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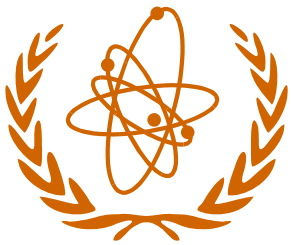

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SECTION A – NEWS

OAU LOME PROPOSAL FOR THE ERADICATION OF TSETSE FLIES ON THE AFRICAN CONTINENT

At their meeting in Lomé, Togo, from 10 to 12 July 2000, the OAU Assembly of the African Heads of State and Government made the following decisions.

The Assembly:

1. TAKES NOTE of the report presented by the Government of Uganda, and COMMENDS the effort undertaken to highlight the problem caused by tsetse flies in Africa;
2. COMMENDS those African countries that have initiated the application of *Sterile Insect Technology* (SIT) for their pioneering effort;
3. RECOGNISES the seriousness of the problem as one of Africa's greatest constraints to socio-economic development severely affecting human and livestock health, limiting land use, causing poverty and perpetuating underdevelopment on the continent;
4. URGES member states to act collectively to rise to the challenge of eliminating the problem through concerted efforts in mobilising the necessary human, financial and material resources required to render Africa tsetse-free within the shortest time possible;
5. ACKNOWLEDGES the trans-boundary nature of the problem, WELCOMES the establishment of the *Pan African SIT Forum* as a mechanism through which sustainable area-wide tsetse eradication can be achieved and CALLS UPON the Secretary General to provide support to the Forum;
6. DECLARES the year 2001 as the year of the control of tsetse fly, to mark the beginning of renewed effort in the campaign for the eradication of tsetse flies in Africa;
7. REQUESTS the Secretary General to undertake all necessary consultations with a view to initiating the campaign from all possible partners and seek their support and co-operation in the implementation of the *Pan African Tsetse Eradication Campaign*. The Secretary General should submit an annual progress report to the OAU Summit, through the Current Chairman.

With respect to point 7 above, the Secretary General of OAU intends to commission a Task Force, comprising experts drawn from different parts of Africa, to formulate a Plan of Action that will help guide and organise the Pan African Tsetse Eradication Campaign. The Task Force is scheduled to conduct its deliberations in Nairobi, Kenya, from 11 to 17 December 2000. The final document describing the Plan of Action will be released as an OAU publication.

Comments on Lomé declaration by PAAT Chairman, Peter Holmes

A recent major development has been the historic declaration of the OAU Heads of State and Government at their meeting in Lomé in July for the eradication of tsetse flies on the African continent. This declaration is most welcome since it gives recognition to the problem of tsetse and trypanosomiasis at the highest political level in Africa. It will hopefully lead to renewed efforts to finally eliminate the risk of trypanosomiasis from Africa, although it is appreciated that this might have a very long timescale. The desire to

go for elimination as the ultimate method of control has been given greater impetus by Len Budd's recent studies which have demonstrated the cost effectiveness of eradication.

At a recent meeting of the PAAT co-ordinators in Addis Ababa the ultimate objective of eradication was endorsed. It is believed that, given the availability of appropriate technologies, an area-wide strategy and clear timetable towards achieving this objective should be established by 2001. It is recognised that the scale and impact of trypano-somiasis in man and animals varies between African countries and progress towards eradication will also vary. Emphasis for eradication should be focused on those locations where the disease impact is greatest and its control and eradication can provide the greatest benefits to human health, well-being and economic development. It is recognised that various stages are required to achieve eradication and these will involve disease control and tsetse suppression prior to final eradication. It is also recognised that in the case of human trypanosomiasis, control will continue to depend on disease surveillance and treatment as the principal priority for the foreseeable future, with tsetse suppression as a complementary tool. Tsetse intervention strategies need to be developed as a component of longer-term human trypanosomiasis prevention measures. In animal trypanosomiasis, tsetse suppression has a greater role to play for immediate problem alleviation in priority areas and will be an important forerunner to eradication.

It is recognised currently that SIT is the most appropriate method to be used in the final phase of eradication and in this regard the recent formation of the OAU SIT Forum is welcomed. The PAAT co-ordinators also recognise the need for an international effort to raise public awareness of trypanosomiasis and mobilise the necessary resources to work for the control and ultimate eradication of tsetse and trypanosomiasis from Africa.

It is hoped that an outline concept note on the proposed strategy can be prepared by OAU/IBAR in collaboration with its PAAT partners for discussion at the next meeting of the PAAT Programme Committee meeting to be held in Geneva in November 2000.

Comments of FAO National Liaison Officers

At their recent meeting in Addis Ababa the nationally accredited FAO Liaison Officers registered their support for the OAU Lomé Declaration and the concept of a Pan African Tsetse Eradication Campaign and stressed the need to strengthen the OAU/IBAR office to ensure its effective implementation. At the same time governments were urged to take immediate measures to strengthen national capacities and capabilities in order to participate effectively in this new initiative.

Other recommendations emanating from the meeting recognised the need for improving diagnostic techniques for field application, enhancing the effectiveness of bait techniques for tsetse control and strengthening the participation of rural communities in actual control operations. A full meeting report will be issued through the FAO Regional Office, Accra, and will be made available via the PAAT information services.

Comments of outgoing ISCTRC Chairman

Dr Victorin Codjia, who was Chairman of the ISCTRC Executive Committee from 1997 to 1999 and has been the National Officer in charge of trypanosomiasis control in Benin since 1987, is regarded as a key motivator in developing plans for a concerted regional approach to tsetse and trypanosomiasis control in West Africa.

In a recent written interview he gave his personal thoughts on some of the most critical current issues in the control of both the disease and the vector (see PAAT Newsletter no. 7). These included the need for increased and sustained collaboration and consultation among all stakeholders and the role of PAAT in promoting concerted international planning and action. African governments were urged to give their backing to the Lomé declaration to eradicate tsetse and show their commitment by defining concerted strategies, mobilising national resources and ensuring the follow-up required to sustain these activities. Although tsetse control is technically feasible, the scale of the problem demands a concerted international effort if any meaningful and lasting success is to be achieved.

PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS

PAAT Information System

It is now possible to download the PAAT Information System (PAATIS). This is made up of three interacting components: the Geographical Information System (GIS) which provides the capacity for storage, display and analysis of layers of spatial data; the Resource Inventory (RI) which contains country level tsetse and trypanosomiasis information; and the Knowledge Base (KB) which allows the user to query an extensive database of accepted literature.

The development of PAATIS has been driven by the need for decision support at a continental and regional level to guide strategic decisions on tsetse and trypanosomiasis control in sub-Saharan Africa.

Additional information and instructions for downloading have recently been circulated on PAAT-L. Interested readers who have not received this information should send enquiries to J.Pender@greenwich.ac.uk or william.wint@zoo.ox.ac.uk.

TSETSE CONTROL PROGRAMMES

Botswana considers a return to aerial spraying

The problem caused by tsetse in the Okavango Delta was initially brought under control through annual aerial spraying campaigns carried out between 1972 and 1991. Since 1992 artificial baits have been deployed to maintain and consolidate the level of control achieved. However, problems experienced in maintaining the situation have recently been compounded by atypical heavy and prolonged rainy conditions. As a result, tsetse dispersal has been accelerating and livestock around the perimeter of the Delta are threatened by trypanosomiasis.

Following the deaths of some 331 cattle, the veterinary authorities have mounted a large-scale campaign to treat all exposed animals with prophylactics. So far 26,000 animals are under treatment but the tsetse challenge and disease risk remains high. There is also a significant danger that human sleeping sickness will eventually return. This in itself is a serious prospect and could be exacerbated by interfacing with HIV which is prevalent in the area. There is considerable concern that this could affect the tourist industry. Over 100,000 tourists visit the Moremi and Chobe parks each year, generating

over $10 million per year from bed occupancy alone and providing employment for about 9000 people.

It is estimated that tsetse now extend over some 11,000 km^2 and the Government of Botswana has approved proposals for an integrated control strategy that will combine aerial spraying with an eventual SIT programme aimed at the eradication of tsetse from the Okavango.

Tsetse control in Zimbabwe

Following the successful aerial and ground spraying campaign of the 1980s, tsetse are now confined to only some 30,000 km^2 in the Zambezi Valley. About half of the country (200,000 km^2) is ecologically suitable for tsetse and could be subject to re-invasion if control operations were suspended. Current operations are based mainly on the deploy-ment of target barriers and the application of insecticides to cattle in the border regions. These campaigns are designed to suppress tsetse populations and prevent re-invasion from the north. The linear barriers formed are now very extensive and in the North-East region alone cover a length of some 350 km.

In the Western region, where much of the area has been cleared up to Lake Kariba, the focus is being placed on the eradication of the remaining foci of tsetse from the remote and rugged Matusadona National Park. Here a barrier of some 13,000 targets has been constructed to isolate the infestation, pending the outcome of an environmental impact assessment on the potential effects of eradicating tsetse. In view of environmental concerns, consideration may be given to the use of the sterile insect technique in any future eradication operation.

A significant and recent development, initiated through the Ministerial 'Agricultural and Services Management Project', has been the implementation of a pilot project designed to assess the feasibility of subcontracting certain services to the private sector.

MEETINGS

Twenty-sixth Meeting of the International Scientific Council for Trypanosomiasis Research and Control

The 26th Meeting of the ISCTRC, under the auspices of the OAU/STRC, will be held in Ouagadougou, Burkina Faso, from 1 to 5 October 2001 at the OUAGA 2000 Conference Hall. The working languages of the meeting will be English and French, with simultaneous interpretation.

The draft agenda includes: Review of research and control activities; Protozoology, immunology and diagnosis; Entomology; Human trypanosomiasis; Animal trypanosomiasis; and *Glossina* control. The special theme of the meeting will be the launch of the Pan African Tsetse Eradication Campaign (PATEC). The Action Plan and Concept Note will be discussed during the conference. Comments and ideas are invited, and should be forwarded to the PATEC Co-ordination Office at OAU/IBAR, Nairobi.

Scientific articles for oral presentation should not exceed 3000 words and should contain a summary not exceeding 250 words. A poster session with brief oral presentations will be organised in the poster room: posters should be 1.25 m × 1 m, with concise title followed by author(s) name(s) and their affiliations, and should be

comfortably readable from a distance of 1 m (recommended character heights: title at least 2 cm, subtitles at least 1 cm, text at least 0.75 cm).

Abstracts (not exceeding 250 words) of scientific articles and posters should be sent in duplicate, in English and French, and preferably by e-mail, so as to reach the Secretariat not later than *30 April 2001*.

For further information, please contact: ISCTRC Secretary, OAU/IBAR, P.O. Box 30786, Nairobi, Kenya (fax 254-2-220546; e-mail Livestock.Projects@OAU-IBAR.org or SolomonHM@OAU-IBAR.org).

Wildlife and Livestock Disease and Sustainability: What makes sense?

This international conference, to be held from 22 to 27 July 2001 at Kwa Maritane and Bakubung Lodges, Pilanesberg National Park, South Africa, is being organised jointly by the Society for Tropical Veterinary Medicine (STVM) and the Wildlife Disease Association (WDA).

Conference sub-themes are: Emerging diseases; Disease scourges of wildlife and livestock; New tools, technologies and vaccine development; Sustainability of current management practices; What makes sense for future wildlife and livestock health management?; Immunology, epidemiology and disease mechanisms; Vectors – role and control; Holistic approaches for people, animals and the environment; Pathogen pollution. Mini-symposia on Immune mechanisms directed against vectors and vector-borne pathogens, Diagnostics of tropical veterinary pathogens, Control of major transboundary diseases' and other topics may be offered depending on response.

For further information, please contact the co-ordinators, Event Dynamics (e-mail millissa@eventdynamics.co.za; http://www.eventdynamics.co.za/stvm/index.html; tel. (+27) 11-706-5010; fax (+27) 11-463-7195). Information will also be available from STVM at http://www.cvm.okstate.edu/~stvm/ and WDA at http://www.wildlifedisease.org/.

PUBLICATION

***Parasitology Today*: special issue**

The PAAT Secretariat, in consultation with the publishers, Elsevier, have agreed to produce a special issue of the journal *Parasitology Today*. The issue will contain articles by selected authors on a range of topics covering tsetse and trypanosomiasis research and control. A pull-out poster, generously sponsored by DFID, will also be included. It is anticipated that this volume will be released in January 2001.

SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

[See also **23**: no. 11614.]

11589 **Barrett, S.V. and Barrett, M.P., 2000.** Anti-sleeping sickness drugs and cancer chemotherapy. *Parasitology Today*, **16** (1): 7-9.

M.P. Barrett: Division of Infection and Immunity, Institute of Biomedical and Life Sciences, University of Glasgow, Glasgow G12 8QQ, UK. [m.barrett@ bio.gla.ac.uk]

Difluoromethylornithine was originally developed as a potential anti-cancer reagent, and suramin, melarsoprol and pentamidine have recently been shown to have toxicity against some types of neoplastically-transformed mammalian cells. This editorial recommends the continued study of drugs for use against both sleeping sickness and cancer in view of the fact that drug resistance and non-availability is compromising the use of currently licensed sleeping sickness drugs.

11590 **Fall, A. and Diop, M., 1998.** Animal recording schemes in Senegal. *In*: Trivedi, K.R. (ed.), *Proceedings of international workshop on animal recording for smallholders in developing countries, Anand, India, 20-23 December 1997* (Rome, Italy; International Committee for Animal Recording; ICAR Technical Series, no. 1), pp. 165-172.

ISRA-LNERV, B.P. 2057, Dakar, Senegal.

Programmes for recording the performance of cattle, sheep and goats in Senegal are described. An open nucleus breeding programme for the genetic improvement of milk yield and resistance to trypanosomiasis in N'Dama cattle has been in progress since 1992.

