections with these trypanosome species reflect transmission of the trypanosomes by the two populations of tsetse in the field, then the epidemiology of trypanosomiasis must differ between these two areas in Kenya. *G. pallidipes* which originated from Nguruman showed higher infection rates to stocks of *T. (Duttonella) vivax* than those from Shimba Hills. However, the infection rates in the two allopatric populations were high, and ranged from 71.3 to 80.0%. Thus, the vector aspects of *T. vivax* trypanosomiasis probably do not differ between these two areas of Kenya.

10279 **Yao, Y., Green, C.H., Krüger, W.D., Sanou, F. and Toure, F., 1997.** Etude de l'infection trypanosomienne de *Glossina longipalpis* Wiedemann, 1840 (Diptera: Glossinidae) et de ses variations en secteur préforestier de Côte d'Ivoire. [Study of trypanosome infection of *G. longipalpis* and its variations in the preforest zone of Côte d'Ivoire.] In: OAU/STRC, 1997 (see 21: no. 10263), pp. 266-270.

Yao: Service de Lutte contre la Trypanosomiase Animale et les Vecteurs, 01 B.P. 3301, Bouaké 01, Côte d'Ivoire.

The infection rate of *G. longipalpis* has been assessed by means of dissections in flies caught with modified Vavoua traps during the rainy and dry seasons on a sheep breeding farm in central Côte d'Ivoire (6°N; 5°W), in relation to factors known to affect vectorial capacity, such as sex, age, season and parasite species. *G. longipalpis* appeared to be infected only by 'vivax-type' and 'congolense-type' trypanosomes in this region. The overall infection rate was 28% and 16% respectively in the dry and rainy seasons. There was no difference in the infection rate of males in the two seasons (7% and 9% respectively in the dry and the rainy season), whereas the infection rate of females varied from 42% in the dry season to 24% in the rainy season. Analysis of infections in relation to physiological age of the females indicated that infection occurred much earlier in the dry season than in the rainy season and that the infection rate increased significantly with age in the rainy season. Fluctuations in level of 'vivax-type' infection seemed to determine fluctuations in infection of the population as a whole.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

[See also **21**: nos. 10293, 10302.]

10280 **Büscher, P., Meirvenne, N. van and Magnus, E., 1997.** A latex agglutination test with mixed variable antigens for diagnosis of *T. b. gambiense* infection. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 92-97.

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

Serological field tests are indispensable tools for mass surveys of human *Trypanosoma brucei gambiense* trypanosomiasis. Studies on the variant-specific antibody profiles of trypanosomiasis patients have revealed the diagnostic potential of three variable surface glycoproteins (VSG) of *T. b. gambiense*, particularly when used in combination. Our laboratory has developed an indirect latex agglutination test in which purified VSG of *T. b. gambiense* variable antigen types LiTat 1.3, 1.5 and 1.6 are coupled onto latex particles. A first evaluation with 313 sera from the WHO Central Serum Bank for Sleeping Sickness revealed 99% specificity and 96% sensitivity at a 1:16 serum dilution. To facilitate field application, the reagent is stabilised by freeze-drying and the technical requirements are kept to a minimum. The latex/*T. b. gambiense* awaits large-scale evaluation.

10281 **Debord, T., Eono, P., Rey, J.L. and Roue, R., 1996.** Les risques infectieux chez les militaires en opération. [Infection risks for soldiers on operational duty.] *Médecine et Maladies infectieuses*, **26** (Special): 402-407.

Service des Maladies Infectieuses et Tropicales, Hôpital Militaire Begin, 69 avenue de Paris, 94160 Saint-Mande, France.

The health risks to which French armed forces serving abroad are exposed are of two types: those brought about by poor hygiene, communal living and operational conditions (including diarrhoea of various aetiologies), and those associated with the tropical environment (especially malaria, also schistosomiasis, leishmaniasis and other parasitic diseases). Three cases of trypanosomiasis occurred over a period of 8 years.

- 10282 **Laveissière, C., Amani, K.R., Angui, P. and Doua, F., 1997.** Soins de santé primaires et contrôle de la maladie du sommeil en forêt de la Côte d'Ivoire. [Primary health care and control of sleeping sickness in the forest area of Côte d'Ivoire.] (Abstract only.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 157-158.

Laveissière: IPR/OCCGE, B.P. 1500, Bouaké, Côte d'Ivoire.

In the Sinfra sleeping sickness focus, 108 community health agents have been trained in sleeping sickness control and primary health care. Blood samples collected on filter papers by these agents during serological surveys are tested in two laboratories (CATT test on dried blood) supervised by two medical nurses trained in diagnosis and treatment. In 3 months, more than 74,410 people have been visited and blood samples collected from about two-thirds of them, leading to the detection of 656 seropositives and 232 parasitologically confirmed cases. Primary health care centres have also been set up in villages. Tsetse control activities will also be undertaken by the agents: they will distribute screens to farmers and also check that they are impregnated with insecticide every 4 months. Detection of the latest cases is being done either by collection of dried blood samples in low prevalence areas or by medical survey in high prevalence areas, with the health agents mobilising the population.

- 10283 **Lejon, V., Moons, A., Büscher, P., Magnus, E. and Meirvenne, N. van, 1997.** Trypanosome specific antibody profile in serum and cerebrospinal fluid of *T. b. gambiense* patients. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 78-91.

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

Human infection with *Trypanosoma brucei gambiense* is characterised by an early stage with the parasites dwelling in lymph and blood, followed by a stage in which the trypanosomes invade the central nervous system, leading to neuropathological events and eventually death. Routinely, the main criteria for diagnosing second stage trypanosomiasis are related to the cerebrospinal fluid (CSF): presence of trypanosomes, increased white blood cell count and protein content. The imprecision of these determinations, together with the arbitrary cut-off values prescribed, is in contrast with the risk of dramatic side-effects associated with melarsoprol treatment. Our laboratory has started an investigation aiming at the improvement of diagnosis of second stage trypanosomiasis. Part of this study concerns the anti-trypanosome antibody profile in serum and CSF and parameters for impairment of the blood-brain barrier. For a limited number (28) of *T. b. gambiense* trypanosomiasis patients, the following determinations have been performed on serum and CSF by means of nephelometry and ELISA: albumin,

total protein, total and trypanosome-specific IgG, IgM, IgA, IgG₁, IgG₂, IgG₃ and IgG₄. The results of this study, although incomplete, suggest some general conclusions. For stage determination, all three CSF parameters should be analysed since mutual relationships are lacking. Blood-brain barrier impairment is not reflected by the presence of trypanosomes and cytorachia but correlates with extremely high CSF protein concentration (> 700 mg/l). Albumin analysis on serum and CSF may be of importance in stage determination since blood-brain barrier damage may have consequences for treatment (drug regime and evaluation of treatment success). Detectable concentrations of IgM in CSF indicate intrathecal synthesis and/or blood-brain barrier damage and should be studied further. Antitrypanosomal IgA, IgM and IgG (in particular IgG₁) are present in patients' CNS, particularly in the second stage. As a marker for CNS inflammation, trypanosome-specific IgM should be studied more extensively.

- 10284 **Magnus, E., Meirvenne, N. van and Büscher, P., 1997.** Serodiagnosis of human infections with *T. b. gambiense* using variant specific trypanolysis tests. (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), p. 107.

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

Twelve *Trypanosoma brucei gambiense* clone populations of distinct variable antigen type (VAT) were combined in immune lysis tests with 340 sera of trypanosome-infected patients from eight different African countries and 267 non-trypanosomiasis control sera. At a serum dilution of 1:4 the diagnostic specificity of the test was 100%. Using single VATs, the sensitivity varied from 39.1 to 98.2%. Eight combinations of two VATs yielded test sensitivities of 98.5%. With three VATs, a sensitivity of 98.8% was obtained in four combinations. The VAT recognition patterns were clearly related to the geographical origin of the sera, reflecting a diversity in variable antigen repertoires. By virtue of its high sensitivity and specificity, the immune lysis assay, combining two or three VATs, can serve as a reference antibody detection test for human infections with *T. b. gambiense*.

