LETTERS

Trypanosomiasis Research

Gina Kolata's article concerning microbiologic investigations of trypanosomes (Research News, 23 Nov., p. 956) holds out hope that sleeping sickness in humans and animals in tropical Africa may one day come under control. However, the article inaccurately states that the disease prevents livestock from living in equatorial Africa, and the map caption on page 957 incorrectly notes that the tsetse belt is nearly devoid of domestic animals.

Trypanosomiasis certainly has hindered the introduction of exotic European and Asian breeds of cattle and has hampered the development of mixed farming, but dwarf indigenous cattle live within the tsetse zone (*1*). Numerically greater and distributed more widely are dwarf goats, whose gamboling antics add much color to life within the region. Hairy, thin-tailed sheep and pigs are less common and have a more discontinuous distribution (*2*). Although dwarf cattle and especially dwarf goats are used in sacrificial and significant ceremonial occasions, all these livestock are eaten except where proscribed by religious and other cultural customs.

Smaller domestic animals such as dogs, chickens, and Guinea fowl are kept and eaten by various ethnic groups in rainforest Africa (*3*). The chicken is often used in sacrificial rites, and the dog may also be used for hunting and guarding. These domestic animals also are often bought and sold in local markets.

Sacrificial and dietary use of these domestic animals suggests their long presence among the various cultural groups occupying the tsetse region of Africa. Only the Guinea fowl may be considered to have been domesticated in tropical Africa.

DONALD E. VERMEER
Department of Geography and Anthropology,
Louisiana State University,
Baton Rouge 70803-4105

References

1. D. E. Vermeer, *Science* **218**, 636 (1982).
1. H. Epstein, *The Origin of the Domestic Animals of Africa* (Africana, New York, 1971), vol. 1, pp. 201–326; *ibid.*, vol. 2, pp. 42–56, 210–220, 333–338.
3. G. P. Murdock, *Africa: Its Peoples and Their Culture History* (McGraw-Hill, New York, 1959), pp. 246, 255, 262, 276, 281, 296.

Gina Kolata's recent articles "Scrutinizing sleeping sickness" and "The search for a malaria vaccine" (Research News, 9 Nov., p. 679) deserve prizes for excellence. Sleeping sickness and malaria are hemoparasitic diseases of world importance not fully appreciated by American medical and veterinary authorities, and Kolata writes superbly about the scientific challenges and humanitarian needs.

Much more needs to be understood about the threat to American livestock of *Trypanosoma vivax* and *Trypanosoma brucei*. The disease is caused by *Trypanosoma vivax* and spread by the tsetse fly in Africa. In Mauritius, Central America, and South America the disease is spread efficiently by other biting diptera, such as stable flies, horse flies, and deer flies. More than 100 years ago the organism was carried from western Africa to South and Central America. The trypanosome spread by the tsetse fly cannot be distinguished morphologically, physiologically, and according to isoenzymatic tests from the African stock carried by the tsetse fly; the disease is the same.

Even earlier, *Trypanosoma brucei* was spread by the camel along caravan routes to eastern Europe, other parts of Africa, and Asia. Eventually it reached South and Central America in the horse. The organism has been designated *Trypanosoma brucei evansi* to distinguish it from *T. brucei brucei*, the African stock spread by the tsetse fly. The two organisms are identical, although the former is now spread by diptera other than the tsetse fly. It is also carried by cattle, which may spread the killing disease to Equidae.

As Kolata writes, trypanosomes affect the immune system. Further, the diseases are hard to diagnose, as there are no simple, routine tests to apply. Numerous costly outbreaks have occurred in at least six Central American and 13 South American countries, and the diseases are spreading.

As a legacy of European colonialism, these African diseases are of interest to institutes of tropical veterinary medicine in England, France, Germany, Holland, and other European countries. The International Laboratory for Research on Animal Diseases in Kenya was organized mainly to do basic research on two hemoparasitic diseases: East Coast fever and trypanosomiasis. A vast amount of research and control activities on *T. brucei*, *T. vivax*, and *T. congolense* of tsetse fly origin have resulted.

In contrast, work on the Central and South American stocks of *T. vivax* and *T. brucei* has been halting, desultory, and sporadic, even though the trypanosomes are widespread. In addition to having the genetic capability to alter their surface protein coats with a tremendous repertoire of variable antigenic types, some trypanosomes are no longer restricted to the *Glossina* species of flies. This bodes ill for the unprepared.

DEAM H. FERRIS
Foreign Animal Disease Diagnostic Laboratory, National Veterinary Services Laboratories, United States Department of Agriculture,
Post Office Box 848,
Greenport, New York 11944

Gina Kolata has written an interesting article on sleeping sickness which reviews one aspect of current work on the parasites that cause this disease, that is, the molecular biology of antigenic variation in African trypanosomes. While scientifically this is very interesting work and as basic science does not need to be justified by medical application, it appears to have only an outside chance of producing anything to help treat or prevent the disease.

Most people familiar with trypanosomiasis agree that, with the possible exception of improving field surveillance and vector control, the most urgent need is for new, more effective, and safe drugs. Efforts in universities aimed at developing better drugs are not so intense as those concentrating on antigenic variation, but this results less from a lack of interest, talent, or viable leads than from the limited support for such work. In spite of a projected low financial return (thought to inhibit pharmaceutical industry participation), collaboration among university laboratories and industry has been fruitful. For example, Merrell Dow Research Institute has provided α-difluoromethylornithine (DFMO) for animal studies at universities, for joint research projects with university-based scientists, and also for clinical work in Africa.