11591 **Greiner, M. and Böhning, D., 1998.** Unbiased point and variance estimates of a prevalence by mixture distribution analysis. *Proceedings of the Society for Veterinary Epidemiology and Preventive Medicine*, **1998**: 77-83.

Greiner: Institute for Parasitology and Tropical Veterinary Medicine, Department of Tropical Veterinary Medicine and Epidemiology, Freie Universität Berlin, Königsweg 67, 14163 Berlin, Germany.

Two applications of mixture distribution analysis are outlined using serological data from a cross-sectional survey on bovine trypanosomosis in Uganda. In the first example the technique is used to establish a so-called 'intrinsic cut-off' value for a *Trypanosoma* ELISA antibody test. This cut-off provides a new approach for the definition of serological 'low and high responders' in exposed animal populations. The approach is useful in the absence of representative reference populations and reduces the bias in the

estimation of seroprevalence. The second example shows how mixture distribution analysis can be used for diagnosing heterogeneity of cluster-level prevalences.

11592 **Hanotte, O., Tawah, C.L., Bradley, D.G., Okomo, M., Verjee, Y., Ochieng, J. and Rege, J.E.O., 2000.** Geographic distribution and frequency of a taurine *Bos taurus* and an indicine *Bos indicus Y* specific allele amongst sub-Saharan African cattle breeds. *Molecular Ecology*, **9** (4): 387-396.

Hanotte: ILRI, P.O. Box 30709, Nairobi, Kenya. [o.hanotte@cgiar.org]

For the first time, and for the whole of sub-Saharan Africa, the geographical distribution and the frequency of an indicine and a taurine *Y* specific allele amongst African cattle breeds is reported. A total of 984 males from 69 indigenous African populations from 22 countries were analysed at the microsatellite locus INRA 124. The taurine allele is probably the oldest one on the continent. However, the taurine and the indicine alleles were present in 291 males (30%) and 683 males (70%), respectively. More particularly, 96% of zebu males (n = 470), 50% of taurine males (n = 263), 29% of sanga males (crossbreed *B. taurus* × *B. indicus*, n = 263) and 95% of zebu × sanga crossbred males (n = 56) had the indicine allele. The Borgou, a breed classified as zebu × taurine cross, showed only the zebu allele (n = 12). The indicine allele dominates today in the Abyssinian region, a large part of the Lake Victoria region and the sahelian belt of West Africa. All but one of the sanga males from the Abyssinian region (n = 64) had the indicine allele. The taurine allele is the commonest only among the sanga breeds of the southern African region and the trypanotolerant taurine breeds of West Africa. In West Africa and in the southern Africa regions, zones of introgression were detected with breeds showing both *Y* chromosome alleles. The data also reveal a pattern of male zebu introgression in Mozambique and Zimbabwe, probably originating from the Mozambique coast. The sanga cattle from the Lake Victoria region and the Kuri cattle of Lake Chad, cattle populations surrounded by zebu breeds, were, surprisingly, completely devoid of the indicine allele. Human migration, phenotypic preferences by the pastoralists, adaptation to specific habitats and to specific diseases are the main factors explaining the present-day distribution of the alleles in sub-Saharan Africa.

11593 **Hendrickx, G., Napala, A., Slingenbergh, J.H.W., Deken, R. de, Vercruysse, J. and Rogers, D.J., 2000.** The spatial pattern of trypanosomosis prevalence predicted with the aid of satellite imagery. *Parasitology*, **120** (2): 121-134.

Hendrickx: FAO Trypanosomosis Project GCP-RAF-347-BEL, B.P. 2034, Bobo Dioulasso, Burkina Faso. [ghendrickx@altavista.com]

Information on the spatial pattern of African animal trypanosomosis forms a prerequisite for rational disease management, but few data exist for any country in the continent. The present study describes a raster or grid-based GIS for Togo, a country representative of subhumid West Africa, with data layers on tsetse, trypanosomosis, animal production, agriculture and land use. It is shown how trypanosomosis prevalence and PCV map displays may be predicted from correlations between representative field data and environmental and satellite data acquired from the National Oceanographic and

Atmospheric Administration (NOAA) and Meteosat platforms. Discriminant analytical methods were used to assess the relationship between the amount of field data used and the accuracy of the predictions obtained. The accuracy of satellite derived predictions decreases from tsetse abundance to trypanosomosis prevalence to PCV value. The predictions improve when eco-climatic and epidemiological predictors are combined. In Togo, and probably elsewhere, the patterns of trypanosomosis prevalence and PCV are much influenced by animal husbandry and other anthropogenic factors. Additional predictor variables, incorporating these influences, might therefore further improve the models.

11594 **Mattioli, R.C., Pandey, V.S., Murray, M. and Fitzpatrick, J.L., 2000.** Immunogenetic influences on tick resistance in African cattle with particular reference to trypanotolerant N'Dama (*Bos taurus*) and trypanosusceptible Gobra zebu (*Bos indicus*) cattle. *Acta Tropica*, **75** (3): 263-277.

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

Resistance to tick attack and tick-borne micro-organisms (TBMs) varies among different breeds of cattle, with *B. indicus* cattle generally possessing a higher resistance than *B. taurus* cattle. The host's immune system appears to be the single most important factor that regulates this resistance. This paper reviews the main effector immune mechanisms governing resistance against ticks and TBMs. The cellular immune response appears more effective and stable than humoral immunity in modulating resistance to ticks and TBMs. Similarities between the immune mechanisms employed by trypanotolerant N'Dama cattle when infected with trypanosomes and those elicited by tick bites and TBMs seem to exist, particularly at the skin level in the early phases of parasitic invasion. Moreover, there is evidence that in the N'Dama breed, resistance against ticks *per se* also has a genetic basis. Therefore, the N'Dama appears to be a unique breed in that it exhibits resistance to several parasitic diseases and/or infections, including helminths, when compared to other cattle breeds in West Africa. It is concluded that the multi-parasite resistant traits of the N'Dama breed should be exploited in those areas where trypanosomosis, ticks and tick-borne diseases constrain animal production. This should be of benefit for low-input farming systems where the use of chemicals for prophylaxis and therapy is limited by their relatively high cost. Additionally, the potential contribution of multiple disease resistant N'Dama cattle should be considered in crossbreeding programmes with exotic dairy breeds for increasing milk production in West Africa.

11595 **Mullins, G., Nkhori, P., Allsopp, R., Kolanyane, M. and Phillemon-Motsu, T., 1997.** The economics of trypanosomiasis control in the Okavango Delta region of Botswana and the scope for public-private sector partnerships. *Epidémiologie et Santé animale*, no. 31-32 (1): 02.20.1-02.20.3.

Mullins: Veterinary Epidemiology and Economics Unit, Department of Animal Health and Production, Ministry of Agriculture, Private Bag 0032, Gaborone, Botswana. [dahp@info.bw]

The Government of Botswana has allocated substantial financial and human resources for the control of *Glossina morsitans centralis* and the eradication of human and

animal trypanosomiasis in the Okavango Delta, an important tourist area of *c*. 20,000 km^2. As of 1996, an estimated 16,000 odour-baited targets had been deployed in the delta. Manpower and logistical problems in servicing the targets, together with complaints from tour operators about the visual disturbance caused by the targets and the presence of mobile tsetse control teams, have suggested an alternative approach to trypanosomiasis control consisting of collaborative partnerships between government and the private sector. A study was conducted to elicit private sector response to this idea, and to assess the economic and social costs and benefits. A clear majority of both safari operators and households expressed willingness to assist with tsetse control, but neither offered a substantial financial contribution and indeed expected financial compensation, though most safari operators would be willing to receive this indirectly as tax relief. Results supported the hypothesis that many functions currently performed by the Tsetse Control Division (TCD) might be transferred to the private sector through partnership arrangements. Potential benefits include rural employment, expanded target coverage, release of TCD field units to concentrate on more difficult areas, and reduced risk of trypanosomiasis for local residents, tourists and animal populations.

11596 **Murray, H.W., Pépin, J., Nutman, T.B., Hoffman, S.L. and Mahmoud, A.A.F., 2000.** Tropical medicine. *British Medical Journal (Clinical Research edition)*, **320** (7233): 490-498.

Department of Medicine, Weill Medical College, Cornell University, New York, NY 10021, USA.

This clinical review discusses recent advances in the diagnosis, treatment and prevention of African trypanosomiasis, leishmaniasis, lymphatic filariasis, malaria and schistosomiasis. The upsurge of *Trypanosoma brucei gambiense* sleeping sickness in Central Africa and the problems of new drug development are highlighted.

11597 **Paterson, A.D., Otte, M.J., Slingenbergh, J., Wint, W. and Rogers, D., 2000.** The application of GIS and remote sensing based modelling techniques, for use in the economic and epidemiological assessment of disease control interventions, at a regional or national level. *Proceedings of the Society for Veterinary Epidemiology and Preventive Medicine*, **2000**: 172-182.

Paterson: Veterinary Epidemiology and Economics Research Unit, University of Reading, P.O. Box 236, Reading RG6 6AT, UK. [veeru@reading.ac.uk]

The quantitative economic assessment of interventions in livestock production systems requires the analysis of the outputs and resource requirements of all the production systems within the target area. Such analyses are not possible without accurate data describing both livestock and human populations, and the production systems within which the livestock are managed. When, as is often the case, such information is unobtainable, these missing data pose a significant constraint to planned livestock development. This paper describes the development of the PAAT Information System which comprises five major components: the PAAT-IS GIS which provides predictions of

farming systems and livestock populations within each 0.05° pixel; a custom written database of production parameters and supporting literature; an 'event' database that allows entry of interventions; various livestock production system models; and a set of custom written software modules that serve to link and integrate the other components. The approach described demonstrates a cost-effective solution for augmenting existing, conventionally gathered field data, using techniques appropriate to the needs and resources of developing countries. It is envisaged that the final version of this tool will be used primarily at the national level.

11598 **Rowlands, G.J., 1998.** Logistic regression analysis in observational studies: possible pitfalls and presentation of results. *Proceedings of the Society for Veterinary Epidemiology and Preventive Medicine*, **1998**: 56-68.

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

With the increased analytical capacity of computers and availability of advanced statistical software, there has been a rapid increase in the use of logistic regression in veterinary epidemiology. Some theoretical aspects of the method are described and 36 papers presented to the 1997 International Symposium of Veterinary Epidemiology and Economics are discussed. Reservations are expressed on some of the approaches currently being used in the modelling of data by logistic regression. The odds ratio is easily derived but knowledge of the average disease incidence might allow clearer inferences to be made of the biological significance and potential impact of a particular odds ratio. The example of PCV measurement, detection of trypanosomes and calving data in zebu cattle in village herds exposed to drug resistant trypanosomes in the Ghibe valley of southwest Ethiopia, and the effect of tsetse control, is used to illustrate how data can be expressed in different ways and to suggest how results may be presented most clearly.

11599 **Veeken, H. and Pécoul, B., 2000.** Drugs for 'neglected diseases': a bitter pill. *Tropical Medicine and International Health*, **5** (5): 309-311.

Veeken: Médecins sans Frontières, P.O. Box 10014, 1001 EA Amsterdam, Netherlands. [hans_veeken@amsterdam.msf.org]

Research and development into tropical diseases have come to a virtual standstill due to low profits. In this editorial, the situation for two typical examples of diseases neglected because of lack of commercial incentives, sleeping sickness and visceral leishmaniasis, is described. Therapy of first-stage sleeping sickness with suramin for *Trypanosoma brucei rhodesiense* and with pentamidine for *T. b. gambiense* has remained unchanged for more than half a century. The long-term supply of suramin is by no means secure and the price of pentamidine has greatly increased since its potential to treat *Pneumocystis carinii* infections in AIDS patients was established. Therapy for second-stage sleeping sickness relies on the toxic drug melarsoprol; resistance to it is increasing and its future production is not guaranteed. Currently the only drug for treating relapse infections is eflornithine but the manufacturer has stopped production and a new producer remains to be identified. It is concluded that drugs for neglected diseases do not belong in the free market; they require a centralised, public, non-profit approach for which

governments, manufacturers and non-governmental organisations have a shared responsibility.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

[See also **23**: no. 11606.]

11600 **Adesiyan, S.A., Jervis, M.A. and Hollander, J. den, 1998.** Morphological variation in *Glossina pallidipes* Austen (Diptera; Glossinidae) over its geographical range. *Nigerian Journal of Entomology*, **15**: 122-135.

Adesiyan: NITR, Vom, Plateau State, Nigeria.

Morphometric studies were carried out on *G. pallidipes* from Zimbabwe and Uganda. Ten and seven characters were used in the multivariate discriminant analysis for the male and female population, respectively. All the characters showed highly significant morphological discrimination ($P < 0.001$) between the two populations which was further confirmed by the separate scatterplot for each sex population. The consistent discriminant characters between the male and female population were: length of 2nd and 3rd antennal segment, width of narrowest point of the head, and length from eye base to buccal tip. The most powerful discriminator between the male populations was the length of the 2nd and 3rd antennal segments whereas in the female populations it was the length from the eye base to the buccal tip. The percentage of 'grouped' cases correctly classified for populations of each sex was 100 with no overlap. The morphological variations observed between the allopatric populations in relation to biological species concepts are discussed.

11601 **Aksoy, S., 2000.** Tsetse – a haven for microorganisms. *Parasitology Today*, **16** (3): 114-118.

Aksoy: Section of Vector Biology, Department of Epidemiology and Public Health, Yale University School of Medicine, 60 College Street, 606 LEPH, New Haven, CT 06510, USA. [serap.aksoy@yale.edu]

Three distinct tsetse symbionts have been identified. Two are present in gut tissue: the primary (P)-symbiont, *Wigglesworthia glossinidia*, resides intracellularly in the specialised epithelial cells (bacteriocytes) which form a U-shaped organ (bacteriome) in the anterior gut, while the secondary (S)-symbiont (*Sodalis glossinidius*) is present in midgut cells. The third organism, which has been characterised from reproductive tissue, is related to *Wolbachia pipientis*. Current knowledge of the role of these symbionts in the nutrition, reproduction and establishment of trypanosome infections in tsetse flies, their evolutionary histories in relation to their tsetse hosts, and their tissue tropism, is reviewed.