- 10285 **Pansaerts, R., Meirvenne, N. van, Magnus, E., Büscher, P. and Bayon, D., 1997.** CATT/*T. b. gambiense*: a prozone phenomenon caused by complement. (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), p. 106.

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

The card agglutination test CATT/*T. b. gambiense* is currently used to facilitate sleeping sickness surveys. The screening test is generally done on freshly collected blood, serum or plasma. Recent laboratory observations have shown that some factors of the complement system may have an adverse effect on the agglutination reaction, reflected by a paradoxical prozone phenomenon yielding weaker test scores at the lower sample dilutions. This can be suppressed by previous complement inactivation. A simple remedy is incorporation in the antigen reagent or buffer of a Ca²⁺/Mg²⁺ binding substance such as Na₂-EDTA. Limited experiments in the Adjumani sleeping sickness focus (northwestern

Uganda) have confirmed that freshly collected blood samples of trypanosomiasis-infected patients often yield stronger agglutination scores in the CATT EDTA version, as compared with the ordinary test version. Field workers are invited to participate in further evaluation of the sensitivity and the specificity of this alternative CATT version as compared with the classical one.

10286 **Truc, P., Diallo, P.B., N'Guessan, P. and Le Ray, D., 1997.** Le kit pour l'isolement *in vitro* des trypanosomes africains (KIVI): une nouvelle micro-méthode de terrain. [The kit for *in vitro* isolation of African trypanosomes (KIVI): a new simple procedure for field use.] *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 98-102.

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

With the kit for *in vitro* isolation of African trypanosomes (KIVI), isolation and culture of stocks of trypanosomes from mammals is easy and successful. Using the same culture medium, a simple procedure has been developed in order to simplify the use of the kit and reduce its cost. Finger-prick samples of blood are obtained using a micropipette with a sterile tip and transferred into a small culture tube together with culture medium. The percentage of success for isolation of stocks is the same as that obtained using the original control protocol and subpassages of the cultures. The simplicity and low cost of this micromethod should facilitate its widespread use for diagnosis or for research necessitating the isolation and culture of pathogenic trypanosomes.

(b) PATHOLOGY AND IMMUNOLOGY

10287 **Odiit, M., Kansiime, F. and Enyaru, J., 1997.** Duration of symptoms of fatality of sleeping sickness caused by *Trypanosoma brucei rhodesiense* in Tororo, Uganda. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 120-125.

Trypanosomiasis Programme, Livestock Health Research Institute, P.O. Box 96, Tororo, Uganda.

Although there have been recent molecular biological studies for evidence of possible changes in trypanosome biochemistry, such studies are not yet complemented by parallel clinical studies to determine the possible implications to the sleeping sickness patient. A study of the duration of symptoms and the case fatality rate due to *T. b. rhodesiense* in sleeping sickness patients admitted to Tororo hospital was carried out to obtain an impression of the virulence of the parasite during the recent epidemic of sleeping sickness in Uganda. The results showed that the disease progressed to the stage of central nervous system involvement between 3 weeks and 2 months after infection. Most (> 80%) deaths occurred within 6 months of infection. The case fatality rate was 6% for patients admitted to hospital. The risk of death in the late stage of sleeping sickness was more than two and a half times that in the early stage. The incidence of melarsoprol encephalopathy was 2.5% and case fatality due to this condition was 1.0%. It appears that the virulence of *T. b. rhodesiense* circulating in south-east Uganda has not changed during the past decades.

- 10288 **Young, J.A. and Ryan, E.T., 1996.** Parasitic infections of the anterior segment. *International Ophthalmology Clinics*, **36** (3): 49-71.

Cornea Service, Massachusetts Eye and Ear Infirmary, Harvard Medical School, 243 Charles Street, Boston, MA 02114, USA.

The increasing popularity of contact lenses, the development of AIDS and the ease of international air travel have led to an increase in parasitic infections in the front of the eye over the past 20 years. The epidemiology, pathology, diagnosis and treatment of various protozoal and helminthic infections which can affect the eye are reviewed. *Trypanosoma brucei gambiense* and *T. b. rhodesiense* are included.

(c) TREATMENT

[See also **21**: nos. 10283, 10287.]

- 10289 **Khonde, N., Pépin, J. and Mpia, B., 1997.** Rechutes après un traitement avec une combinaison de pentamidine et de suramine des cas de trypanosomiase gambienne au premier stade. [Relapses following treatment of early-stage Gambian trypanosomiasis with a combination of pentamidine and suramin.] *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 126-128.

Pépin: Centre de Santé Internationale, Centre Universitaire de Santé de l'Estrie, 3001 12ème Avenue Nord, Sherbrooke, Quebec J1H 5N4, Canada.

We reviewed the records of 659 patients with early-stage (CSF WBC count: 1-5/mm³) parasitologically proven *Trypanosoma brucei gambiense* trypanosomiasis treated in Nioki Hospital, Zaire, between 1 January 1983 and 31 December 1992. Six hundred and sixteen patients had been treated with a combination of pentamidine (4 mg/kg i.m. on days 1, 3, 5, 13, 15, 17) and suramin (20 mg/kg i.v. on days 1 and 13), 30 with a combination of diminazene (7 mg/kg i.m. on days 1, 2, 3) and suramin (20 mg/kg on day 1), 9 with suramin alone and 4 with pentamidine alone. There was a trend for treatment failures to be more frequent with diminazene/suramin (5/30 (16.7%)) than with pentamidine/suramin (46/616 (7.5%)). With pentamidine/suramin, area of residence did not affect the risk of relapse. The frequency of treatment failure was identical when comparing patients treated between 1983 and 1987 to those treated from 1988 to 1992, and the overall rate (7.5%) was similar to that reported with pentamidine monotherapy up to 40 years ago. Even within this small range of CSF WBC count, relapses were less frequent among patients with 1-2 WBC/mm³ than among those with 3-5/mm³ (16/382 (4.2%) compared to 30/232 (12.9%)). Nine patients (1.5%) died during or shortly after pentamidine/suramin treatment. Thus, pentamidine and suramin remain an acceptable choice for early-stage cases and is superior to diminazene/suramin; we do not know if the addition of suramin decreases the failure rate. Children relapsed more frequently than adults and should perhaps be given higher doses.

- 10290 **Khonde, N., Pépin, J. and Mpia, B., 1997.** Essai ouvert d'un traitement de courte durée (7 jours) d'eflornithine par voie IV dans les rechutes de maladie du sommeil à *T. b. gambiense*. [Open trial of a short (7-day) i.v. course of eflornithine for relapsing cases of *T. b. gambiense* sleeping sickness.] *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 155-156.*

Pépin: Centre de Santé Internationale, Centre Universitaire de Santé de l'Estrie, 3001 12ème Avenue Nord, Sherbrooke, Quebec J1H 5N4, Canada.

Forty-seven patients with *Trypanosoma brucei gambiense* trypanosomiasis, who relapsed following melarsoprol therapy, were treated with a 7-day course of eflornithine at 100 mg/kg i.v. every 6 h. There were 15 children between 3 and 16 years of age, and 32 adults. In the lumbar puncture performed just before eflornithine therapy, trypanosomes had been seen in the CSF of 23 patients; the CSF WBC count was between 20 and 100/mm³ in 19 patients and over 100/mm³ in 28 patients. After treatment, four patients died but only one of them with symptoms suggesting a relapse (he died in his village). Thirty-three patients have been followed for at least one year after eflornithine treatment, and only one of them has relapsed. If we include the patient who probably died of a relapse, the failure rate was 5.9% (2/34). This suggests that a 7-day course of eflornithine is an adequate treatment for patients who relapse following melarsoprol treatment. It should not be extrapolated that this 7-day regimen will be adequate for new cases, as these patients have lower CSF levels of eflornithine than relapsing cases, presumably because their blood-brain barrier is less severely impaired than that of relapsing cases.

