sults on pseudo-plane quintuplets. He mentioned two surfaces slightly more complicated than the plane into which these quintuples can be imbedded. Dr. M. Sadowsky, of the Armour Institute of Technology, presented a new model of surfaces whose local metric is that of the Euclidean plane. Dr. L. M. Blumenthal gave a new metric characterization of the straight line.

On the following morning Dr. Marston Morse, of the Institute for Advanced Study, spoke about metric spaces related to the theory of critical points and applied in the calculus of variations. Dr. Karl Menger, of the University of Notre Dame, analyzed the minimum problem of the calculus of variations from the point of view of metric geometry. Dr. I. J. Schoenberg, of Colby College, dealt with the analytical aspects of isometric imbedding. The discussion was conducted by Dr. G. A. Bliss, of the University of Chicago.

The last meeting, directed by Dr. Marston Morse, dealt with the problem of imbedding metric spaces into Euclidean and more general spaces. Dr. Emil Artin, of Indiana University and the University of Notre Dame, dealt with the algebraic treatment of the question; Rev. B. J. Topel, University of Notre Dame, with imbedding into groups; Dr. A. M. Milgram, of the University of Notre Dame, with the imbedding of partially ordered sets into certain universal ordered sets. Dr. Karl Menger, of the University of Notre Dame, sketched a general theory of relation-preserving imbedding synthesizing these various theories.

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REPORTS

TRYPARSAMIDE IN THE CONTROL OF AFRICAN SLEEPING SICKNESS

RECENT reports on the progress of the extensive campaigns against African sleeping sickness (*T. gambiense* infection) indicate that the outlook for satisfactory control is much more promising than has heretofore been the case. This encouraging situation is directly associated with tryparsamide therapy, the effects of which were first demonstrated in the Belgian Congo in 1921.[1,2]

One of the major obstacles to a successful solution of the problem has been the failure of therapeutic agents in advanced cases, that is, those with involvement of the central nervous system. It is now known from the results of cerebrospinal fluid examination, moreover, that this involvement occurs much earlier than was formerly thought. Various drugs which are of benefit in the early phases of the infection are of little or no avail in later stages. Not only does the disease progress to a fatal termination, but the recurring presence of trypanosomes in the peripheral circulation constitutes a potential reservoir of infection. In marked contrast to these unsatisfactory results are those obtained with tryparsamide, the therapeutic action of which extends to the advanced stages. Because of this unique property, tryparsamide can be used in the routine mass treatment of both early and late cases.

Campaigns against sleeping sickness have long been a prominent feature of public health activities in the various colonies concerned, for control of the disease is a vital necessity to tropical Africa. A marked intensification of this work began some fifteen years ago, and it is significant that it was directly associated with the demonstration of the curative action of tryparsamide. An example of the notable results achieved is shown in the accompanying tabulation of official statistics of the Belgian Congo for the eleven-year period 1926–37, during which time tryparsamide has been increasingly employed.[3]

ELEVEN-YEAR RESULTS OF THE SLEEPING SICKNESS CAMPAIGN IN THE BELGIAN CONGO
1926–1937

Year	Number of natives examined	Old cases under treatment	New cases	Index of new infections, per cent.
1927	1,704,477	70,940	16,260	0.95
1928	2,126,356	46,372	24,440	1.16
1929	2,383,892	50,244	27,046	1.12
1930	2,779,448	70,423	33,562	1.20
1931	2,685,768	67,272	25,582	0.95
1932	2,832,083	77,268	21,346	0.75
1933	3,572,423	93,954	27,939	0.78
1934	3,824,097	86,147	24,101	0.63
1935	4,356,270	66,774	18,930	0.43
1936	5,282,646	53,429	18,708	0.36
1937	5,034,442	50,980	14,921	0.29

It will be noted that, although the number of natives examined annually for sleeping sickness was trebled in this period, that is, from 1,704,477 examined in 1926 to 5,034,477 in 1937, the index of new infections in 1937, 0.29 per cent., had fallen to one fourth the maximum figures of 1.16, 1.12, 1.20 per cent. in 1928, 1929, 1930, respectively. In addition, there was a marked decrease in the number of old cases continued under treatment from year to year, that is, from the high number of 93,954 in 1933 to 50,980 in 1937, a result of particular significance from the standpoint of efficiency of treatment.

Highly satisfactory results are reported by the Fonds Reine Elizabeth. This organization has had a wide experience in sleeping sickness work since 1931,

[1] L. Pearce, *Jour. Exp. Med.*, 24: 6, Supplement No. 1, 1921.

[2] L. Pearce, *Rockefeller Institute for Medical Research Monograph 23*, 1930, Science Press.