The use of symbionts to introduce foreign antitrypanosomal genes into tsetse to modulate vector competence is discussed.

11602 **Cheng, Q., Ruel, T.D., Zhou, W., Moloo, S.K., Majiwa, P., O'Neill, S.L. and Aksoy, S., 2000.** Tissue distribution and prevalence of *Wolbachia* infections in tsetse flies, *Glossina* spp. *Medical and Veterinary Entomology*, **14** (1): 44-50.

Aksoy: Department of Epidemiology and Public Health, Section of Vector Biology, Yale University School of Medicine, 60 College Street, New Haven, CT 06510, USA. [serap.aksoy@yale.edu]

Tsetse flies harbour three different symbiotic microorganisms, one being *Wolbachia* which causes a variety of reproductive abnormalities in a wide range of arthropods, one of which is termed cytoplasmic incompatibility that, when expressed, results in embryonic death due to disruptions in fertilisation. PCR analysis was used to examine colonised and field populations of various species of tsetse flies for the presence of *Wolbachia*. Infections were detected in 100% of sampled colonised flies in the *morsitans* (*Glossina morsitans centralis, G. m. morsitans, G. swynnertoni* and *G. pallidipes*) and *fusca* (*G. brevipalpis* and *G. longipennis*) groups but in none of the *palpalis* group (*G. fuscipes, G. tachinoides, G. palpalis palpalis* and *G. p. gambiensis*). Although different field populations of *G. longipennis, G. pallidipes, G. fuscipes* and *G. tachinoides* were all negative for *Wolbachia*, there was significant heterogeneity in observed infection frequencies in field populations of *G. swynnertoni*, *G. austeni* and *G. brevipalpis*. Using *Wolbachia* surface protein (*wsp*) gene sequence analysis, the infections associated with different fly species were all found to be unique within the A group of the *Wolbachia pipientis* clade. Analysis of the tissue tropism of infections in three species showed that, while infections in *G. m. morsitans* and *G. brevipalpis* were limited to reproductive tissues, *Wolbachia* could be detected in various somatic tissues of *G. austeni*.

11603 **Luo, C.-H. and Zheng, L.-B., 2000.** Independent evolution of *Toll* and related genes in insects and mammals. *Immunogenetics*, **51** (2): 92-98.

Zheng: Yale University School of Medicine, Epidemiology and Public Health, 60 College Street, New Haven, CT 06520, USA.

Toll and Toll-related proteins play an important role in antibacterial innate immunity in insects, plants and mammals. The first comprehensive phylogenetic analysis of *Toll*-related genes from both insects and mammals is presented. *Drosophila melanogaster* contains *Toll* and a highly homologous gene, *Tehao*. The protein, Dm Tehao, comprises 795 amino acid residues and its cytoplasmic domain shares a striking 61% identity with Dm Toll. Two *Toll* homologues were found in *Anopheles gambiae* and one *Toll*-like gene each was identified from *Aedes aegypti* and *Glossina palpalis palpalis*. Phylogenetic analyses revealed separate clustering of Toll and related proteins from insects and mammals, suggesting independent evolution of the Toll family of proteins and of innate immunity in arthropods and vertebrates. These results also provide new avenues to understanding the function of Toll proteins in insect innate immunity against bacteria, fungi and protozoans.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

11604 **Adeyemi, I.G. and Esuruoso, G.O., 1997.** City resident tsetse: preliminary epizootiological investigation in Ibadan, south western Nigeria. (Meeting abstract.) *Epidémiologie et Santé animale*, no. 31-32 (1): 04.06.1.

Esuruoso: University of Ibadan, P.O. Box 14400, Ibadan, Nigeria.

Unbaited blue biconical and NITSE traps were used to sample tsetse populations from July to December 1996 at TRFUI, Ibadan, Nigeria. A total of 43 tsetse flies (all *Glossina palpalis*) were caught, 27 of them (62.8%) at the peak of the rainy season (July-August). Comparative trapping in sheep/goat and cattle paddocks during October-December revealed that *G. palpalis* infested the cattle paddock (57%) more than the sheep/goat paddock and that 100% of tsetse caught at the cattle paddock were fed compared with *c.* 80% of those in the sheep/goat paddock. Despite the disappearance of *G. tachinoides* from a similar area of Nigeria due to host reduction, dwindling livestock and changes in demography have not eliminated *G. palpalis* from the TRFUI area over a period of at least 30 years.

11605 **Gracio, A.J. dos S., 1999.** Tsetse flies (Diptera: Glossinidae) and African trypanosomiasis in Guinea Bissau, West Africa. *Acta Parasitologica Portuguesa*, **2** (1-2) [1994/1995]: 51-56.

Unidade de Entomologia Medical, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira 96, 1349-008 Lisbon, Portugal.

A tsetse survey was carried out from 1989 to 1994 in all regions of Guinea-Bissau, including the two islands of Bijagos Archipelago: Bubaque and Ilheu do Meio. Adult tsetse flies were caught in areas with shady vegetation. *Glossina palpalis gambiensis* was found in mangrove swamps, mesophile forests and gallery forests. *G. morsitans submorsitans* was found in savanna and gallery forests. *G. longipalpis* was found only in savanna.

11606 **Jarry, M., Gouteux, J.-P. and Khaladi, M., 1996.** Estimation de taux de survie dépendants de l'âge chez les glossines (mouches tsé-tsé) à partir des distributions en âge physiologique des femelles. [Estimation of age-dependent survival rate of tsetse flies from physiological age distributions of the females.] *In*: Recueil des résumés des communications des XXVIIIe Journées de Statistique, Université Laval, Québec (1996), pp. 425-430.

Jarry: Laboratoire de Mathématiques Appliquées, URA CNRS 1204, IPRA-UPPA, Avenue de l'Université, 64000 Pau, France. [marc.jarry@univ-pau.fr]

The characteristic viviparous reproduction of tsetse flies makes it possible to determine the 'physiological age' of females by examination of their ovaries. After a brief account of the tsetse life cycle, a matrix model for the study of tsetse populations is described. It is shown how this model can be used to obtain estimates of the survival rates of female tsetse flies from their physiological age distributions.

11607 **Jarry, M., Khaladi, M. and Gouteux, J.-P., 1996.** Que faire des données démographiques transversales? L'exemple des données structurées en âge physiologique chez les mouches tsé-tsé. [How to use cross-sectional demographic data. Example of physiological age data in tsetse flies.] *In*: *Tendances nouvelles en modélisation pour l'environnement* (Acte des Journées du Programme Environnement, Vie et Sociétés (3-4)), pp. 52-57.

Jarry: Laboratoire de Mathématiques Appliquées, URA CNRS 1204, IPRA-UPPA, Avenue de l'Université, 64000 Pau, France. [marc.jarry@univ-pau.fr]

A matrix model for tsetse populations has been constructed which enables calculation of the population growth rate, λ, from the survival rate of pupae, the duration of the pupal stage and the survival rate of adult females, *a*, determined from their physiological age distributions. The method is applied to data collected from a study lasting several annual cycles (September 1964 to April 1967) of a population of *Glossina palpalis gambiensis* in a forested zone of Burkina Faso. A close link was seen between *a* and λ, with λ remaining close to 1 over the whole of the study period; variations between 0.83 and 1.10 resulted from adverse (high temperature) or favourable environmental conditions. Fluctuations in the survival rate of pupae seemed to be less important, while the effect of the duration of the pupal stage seemed to be variable, depending on the adult survival rate. Despite some imperfections of the model, this study confirms that natural populations of tsetse flies have a remarkable stability.

11608 **Kappmeier, K., 2000.** A newly developed odour-baited 'H trap' for the live collection of *Glossina brevipalpis* and *Glossina austeni* (Diptera: Glossinidae) in South Africa. *Onderstepoort Journal of Veterinary Research*, **67** (1): 15-26.

Kappmeier: Entomology Division, Onderstepoort Veterinary Institute, Private Bag X05, ZA-0110 Onderstepoort, South Africa. [karink@moon.ovi.ac.za]

A new trap, named the H trap, was developed at Hellsgate Tsetse Research Station in South Africa for the simultaneous collection of live *G. brevipalpis* and *G. austeni*. Its design followed an evaluation of the responses of the two species towards traps that are used elsewhere in Africa for the collection of other tsetse fly species. These traps were found at Hellsgate to be unsuitable for capturing both *G. brevipalpis* and *G. austeni*. Some new trap designs and many modifications of these were tested, most of which were unsuccessful. The odour-baited blue and black H trap represents a different approach for trapping tsetse flies as it is fitted with lateral cones of white netting which induce the flies to take a more horizontal flight path once they have entered the trap, instead of the vertical

flight paths they assume in existing tsetse fly traps. A number of modifications of the prototype H trap were devised (H1-H5), before the final design was established. Catches of up to 76 *G. brevipalpis* and 37 *G. austeni* were obtained per trap on a single day with the H3 modification. Further modifications improved on the trap's efficiency in capturing *G. brevipalpis* and *G. austeni*. The final modification caught a record number of 180 *G. brevipalpis* and 57 *G. austeni* on a single day.

11609 **La Rocque, S. de and Cuisance, D., 1997.** Facteurs discriminants de la présence de glossines au Burkina Faso: intérêts dans la prévision du risque de trypanosomoses. [Factors affecting the presence of tsetse flies in Burkina Faso: significance in forecasting the risk of trypanosomiasis.] *Epidémiologie et Santé animale*, no. 31-32 (1): 02.06.1-02.06.3.

Campus International de Baillarguet, B.P. 5035, 34032 Montpellier Cedex 1, France. [cuisance@cirad.fr]

An entomological and parasitological survey was undertaken in 1996 in the agropastoral area of Sideradougou, Burkina Faso, in the 120 km hydrographic network which had previously been surveyed 15 years earlier. More than 3600 tsetse (*Glossina tachinoides* and *G. palpalis gambiensis*) were captured in traps placed every 100 m and half were dissected to see if they were infected. Habitat details at capture sites were recorded and all data collected were geographically referenced for inclusion in a GIS. The results indicated a heterogeneous spatial distribution of tsetse, different from the earlier survey results. Three zones could be identified. In zone 1, the human and tsetse situation was similar to that 15 years ago. In the other two zones, human immigration had greatly increased, resulting in increased land cultivation. Zone 2 (north) had cultivated areas surrounded by forest in which *G. tachinoides* had survived but *G. p. gambiensis* had practically disappeared. In zone 3 (south), cultivations were at least 300 m from the river network, and dense riverine forest, the natural tsetse habitat, was preserved; livestock were abundant and frequented water points. Both tsetse species were abundant in this zone and numbers exceeded those seen 15 years earlier. Trypanosome infection rates differed in the western (upstream) and eastern (downstream) parts of the river network. In the former, only 39.2% of parasitologically identified infections were positive by PCR, suggesting trypanosomes of reptiles as blood meal identification showed a marked feeding preference for monitor lizards and crocodiles. In the eastern part, 80% of parasitologically identified infections were positive by PCR for trypanosomes pathogenic to livestock, and blood meal analysis showed a preference for suids and ruminants. The number of potentially infective tsetse per km was 2.92 in the west compared with 6.3 in the east.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **23**: nos. 11595, 11608, 11632.]

11610 **Hargrove, J.W., Omolo, S., Msalilwa, J.S.I. and Fox, B., 2000.** Insecticide-treated cattle for tsetse control: the power and the problems. *Medical and Veterinary Entomology*, **14** (2): 123-130.

Hargrove: Tsetse Control, Box CY52, Causeway, Zimbabwe. [jhargrove@rttcp.org.zw]

Trypanosomiasis control increasingly involves financial input from livestock owners and their active participation. If control is carried out on smaller scales than in the past, methods such as aerial and ground spraying and SIT will have reduced application. There will be increased reliance on trypanocidal drugs, and on bait methods of tsetse control, where flies are attracted to point sources and killed. If drug resistance develops, cheap and simple bait methods offer the only means of disease control that might be applied, and paid for, by stockowners themselves. The methods have been effective in some circumstances, but not in others, and it is important to understand the reasons for the successes and the failures. Analysis is presented of the results of two Tanzanian tsetse control campaigns involving the use of insecticide-treated cattle. Between 1991 and 1996, following the introduction of widespread dipping in the Kagera Region, trypanosomiasis declined from > 19,000 cases to < 2400 and deaths from > 1000 to 29. On four ranches in the region, tsetse (*Glossina morsitans centralis* and *G. pallidipes*) have been almost eliminated and trypanosomiasis prophylaxis is no longer used. Similarly aggressive use of pyrethroids on Mkwaja Ranch in Tanga Region has not had such dramatic effects. Tsetse (*G. m. morsitans, G. pallidipes* and *G. brevipalpis*) and trypanosomiasis are still common, despite high levels of prophylaxis and the deployment of ≈ 200 odour-baited targets. The difference in the results is attributed to a combination of the much smaller area covered by treated animals at Mkwaja, a greater susceptibility to re-invasion and a more suitable habitat for the flies. A better understanding of the dynamics of the use of insecticide-treated cattle is needed before we can predict confidently the outcome of particular control operations.

11611 **Kamau, S.W., Omukuba, J., Kiragu, J., Masika, P., Ndung'u, J.M., Wachira, P. and Mehlitz, D., 2000.** Financial analysis of animal trypanosomiosis control using cypermethrin pour-on in Kenya. *Preventive Veterinary Medicine*, **44** (3-4): 231-246.

Kamau: Institute of Parasitology, University of Zurich, Winterthurerstrasse 266A, CH-8057 Zurich, Switzerland.