- 10291 **Maiso, F., Khonde, N., Mbulamberi, D., Doua, F., Ngampo, S., Kuzoe, F. and Pépin, J., 1997.** Multicenter randomized trial of 7 vs 14 days of eflornithine in Gambian trypanosomiasis. (Extended English abstract only.) *In: OAU/STRC, 1997 (see 21: no. 10263), pp. 129-130.*

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

A total of 243 patients with parasitologically proven *Trypanosoma brucei gambiense* trypanosomiasis (203 new and 39 relapsing cases) from Zaire, Uganda, Congo and Côte d'Ivoire were enrolled in a trial to compare 7 and 14 days i.v. eflornithine treatment (100 mg/kg every 6 h). They were randomly allocated to the two treatment groups which were similar for age, sex, history of past trypanosomiasis, hospital where enrolled, presence of CSF trypanosomes and CSF white blood cell count (all over 5/mm³). Adverse effects were similar in the two groups, and the duration of follow-up so far is identical (69 for at least 6 months and 38/34 for at least a year). Results are preliminary but a number of trends have been identified: relapses were more frequent in the 7 day group (19%) than in the 14 day group (12%), among new cases (17%) than among cases who had relapsed after an earlier trypanocidal treatment, usually melarsoprol (5%), among patients with trypanosomes in the CSF prior to eflornithine treatment (21%) than among those without (8%), and among patients in Uganda (32%) than those elsewhere (6%).

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

[See also **21**: no. 10257.]

- 10292 **Githiori, J.B., Waithanji, E.M., Okech, G.O. and Ndung'u, J.M., 1997.** Trypanosomiasis, helminthiasis, and other conditions of donkeys in Lamu and Mwingi Districts, Kenya. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 210-216.

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

In an effort to study the epidemiology and importance of trypanosomiasis in donkeys in Kenya, two districts, Lamu and Mwingi, were selected where donkeys were in high numbers and trypanosomiasis was endemic in livestock. Approximately 200 donkeys were randomly selected in each district. A detailed clinical examination was carried out and blood samples were collected from sick donkeys for determination of PCV and for buffy coat examination (BCE) for the presence of trypanosomes. In Lamu 3% of the animals had trypanosomes on BCE, while no parasites were seen by this method in Mwingi. In Lamu, 57 out of 141 samples (36%) had anti-trypanosomal antibodies while 60 (42.6%) had trypanosomal antigens. In Mwingi, 7 of 77 samples (9.1%) had antibodies and 21 (27%) had antigens. *Trypanosoma congolense* antigens were most frequently detected in Mwingi while *T. brucei* antigens were the most frequent in Lamu. The clinical signs associated with trypanosomiasis were: starry hair coat, dullness, alopecia, wounds, corneal opacity, enlarged lymph nodes, pale mucous membranes, jugular pulsation, laboured respiration, lachrymation, cough, abortion, oedema, orchitis, vaginal discharge and diarrhoea. Of the donkeys sampled, 45.1% had anaemia (PCV below 24%) and 16.1% had pyrexia. Other conditions affecting the donkeys included skin, eye and foot problems and tickborne diseases. Helminthiasis was a major problem in donkeys and control of both conditions could lead to improved health of this draught animal and reduce the chances of the donkey acting as a reservoir of trypanosomiasis and helminthiasis to other livestock.

- 10293 **Masake, R.A., 1997.** Diagnosis of African trypanosomosis. (Review.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 69-77.

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

Diagnosis is an essential requirement in the management of disease both at the level of the individual, when a decision has to be made whether to treat or not, and at the epidemiological level for evaluating the performance of disease control strategies. The centrality of diagnosis in disease management has, therefore, led to the introduction of a variety of tests for detection of trypanosome infection. The standard parasitological techniques routinely applied in the field are not sufficiently sensitive despite the significant improvements made in them over the years. In view of this, the more sensitive indirect immunofluorescence antibody detection test (IFAT), enzyme-linked

immunoassays (ELISA) and card agglutination assays (CATT) were developed for revealing the presence of anti-trypanosome antibodies. Unfortunately, antibody detection tests have several shortcomings, including the lack of defined antigens common to all trypanosomes, inapplicability of these assays in the field in their current format and finally recognition of the fact that presence of antibody cannot always be equated with presence of trypanosome infection. In an effort to come up with technologies which are likely to give accurate information on current status of infection, techniques are in place for trapping trypanosome antigens (Ag-ELISA) and amplifying trypanosome DNA (PCR). These new technologies, with a bit of improvement, are likely to revolutionise diagnosis of trypanosomiasis in animals, man and tsetse flies.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **21**: nos. 10261, 10292.]

10294 **Anosa, V.O., Logan-Henfrey, L. and Wells, C.W., 1997.** Bone marrow and macrophage functions as determinants of bovine trypanotolerance. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 166-172.

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

Sequential changes in the blood and bone marrow were studied by light and transmission electron microscopy in three Boran and three N'Dama cattle before and after a primary infection with *Trypanosoma congolense* IL 1180. Parasitaemia was essentially similar in the Boran and the N'Dama between day 11 p.i. and day 59 p.i. Thereafter, until 112 days p.i. when the study was terminated, parasitaemia was higher in the Boran than in the N'Dama. During the acute phase, the infection induced anaemia and leucopenia which were milder in the N'Dama than in the Boran. In the chronic phase, the leucocyte numbers and PCV of the N'Dama improved, approaching pre-infection levels, whereas the values for the Boran continued to drop. Moderate thrombocytopenia developed in the two breeds of cattle with no remarkable differences between them. The cellularity of bone marrow biopsies were similar in the two breeds before infection. Following infection, the bone marrow biopsies of N'Dama cattle were consistently hypercellular while those of the Boran were hypocellular. The infection caused marked erythroid hyperplasia with marked hypoplasia of granulocyte elements in the Boran while there were only moderate corresponding shifts in these cell lineages in the N'Dama. There was moderate hyperplasia of macrophages in the bone marrow of both breeds, and the calculated volume index of macrophages was 19.5 ± 3.6 in the Boran and 33.2 ± 3.9 in the N'Dama ($P < 0.005$) compared to 5.3 ± 1.4 and 4.7 ± 0.6 , respectively, before infection. The macrophages of both breeds were activated as shown by their significantly increased sizes and organelle (mitochondria, ER) contents, but those of the N'Dama were more activated. The macrophages in the bone marrow phagocytosed immature and mature haemopoietic cells in the bone marrow, particularly erythrocytes, granulocytes and thrombocytes and smaller numbers of lymphoid cells and monocytes. Cell phagocytosis was preceded by cell to macrophage attraction, and then adhesion. Prior to infection, the macrophages had contacts with haemopoietic cells through V- or U-shaped microvilli apparently associated with macrophage control of haemopoiesis; these contacts increased during infection.

Target cell adhesion to macrophages and phagocytosis, and contacts with haemopoietic cells were more marked with macrophages of the N'Dama than in the Boran, and these activities were further reduced in the Boran at 98 and 112 days p.i. In conclusion, it would appear that the N'Dama achieve this superior tolerance because of the hypercellularity of the bone marrow and the greater activation of the macrophages which result in greater haemopoiesis. Since cytophagia was also greater in the N'Dama, our results indicate that this breed produces more blood cells and destroys more than the Boran. The balance between production and destruction appears to be much greater in the N'Dama than in the Boran. The results of this study show that the bone marrow is the key determinant organ of trypanotolerance in cattle while the macrophages, particularly those of the bone marrow, form the pivot of this control.

10295 **Joshua, R.A., Neils, J.S. and Oladosu, L.A., 1997.** Haematologic and serum mineral changes in sheep infected with *Trypanosoma congolense*. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 229-232.

Joshua: Paraclinical Veterinary Studies, University of Zimbabwe, P.O. Box MP 167, Harare, Zimbabwe.