[3] L. Van Hoof, "Rapport sur l'Hygiène Publique au Congo Belge," 1937.

first in the Bas-Congo and, beginning in 1935, in the adjacent Kwango area, two provinces in which the disease is a particularly serious problem. The intensive five-year campaign in the Bas-Congo resulted in a decrease of the total endemic index of 2.49 per cent. in 1931 to 0.59 per cent. in 1936.[4] During two and one-half years in the Kwango, 35,099 patients were under observation, of whom 28,008 were considered to have been satisfactorily treated, 4,451 were still under treatment, 1,225 had died and 1,415 had disappeared.[5] The conclusion was reached that with adequate treatment more than 90 per cent. of curative results could be obtained.

A typical course of treatment comprises 1 gram of moranyl (germanine or Bayer 205) followed by 12 to 14 weekly doses of tryparsamide.[4] The average dosage of tryparsamide is 1.0 to 3.0 grams. It may be necessary to prolong or to repeat treatment in advanced cases.[2]

In the Cameroons (French Mandate) a similar intensive campaign has likewise included the use of tryparsamide, particularly in cases known to be advanced. The official medical report for 1936[6] states that in this year 515,933 persons of a population of 572,910 living in seven severely infected districts were examined. There were 24,006 old and 2,107 new cases. Of the old cases under treatment, it was found that 23,362 patients no longer had trypanosomes in the peripheral blood, while in 644 patients organisms were still present. Of special significance, however, from the standpoint of satisfactory treatment was the fact that during the year 11,659 patients were considered cured upon the basis of blood and cerebrospinal fluid examination. The precise system of treatment employed is not given in this report, but it is known from other sources that tryparsamide enters largely into the therapeutic procedures followed. Additional evidence of the progress of the work in the entire colony is afforded by the decline in the index of "circulating virus," that is, the proportions of persons in whom trypanosomes are demonstrated in the peripheral blood: 1932, 1.43 per cent.; 1933, 0.82 per cent.; 1934, 0.8 per cent.; 1935, 0.8 per cent.; and 1936, 0.56 per cent.

Recent surveys carried out in colonies west of the Cameroons show that sleeping sickness occupies a more important place among diseases than was hitherto supposed. This is the case, for instance, in Nigeria, where a sleeping sickness service was established in 1931. The official medical report for 1936[7] states that the total number of cases diagnosed and treated since the initiation of this service is 240,900, while 24,033 patients have been treated at general medical stations. During the year 1936, examination of 417,495 natives in the northern provinces of the colony revealed 47,550 cases, an incidence of nearly 11.5 per cent. An additional 14,571 cases were diagnosed and treated at field dispensaries and general hospitals, making a total of 62,021 cases treated in this year. The standard treatment now comprises three 1.0 gram doses of antrypsol or Bayer 205, followed by five 2.0 gram doses of tryparsamide.

Finally, attention should be directed to the fact that the introduction of tryparsamide therapy has resulted in the gratifying response of native cooperation in the treatment of both old and new cases. This significant change in the point of view of the native population which has been emphasized in various reports is obviously a factor of the greatest practical importance in the control of the disease.

The immense scope of the sleeping sickness problem is shown in a report of the League of Nations dealing with the geographical distribution of the disease.[8] From official data for 1935 or in a few instances for 1934, the following conclusions are drawn:

> In the African territories situated between the tropics, the total population of which may be estimated at 65 millions, nearly 7 millions were examined in the course of a single year. 140,000 fresh cases were discovered and treated, besides a similar number of old cases. In territories where the campaign has been going on for a long time (Belgian Congo, French Equatorial Africa, Cameroons under French Mandate), out of nearly 15 million inhabitants, the number examined in the course of a year exceeds 6 millions.

An effective therapeutic agent is a crucial factor in sleeping sickness campaigns, but the importance of other measures can not be overlooked. Authorities are well aware of the necessity of communal clearings directed against the tsetse fly and of the control of the movement and concentration of populations. Nevertheless, under the conditions now obtaining in tropical Africa, the successful solution of the problem must necessarily include the mass employment of therapeutic agents which are capable of curing not only early, but advanced cases. Up to the present time the only drug which fulfils this double requirement is tryparsamide. Future accomplishments based upon its widespread administration throughout infected areas are clearly foreshadowed by the unprecedented results already obtained.

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[4] De Brauwere, Fonds Reine Elizabeth. Rapport Annuel, 1936.

[5] *Ibid.*, 1937.

[6] Rapport Annuel du Territoire du Cameroun, 1936.

[7] Annual Report of Medical Services of Nigeria, 1936.

[8] Epidemiological Report (Sleeping Sickness) of the League of Nations, 1936, Nos. 10–12.