The financial impact of the use of cypermethrin pour-on (Ectopor) in the control of animal trypanosomiasis was determined in a trial undertaken by KETRI in two adjacent ranches in the Coast Province of Kenya between December 1990 and February 1992. The trial site was in an area of high apparent density of tsetse flies (*Glossina pallidipes*), and at the start of the trial no cattle were kept in this area. Cypermethrin was applied fortnightly to the 1100 Orma Boran steers which were kept in pour-on ranch A. Of these, 100 animals were identified as pour-on sentinels and compared to another 100 steers which were kept in control ranch B to act as control sentinels. Pour-on application led to a significant decrease in tsetse apparent density in ranch A, to 90% of the initial density in some areas. The animals treated with pour-on had a significantly higher mean PCV, and the weekly prevalence of trypanosome infections in treated animals was < 4%, with only one exception when it was < 10%. In the control animals, the prevalence ranged between 10 and 50% (with a few exceptions when it was < 10%). The incidence of tick-borne

diseases was lower in the pour-on animals. The mean monthly weights of the pour-on animals was significantly higher, and at the end of the trial they had a mean weight gain of 136.70 ± 16.7 kg while the control animals had gained 97.16 ± 22.6 kg. The financial net return of using cypermethrin pour-on was positive and the financial rate of return of 122.6% indicated that use of this product was highly beneficial despite its high cost.

11612 **Rowlands, G.J., Swallow, B.M., Kristjanson, P.M., Leak, S.G.A. and Mulatu, W., 1997.** Sustainability and economic benefits of tsetse control using an insecticide pour-on applied to cattle in southwest Ethiopia. *Epidémiologie et Santé animale*, no. 31-32 (1): 02.A.19.

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

A tsetse control campaign using cypermethrin 'pour-on' applied monthly to village zebu cattle in a region in south-west Ethiopia has provided long-term sustainability since 1991, resulting in major economic benefits to the farming community. During the last four years, farmers have paid a cost-recovery price for each animal given treatment. Relative densities of tsetse and biting flies fell by 95% during the second year of vector control. Despite very high levels of drug resistance, trypanosomal prevalence in cattle has been reduced by 63% and the number of curative trypanocidal treatments per animal by 50%. Significant improvements in livestock productivity have led to benefits outweighing the costs of control by a factor of 12 to 1, contributing to increases in individual household income of between 10 and 34%.

11613 **Vreysen, M.J.B., Saleh, K.M., Ali, M.Y., Abdulla, A.M., Zhu, Z.-R., Juma, K.G., Dyck, V.A., Msangi, A.R., Mkonyi, P.A. and Feldmann, H.U., 2000.** *Glossina austeni* (Diptera: Glossinidae) eradicated on the Island of Unguja, Zanzibar, using the sterile insect technique. *Journal of Economic Entomology*, **93** (1): 123-135.

Vreysen: IAEA, P.O. Box 100, A-1400 Vienna, Austria.

An area-wide integrated tsetse eradication project was initiated in Zanzibar in 1994 by the IAEA and the governments of Tanzania and Zanzibar, to eradicate *G. austeni* from Unguja Island (Zanzibar) using the SIT. Suppression of the tsetse population on Unguja was initiated in 1988 by applying residual pyrethroids as a pour-on formulation to livestock and by the deployment of insecticide-impregnated screens in some of the forested areas. This was followed by sequential releases of gamma-sterilised male flies by light aircraft. The flies, packaged in carton release containers, were dispersed twice a week along specific flight lines separated by a distance of 1-2 km. More than 8.5 million sterile male flies were released by air from August 1994 to December 1997. A sterile to indigenous male ratio of > 50:1 was obtained in mid-1995 and it increased to > 100:1 by the end of 1995. As a consequence the proportion of sampled young females (1-2 ovulations), with an egg *in utero* in embryonic arrest or a uterus empty as a result of expulsion of a dead embryo, increased from < 25% in the first quarter to > 70% in the last quarter of 1995. In addition, the age structure of the female population became significantly distorted in favour of old flies (≥ 4 ovulations) by the end of 1995. The

apparent density of the indigenous fly population declined rapidly in the last quarter of 1995, followed by a population crash in the beginning of 1996. The last trapped indigenous male and female flies were found in weeks 32 and 36 of 1996, respectively. Time for six fly generations elapsed between the last catch of an indigenous fly and the end of the sterile male releases in December 1997.

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

[See also **23**: no. 11609.]

11614 **Fournet, F., Traoré, S., Prost, A., Cadot, E. and Hervouët, J.-P., 2000.** Impact of the development of agricultural land on the transmission of sleeping sickness in Daloa, Côte d'Ivoire. *Annals of Tropical Medicine and Parasitology*, **94** (2): 113-121.

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

A retrospective survey, based on medical records for the period 1956 to 1995, was carried out in and around Daloa, a town surrounded by coffee and cocoa plantations, in order to determine whether agricultural land within the boundaries of the town and on its outskirts is conducive to the risk of trypanosomiasis. Eight peripheral villages, at the most 9.5 km from the town centre, and the leprosy hospital were included in the peri-urban area ('area of mobility'). Between 1956 and 1995, 417 cases of sleeping sickness were recorded; 60% lived in the town, 63.7% were aged < 30 years and 65.7% were male. Between 1982 and 1995, 80% of cases were engaged in agricultural activity (57.6% in coffee and/or cocoa plantations and 23.7% in irrigated rice fields) before the onset of disease, i.e. in the area of mobility, not in the town. In an entomological survey carried out between April 1997 and February 1998, ≈ 33,000 *Glossina palpalis palpalis* were caught but only 3.1% were collected in the town. Presence of flies was associated with coffee and cocoa plantations, tracks and water-supply points. The highest epidemiological risk index observed (0.48887) was in June in the area of mobility. In the villages/hospital and the area of mobility, the risk appeared to be associated with high levels of human-vector contact, but in the town was associated with high numbers of teneral female tsetse. Trypanosomes (presumably *Trypanosoma brucei* s.l. or *T. congolense*) were observed in 11.4% of the dissected midguts. The results of the study show that the development of agricultural land leads to increased human-vector contact and, as a result, increased risk of sleeping sickness. Such land-management methods may therefore be useful as risk indicators for transmission. Transmission does not occur in the town of Daloa itself but in surrounding areas under cultivation. The use of the epidemiological risk index seems to be inappropriate in urban (and perhaps peri-urban) areas. The results emphasise not only the importance of environmental and demographic data in elucidating the epidemiology of human trypanosomiasis but also the need for further investigations in peri-urban areas.

11615 **Gouteux, J.P. and Artzrouni, M., 1999.** Un modèle de transmission de la maladie du sommeil avec population vectorielle ouverte: application au foyer de

Nola (République Centrafricaine). [A model of sleeping sickness transmission with open vector populations: application to the Nola-Bilolo focus (Central African Republic).] *Annales de la Société Entomologique de France*, **35** (Suppl.): 540-548.

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

An earlier model of sleeping sickness is improved by incorporating tsetse emigration and reinvasion. The emigration rate is considered constant and linked to the natural displacement of the flies, and immigration (of both susceptible and infected flies) occurs only when the tsetse population drops below a threshold value. The vector population evolves towards an equilibrium value that depends on the birth/mortality rate, the emigration rate and the intensity of reinvasion. With a basic reproduction number of the system (R_0) of less than 1, i.e. the disease going towards extinction, the introduction of a small proportion of infected tsetse among the immigrant flies (< 1%) is sufficient to maintain human prevalence in equilibrium at a rate of 8-35%, depending on the assumed duration of the first stage of the disease. A new index, the 'half life' of the epidemic, the time necessary for the prevalence to halve, is introduced to help in assessing the long-term dynamics of the disease. The model is successfully used to understand the epidemiology of sleeping sickness in the Nola-Bilolo forest focus of the Central African Republic.

11616 **Grébaut, P., Wang Sonnè, Bodo, J.M., Ebo'o Eyenga, V., Binzouli, J.J., Ndong Ngoé, C., Nomo, E., Nkinin, S., Njiokou, F., Ollivier, G., Foumane, V. and Bureau, P., 2000.** Aspects épidémiologiques d'un foyer de maladie du sommeil mal connu: le foyer de Bipindi au Cameroun. [Epidemiological aspects of a little known sleeping sickness focus: the Bipindi focus in Cameroon.] *Bulletin de Liaison et de Documentation de l'OCEAC*, **33** (2): 16-22.

Grébaut: Laboratoire de Recherche sur la Trypanosomiase, OCEAC, B.P. 288, Yaoundé, Cameroon. [grebaut@iccnet.cm]

Since the beginning of the 20th century, sleeping sickness has been endemic in the Bipindi (Lolodorf) focus of Cameroon. It has been suggested that the onset of the disease in this region was due to multiple human migratory waves across the area since the end of the last century, though no epidemics have ever been observed. Two medical surveys of the focus in late 1998 and early 1999, covering between 55 and 70% of the population, discovered a total of 44 cases of sleeping sickness. All except two came from the villages of Lambi (prevalence 3.8%) and Bidjouka (prevalence 3.6%) which constitute the epicentre of the focus. Of these 44 cases, 35 were in the first stage and 9 in the second stage of the disease. The reasons for the persistent endemic situation in the focus are discussed. Lambi and Bidjouka are situated in an area where streams descend from the mountain and pass through cocoa plantations to the river Mougué, creating sites favourable for tsetse, with water points which are frequented by the human population and also by pigs which are known to be the preferred host of tsetse. While the epicentre of the focus seems to be restricted to the two villages, 'absenteeism' of around 30% during the

survey, and the presence of two cases outside the epicentre, makes continued surveillance essential.

11617 **Kazadi, J.-M., Losson, B. and Kageruka, P., 2000.** Compétence vectorielle des mouches non ténérales de *Glossina morsitans morsitans* (souche Mall) infectées par *Trypanosoma (Nannomonas) congolense* IL 1180. [Vectorial competence of non-teneral *G. m. morsitans* (Mall) infected with *T. (N.) congolense* IL 1180.] *Bulletin de la Société de Pathologie exotique*, **93** (2): 125-128.

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

Non-teneral *G. m. morsitans* (Mall), about 16 days old, were fed once on a rat infected with *T. congolense* IL 1180. Taking the sexes together, the overall vectorial competence (VC) of these flies was found to be 0.1035. The VC of the males was higher than that of the females. More females than males were infected with the meso-procyclic stage, while more males than females were infected with the metacyclic stage. The results of this study show that age limits but does not abolish metacyclogenesis in non-teneral *G. m. morsitans* (Mall).

11618 **Lehane, M.J., Msangi, A.R., Whitaker, C.J. and Lehane, S.M., 2000.** Grouping of trypanosome species in mixed infections in *Glossina pallidipes*. *Parasitology*, **120** (6): 583-592.

M.J. Lehane: School of Biological Sciences, University of Wales, Bangor LL57 2UW, UK.

Trypanosomes in the dissection-positive proboscis of *G. pallidipes* were identified by PCR using species-specific primers. Of the 3741 flies dissected, 643 were proboscis positive. PCR performed on 406 of these gave positive identifications in 352 (86.7%) and infection rates of 14.8% for *Trypanosoma congolense*-type infections, 2.8% for *T. vivax*-type infections and 1.4% for the unidentified group. Of the 352 PCR-identified infections, 225 were single, 111 were double, 13 were triple and 3 were quadruple infections. Statistical analysis suggests that mixed infections group into three largely separate divisions among the tsetse population: (i) *T. congolense* savanna and *T. congolense* Kenya coast, (ii) *T. simiae*, *T. congolense* Tsavo and *T. godfreyi*, and (iii) *T. vivax*. It is concluded that either differing feeding patterns among members of the fly population or the ability of the trypanosomes in each of the infection categories to significantly influence the maturation of trypanosomes in the other categories are the most likely causes of the groupings noted. Chi-squared analysis of dissection and PCR methods of trypanosome identification revealed profound differences ($\chi^2 = 19.1$; D.F. = 1; $P > 0.05$). If confirmed in other studies, these findings have serious implications for our understanding of trypanosome epidemiology in tsetse flies, much of which is founded on data from dissection-based trypanosome identifications.

11619 **Ouma, J.O., Masake, R.A., Masiga, D.K., Moloo, S.K., Njuguna, J.T. and Ndung'u, J.M., 2000.** Comparative sensitivity of dot-ELISA, PCR and

dissection method for the detection of trypanosome infections in tsetse flies (Diptera: Glossinidae). *Acta Tropica*, **75** (3): 315-321.

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A visually read dot-enzyme linked immunosorbent assay (dot-ELISA) developed for the detection of trypanosomes in tsetse flies (*Glossina pallidipes*, *G. longipennis*) was evaluated in the laboratory and under field conditions. The fly dissection method was used as a standard technique and compared to the polymerase chain reaction (PCR). In laboratory studies, 133 and 126 tsetse flies were experimentally infected with different stocks of *Trypanosoma brucei* and *T. congolense*, respectively. Twenty-five days after infection, the flies were dissected and tested for the presence of trypanosomes using dot-ELISA and PCR. Dot-ELISA detected 98.4% of *T. brucei* and 94% of *T. congolense* infections in tsetse midguts, while PCR detected 97.6% of *T. brucei* and 96% of *T. congolense* tsetse midgut samples. For field evaluation of dot-ELISA, 700 tsetse flies were caught and screened for trypanosome infections by dissection. Seven of these (1%) had trypomastigotes in the midgut, 23 (3.3%) in the proboscis and none had trypanosomes in the salivary glands. All the flies with midgut infections also had trypanosomes in their proboscides. Five of the seven flies (71.4%) with midgut infections, revealed by dissection, were also positive for *T. congolense* by the dot-ELISA and PCR techniques. Dot-ELISA detected *T. congolense* infections in an additional 86 (12.4%) of the 700 flies dissected. Of the 23 infections in the proboscis, 16 were *T. vivax*. Dot-ELISA detected 13 of the 16 (81%) while PCR detected 15 of the 16 (94%) *T. vivax* infections. No *T. brucei* infection was detected by any of the methods in any of the 700 tsetse flies examined. The results obtained from both the laboratory and the field studies indicate that the dot-ELISA and PCR techniques are sensitive and species-specific in revealing trypanosome infections in tsetse flies. While dot-ELISA required a single test to detect *T. congolense*, several primer pairs were needed for PCR. The potential use of dot-ELISA as a tool for studying the epidemiology of trypanosomosis, while considering its field applicability and relatively lower cost, is discussed.