The course of infection by a recently isolated *T. congolense* stock was studied in a group of fully susceptible sheep. Basic biochemical changes in serum and haematological values as well as clinical signs were studied in the experimentally infected animals and in a control group of sheep. The trypanosome stock was highly virulent in sheep, resulting in death in less than 20 days if not treated. The infection was characterised by a short prepatent period, low PCV, pale mucous membranes and generally low haematological values. Contemporaneous studies on the serum mineral levels in infected and control animals were carried out using an autoanalyser. Results indicated significantly higher levels of calcium and iron ($P < 0.001$) and a lower level of phosphorus ($P < 0.001$) in infected sheep than in controls. There was no significant change in the serum copper levels in infected and control animals. The imbalance in the ratio of serum calcium, phosphorus and iron could be an important factor in the virulence of *T. congolense* in sheep.

10296 **Katunguka-Rwakishaya, E., Parkins, J.J., Fishwick, G., Murray, M. and Holmes, P.H., 1997.** The pathophysiology of *Trypanosoma congolense* infection in sheep: influence of dietary energy. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 226-228.

Katunguka-Rwakishaya: Department of Veterinary Medicine, Makerere University, P.O. Box 7062, Kampala, Uganda.

The intensity of parasitaemia, live body weight gains and blood biochemical changes were measured in two groups of sheep infected experimentally with *T. congolense* and given either a high (9.9 MJME/day) or a low (6.1 MJME/day) energy intake. It was observed that infected animals on a low energy intake tended to have a longer prepatent period, but following patency they developed more severe anaemia and greater retardation of growth than those on a high energy intake. Both infected groups exhibited significant

reductions in serum total lipids, plasma cholesterol and albumin. However, these changes were more severe in the animals receiving a low energy ration than in those on a high one. It was concluded that adequate energy nutrition enhances the ability of trypanosome-infected animals to withstand the adverse effects of infection by promoting better weight gains and moderating the severity of pathophysiological changes associated with ovine trypanosomiasis.

- 10297 **Mulatu, W., Rowlands, G., d'Ieteren, G.D.M., Leak, S.G.A. and Nagda, S.M., 1997.** Productivity of cattle treated with cypermethrin 'pour-on' insecticide to control tsetse in south-west Ethiopia. (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), p. 297.

Mulatu: ILRI, P.O. Box 5689, Addis Ababa, Ethiopia.

Approximately 90 village Ethiopian Highland Zebu cattle at Gullele in south-west Ethiopia were ear-tagged in March 1986 and they and their offspring monitored monthly until February 1996. In January 1991 a tsetse control campaign began using a synthetic pyrethroid cypermethrin 'pour-on' applied monthly to cattle. This resulted in reductions of 95% in mean relative densities of tsetse and biting flies from 1992 to 1995. A cost recovery scheme was introduced in December 1992, and thereafter farmers paid for treatment. Cattle from neighbouring herds not affected by this campaign were also monitored and these were used, where possible, as statistical controls. Tsetse control resulted in a reduction of 64% in prevalence of trypanosomal infections and 50% in the number of treatments of diminazene aceturate given to cattle detected parasitaemic or showing clinical signs of trypanosomosis. Associated with these reductions there were significant increases of 20% in mean calf growth rate over the wet season ($P < 0.05$) and an average decrease of 50% in abortion rate and calf mortality to 12 months of age ($P < 0.05$). There was an increase of 37% in the ratio of live calves under 12 months of age to cows (from 0.49 ± 0.03 to 0.66 ± 0.08 ($P < 0.05$)) and an average increase of 6% in adult body weight ($P < 0.05$ for cows; $P < 0.01$ for oxen). Packed red cell volume was significantly increased only in adult males. Despite the increase in calf growth rate over the wet season, there was no significant increase in mean body weight at 12 months of age. Calving rate did not change significantly. The major benefit of tsetse control appears to have been the increase in numbers of cattle raised and new owners settling in the area. Generally, however, the significances of the results were difficult to substantiate statistically.

- 10298 **Okech, G., Watson, E.D., Luckins, A.G. and Makawiti, D.W., 1997.** The effect of *Trypanosoma vivax* infection on late pregnancy and post-partum return to cyclicity in Boran cattle. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 162-165.

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

A study was designed to examine the effect of infection with *T. vivax* KETRI 2501 on the maintenance of pregnancy and post-partum return to reproductive normality in susceptible Galana Boran and trypanotolerant Orma Boran heifers during the third trimester of pregnancy. One out of three infected Galana heifers had a premature birth and

subsequent perinatal mortality. Of the two heifers that produced live calves, one of the calves died shortly after birth, while the other survived. Two out of three Orma heifers had premature births, and all three calves died shortly after birth. All control animals produced live calves at term, all of which survived. Infection with *T. vivax* during the third trimester of pregnancy delayed the resumption of ovarian activity after calving, with the Ormas taking a significantly ($P < 0.05$) shorter time from calving to ovulation. There was no clear evidence that premature birth was associated with pathological changes in reproductive organs. Results from this study demonstrated that infection with pathogenic *T. vivax* during late pregnancy influenced the outcome of pregnancy in both susceptible Galana and trypanotolerant Orma Borans, resulting in premature births, perinatal mortalities, retained placentae, low birth weights and prolonged periods to onset of post-partum ovarian activity.

- 10299 **Onah, D.N., Hopkins, J. and Luckins, A.G., 1997.** Effects of *Trypanosoma evansi* on the output of cells from a lymph node draining the site of *Pasteurella haemolytica* vaccine administration. *Journal of Comparative Pathology*, **117** (1): 73-82.

Onah: Department of Life Science, University of Nottingham, University Park, Nottingham NG7 2RD, UK.

The prefemoral efferent lymphatics of sheep infected with *T. evansi* and inoculated with *P. haemolytica* vaccine, and of those given only the vaccine, were surgically cannulated to study the effects of the infection on the total cellular output and on the output of blast cells from the node in response to the vaccine. *T. evansi* delayed and depressed the increases in total cell and lymphoblast outputs. In uninfected sheep, the total cellular output increased and peaked at more than twice the prevaccination values on days 4 and 5 after primary vaccination, but the increases were smaller and peaked on days 6 and 8 after primary vaccination in the infected sheep. The output of lymphoblasts mirrored the total cell output, though it was suppressed to a greater degree by *T. evansi*. The output of blasts peaked at more than 8 and 14 times the prevaccination values in the uninfected animals after primary and secondary (booster) vaccinations, respectively, but in infected animals it peaked at twice the prevaccination values after the primary vaccination and showed no increase after booster vaccination until 11 days later. It is concluded that the inhibition of total and blast cell outputs by *T. evansi* may limit the early systemic dissemination of antigen-specific cells, thus playing a role in the induction of immunosuppression by the parasite.

- 10300 **Romney, D.L., N'Jie, A., Clifford, D., Holmes, P.H., Richard, D. and Gill, M., 1997.** The influence of plane of nutrition on the effects of infection with *Trypanosoma congolense* in trypanotolerant cattle. *Journal of Agricultural Science (Cambridge)*, **129** (1): 83-89.

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

Thirty-two N'Dama heifers were offered *ad libitum* Andropogon hay plus 10.2 g/kg liveweight (LW) groundnut hay (GNH) (L) or 10.2 g/kg LW GNH and 3.9 g/kg LW groundnut cake (GNC) (H). After 4 weeks on the diets, half of each group were infected intradermally with *T. congolense* clone ITC 50 (LI and HI). Peak parasitaemia occurred 6-8 days p.i. and started to decrease *c.* 56 days later. No differences in parasitaemia were observed between LI and HI animals. Packed cell volume (PCV) fell in all treatments (by 5.4, 13.8, 3.7 and 9.4 units after 49-63 days p.i. for the L, LI, H and HI groups, respectively) and significant effects of infection and diet were observed. GNH and GNC intakes were maintained during the trial; however, infected animals had a decreased intake of Andropogon hay. LI animals lost significantly more weight during the experimental period than the non-infected controls (-71.4 *v.* -13.7 g/day). Meanwhile, HI animals gained less weight compared with the H group (52.2 *v.* 167.6 g/day). Weight losses appeared to be due to decreased food intake. In the period 54-68 days p.i., plasma concentrations of albumin were lower and plasma protein was higher in infected animals. Plasma cholesterol concentrations were also lower in infected animals 54-68 days p.i. Plasma urea concentrations were higher in supplemented animals but were not affected by infection. The results showed that animals on a higher plane of nutrition showed less severe clinical signs of infection. However, for all the parameters considered, the magnitude of the difference between groups on different diets was similar for both infected and control animals, suggesting that mechanisms of resistance were not affected by the planes of nutrition considered.