DFMO, a polyamine synthesis inhibitor originally developed as an antitumor agent, has shown promise as a chemotherapeutic agent (alone and in combination with other drugs) for the treatment of sleeping sickness. DFMO alone has been used to treat terminally ill patients who had failed to respond to any other drug (*1*). The results, although still from early clinical trials, have been dramatic and point to the emergence of a novel, nontoxic trypanocide. Furthermore, animal studies have indicated that DFMO is even more potent if combined with other drugs, such as suramin (*2*).

The first report of DFMO's activity against African trypanosomes appeared in 1980 (*3*). Since then at least 26 papers have been published on the investigation of this compound as an antiparasitic agent. Significantly, DFMO may be use-

ful in the treatment of *Pneumocystis carinii* pneumonia in AIDS patients (*4*).

Although we are especially familiar with DFMO (*2, 3, 5*), many other viable approaches are being investigated, some in our own laboratories and many others in the laboratories of our colleagues.

CYRUS J. BACCHI
Haskins Laboratories and *Department of Biology, Pace University, New York 10038*

ALLEN B. CLARKSON, JR.
Department of Medical and Molecular Parasitology, New York University School of Medicine, New York 10016

References

1. A. Sjoerdsma and P. T. Schechter, *Clin. Pharmacol. Therapeut.* **35**, 287 (1984).
2. A. B. Clarkson *et al.*, *Am. J. Trop. Med. Hyg.* **33**, 1073 (1984).
3. C. J. Bacchi, H. C. Nathan, S. H. Hutner, P. P. McCann, A. Sjoerdsma, *Science* **210**, 332 (1980).
4. J. A. Golden, A. Sjoerdsma, D. V. Santi, *West. J. Med.* **141**, 613 (1984).
5. A. B. Clarkson *et al.*, *Proc. Nat. Acad. Sci. U.S.A.* **80**, 5729 (1983); P. P. McCann *et al.*, in *Mechanism of Drug Action*, T. P. Singer and R. N. Ondarza, Eds. (Academic Press, New York, 1984), p. 159.

Biological and Chemical Warfare

In R. Jeffrey Smith's article about concerns raised by the Army's proposed new facility for testing aerosols of lethal biological agents (News and Comment, 7 Dec., p. 1176), a number of scientists are quoted as criticizing the project on the basis of its being defensive "overkill" and the likelihood that it will generate information leading directly to the development of offensive biological weapons. No one questions the value of defensive studies per se. But a policy of developing defenses against biological and chemical weapons that the Soviet Union might possibly develop entails serious risks. The same policy is sure to be adopted reciprocally by the Soviet Union, leading almost inevitably to a superpower race to develop and perfect increasingly lethal weapons, for, as many scientists have pointed out, biological studies for defensive and offensive purposes are virtually indistinguishable. Many smaller nations also have the capacity to join the race and might do so for both deterrent and protective purposes. Ultimately, some of the perfected weapons could fall into the hands of terrorists. A world bristling with sophisticated biological and chemical weapons will be a good deal less safe than it is now, even if the weapons are not used, as shown by the present dangerous state of our decaying chemical weapons stockpile.

Not to develop defenses against conceivable biological and chemical weapons also entails risks. But if such a policy were clearly avowed and openly maintained, thereby lessening the perceived threat to other nations, those nations might be encouraged in their own self-interest to follow suit, and an international treaty might result. Taking a chance on mutual security in this sphere is considerably less dangerous than preparing for the worst, for no defense against biological or chemical weapons can be fully satisfactory, and the defensive preparations themselves, like "star wars," will make offense more likely.

BARBARA HATCH ROSENBERG
Molecular Biology and Virology Unit, Memorial Sloan-Kettering Cancer Center, New York 10021

Chemical Information Online

I was pleased to see that *Science* is continuing to present articles regarding the status of the Chemical Information System (CIS), which we used to provide to the public on behalf of the Environmental Protection Agency. I was also pleased to see that Jeffrey L. Fox indicates in his most recent article (News and Comment, 16 Nov., p. 816) that we will now be making the CIS available to the public commercially.

The article states that we will not leave the system "intact." While this is semantically correct, it implies that we will be dismantling the CIS. In fact, we will be adding new databases and system capabilities.

The article also erroneously states that Information Consultants Incorporated will be putting the contents of *The Merck Index* online. Actually, on 28 November the final signatures were placed on a contract between Fein-Marquart Associates and Merck & Company; *The Merck Index Online*—an updated version of the published 10th edition—is now the only public, online access to *The Merck Index*. This and many other new and updated databases will be placed onto the CIS, as provided by our subsidiary, Chemical Information Systems, Inc.

ALVIN E. FEIN
Fein-Marquart Associates, Inc., 7215 York Road, Baltimore, Maryland 21212

Erratum: In the article "Panel says Depo-Provera not proved safe" (News and Comment, 23 Nov., p. 950), the dosages of Depo-Provera, a progestogen, and estrogens used in cancer therapy and as a contraceptive were incorrectly reported. In cancer therapy, the hormones are used in large doses. In contraceptives, the dosages are small.