11620 **Sané, B., Garcia, A., Fournet, F. and Laveissière, C., 1999.** Répartition des groupes d'âge de *Glossina palpalis palpalis* femelle dans les plantations et les talwegs en zone forestière de Côte d'Ivoire. Relation avec la prévalence de la maladie du sommeil. [Age group distribution of female *G. p. palpalis* in plantations and shallow water in the forest zone of Côte d'Ivoire. Relationship with sleeping sickness prevalence.] *Bulletin de la Société de Pathologie exotique*, **92** (3): 210-212.

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

In foci with a high prevalence of human African trypanosomiasis (HAT), equivalent proportions of the different age groups of female *G. p. palpalis* (nulliparous, young parous and old parous) were caught in epidemiologically risky biotopes. However, in foci without HAT or with only a low prevalence (< 0.2%), the age group proportions in the same biotopes differed significantly. Female age group distributions in epidemiologically

risky biotopes could thus be an additional indicator for directing control activities in HAT foci.

11621 **Simo, G., Njiokou, F., Nkinin, S., Mgbedié, M., Laveissière, C. and Herder, S., 2000.** Etude de la prévalence des infections à trypanosomes chez les animaux sauvages du foyer de la maladie du sommeil de Bipindi, Cameroun. [Study of the prevalence of trypanosome infections in wild animals in the Bipindi sleeping sickness focus, Cameroon.] *Bulletin de Liaison et de Documentation de l'OCEAC*, **33** (2): 8-15.

Simo: Laboratoire de Recherche sur la Trypanosomiase, OCEAC, B.P. 288, Yaoundé, Cameroon. [trypoceac@camnet.cm]

In this study, PCR was used to determine the prevalence of different trypanosome species in wild animals from the Bipindi (Cameroon) sleeping sickness focus. Preliminary results showed that 39% (64/164) of wild animals in this focus had been in contact with at least one species of trypanosome. *Trypanosoma brucei* s.l. had the highest prevalence (22%), while the prevalence of *T. vivax* was fairly high (11%). The prevalence of the *Nannomonas* subgenus (*T. congolense* forest type, *T. congolense* savanna type and *T. simiae*) was low (6%). *T. simiae* and *T. congolense* forest type were found only in rodents and primates. The parasite pathogenic to man, *T. b. gambiense* group 1, had a prevalence of 8%. Animals with a high prevalence of *T. b. gambiense* were rodents (*Atherurus africanus* and *Cricetomys gambianus*), monkeys (*Cercopithecus* and *Cercocebus*) and ungulates (*Cephalophus*). Two small carnivores (*Genetta servalina* and *Nandinia binotata*) also harboured trypanosomes pathogenic to man. Confirmation of these results by a more exhaustive study will allow a better understanding of the wild animal reservoir of *T. b. gambiense* and of the resurgence, perpetuation and spread of sleeping sickness.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

[See also **23**: no. 11627.]

11622 **Bureau, P., Lucas, P. and Nangouma, A., 2000.** La trypanosomiase humaine africaine (THA) en République Centrafricaine: quelques données pour 1999. [Human African trypanosomiasis in the Central African Republic: some data for 1999.] *Bulletin de Liaison et de Documentation de l'OCEAC*, **33** (1): 47-48.

Bureau: OCEAC, B.P. 288, Yaoundé, Cameroon.

Altogether, 869 cases of HAT have been reported in 1999 in the three historic foci of the Central African Republic. The Haut Mbomou (Obo) focus in the east of the country, along the border with Congo D.R., accounts for half the cases and gives cause for concern. During the year, 14,548 inhabitants were actively screened; at least 72 villages along more than 300 km were considered endemic, the disease having spread in the

western end of the focus. The situation in the Ouham (Batangafo) focus in the north, near the border with Chad, is also very worrying. Screening by lymph node palpation/puncture of 35,584 inhabitants of 126 villages showed newly affected communities in an area free of the disease for 40 years. In addition, 12,780 other people were screened by standard methods. In total, 203 cases were diagnosed by the mobile team and 88 at permanent centres. Control of HAT in both these foci is complicated by population movements across the border. The situation in the Nola focus in the south-west, however, appears to be stationary, with 72 cases, but vigilance should not be reduced, especially in view of the risk of transmission in the less accessible busy mining communities in the region.

11623 **Coker, A.O., Isokpehi, R.D., Thomas, B.N., Fagbenro-Beyioku, A.F. and Omilabu, S.A., 2000.** Zoonotic infections in Nigeria: overview from a medical perspective. *Acta Tropica*, **76** (1): 59-63.

Coker: Campylobacter Research Laboratory, Department of Medical Microbiology and Parasitology, College of Medicine, University of Lagos, Idiaraba, Lagos, Nigeria.

Zoonotic infections that are endemic in Nigeria include tuberculosis, trypanosomiasis, toxoplasmosis, taeniasis, rabies, lassa fever and yellow fever, and more are emerging. Data on human *Trypanosoma brucei gambiense* infection are limited. The apparently low figures might be due to the poor and uncoordinated manner by which data are compiled. Anecdotal evidence suggests that an endemic situation probably exists in the northern part of Nigeria.

11624 **Kohagne, T.L., Nkinin, S.W., Grébaut, P., Njiokou, F. and Penchenier, L., 2000.** Cinétique de *Trypanosoma brucei gambiense* en culture sur milieux KIVI et Cunningham. [Kinetics of *T. b. gambiense* in culture using KIVI and Cunningham's medium.] *Bulletin de Liaison et de Documentation de l'OCEAC*, **33** (1): 17-21.

Penchenier: Laboratoire de Recherche sur la Trypanosomiase, OCEAC, B.P. 288, Yaoundé, Cameroon. [trypoceac@camnet.cm; lt.penchenier@infonie.fr]

The kit for *in vitro* isolation (KIVI) is a satisfactory method for isolating stocks of *T. b. gambiense* in the field but laboratory research (serological tests, genetic studies, etc.) needs large quantities of trypanosomes which KIVI cannot provide. It is therefore necessary to progress to mass culture using Cunningham's medium. A study to optimise this process by investigating the growth and survival of trypanosomes in KIVI culture was undertaken using 14 stocks isolated from sleeping sickness patients in the Campo focus of Cameroon. Parasite numbers were counted regularly from the day on which the KIVI was first declared positive to that on which trypanosomes had completely disappeared from the medium. Statistical analysis showed that trypanosomes actively multiplied in the KIVI and attained their highest growth peak after a mean of 26 ± 1 days. There was a significant (P = 0.03) negative linear correlation between the initial density of parasites and the number of days to the growth peak. After initial inoculation, a KIVI needed to be checked for at least 40 days before being declared negative. The length of time during

which a positive KIVI supported trypanosome survival could exceed 50 days but varied according to stock. Subcultures in Cunningham's medium carried out before 22 days resulted in high densities of trypanosomes (1200×10^6 parasites/ml) while those carried out after 34 days gave low densities (200×10^6 parasites/ml), insufficient for research. The preservation of trypanosomes in the KIVI medium is therefore sufficiently long to allow field trips lasting up to 3 weeks.

11625 **Maddocks, S. and O'Brien, R., 2000.** African trypanosomiasis in Australia. *New England Journal of Medicine,* **342** (17): 1254.

Maddocks: Westmead Hospital, Sydney, NSW, Australia.

A case of African trypanosomiasis in a 30-year-old woman returning to Australia from a 4-week trip to East Africa is reported. Fevers, rigors and severe headache persisted, and nausea, vomiting and myalgia developed. Examination revealed fever, tachycardia, postural hypotension, palpable spleen and a macular, erythematous lesion on the inner right thigh. *Trypanosoma brucei rhodesiense* was seen in a peripheral blood film, but CSF was normal. The patient's symptoms rapidly resolved with first pentamidine and then suramin treatment.

11626 **Miézan, T.W., Meda, H.A., Doua, F., Djè, N.N., Lejon, V. and Büscher, P., 2000.** Single centrifugation of cerebrospinal fluid in a sealed Pasteur pipette for simple, rapid and sensitive detection of trypanosomes. *Transactions of the Royal Society of Tropical Medicine and Hygiene,* **94** (3): 293.

Büscher: Department of Parasitology, Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium. [pbuscher@itg.be]

A modified single centrifugation (MSC) technique is described as an alternative to double centrifugation (DC). Trypanosomes were searched for in blood from 52 CATT-positive persons in Côte d'Ivoire by mAECT, quantitative buffy coat and KIVI, and in lymph by examination of lymph-node aspirate. CSF was examined for trypanosomes by DC and in parallel by MSC using 2 ml in a sealed Pasteur pipette which was centrifuged for 10 min at 600 *g*. Combining all methods, trypanosomes were detected in 42 (80.8%) of the 52 patients; according to WHO criteria 35 of these patients (83.3%) were in the meningo-encephalitic stage. Trypanosomes were detected in 34 CSF samples; the DC and MSC techniques were positive in, respectively, 28 and 33 patients. MSC detected trypanosomes in 6 samples negative with DC, whereas DC detected trypanosomes in only 1 MSC-negative sample. The difference in sensitivity was not statistically significant, and there was no significant difference between MSC and white cell count or total protein concentration in CSF as criteria for stage determination. It is concluded that MSC is a rapid, simple and sensitive technique for diagnosis and stage determination of HAT, and for post-treatment follow-up.

(b) PATHOLOGY AND IMMUNOLOGY

11627 **Bisser, S., Ayed, Z., Bouteille, B., Stanghellini, A., Breton, J.C., Dumas, M. and Jauberteau, M.O., 2000.** Central nervous system involvement in African

trypanosomiasis: presence of anti-galactocerebroside antibodies in patients' cerebrospinal fluid. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **94** (2): 225-226.

Bisser: Institut d'Epidémiologie Neurologique et de Neurologie Tropicale, Faculté de Médecine, 2 rue du Docteur Raymond Marcland, F-87025 Limoges Cedex, France. [ient@unilim.fr]

Therapeutic choice in HAT is directly dependent on CNS involvement but the sensitivity of the classically used indicators (CSF cell count, protein concentration and presence of trypanosomes) is questionable. Autoantibodies against major components of the CNS have been detected and could be diagnostic markers for stage determination. A field study of 105 adults with parasitologically proven *Trypanosoma brucei gambiense* HAT and 59 matched controls was conducted in Congo P.R. Disease stage was assessed from CSF cell count (cut-off 5 cells/µl) and/or presence of trypanosomes. Patients were classified into five clinical groups according to severity of neuropsychiatric signs. Protein profile values, including levels of IgG, IgM and albumin in sera and CSF, were used to determine blood-CSF barrier (B-CSFB) dysfunction and IgG intrathecal synthesis. An ELISA was used to detect anti-galactocerebroside (anti-GalC) antibodies in serum and CSF. Rises in serum and CSF total proteins, albumin, IgG, IgM and B-CSFB dysfunction were found to be significantly associated with the neurological stage ($P < 0.05$) but only in advanced cases. Serum anti-GalC antibodies were significantly increased compared to controls ($P < 0.0001$); they were positive for 29 patients (27.6%), but did not correlate with the other inflammatory markers in sera and CSF. In contrast, anti-GalC antibodies in CSF were significantly associated with the second stage, being detected in 20 second stage and 2 first stage patients; their presence was correlated with the other CSF inflammatory markers (IgG, IgM, proteins), B-CSFB dysfunction and intrathecal synthesis of immunoglobulins, and was also significantly associated with the presence of neurological signs ($P < 0.0001$). There was no correlation between serum and CSF anti-GalC antibodies, suggesting their intrathecal synthesis instead of passive diffusion. Anti-GalC antibodies identified two more patients as second stage in addition to those identified by clinical examination alone (11) and classical biological field criteria (28).

11628 **Girard, M., Bisser, S., Büscher, P., Bouteille, B., Preud'Homme, J.-L. and Jauberteau, M.-O., 2000.** Cross-reactivity of anti-galactocerebroside auto-antibodies with a *Trypanosoma brucei* proteolipidic epitope. *Clinical and Experimental Immunology*, **119** (3): 516-522.

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

Pathogenic mechanisms of the demyelinating encephalopathy featuring in the nervous phase of human African trypanosomiasis (HAT) are largely unknown but might include autoimmune disorders. A variety of autoantibodies is detected during the disease and anti-galactocerebroside (GalC) antibodies have previously been found in the serum and CSF of patients in the nervous stage of HAT. It is now shown that anti-GalC antibodies recognise an antigen located on the parasite membrane and common to

different strains of trypanosomes. By using affinity chromatography with a rabbit anti-GalC antiserum, a 52-kD proteolipid was isolated from the membrane of *T. b. brucei* AnTat 1.9, AnTat 1.1E, and *T. b. rhodesiense* Etat 1.2/R and Etat 1.2/S. Antibodies directed against this antigen were found in the CSF from patients with nervous stage HAT. These CSF also contained anti-GalC antibodies and adsorption with the proteolipid decreased anti-GalC reactivity. Immunisation of mice with this antigen induced the production of antibodies which cross-reacted with GalC but no protection from experimental infection with *T. b. brucei*. These data support the hypothesis that anti-GalC antibodies detected in the CSF from HAT patients might be induced by molecular mimicry with a parasite antigen.

11629 **Nieman, R.E. and Kelly, J.J., 2000.** African trypanosomiasis. *Clinical Infectious Diseases*, **30** (6): 985.

Nieman: Associates in Infectious Diseases, 1235 York Road (Suite 220), Abington, PA 19001, USA.