10301 **Witola, W.H. and Lovelace, C.E.A., 1997.** Serum proteins changes in indigenous Zambian goats with trypanosomosis. (Meeting abstract no. 2344.) *FASEB Journal*, **11** (9): A1257.

University of Zambia, Lusaka, Zambia.

Serum total proteins, albumin and globulin concentrations were determined in adult indigenous Zambian goats undergoing experimentally induced *Trypanosoma congolense* infection for 10 consecutive days. The mean serum total protein and globulin concentrations increased significantly ($P < 0.05$) within 3 weeks of infection and remained elevated until the end of the experiment. The mean albumin levels did not show any significant variations while the A:G ratio significantly ($P < 0.05$) dropped in the fifth week and remained consistently low. Since liver and kidney pathological changes are associated with lowered serum total proteins and albumin concentrations, these results showed that trypanosomosis in goats does not induce obvious pathological changes in these organs. However, trypanosomosis does provoke the immune system, leading to enhanced production of serum globulins.

(c) TRYPANOTOLERANCE

[See **21**: nos. 10257, 10261, 10294.]

(d) TREATMENT

[See also **21**: nos. 10276, 10319, 10321-10323.]

- 10302 **Angus, S.D., Githiori, J.B., Stevenson, P.G., Ndung'u, J.M., Green, C.H., Maudlin, I. and Holmes, P.H., 1997.** Chemoprophylaxis of the animal reservoir – a new approach to the control of Rhodesian sleeping sickness. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 197-209.

Angus: Department of Veterinary Physiology, University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

A linear epidemiological study was carried out in Busia District in the Western Province of Kenya, an endemic area of Rhodesian sleeping sickness, to examine the importance of domestic livestock as a potential reservoir of human infection. The study was carried out in four villages over a 13 month period. After collecting 6 months' baseline data, the villages were paired, with one village in each group acting as a control, for comparative drug trials using the chemoprophylactic trypanocidal drugs isometamidium chloride (Samorin) and homidium bromide (Ethidium). Block treatment of all livestock (cattle, sheep, goats and pigs) was carried out in each of the trial villages at a dose rate of 1 mg/kg and all untreated livestock entering these villages during the trial period were treated with the same drug. In the village treated with isometamidium it took up to 7 days to clear animals of pathogenic trypanosomes (*Trypanosoma vivax*, *T. congolense* and *T. brucei*). Isometamidium was 98% effective as a prophylactic against all trypanosomes at 10 weeks post treatment, 94% at 12 weeks, 81% at 14 weeks and 51% at 17 weeks. A significant increase in the mean PCV and liveweight gain was seen during the period of prophylaxis. Despite very low tsetse challenge, breakthrough infections in the homidium group were seen at 3 and 4 weeks post treatment. Homidium was effective at curing infections with *T. vivax*, *T. congolense* and *T. brucei* but was much less effective than isometamidium as a prophylactic. Because of the very low level of challenge it was only possible to estimate the degree of homidium prophylaxis at 85% at 3-4 weeks and at a negligible level at 8 weeks post treatment. Homidium prophylaxis did not significantly affect either mean PCV or liveweight gain. These results suggest that prophylactic treatment with isometamidium twice at 12 week intervals could virtually eliminate the reservoir of *T. brucei* in cattle for 6 months and help rapidly reduce the incidence of sleeping sickness in the human population.

- 10303 **Atse, P.A., Coulibaly, L., Hecker, P.A., Krebs, H.A., d'Ieteren, G., Rowlands, G.J., Leak, S.G.A. and Nagda, S.M., 1997.** Evidence for trypanocidal drug resistance at Ferkessedougou feedlot, northern Côte d'Ivoire. (Abstract only.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 250-251.

Atse: Projet Conjoint SODEPRA/GTZ/CIPEA, B.P. 143, Boundiali, Côte d'Ivoire.

Eleven groups of male cattle (39 on average per group) were monitored for presence of trypanosomes at 3-weekly intervals for periods of up to 27 weeks at Ferkessedougou feedlot, northern Côte d'Ivoire, in an area supposedly free of tsetse. All animals originated from or grazed during transhumance in south-west Mali. The groups were assigned to different treatment regimes as they entered the feedlot. All animals of six groups were treated with diminazene aceturate on the first day of sampling, three groups at

a dose of 3.5 mg/kg and three groups at 7 mg/kg bodyweight. Similarly, three groups were treated with isometamidium chloride at a dose of 0.5 mg/kg. As the feedlot ceased its operations, only one group was treated with the same drug at a dose of 1 mg/kg and an 11th group was treated with homidium bromide at a dose of 1 mg/kg. Every animal was thus treated with either diminazene, isometamidium or homidium at the time of first sampling and with a 'sanative pair' if detected parasitaemic again. No animals were detected parasitaemic at any time in the one group initially treated with homidium. Five animals were detected parasitaemic at week 0 in two groups treated with isometamidium at 1 mg/kg. Two of these animals were detected parasitaemic again, one at 3 weeks and one at 12 weeks following treatment. Infections were then treated with diminazene at 7 mg/kg and apparently cured. No animals were detected parasitaemic at any time in the other two groups treated with isometamidium. There were 15 subsequent cases of parasitaemia in animals first treated with diminazene at 3.5 mg/kg that were sampled on at least three occasions following further treatment with isometamidium. Parasitaemia was detected again in 8 animals (53%) within 9 weeks of treatment. These results provide evidence of a problem of drug resistance to isometamidium having developed among trypanosomes in two of the eleven groups of animals. Diminazene at 3.5 mg/kg had apparently failed to cure infection in 14 animals in these two groups. There was, however, less evidence of drug failure when the higher dose of 7 mg/kg was used in two other groups.

10304 **Coulibaly, L., Hecker, P.A., Krebs, H.A., Rowlands, G.J., d'Ieteren, G.D.M., Leak, S.G.A., Peregrine, A.S. and Nagda, S.M., 1997.** Failure of trypanocidal drugs to cure trypanosome infections in cattle in Boundiali District, northern Côte d'Ivoire. (Abstract only.) *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 248-249.

Coulibaly: Projet Conjoint, SODEPRA/GTZ/CIPEA, B.P. 143, Boundiali, Côte d'Ivoire.

Twelve traditional herds of cattle in the area of Boundiali, northern Côte d'Ivoire, were examined monthly from 1990 to 1992 for the presence of trypanosomes. The herds were randomised into three treatment groups; cattle in four herds received diminazene aceturate at 3.5 or 7 mg/kg bodyweight when detected parasitaemic; cattle in four herds received isometamidium chloride at 0.5 or 1 mg/kg when detected parasitaemic; and cattle in four herds received homidium bromide at 1 mg/kg when detected parasitaemic. Thirty-one percent of 236 cases that were parasitaemic and treated were parasitaemic at the next month's sample when treated with diminazene or within 2 months when treated with isometamidium or homidium. This percentage was much higher than the monthly incidence of new infections (mean 4%; 85% of infections *Trypanosoma vivax*, 15% *T. congolense*) and suggested that approximately 27% of infections may have been drug resistant. Some animals continued to be detected parasitaemic over several months. In order to relate the number of detected parasitaemias to the number of separate individual infections, an estimated new infection was defined as a case of parasitaemia preceded by at least 2 months without detection of the same species of trypanosome. The infections were then examined to determine the proportion that may have recurred. There were no significant differences in rates of recurrence of infection among the three drugs (20/68

(29%) for diminazene, 15/39 (38%) for isometamidium, and 18/62 (29%) for homidium), or between different doses for each drug. However, when cattle greater than 36 months of age were compared with those less than 36 months of age, the mean treatment failure rate in the older cattle was half that in younger cattle (22% and 41%, respectively; $\chi^2 = 8.1$, $P < 0.01$). This implies that the overall failure rate of the drugs to cure infections, presumably due to drug resistance, was compensated to some extent by an acquired immunity to trypanosomal infections as the animals grew older.

10305 **d'Ieteren, G., Coulibaly, L., Atse, P.A., Hecker, P.A., Krebs, H.A., Rowlands, G.J., Leak, S.G.A. and Nagda, S.M., 1997.** Trypanocidal drug resistance in four regions of Côte d'Ivoire: importance and possible impact on sustainability of integrated strategies for trypanosomiasis control. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 233-247.

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

The efficacies of three trypanocidal drugs, diminazene aceturate, isometamidium chloride and homidium bromide, were evaluated in four representative areas of Côte d'Ivoire with different production systems, degree of integration of different trypanosomiasis control approaches and delivery of veterinary inputs. Herds were selected as follows: (i) twelve traditional, sedentary herds around Boundiali with a mixture of cattle genotypes, dominantly crosses between trypanotolerant and trypanosusceptible cattle; (ii) eleven groups of zebu cattle at the Ferkessedougou feedlot, originating dominantly from Mali; (iii) fifteen private N'Dama cattle herds in the Bouaké area; (iv) sixteen herds of N'Dama cattle at the Marahoué State Ranch. Groups of animals or herds in the four locations were systematically treated with one of the three drugs at 3.5 or 7 mg/kg body weight for diminazene, 0.5 or 1 mg/kg for isometamidium and 1 mg/kg for homidium. Screening for relapse was done either at 3 week intervals in three sites, or at monthly intervals at the Boundiali area. There was evidence for resistance to all three trypanocidal drugs at Boundiali (see also **21**: no. 10304) and to isometamidium at Ferkessedougou in cattle imported from southern Mali; at Ferkessedougou a dose of 7 mg/kg seemed necessary for successful application of diminazene (see also **21**: no. 10303). Both *Trypanosoma congolense* and *T. vivax* species appeared to express resistance to the three trypanocidal drugs; in the tsetse controlled area of Boundiali it might be difficult to control the residual *T. vivax* population which caused 86% of infections. Further south, there was less evidence of resistance to the three trypanocidal drugs, except possibly for homidium at Bouaké. The self-cure ability of the N'Dama may have helped to prevent evidence for drug resistance being revealed in this area.

10306 **Roderick, S., Stevenson, P. and Mwendia, C., 1997.** Approaches to the management of trypanosomiasis by Maasai pastoralists in Kenya. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 217-225.

Roderick: Pan Livestock Services Limited, Department of Agriculture, University of Reading, RG6 2AT, UK.

Cattle trypanosomiasis and productivity were monitored in a tsetse-infested area of south-western Kenya between 1990 and 1994. Grazing management, trypanocide use and tsetse trapping were evident as measures for the control of trypanosomiasis. Annual trypanocide use ranged between 0.5 and 3.0 treatments per animal and was influenced by season, management and location. Comparative trials indicated that liveweight losses associated with grazing animals in tsetse-infested areas may be offset by treatment and superior grazing. Under trial conditions there were no real benefits achieved from the prophylactic control of trypanosomiasis under the prevailing low to medium tsetse challenge. The data collected in the study were both comprehensive and long term, providing extensive base-line information that may be used in the planning, implementation and monitoring of pastoralist development projects in the tsetse-infested areas of Africa.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

10307 **Pereira de Almeida, P.J.L., Meirvenne, N. van, Wuyts, N., Büscher, P. and Magnus, E., 1997.** Development of a diagnostic PCR for sleeping sickness. (Abstract only.) *In: OAU/STRC, 1997* (see **21**: no. 10263), p. 105.

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

Preliminary PCR experiments have been carried out with four different primer sets recognising respectively the following nuclear trypanosome DNA sequences: a repetitive satellite sequence (primer set TBR, and an alternative, TRA), a repetitive transposon-like element (primer set pMUTec 6.6258) and the unique 5' junction of the spliced leader sequence (primer set ORPHON5J). Control assays were done on trypanosome pellets belonging to 16 different stocks of *Trypanosoma brucei* ssp., *T. evansi*, *T. vivax* and *T. congolense*. The TBR, ORPHON5J and pMUTec 6.6258 primer sets reacted exclusively with *Trypanozoon* taxa. The TRA primers reacted with all *Trypanozoon* taxa but also with *T. vivax* when the quantity of DNA presented was sufficiently high. Whereas primer sets TBR and TRA yielded multiple band patterns, the ORPHON5J and pMUTec 6.6258 sets yielded a single band. The results of some experiments using these primers on dried blood samples from *T. b. gambiense* foci in Uganda and Zaire are presented.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **21**: nos. 10347, 10363.]

10308 **Black, S.J., Muranjan, M. and Wang, Q., 1997.** Identification of the Cape Buffalo serum trypanocidal protein: xanthine: oxygen oxidoreductase. (Meeting abstract no. 201.) *Biochemical Society Transactions*, **25** (3): 534S.

Black: Department of Veterinary and Animal Sciences, University of Massachusetts, Amherst, MA 01003, USA.

- 10309 **Damayanthi, 1997.** Biochemical changes associated with experimental *Trypanosoma evansi* infection in albino mice. (Meeting abstract no. 697.) *Molecular Biology of the Cell*, **8** (Suppl.): 120a.

Department of Zoology, Kakatiya University, Warangal 506 009, India.

- 10310 **Fakae, B.B., Harrison, L.J.S., Ross, C.A. and Sewell, M.M.H., 1997.** Expression of acquired immunity to *Heligmosomoides polygyrus* in mice concurrently infected with *Trypanosoma congolense*. *International Journal for Parasitology*, **27** (9): 1107-1114.

Harrison: CTVM, Easter Bush, Roslin, Midlothian EH25 9RG, UK.

- 10311 **Herkenham, M., Quan, N., McCoy, A.N., Whiteside, M.B., Mhlanga, J.D.M. and Kristensson, K., 1997.** Central expression of inflammatory cytokines in African trypanosomiasis: a model for chronic brain infection by parasites. [*T. brucei*; rats.] (Meeting abstract no. 393.1.) *Society for Neuroscience Abstracts*, **23** (1-2): 992.

Herkenham: Section on Functional Neuroanatomy, NIMH, Bethesda, MD 20892, USA.

(c) CHEMOTHERAPEUTICS

[See also **21**: no. 10339.]

- 10312 **Bacchi, C.J., Sanabria, K., Spiess, A.J., Vargas, M., Marasco, C.J., Jimenez, L.M., Goldberg, B. and Sufrin, J.R., 1997.** *In vivo* efficacies of 5'-methylthioadenosine analogs as trypanocides. [*T. b. brucei*, *T. b. rhodesiense*; mice.] *Antimicrobial Agents and Chemotherapy*, **41** (10): 2108-2112.

Bacchi: Haskins Laboratories, Pace University, 41 Park Row, New York, NY 10038-1598, USA.

- 10313 **Burudi, E.M.E., Karanja, S.M., Njue, A.I., Githiori, J.B. and Ndung'u, J.M., 1997.** CNS human African trypanosomiasis: a place for combination therapy. *In*: OAU/STRC, 1997 (see **21**: no. 10263), pp. 149-154.