This letter refers to a recent review by Sinha *et al.* (see *TTIQ* **23**: no. 11497) of cases of trypanosomiasis in travellers returning to the USA from Africa, pointing out the omission of their earlier report (Nieman *et al.* 1989, *TTIQ* **12**: no. 5851) which described spurious hypoglycaemia in a case of East African trypanosomiasis.

(c) TREATMENT

[See also **23**: nos. 11589, 11599, 11627.]

11630 **Burri, C., Nkunku, S., Merolle, A., Smith, T., Blum, J. and Brun, R., 2000.** Efficacy of new, concise schedule for melarsoprol in treatment of sleeping sickness caused by *Trypanosoma brucei gambiense*: a randomised trial. *Lancet*, **355** (9213): 1419-1425.

Burri: Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland. [Christian.Burri@unibas.ch]

African trypanosomiasis has reached epidemic dimensions in various countries of central Africa. Treatment of the second stage is long and complicated, and is hampered by severe adverse reactions to the first-line drug, melarsoprol. Despite these problems, melarsoprol is likely to remain the drug of choice for the next decade. A randomised trial was therefore carried out comparing the standard treatment schedule with a new, concise regimen. The safety and efficacy of the new schedule were assessed in patients presenting with sleeping sickness to a hospital in Kwanza Norte, Angola. The control group followed the 26-day standard Angolan schedule of three series of four daily injections of melarsoprol at doses increasing from 1.2 to 3.6 mg/kg within each series, with a 7-day interval between series. The new treatment schedule comprised 10 daily injections of 2.2 mg/kg. Primary outcomes assessed were elimination of parasites, deaths attributed to treatment, and rate of encephalopathy. Analysis was by intention to treat. Of 767 patients with second-stage disease, 500 were enrolled: 250 were assigned to the standard schedule

and 250 to the new schedule. Forty patients on the standard schedule and 47 on the new schedule had adverse events which resulted in treatment disruption or withdrawal. Fifty patients on the standard regimen deviated or withdrew from treatment, compared with two on the new regimen. Parasitological cure 24 h after treatment was 100% in both groups; there were six deaths (all due to encephalopathy) 30 days after treatment in each group. The number of patients with encephalopathic syndromes was also the same in each group (14). Skin reactions were more common with the new treatment, but all could be resolved by additional medication or withdrawal of treatment. Considering the economic and practical advantages of the new 10-day schedule over the standard 26-day treatment schedule, and the similarity of treatment outcome, the new schedule is a useful alternative to the present standard, especially in epidemic situations and in locations with limited resources.

11631 **Stanghellini, A., 2000.** La trypanosomose humaine africaine. Stratégie thérapeutique de lutte. [Human African trypanosomiasis. Therapeutic control strategy.] *Bulletin de la Société de Pathologie exotique*, **93** (1): 31-33.

Programa Nacional de Luta contra a Tripanossomíase, Luanda, Angola.

Although therapeutic strategies for trypanosomiasis appear to be straightforward, their application in the field raises a number of questions. After a short account of the drugs currently available, the author discusses: (i) the criteria for eligibility for treatment: the problems of when to begin treatment of immunological suspects and of the determination of the stage of development of the disease; (ii) present-day problems: availability of drugs, side effects and therapeutic failures. While efforts should be continued to make existing drugs available, it is important not only to find ways of improving their use but also to carry out fundamental research to develop new active compounds.

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

[See also **23**: nos. 11591, 11593, 11637, 11639, 11645-11647, 11675, 11676.]

11632 **Magona, J.W., Greiner, M. and Mehlitz, D., 2000.** Impact of tsetse control on the age-specific prevalence of trypanosomosis in village cattle in southeast Uganda. *Tropical Animal Health and Production*, **32** (2): 87-98.

Magona: Livestock Health Research Institute, P.O. Box 96, Tororo, Uganda.

The prevalence of trypanosomosis, mean PCV and anti-trypanosomal antibody levels in village cattle of different age groups (< 0.5 year, 0.5-2 years, > 2-5 years and > 5 years) in areas with tsetse (*Glossina fuscipes fuscipes*) control (TC) were compared with those of corresponding age groups in areas without tsetse control (NTC) in Tororo, southeast Uganda. The prevalence of trypanosomosis in cattle in the age groups 0.5-2

years, > 2-5 years and > 5 years in the TC areas was significantly lower than in cattle in similar age groups in the NTC areas ($P < 0.5$). *Trypanosoma vivax* was the predominant trypanosome species in the TC areas, while *T. congolense* was the predominant species in the NTC areas. The mean trypanosome antibody levels in cattle in the age groups < 0.5 year, 0.5-2 years and > 2-5 years in the TC areas were significantly lower than those of the similar age groups in the NTC areas ($P < 0.5$). The mean PCV values for cattle in the age groups 0.5-2 years, > 2-5 years and > 5 years from the TC areas were significantly higher than those of the similar age groups in the NTC areas. Tsetse control thus appeared to have a considerable impact on the prevalence of trypanosomosis, distribution of trypanosome species, specific antibody levels and PCV of cattle in the different age groups.

11633 **Rebeski, D.E., Winger, E.M., Okoro, H., Kowalik, S., Bürger, H.J., Walters, D.E., Robinson, M.M., Dwinger, R.H. and Crowther, J.R., 2000.** Detection of *Trypanosoma congolense* antibodies with indirect ELISAs using antigen-precoated microtitre plates. *Veterinary Parasitology*, **89** (3): 187-198.

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

The study reports the performance of four indirect enzyme-linked immunosorbent assays (ELISAs) for antibody detection using microtitre plates which were precoated with native or heat/detergent-denatured antigens from *T. congolense* and *T. vivax*, and stored for between 1 and 206 days at +37°C. Bovine serum samples were obtained by sequential bleeding of 3-month-old *T. congolense*-infected bulls and their uninfected cohorts, as well as by a single bleeding of uninfected adult cattle. The first day of antibody detection, and observations on samples after this (defined as estimated ELISA sensitivity), depended on the cut-off value in the specific ELISAs. Cut-off values from pre- and early post-infection samples of individual animals demonstrated a seroconversion in all ELISAs on average after 10-15 days p.i. Antibody detection was delayed in the *T. congolense* native and denatured antigen-based ELISAs using cut-off points from uninfected cohort cattle (16.5 and 19.3 days p.i.) and the adult cattle population (22.1 and 25.0 days p.i.). The *T. vivax* antigen-based ELISAs, however, lacked crossreactiviy to *T. congolense* antibodies. The estimated sensitivity of each *T. congolense* antigen-based ELISA was above 96% throughout, but significantly lower for the *T. congolense* native antigen-based ELISA (91.1%) when the adult cattle derived cut-off point was used ($P < 0.01$). The sensitivity of the phase contrast buffy coat technique was similar to the *T. congolense* antigen-based ELISAs, but significantly lower when the *T. congolense* denatured antigen-based ELISA was used at the adult cattle derived cut-off point ($P < 0.05$). The implications of the results for future research on ELISAs are discussed.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **23**: nos. 11590, 11598.]

11634 **Adejinmi, J.O. and Akinboade, O.A., 2000.** Serum biochemical changes in WAD goats with experimental mixed *Trypanosoma brucei* and *Cowdria ruminantium* infections. *Tropical Veterinarian*, **18** (1-2): 111-120.

Adejinmi: Department of Veterinary Microbiology and Parasitology, University of Ibadan, Ibadan, Nigeria.

Serum biochemical changes were determined in two groups (four infected and three controls in each) of West African Dwarf goats. Group 1 goats were experimentally infected first with *T. brucei* and later superimposed with *C. ruminantium*; Group 2 were infected first with *C. ruminantium* and later superimposed with *T. brucei*. There were no significant differences in the effects produced in the two groups of goats; hence it does not matter which of the parasites was first used to infect the animals. The mixed infections in the two groups of goats produced an acute disease resulting in the development of fever, anaemia, oedema, weight loss, unsteady gait, paddling, posterior paralysis, convulsions and death. Infected goats showed increases in the values of serum sodium, chloride, bicarbonate, inorganic phosphate, globulin, urea and creatinine. The serum potassium, total protein, albumin and albumin:globulin ratio were depressed. These observations suggest damage to host tissues and parathyroid gland, renal and hepatic malfunction.

11635 **Anosa, V.O., Logan-Henfrey, L.L. and Wells, C.W., 1999.** The role of the bone marrow in bovine trypanotolerance II. Macrophage function in *Trypanosoma congolense*-infected cattle. *Comparative Haematology International*, **9** (4): 208-218.

Anosa: Department of Veterinary Pathology, University of Ibadan, Ibadan, Nigeria. [library@ibadan.ac.ng]

Sequential biopsies of sternal bone marrow of three trypanosusceptible Boran and three trypanotolerant N'Dama cattle were examined by light and transmission electron microscopy before and up to 112 days p.i. with *T. congolense*. Before infection, the percentage of cells of the mononuclear phagocyte system including the macrophages and the calculated index of macrophage volume in the bone marrow were similar in both breeds, whereas the mean macrophage surface area was significantly higher ($P < 0.0001$) in the Boran than in the N'Dama. During *T. congolense* infection, the mononuclear phagocyte system cell counts, the macrophage surface area and the calculated macrophage volume index increased significantly in both breeds, particularly in the N'Dama. Macrophages phagocytosed only a few erythrocytes and mature neutrophils in both breeds before infection. During infection, macrophages engulfed many erythrocytes, reticulocytes, normoblasts, granulocytes and their precursors, and thrombocytes, whereas lymphocytes and monocytes were seldom phagocytosed. Many macrophages phagocytosed cells from more than one cell lineage, and phagocytosis of nucleated cells was preceded by attraction of the target cell and subsequent adhesion to the macrophage, suggesting a common mechanism of cell destruction. The macrophages of cattle maintained contact, through reciprocal U- or V-shaped microvilli or filiform processes, with haemopoietic cells. These contacts increased during the acute phase of *T. congolense* infection in both breeds and remained elevated in the N'Dama until 112 days p.i., whereas

they dropped to preinfection levels in the chronic phase (98, 112 days p.i.) in the Boran. Cumulatively, the absolute numbers, surface area, organelle contents and calculated volume index of the macrophages, percentage of macrophages with phagocytosed cells, the total cells engulfed, adhesion of target cell to macrophage prior to phagocytosis, phagocytosis of multiple cell lines, as well as the percentage of macrophages in contact with haemopoietic cells, and the total haemopoietic cells in contact with macrophages were significantly higher in the N'Dama than in the Boran. Cell phagocytosis and contact with haemopoietic cells decreased in Boran cattle during the chronic phase but remained elevated in the N'Dama. The positive balance between the beneficial effects of macrophage activation in the bone marrow (enhanced haematopoiesis, and presumably parasite clearance and antigen processing) and its deleterious effect (cytophagia) was greater in the trypanotolerant N'Dama than in the Boran, enabling the N'Dama to resist infection better. This study therefore demonstrates that superior bone marrow responses, pivoted on vital macrophage functions, play a major role in trypanotolerance.

11636 **Baraka, T.A., El-Sherif, M.T., Kubesy, A.A. and Illek, J., 2000.** Clinical studies of selected ruminal and blood constituents in dromedary camels affected by various diseases. *Acta Veterinaria Brno*, **69** (1): 61-68.

Baraka: Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences, Palackeho 1-3, 61242 Brno, Czech Republic.

Selected ruminal and blood constituents were investigated in 81 dromedary camels affected by various diseases including simple indigestion, ruminal acidosis, frothy bloat, trypanosomiasis (n = 11), caseous lymphadenitis, contagious skin necrosis and in healthy camels (n = 38). Samples of ruminal fluid were examined for physical characteristics, protozoan activity and biochemical constituents. Blood samples were tested for total erythrocyte count, haemoglobin concentration, PCV, mean cellular volume, mean cell haemoglobin, mean cell haemoglobin concentration, and total and differential leukocyte counts. Blood serum samples were tested for total protein concentration and biochemical constituents. Compared with normal camels, significant changes were found in the trypanosomiasis group for ruminal inorganic phosphorus ($P < 0.001$), blood serum chlorides ($P < 0.01$), ruminal urea, calcium and potassium concentrations, erythrocyte count, and blood serum sodium and potassium concentrations ($P < 0.05$).

11637 **Greiner, M., Mattioli, R.C., Faye, J., Rebeski, D., Winger, E. and Mehlitz, D., 2000.** Study on the susceptibility and detectability of bovine trypanosomosis under natural infection challenge by survival analysis. *Proceedings of the Society for Veterinary Epidemiology and Preventive Medicine*, **2000**: 115-123.

Greiner: Department of Tropical Veterinary Medicine and Epidemiology, Free University of Berlin, Königsweg 67, D-14163 Berlin, Germany.

This paper presents the results of a supplementary analysis of data obtained in an earlier study (Mattioli *et al*. 1998, *Acta Tropica*, **71**: 57-71; see *TTIQ* **22**: no. 10755) in which previously uninfected N'Dama, Gobra zebu and Gobra × N'Dama crossbred cattle were exposed to natural tsetse and tick challenge and their clinical response and the

parasitological detectability of trypanosomes were studied. The present paper focuses on the incidence aspect of the events such as first occurrence of clinical signs and detectable trypanosomes and trypanosomal antigen. The analysis confirmed important differences in the clinical and parasitological response to trypanosomosis challenge between N'Dama and other breeds. It is suggested that incidence studies are more suitable for detecting risk factors for animal trypanosomosis than prevalence-based (cross-sectional) studies because the latter often result in misinterpretation of factors that increase the survival time under infection as risk factors. From the practical viewpoint, this study supports reservations against using antigen ELISA tests as a single diagnostic tool.

11638 **Logan-Henfrey, L.L., Anosa, V.O. and Wells, C.W., 1999.** The role of the bone marrow in bovine trypanotolerance I. Changes in blood and bone marrow in *Trypanosoma congolense*-infected cattle. *Comparative Haematology International*, **9** (4): 198-207.