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

This study aimed at establishing a late-stage DFMO-sensitive vervet monkey model of *Trypanosoma brucei rhodesiense* sleeping sickness for use in improvement of chemotherapeutic management of the disease in man. Two vervet monkeys were infected i.v. with *T. b. rhodesiense* KETRI 2772 and clinically monitored. Treatment was initiated 42 days p.i., when parasites were present in the CSF but may not have invaded the CNS parenchyma. DFMO was administered orally at 200 mg/kg body weight every 6 h for

28 days. Parasitaemia cleared after 3 days, and subsequently CSF parasites, and remained so until 10 days after termination of treatment. No toxicity was observed. Relapsing cases were treated with a suramin-DFMO combination 124 days p.i., with DFMO administered as above, and suramin given at 20 mg/kg body weight i.v. on days 1, 3, 6 and 10 of DFMO treatment. Parasitaemia disappeared within 3 days while the CSF became negative of parasites within a week. The animals remained aparasitaemic during a 400-day follow-up period. Thus, DFMO's efficacy against late-stage disease appears to be tremendously enhanced by suramin. Studies are under way to evaluate the efficacy of this drug combination on a primary infection.

- 10314 **Byington, C.L., Dunbrack, R.L., Whitby, F.G., Cohen, F.E. and Agabian, N., 1997.** *Entamoeba histolytica*: computer-assisted modeling of phosphofructokinase for the prediction of broad-spectrum antiparasitic agents. [Incl. *T. b. gambiense*.] *Experimental Parasitology*, **87** (3): 194-202.

Byington: Department of Pediatrics, University of Utah Health Sciences Center, 50 N. Medical Drive, Salt Lake City, UT 84132, USA.

- 10315 **Gamage, S.A., Figgitt, D.P., Wojcik, S.J., Ralph, R.K., Ransijn, A., Mauel, J., Yardley, V., Snowdon, D., Croft, S.L. and Denny, W.A., 1997.** Structure-activity relationships for the antileishmanial and antitrypanosomal activities of 1'-substituted 9-anilinoacridines. [Incl. *T. brucei*.] *Journal of Medicinal Chemistry*, **40** (16): 2634-2642.

Gamage: Cancer Research Laboratory, Faculty of Medicine and Health Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand.

- 10316 **Gichuki, C.W., Burke, J.M., Jennings, F.W., Sommer, I.U., Kennedy, P.G.E. and Murray, M., 1997.** Eflornithine prevents the development of and reverses the pathological changes in post-treatment reactive encephalitis in *T. b. brucei*-infected mice. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 139-148.

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

Two groups of adult female mice were infected with an eflornithine-resistant *Trypanosoma brucei brucei* stabilate. On day 21 p.i. they were treated with diminazene aceturate to induce post-treatment reactive encephalitis (PTRE). One group of mice was treated with a 14 day course of eflornithine at the time of PTRE induction and the other during an established PTRE. Eflornithine prevented both the development of astrocyte activation and inflammatory cell infiltrates usually observed in the brains of mice during PTRE, and also reversed the astrocyte activation and inflammatory cell infiltration seen in an already established PTRE. The use of eflornithine as an adjunct to melarsoprol treatment of late-stage sleeping sickness might therefore prevent and/or attenuate the reactive arsenical encephalopathy, even when the infecting trypanosomes are eflornithine-resistant.

- 10317 **Harmon, M.A., Scott, T.C., Li, Y.H., Boehm, M.F., Phillips, M.A. and Mangelsdorf, D.J., 1997.** *Trypanosoma brucei*: effects of methoprene and

other isoprenoid compounds on procyclic and bloodstream forms *in vitro* and in mice. *Experimental Parasitology*, **87** (3): 229-236.

Phillips: Department of Pharmacology, University of Texas Southwestern Medical Center, Dallas, TX 75235-9041, USA.

- 10318 **Hunter, W.N., 1997.** A structure-based approach to drug discovery; crystallography and implications for the development of antiparasite drugs. *Parasitology*, **114** (Suppl.): S17-S29.

Department of Biochemistry, University of Dundee, Dundee DD1 4HN, UK.

- 10319 **Joshua, R.A., Obwolo, M.J. and Bwangamoi, O., 1997.** Effect of mode of administration on the efficacy of diminazene aceturate on *Trypanosoma congolense* infections in mice. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 177-183.

Department of Paraclinical Veterinary Studies, University of Zimbabwe, P.O. Box MP 167, Harare, Zimbabwe.

Various treatment regimens were carried out to assess the efficacy of diminazene aceturate and isometamidium chloride on fourteen isolates of *T. congolense* in mice. All isolates were susceptible to a single injection of isometamidium at 0.5 mg/kg. Eight isolates were susceptible to a normal therapeutic dose of diminazene administered as a single dose. Four isolates were resistant to a single dose at 28 mg/kg and were subjected to further tests. Two doses at 14 mg/kg in 24 h against these isolates effected a cure; two doses at 14 mg/kg in 5 h were partially effective. Divided doses at either 3.5 or 7 mg/kg had only a transient effect on parasitaemia and the infection eventually relapsed. It is suggested that administration in two divided doses results in a sustained level of drug circulation, but it would be unwise to equate dose levels in mice and other animals.

- 10320 **Kaminsky, R., Schmid, C. and Lun, Z.R., 1997.** Susceptibility of dyskinetoplastic *Trypanosoma evansi* and *T. equiperdum* to isometamidium chloride. *Parasitology Research*, **83** (8): 816-818.

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

- 10321 **Maina, N.W.N., Otieno, C., Okwara, J., Ngatia, P.N., Auma, J.E., Nyang'ao, J.M.N., Olaho-Mukani, W. and Sutherland, D.V., 1997.** Drug resistance of *Trypanosoma evansi* isolated from camel herds in Kenya. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 190-196.

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

The sensitivity patterns of 21 *T. evansi* isolates collected from camel herds in four districts of Kenya (Tana River, Laikipia, Marsabit and Isiolo) to Cymelarsan, suramin and

Trypacide (quinapyramine sulphate) were assessed *in vitro*. Eighteen isolates were sensitive to Cymelarsan with IC₈₀ values in the range 3-35 ng/ml, while three showed reduced sensitivity to Cymelarsan (IC₈₀ 50-150 ng/ml). Resistance to Trypacide was observed in twelve isolates at a concentration of 500 ng/ml, while eight were resistant to suramin at 10 µg/ml. Only six isolates were resistant to both Trypacide and suramin. The isolates collected from Isiolo were all resistant to Trypacide, while two, one and one isolates from Tana River, Marsabit and Laikipia, respectively, were resistant at 500 ng/ml. While all the isolates from Laikipia were sensitive to suramin (IC₈₀ 0.06-3 µg/ml), five, two and one isolates collected from Isiolo, Tana River and Marsabit, respectively, were resistant at 10 µg/ml. We recommend the use of Cymelarsan for the treatment of *T. evansi* infections in regions where Trypacide/suramin resistance was noted.

10322 **Mdachi, R.E., Murilla, G.A., Ochieng, J.O., Karanja, W.M., Kinyosi, B.W. and Ndubi, J.K., 1997.** The use of multiple doses of Berenil in treatment of resistant trypanosome infections in a mouse model. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 184-189.

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

Studies carried out at KETRI have shown that there is potential for use of multiple regimens in the treatment of resistant trypanosome infections. In the present study the variability of trypanosome strains and species in the effective use of multiple treatment regimens using diminazene aceturate (Berenil) was determined in a mouse model. Three strains of *Trypanosoma congolense* (KETRI 2878, KETRI 2887 and KETRI 2776) and one of *T. vivax* (KETRI 2895) which were resistant to a single dose of up to 30 mg/kg of diminazene were used. Three doses (3.5 mg/kg, 7.0 mg/kg and 10 mg/kg) were used on each strain. Each treatment regimen was tested in a group of six mice. The maximum number of doses administered for each treatment regimen was 12, and the minimum three. The optimal number of treatments required for 100% cure varied with the strain, dose and frequency of treatment. Only one strain of *T. congolense* (KETRI 2878) was cured in all six mice when a dose of 3.5 mg/kg was used. At 10 mg/kg the multiple treatment regimen involving three treatments was 100% curative to all strains tested. Where there was no complete cure, the multiple treatment regimen prolonged the life span of the animals significantly. In addition, the efficacy of the multi-treatment regimen was dependent on the time of first treatment after infection. It would therefore appear that diminazene can be used effectively in multiple treatment regimes on resistant trypanosome infections. Treating initially at 10 mg/kg followed by a few more treatments at 7.0 mg/kg would be curative to most resistant strains.