Anosa: Department of Veterinary Pathology, University of Ibadan, Ibadan, Nigeria. [library@ibadan.ac.ng]

This study compared the changes in the bone marrow of five trypanotolerant N'Dama cattle with those of four trypanosusceptible Boran cattle during trypanosome infection. In the early parasitaemic phase, from 12 to 21 days p.i., tsetse-transmitted primary *T. congolense* IL 1180 infection induced parasitaemia, slight depression in PCV, marked leucopenia due to lymphocytopenia and eosinopenia, and thrombocytopenia which were of similar intensity in Boran and N'Dama cattle. However, from 28 days p.i. until the end of the experiment on 112 days p.i., the parasitaemia was higher in the Boran than in the N'Dama. Severe anaemia and leucopenia characterised by lymphopenia, neutropenia, eosinopenia and monocytopenia persisted in Boran cattle. In contrast, the PCV values dropped gradually in N'Dama cattle and from 77 days p.i. recovered slowly to values just below preinfection levels by 112 days p.i. The total and differential leucocyte counts of the N'Dama cattle stabilised at approximately two-thirds of preinfection values between 28 and 112 days p.i., and were double those of the Boran. Marked thrombocytopenia occurred in both breeds. The anaemia was initially macrocytic hypochromic but terminally became microcytic hypochromic in both breeds. Light and electron microscopic studies of sequential biopsies of the bone marrow of these animals showed that the bone marrow response was the key to these differences between the N'Dama and Boran. The biopsies of the bone marrow of the N'Dama cattle were hypercellular (scored 4.5 ± 1.0 compared to 4.0 for controls) with mild hyperplasia of erythroid cells and mild hypoplasia of myeloid cells from 28 to 112 days p.i., endowing the animals with higher haemopoietic potential that enabled them to replace most lost cells. In contrast, the Boran cattle had hypocellular (scored 2.4 ± 1.1) bone marrow biopsies with relative erythroid hyperplasia and myeloid hypoplasia, resulting in low capacity of cell replacement manifested as severe unremitting anaemia and leucopenia. The bone marrow of both breeds showed moderate hyperplasia of cells of the mononuclear phagocyte system. Therefore, this study showed, for the first time, that the bone marrow response is a key determinant factor of trypanotolerance as it determines the animal's capability for blood cell regeneration.

11639 **Olaho-Mukani, W. and Mahamat, H., 2000.** Trypanosomiasis in the dromedary camel. *In*: Gahlot, T.K. (ed.), *Selected topics on camelids* (Bikaner, India; Camelid Publishers), pp. 255-270.

Olaho-Mukani: Livestock Health Research Institute, P.O. Box 96, Tororo, Uganda.

The aetiology, epidemiology, clinical manifestation, pathology, diagnosis, control and treatment of trypanosomiasis in dromedaries are reviewed.

11640 **Yadvendra Singh, Pathak, K.M.L., Kapoor, M., Harsh, D. and Verma, K.C., 1997.** Clinico-haematological studies in camels naturally infected with *Trypano-soma evansi*. *Journal of Veterinary Parasitology*, **11** (1): 43-46.

Yadvendra Singh: Department of Veterinary Parasitology, College of Veterinary and Animal Science, Bikaner 334001, India.

Clinical and haematological aspects of trypanosomiasis were investigated in 40 naturally infected camels. Infected animals showed high temperature, marked depression, dullness, impaired appetite, loss of condition, emaciation of hind quarters, anaemia and, in some animals, corneal opacity; reduction in hump size was recorded in a few animals. Compared with healthy controls, infected camels showed reduced haemoglobin, PCV and total erythrocyte count, and increased total leukocyte count, and neutrophil, eosinophil and monocyte count, together with decreased lymphocyte count.

(c) TRYPANOTOLERANCE

[See also **23**: nos. 11592, 11594, 11635, 11638, 11649.]

11641 **Almeida, A.M. de, 1999.** A tripanotolerância de algumas raças bovinas e a sua importância socio-econômica. [Trypanotolerance in some cattle breeds and its socio-economic importance.] [N'Dama, West African Shorthorn.] (Review.) *Veterinária Técnica*, **9** (3): 8-14.

Instituto de Investigação Científica Tropical, Centro de Veterinária e Zootecnia, Faculdade de Medicina Veterinária, Rua Gomes Freire, 1199 Lisbon, Portugal.

11642 **Wang, Q., Hamilton, E. and Black, S.J., 2000.** Purine requirements for the expression of Cape buffalo serum trypanocidal activity. *Comparative Biochemistry and Physiology (C)*, **125** (1): 25-32.

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

Cape buffalo serum contains xanthine oxidase which generates trypanocidal H_2O_2 during the catabolism of hypoxanthine and xanthine. The present studies show that xanthine oxidase-dependent trypanocidal activity in Cape buffalo serum was also elicited by purine nucleotides, nucleosides and bases even though xanthine oxidase did not catabolise those purines. The paradox was explained in part by the presence in serum of purine nucleoside phosphorylase and adenosine deaminase that, together with xanthine oxidase, catabolised adenosine, inosine, hypoxanthine and xanthine to uric acid, yielding trypanocidal H_2O_2. In addition, purine catabolism by trypanosomes provided substrates for serum xanthine oxidase and was implicated in the triggering of xanthine oxidase-dependent trypanocidal activity by purines that were not directly catabolised to uric acid in Cape buffalo serum, namely guanosine, guanine, adenine monophosphate, guanosine diphosphate, adenosine 3′:5-cyclic monophosphate and 1-methylinosine. The concentrations of guanosine and guanine that elicited xanthine oxidase-dependent trypanocidal activity were 30-270-fold lower than those of other purines requiring trypanosome processing which suggests differential processing by the parasites.

(d) TREATMENT

[See also **23**: no. 11639.]

11643 **Anene, B.M., Chukwu, C.C. and Anika, S.M., 1999.** Sensitivity to diminazene aceturate and isometamidium chloride of trypanosomes isolated from dogs in Nsukka area, Nigeria. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux,* **52** (2): 129-131.

Anene: Faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria.

The sensitivity of trypanosomes isolated from clinically infected dogs in Nsukka, Nigeria, to diminazene aceturate (Berenil, 7 and 14 mg/kg body weight) and isometamidium chloride (Samorin, 0.25 and 0.5 mg/kg) was evaluated in mice. Of the 11 infected blood samples tested (10 with *Trypanosoma brucei*, one with mixed *T. brucei* and *T. congolense*), 3 and 5 contained parasites that were considered to have low levels of resistance to Berenil and Samorin, respectively, while 3 samples each contained parasites that expressed moderate to high levels of resistance. It is concluded that this trypanosome resistance to standard treatment doses of trypanocides may represent a serious danger to effective drug therapy of trypanosomiasis of dogs in the area.

11644 **Anene, B.M., Ogbuanya, C.E., Mbah, E.S. and Ezeokonkwo, R.C., 1999.** Preliminary efficacy trial of Cymelarsan in dogs and mice artificially infected with *Trypanosoma brucei* isolated from dogs in Nigeria. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **52** (2): 123-128.

Anene: Faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria.

The efficacy of melarsenoxide cysteamine (Mel Cy) against *T. brucei* isolated from dogs was studied in experimentally infected mice and dogs. Infected mice were treated once i.p. with Mel Cy at dose rates of 2.5 and 5.0 mg/kg body weight 7 and 14 days p.i. All groups of mice treated 14 days p.i. relapsed, while almost all of the mice treated 7 days p.i. remained parasitologically negative during the 63-day observation period. Five dogs infected with a stock of the parasite were treated s.c. at a dose of 2.5 mg/kg 7 days p.i. (one dog), 14 days p.i. (two dogs) or 21 days p.i. (two dogs) and on 2 consecutive days. Following treatment, improvements in the clinical condition as well as weight gains were recorded in the dogs. The only relapse occurred in one of the two dogs treated 14 days p.i. It is suggested that, at the dose regimen used in this study, Mel Cy might be effective in the treatment of trypanosomiasis due to *T. brucei* in dogs.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

11645 **Katz, J.B., Chieves, L., Hennager, S.G. and Nicholson, J.M., 1998.** Immunoblotting and competitive ELISA for the confirmatory serodiagnoses of equine piroplasmosis, dourine and glanders. *Proceedings 102nd Annual Meeting of the United States Animal Health Association*, **1998**: 367.

Katz: National Veterinary Services Laboratories, USDA, Animal and Plant Health Inspection Service, Ames, IA 50010, USA.

An immunoblot approach was developed to permit the concurrent serodiagnosis of *Babesia equi*/*B. caballi*, *Trypanosoma equiperdum* and *Burkholderia mallei* infections using a single nitrocellulose strip bearing antigens characteristic of all four pathogens. The approach appears to be at least as sensitive and possibly more specific than the complement fixation test. Competitive ELISA tests are also being developed.

11646 **Katz, J.B., Chieves, L.P., Hennager, S.G., Nicholson, J.M., Fisher, T.A. and Byers, P.E., 1999.** Serodiagnosis of equine piroplasmosis, dourine, and glanders using an arrayed immunoblotting method. *Journal of Veterinary Diagnostic Investigation*, **11** (3): 292-294.

Katz: National Veterinary Services Laboratories, USDA, Animal and Plant Health Inspection Services, Ames, IA 50010, USA.

11647 **Katz, J., Dewald, R. and Nicholson, J., 2000.** Procedurally similar competitive immunoassay systems for the serodiagnosis of *Babesia equi*, *Babesia caballi*, *Trypanosoma equiperdum*, and *Burkholderia mallei* infection in horses. *Journal of Veterinary Diagnostic Investigation*, **12** (1): 46-50.

Katz: National Veterinary Services Laboratories, USDA, Animal and Plant Health Inspection Services, Ames, IA 50010, USA.

11648 **Omanwar, S., Rao, J.R., Basagoudanavar, S.H., Singh, R.K. and Butchaiah, G., 1999.** Direct and sensitive detection of *Trypanosoma evansi* by polymerase chain reaction. *Acta Veterinaria Hungarica*, **47** (3): 351-359.

Rao: Division of Parasitology, Indian Veterinary Research Institute, Izatnagar 243122, Uttar Pradesh, India.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **23**: nos. 11628, 11642, 11713.]

11649 **Clapcott, S.J., Teale, A.J. and Kemp, S.J., 2000.** Evidence for genomic imprinting of the major QTL controlling susceptibility to trypanosomiasis in mice. [*T. congolense.*] *Parasite Immunology*, **22** (5): 259-263.

Clapcott: Department of Zoology, University of Oxford, Oxford OX1 3PS, UK.

11650 **Hamadien, M., Bakhiet, M. and Harris, R.A., 2000.** Interferon-γ induces secretion of trypanosome lymphocyte triggering factor via tyrosine protein kinases. [*T. b. brucei*; rats.] *Parasitology*, **120** (3): 281-287.

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

11651 **Ijagbone, I.F. and Agbede, S.A., 2000.** A case of congenital transmission of *Trypanosoma brucei* in mice. *Tropical Veterinarian*, **18** (1-2): 37-38.

Ijagbone: Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Ibadan, Nigeria.

11652 **Keita, M., Vincendeau, P., Buguet, A., Cespuglio, R., Vallat, J.-M., Dumas, M. and Bouteille, B., 2000.** Inducible nitric oxide synthase and nitrotyrosine in the central nervous system of mice chronically infected with *Trypanosoma brucei brucei*. *Experimental Parasitology*, **95** (1): 19-27.

Keita: Faculté de Médecine, Institut d'Epidémiologie Neurologique et de Neurologie Tropicale, 2 rue du Dr Marcland, F-87025 Limoges, France.

11653 **Liu, Y.-J., Mustafa, M., Li, H.-L., Nuortio, L., Mustafa, A. and Bakhiet, M., 2000.** Modulation of early immune responses and suppression of *Trypanosoma brucei brucei* infections by surgical denervation of the spleen. [Rats.] *Neuroimmunomodulation*, **8** (1): 31-38.

Bakhiet: Division of Infectious Diseases (F82), Karolinska Institute, Huddinge University Hospital, S-14186 Huddinge, Sweden.

11654 **Momi, S., Perito, S., Mezzasoma, A.M., Bistoni, F. and Gresele, P., 2000.** Involvement of platelets in experimental mouse trypanosomiasis: evidence of mouse platelet cytotoxicity against *Trypanosoma equiperdum*. *Experimental Parasitology*, **95** (2): 136-143.

Momi: Section of Internal and Cardiovascular Medicine, Department of Internal Medicine, University of Perugia, I-06126 Perugia, Italy.

11655 **Namangala, B., Baetselier, P. de, Brijs, L., Stijlemans, B., Noel, W., Pays, E., Carrington, M. and Beschin, A., 2000.** Attenuation of *Trypanosoma brucei* is associated with reduced immunosuppression and concomitant production of Th2 lymphokines. [Mice.] *Journal of Infectious Diseases*, **181** (3): 1110-1120.

Beschin: Cellular Immunology Unit, Flemish Interuniversity Institute for Biotechnology, VIB-VUB, Paardenstraat 65, B-1640 Sint-Genesius-Rode, Belgium. [abeschin@vub.ac.be]

11656 **Ngure, R.M., Gateri, L.M., Ngotho, J.M. and Ndung'u, J.M., 2000.** Application of the Vettest 8008 system for the biochemical analysis of vervet monkey plasma. *Veterinary Record*, **146** (21): 612-613.

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

11657 **Onah, D.N. and Wakelin, D., 2000.** Murine model study of the practical implication of trypanosome-induced immunosuppression in vaccine-based disease control programmes. [*T. brucei*; *Trichinella spiralis.*] *Veterinary Immunology and Immunopathology*, **74** (3-4): 271-284.

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

11658 **Schofield, L., McConville, M.J., Hansen, D., Campbell, A.S., Fraser-Reid, B., Grusby, M.J. and Tachado, S.D., 1999.** CD1d-restricted immunoglobulin G formation to GPI-anchored antigens mediated by NKT cells. [Incl. *T. brucei*.] *Science*, **283** (5399): 225-229.

Schofield: Walter and Eliza Hall Institute of Medical Research, P.O., Royal Melbourne Hospital, Victoria 3050, Australia. [schofield@ wehi.edu.au]

11659 **Stoppini, L., Buchs, P.A., Brun, R., Muller, D., Duport, S., Parisi, L. and Seebeck, T., 2000.** Infection of organotypic slice cultures from rat central nervous tissue with *Trypanosoma brucei brucei*. *International Journal of Medical Microbiology*, **290** (1): 105-113.

Seebeck: Institute for General Microbiology, University of Bern, Baltzerstrasse 4, CH-3012 Bern, Switzerland.

11660 **Tabel, H., Kaushik, R.S. and Uzonna, J., 1999.** Experimental African trypanosomiasis: differences in cytokine and nitric oxide production by macrophages from resistant and susceptible mice. [*T. congolense.*] *Pathobiology*, **67** (5-6): 273-276.

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

11661 **Umar, I.A., Toh, Z.A., Igbalajobi, F.I., Igbokwe, I.O. and Gidado, A., 2000.** The effect of orally administered vitamins C and E on severity of anaemia in *Trypanosoma brucei*-infected rats. *Tropical Veterinarian*, **18** (1-2): 71-77.

Umar: Department of Biochemistry, College of Medical Sciences, University of Maiduguri, Maiduguri, Nigeria.

(c) CHEMOTHERAPEUTICS

[See also **23**: nos. 11656, 11681, 11687, 11689, 11691, 11717-11719.]

11662 **Brändle, E., Hannemann, J., Yousif, T. and Baumann, K., 1998.** Suramin-interaction with contraluminal transport systems in rat renal proximal tubule. *Nova Acta Leopoldina*, **78** (306): 261-267.

Brändle: Urological Department, University Hospital Ulm, Prittwitzstrasse 43, D-89075 Ulm, Germany.

11663 **Camacho, M. del R., Mata, R., Castaneda, P., Kirby, G.C., Warhurst, D.C., Croft, S.L. and Phillipson, J.D., 2000.** Bioactive compounds from *Celaenodendron mexicanum*. [Incl. *T. b. brucei.*] *Planta Medica*, **66** (5): 463-468.

Camacho: Department of Pharmaceutical Chemistry, School of Pharmacy, University of London, 29-39 Brunswick Square, London WC1N 1AX, UK. [mcamacho@ulsop.ac.uk]

11664 **Chibale, K., Visser, M., Yardley, V., Croft, S.L. and Fairlamb, A.H., 2000.** Synthesis and evaluation of 9,9-dimethylxanthene tricyclics against trypanothione reductase, *Trypanosoma brucei*, *Trypanosoma cruzi* and *Leishmania donovani*. *Bioorganic & Medicinal Chemistry Letters*, **10** (11): 1147-1150.

Chibale: Department of Chemistry, University of Cape Town, ZA-7701 Rondebosch, South Africa.

11665 **Enanga, B., Mezui Me Ndong, J., Boudra, H., Debrauwer, L., Dubreuil, G., Bouteille, B., Chauvière, G., Labat, C., Dumas, M., Périé, J. and Houin, G., 2000.** Pharmacokinetics, metabolism and excretion of megazol in a *Trypanosoma brucei gambiense* primate model of human African trypanosomiasis:

preliminary study. [Vervet monkeys.] *Arzneimittel-Forschung*, **50** (2): 158-162.

Houin: Laboratoire de Pharmacocinétique et Toxicologie Clinique, Centre Hospitalier Universitaire Rangueil, 1 avenue Jean Poulthès, F-31054 Toulouse Cedex, France. [houin.g@chu-toulouse.fr]

11666 **Girault, S., Grellier, P., Berecibar, A., Maes, L., Mouray, E., Lemière, P., Debreu, M.-A., Davioud-Charvet, E. and Sergheraert, C., 2000.** Anti-malarial, antitrypanosomal, and antileishmanial activities and cytotoxicity of bis(9-amino-6-chloro-2-methoxyacridines): influence of the linker. [Incl. *T. brucei*.] *Journal of Medicinal Chemistry*, **43** (14): 2646-2654.

Sergheraert: UMR 8525 CNRS, Université de Lille II, Institut de Biologie et Institut Pasteur de Lille, 1 rue du Professeur Calmette, 59021 Lille, France.

11667 **Igbokwe, I.O., Konduga, A.M. and Hamidu, L.D., 2000.** The effect of Novidium® treatment on fasting plasma glucose concentration of healthy rabbit. [Homidium chloride.] *Tropical Veterinarian*, **18** (1-2): 27-28.

Igbokwe: Department of Veterinary Pathology, College of Medical Sciences, University of Maiduguri, Maiduguri, Nigeria.

11668 **Khabnadideh, S., Tan, C.L., Croft, S.L., Kendrick, H., Yardley, V. and Gilbert, I.H., 2000.** Squalamine analogues as potential anti-trypanosomal and anti-leishmanial compounds. [*T. brucei*.] *Bioorganic & Medicinal Chemistry Letters*, **10** (11): 1237-1239.

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

11669 **Mbati, P.A., Hirumi, K., Inoue, N., Situakibanza, N.H. and Hirumi, H., 2000.** Suggested dosage rates of melarsoprol in the treatment of mice experimentally infected with *Trypanosoma brucei gambiense*. *Onderstepoort Journal of Veterinary Research*, **67** (1): 71-74.

Mbati: Parasitology Research Programme, University of the North, Qwa-Qwa Campus, Private Bag X13, ZA-9866 Phuthaditjhaba, South Africa.

11670 **Mikus, J., Harkenthal, M., Steverding, D. and Reichling, J., 2000.** *In vitro* effect of essential oils and isolated mono- and sesquiterpenes on *Leishmania major* and *Trypanosoma brucei*. *Planta Medica*, **66** (4): 366-368.

Reichling: Institut für Pharmazeutische Biologie, Universität Heidelberg, Im Neuenheimer Feld 364, D-69120 Heidelberg, Germany. [Juergen.Reichling@ t-online.de]

The effect of 12 essential oils and eight isolated mono- and sesquiterpenes on the viability of bloodstream forms of *T. brucei*, promastigotes of *L. major* and human HL-60 cells was evaluated using the Almar Blue assay. Three of the essential oils, *Melissa officinalis* (balmmint) oil, *Thymus vulgaris* (thyme) oil and *Melaleuca alternifolia* (tea tree) oil, were 50-80-fold more toxic to bloodstream forms of *T. brucei* than to HL-60 cells. Terpinen-4-ol, the main compound of tea tree oil, was 1000-fold more toxic to trypanosomes than to the human cells. None of the oils or terpenes tested proved more toxic to *L. major* than to HL-60 cells.

11671 **Shuaibu, M.N., Ameh, D.A., Bonire, J.J., Adaudi, A.O., Ibrahim, S. and Nok, A.J., 2000.** Trypanocidal activity of organotin chlorides on *Trypanosoma brucei*-infected mice. *Parasite*, **7** (1): 43-45.

Shuaibu: Institute of Tropical Medicine, Nagasaki University, 1-12-4 Sakamoto, Nagasaki 852, Japan.

11672 **Susperregui, J., Bayle, M., Léger, J.M. and Déléris, G., 1998.** Synthesis, structure and trypanocidal activity of dibutyltin derivatives of 2-mercapto-benzoxazole and 5-chloro-2-mercaptobenzothiazole. [*T. equiperdum.*] *Journal of Organometallic Chemistry*, **556** (1-2): 105-110.

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

11673 **Wahba, A.A., 1999.** Some studies on the efficacy of triquin on *Trypanosoma evansi*. [Rats.] *Egyptian Journal of Agricultural Research*, **77** (2): 931-940.

Animal Health Research Institute, Agricultural Research Centre, Giza, Egypt.

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

[See **23**: no. 11624.]

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

[See also **23**: no. 11679.]

11674 **Gibson, W., Bingle, L., Blendeman, W., Brown, J., Wood, J. and Stevens, J., 2000.** Structure and sequence variation of the trypanosome spliced leader transcript. [Incl. *T. brucei, T. congolense, T. simiae, T. vivax.*] *Molecular and Biochemical Parasitology*, **107** (2): 269-277.

Gibson: School of Biological Sciences, University of Bristol, Bristol BS8 1UG, UK. [w.gibson@bristol.ac.uk]

11675 **Kihurani, D.O., Masake, R.A., Nantulya, V.M. and Mbiuki, S.M., 2000.** Characterization of trypanosome isolates from naturally infected horses on a farm in Kenya. *Veterinary Parasitology*, **89** (3): 173-185.

Kihurani: Clinical Studies Department, Faculty of Veterinary Medicine, University of Nairobi, P.O. Box 29053, Nairobi, Kenya.

Following an outbreak of trypanosomosis in horses on a farm in Kenya, 18 trypanosome isolates were collected from infected animals between June 1990 and August 1991 and cryopreserved for characterisation. The characterisation was done on the basis of morphology using Giemsa-stained blood and buffy coat smears, infectivity to mice, recombinant DNA hybridisation, and chromosome separation by orthogonal field alternation gel electrophoresis (OFAGE). Morphologically, all the trypanosome isolates were identified as belonging to the subgenus *Nannomonas*, and 16 of the 18 isolates were infective to mice. The isolates were further classified using recombinant DNA hybridisation as the savanna type of *Trypanosoma congolense*. Chromosome separation by OFAGE, carried out on six clones derived from different isolates, also exhibited a profile characteristic of *T. congolense* savanna type. However, there were differences in the number and positions of the medium-sized and minichromosomes, indicating a diversity of serodemes within the isolates.

11676 **Qu, L.-H., Lun, Z.-R., Zhou, H. and Yu, X.-Q., 1999.** [Trypanosome Ls-rRNA analysis and application for trypanosome rDNA probes.] [*T. congolense, T. evansi, T. brucei.*] (In Chinese with English summary.) *Acta Scientiarum Naturalium Universitatis Sunyatseni*, **38** (1): 54-58.

Biotechnology Research Centre, Zhongshan University, Guangzhou 510275, China.

11677 **Tibayrenc, M. and Ayala, F.J., 1999.** Evolutionary genetics of *Trypanosoma* and *Leishmania*. [Incl. *T. brucei.*] (Review.) *Microbes and Infection*, **1** (6): 465-472.

Tibayrenc: Centre d'Etudes sur le Polymorphisme des Microorganismes, UMR CNRS/IRD 9926, IRD, B.P. 5045, F-34032 Montpellier, France.

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

11678 **Armah, D.A. and Mensa-Wilmot, K., 2000.** Tetramerization of glycosylphosphatidylinositol-specific phospholipase C from *Trypanosoma brucei*. *Journal of Biological Chemistry*, **275** (25): 19334-19342.

Mensa-Wilmot: Department of Cellular Biology, University of Georgia, 724 Biological Sciences Building, Athens, GA 30602, USA.

11679 **Asbeck, K., Ruepp, S., Roditi, I. and Gibson, W., 2000.** GARP is highly conserved among *Trypanosoma congolense* Savannah, Forest and Kilifi subgroups. *Molecular and Biochemical Parasitology*, **106** (2): 303-306.

Gibson: School of Biological Sciences, University of Bristol, Bristol BS8 1UG, UK.

11680 **Bakalara, N., Santarelli, X., Davis, C. and Baltz, T., 2000.** Purification, cloning, and characterization of an acidic ectoprotein phosphatase differentially expressed in the infectious bloodstream form of *Trypanosoma brucei*. *Journal of Biological Chemistry*, **275** (12): 8863-8871.

Bakalara: Laboratoire de Parasitologie Moléculaire, CNRS-UMR 5016, Université de Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux, France.

11681 **Barrett, M.P., Mottram, J.C. and Coombs, G.H., 1999.** Recent advances in identifying and validating drug targets in trypanosomes and leishmanias. [Incl. *T. brucei*.] (Review.) *Trends in Microbiology*, **7** (2): 82-88.

Mottram: Wellcome Unit of Molecular Parasitology, University of Glasgow, Glasgow G11 6NU, UK. [j.mottram@udcf.gla.ac.uk]

11682 **Bayele, H.K., Eisenthal, R.S. and Towner, P., 2000.** Complementation of a glucose transporter mutant of *Schizosaccharomyces pombe* by a novel *Trypanosoma brucei* gene. *Journal of Biological Chemistry*, **275** (19): 14217-14222.

Bayele: Department of Biochemistry and Molecular Biology, Royal Free and University College Medical School, Rowland Hill Street, London NW3 2PF, UK.

11683 **Belli, S.I., 2000.** Chromatin remodelling during the life cycle of trypanosomatids. [Incl. *T. brucei*.] (Review.) *International Journal for Parasitology*, **30** (6): 679-687.

Molecular Parasitology Unit, Department of Cell and Molecular Biology, University of Technology Sydney, Westbourne Street, Gore Hill, NSW 2065, Australia. [Sabina.Belli@uts.edu.au]

11684 **Bertrand, K.I. and Hajduk, S.L., 2000.** Import of a constitutively expressed protein into mitochondria from procyclic and bloodstream forms of *Trypanosoma brucei*. *Molecular and Biochemical Parasitology*, **106** (2): 249-260.

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

11685 **Bieger, B. and Essen, L.-O., 2000.** Crystallization and preliminary X-ray analysis of the catalytic domain of the adenylate cyclase GRESAG4.1 from *Trypanosoma brucei*. *Acta Crystallographica (D)*, **56** (3): 359-362.

Essen: Department of Membrane Biochemistry, Max-Planck-Institut für Biochemie, Am Klopferspitz 18A, D-82152 Martinsried, Germany.

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