10323 **Peregrine, A.S., Kemei, S. and Ndoutamia, G., 1997.** Cross-resistance phenotypes associated with induction of resistance to isometamidium chloride and quinapyramine sulphate in *Trypanosoma congolense*. *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 173-176.

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

Isometamidium chloride, homidium chloride and bromide, diminazene aceturate and the salts of quinapyramine are chemically closely related and cross-resistance has been suggested which may contribute to the multiple-drug resistance phenotypes observed in the field. *T. congolense* IL 1180 is a cloned population expressing a high level of sensitivity to these drugs: CD₅₀ values in mice are 0.018 mg/kg body weight for isometamidium, 0.37 mg/kg for homidium chloride, 0.23 mg/kg for quinapyramine sulphate and 2.3 mg/kg for diminazene. The resistance of *T. congolense* IL 1180 to isometamidium was increased by repeated subcurative treatment of infected mice to a CD₅₀ of 1.7 mg/kg (94-fold increase) over an 11 month period to produce a population designated *T. congolense* IL 3343. This population was characterised in mice for its resistance to the other three drugs and had CD₅₀ values of 12.1 mg/kg for homidium (33-fold increase), 0.97 mg/kg for quinapyramine (4-fold increase) and 7.8 mg/kg for diminazene (3-fold increase). In a second study, resistance to quinapyramine was induced in *T. congolense* IL 1180, resulting in a population designated *T. congolense* IL 1180/stabilate 12. The CD₅₀ of this population was > 9.6 mg/kg (40-fold increase). CD₅₀ values for the other drugs were 0.1 mg/kg for isometamidium (6-fold increase), 10.4 mg/kg for homidium (28-fold increase) and 12.7 mg/kg for diminazene (6-fold increase). These data thus indicate that development of resistance to isometamidium in *T. congolense* IL 1180 was associated with a high level of cross-resistance to homidium but low levels of cross-resistance to diminazene and quina-pyramine. In contrast, the development of resistance to quinapyramine was associated with relatively high levels of cross-resistance to isometamidium, homidium and diminazene. These data therefore confirm the rationale for using isometamidium and diminazene as a 'sanative combination', and contra-indicate the use of quinapyramine in cattle, sheep and goats. The development of resistance to diminazene in the field appears most likely to be associated with the use of quinapyramine.

10324 **Polenova, T., Iwashita, T., Palmer, A.G. and McDermott, A.E., 1997.** Conformation of the trypanocidal pharmaceutical suramin in its free and bound forms: transferred nuclear Overhauser studies. [*T. brucei*.] *Biochemistry*, **36** (46): 14202-14217.

McDermott: Department of Chemistry, Columbia University, New York, NY 10027, USA.

10325 **Räz, B., Iten, M., Grether-Bühler, Y., Kaminsky, R. and Brun, R., 1997.** The Alamar Blue[®] assay to determine drug sensitivity of African trypanosomes (*T. b. rhodesiense* and *T. b. gambiense*) *in vitro*. *Acta Tropica*, **68** (2): 139-147.

Brun: Swiss Tropical Institute, Socinstrasse 57, P.O. Box, CH-4002 Basel, Switzerland.

10326 **Wang, C.C., 1997.** Validating targets for antiparasite chemotherapy. *Parasitology*, **114** (Suppl.): S31-S44.

Department of Pharmaceutical Chemistry, University of California, San Francisco, CA 94143-0446, USA.

- 10327 **Wilkes, J.M., Mulugeta, W., Wells, C. and Peregrine, A.S., 1997.** Modulation of mitochondrial electrical potential: a candidate mechanism for drug resistance in African trypanosomes. [*T. congolense*.] *Biochemical Journal*, **326** (3): 755-761.

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

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

- 10328 **Truc, P., Diallo, P.B. and Godfrey, D.G., 1997.** Identification génétique et pathogénicité de *Trypanosoma brucei* s.l. chez l'homme: une forme aiguë de THA est suspectée en Côte d'Ivoire. [Genetic identification and pathogenicity of *T. brucei* s.l. in man: an acute form of HAT is suspected in Côte d'Ivoire.] *In: OAU/STRC, 1997* (see **21**: no. 10263), pp. 131-138.

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

In Côte d'Ivoire, two groups of zymodemes infecting man have been isolated and identified using KIVI and isoenzyme electrophoresis. The first corresponds to the classical subspecies *T. b. gambiense* (group 1): almost all the stocks belonging to this group have been isolated from patients clinically showing a classical chronic form of West African human African trypanosomiasis (HAT). Furthermore, one stock isolated from a wild animal (hartebeest, *Alcelaphus buselaphus*) belongs also to this first group. The second group is more heterogeneous and comprises both human and animal (domestic and wild) stocks. This second group can be equated with the 'Bouaflé' group, and includes stocks isolated from patients showing an acute clinical form of HAT. Epidemiological investigations reinforce the hypothesis that a severe form of HAT currently exists in Côte d'Ivoire with a domestic and wild animal reservoir, reminiscent of the East African 'rhodesiense' form of HAT.

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

[See also **21**: no. 10318.]

- 10329 **Ajayi, W.U. and Hill, G.C., 1997.** Structure-function analysis of the unique cytochrome independent terminal alternative oxidase of *Trypanosoma brucei*. (Meeting abstract no. 1003.) *FASEB Journal*, **11** (9): A1029.

Hill: Molecular Parasitology Training Program, Meharry Medical College, Nashville, TN 37208-3599, USA.

- 10330 **Brown, S.V. and Williams, N., 1997.** Regulation of the *Trypanosoma brucei* ATP synthase β subunit. (Meeting abstract no. 1333.) *FASEB Journal*, **11** (9): A1084.

Williams: Department of Microbiology, State University of New York, Buffalo, NY 14214, USA.

- 10331 **Dungan, J.M., Moeller, T. and Agabian, N., 1997.** Comparative analysis of U5-like RNAs in kinetoplastid organisms. [*T. brucei*.] (Meeting abstract no. 607.) *FASEB Journal*, **11** (9): A960.

Agabian: Program in Molecular Pathogenesis, University of California, San Francisco, CA 94143-0422, USA.

- 10332 **El-Sayed, N.M.A. and Donelson, J.E., 1997.** African trypanosomes have differentially expressed genes encoding homologues of the *Leishmania* GP63 surface protease. [*T. b. rhodesiense*.] *Journal of Biological Chemistry*, **272** (42): 26742-26748.

Donelson: Department of Biochemistry, University of Iowa, Iowa City, IA 52242, USA.

- 10333 **Engstler, M., Wirtz, E. and Cross, G.A.M., 1997.** Generation of constitutive and inducible trans-sialylation dominant-negative phenotypes in *Trypanosoma brucei* and *Trypanosoma cruzi*. *Glycobiology*, **7** (7): 955-964.

Cross: Laboratory of Molecular Parasitology, Rockefeller University, 1230 York Avenue, New York, NY 10021, USA.

- 10334 **Ferguson, M.A.J., 1997.** The surface glycoconjugates of trypanosomatid parasites. [Incl. *T. brucei*.] *Philosophical Transactions of the Royal Society of London (B)*, **352** (1359): 1295-1302.

Department of Biochemistry, University of Dundee, Dundee DD1 4HN, UK.

- 10335 **Fraser-L'Hostis, C., Defrise-Quertain, F., Coral, D. and Deshusses, J., 1997.** Regulation of the intracellular pH in the protozoan parasite *Trypanosoma brucei brucei*. *Biological Chemistry Hoppe-Seyler*, **378** (9): 1039-1046.

Deshusses: Department of Biochemistry, University of Geneva, 30 Quai E. Ansermet, CH-1211 Geneva 4, Switzerland.

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