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BELGIUM.

DIPLOMATIC AND CONSULAR REPORTS.

PRECAUTIONS TAKEN IN BELGIUM TO COMBAT ANKYLOSTOMIASIS.

FOREIGN OFFICE,
February, 1907.

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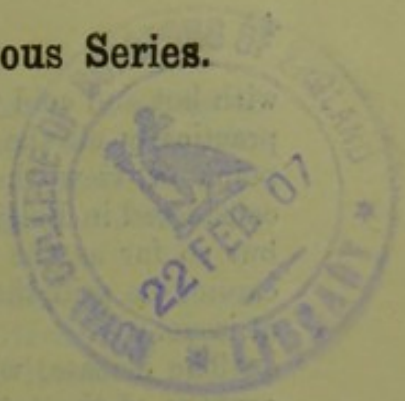

Report on the Precautions taken to combat Ankylostomiasis (Miners' Worm Disease) in Belgium

By Consul-General Sir Cecil Hertslet.

Introduction.

Ankylostomiasis, the disease which has been known and guarded against for some years in Belgium, appears, from accounts which have been published from time to time, to be attracting considerable attention in the United Kingdom, and my object in writing the following report is to call attention to the precautions which are taken in Belgium in regard to the disease, which precautions are generally considered to have been highly effectual in reducing the large number of cases which existed in Belgian mines in previous years. The particulars and details of the mode of treatment of the disease in this country may possibly be of some utility in formulating any scheme which it may be proposed to set on foot in the United Kingdom for the suppression of ankylostomiasis, and I have, therefore, compiled this brief special report in advance of one (upon which I am now occupied) relating to the whole of the Belgian coal-mining industry, and having particular reference to the prevention of accidents in mines from firedamp and other causes.

The Belgian system in regard to the treatment and attempted suppression of ankylostomiasis appears to be highly satisfactory, and the results which have been obtained since it came into force speak for themselves as to the efficacy of the mode and general carrying out of the system.

Up to the present time no pecuniary assistance has been offered by the Belgian Government to those who were originally responsible for the inauguration of the scheme, nor to those who are now actively engaged in doing everything possible to combat the disease. Great aid was, however, given by the passing of the law—which is quoted hereafter—prescribing the clinical and microscopical examination of the workers in all the mines at the discretion of the Administration of Mines, and material assistance was also afforded by that clause of the law relating to the necessity of cleanliness in the mines and among the men employed.

The principal and best equipped mines of this country (such as those of Mariemont and Bascoup in the Centre district) are furnished

with hot and cold water baths of sufficient number for the use of practically all the men employed in the pits, and from a hygienic point of view these baths are an excellent institution, and are considered in Belgium to be of utility in combating ankylostomiasis; but so far as the ultimate checking of the disease is concerned it cannot be said that they have very much bearing on the point at issue.

The disease, which had a few years ago attacked a large percentage of the total workers employed in Belgian mines, has now been substantially controlled, and in the Liége district in particular the number of cases of infected workmen has almost been brought to a minimum. It is obvious from the nature of the disease that it is to all intents and purposes impossible to entirely stamp it out in mines, but it is beyond question that the system of combating ankylostomiasis in Belgium is highly efficacious, and that before long the object in view will be in a great measure attained in this country, viz., the reduction to a minimum of the number of workmen infected by the disease.

Ankylostomiasis, or miners' worm disease.

This disease, although well known in those countries having a warm and humid climate, is confined to the mining classes in the colder latitudes of Europe. So far as Belgium is concerned the disease was first recognised as having made its appearance about the year 1896, but at that time, though more than one medical practitioner diagnosed the disease as being similar to that well known in warmer climates (such as Cairo and other parts of Egypt and also various tropical places), many other doctors and many of the coal mine owners also were loth to admit that the illness which was making its appearance among the workers in the Belgian mines was similar to, in fact almost identical with, that known as ankylostomiasis in other countries.

About the year 1898 many more persons began to realise that the repeated and increasing cases of feebleness among the mine labourers were in reality caused by this ravaging disease, and it was at that time that precautions were first taken with a view to combating it in the Belgian mining centres.

Before writing further with reference to the steps now taken in Belgium to safeguard miners from contracting ankylostomiasis and the measures for effectually curing the disease when it has once been contracted, it may be of interest to give some particulars respecting this peculiar illness, which, though of course known to the medical world, may not be familiar to the public at large.

In the first place, the original diagnosis of ankylostomiasis was that the disease was caused, as is usual in such cases, by infection or contagion, and this view of the question has since been proved to be in a certain degree the correct one. During the last few years, however, continual research has brought to light the fact, which is apparently incontestable, that the disease is primarily caused by the penetration of ankylostomiasis germs through the skin. This discovery of the contamination of the human body by

the penetration of the skin from the exterior by larvæ or germs of disease not only upset all the then existing ideas respecting the action of parasites, but definitely proved that the formulæ used at the time for the treatment of ankylostomiasis would undoubtedly require considerable modification.*

Before proceeding with the explanation of this disease of miners I feel bound to express my indebtedness to Doctor Herman, Director of the Institute of Bacteriology of the province of Hainaut, for his courtesy in furnishing me with full information respecting the growth of ankylostomiasis in Belgium and the present method of treating the disease.

As is generally known, in most, if not all, mining centres this malady—believed to have been introduced by men coming from either Austria-Hungary or Northern Africa—has extended so much of recent years among the workers in the mines that it is absolutely necessary to establish irrefutably the possible and actual modes of infection, and the conditions in which these ankylostomes or parasites, having become implanted in the human body, eventually work their way into the intestines, and there acquire their ultimate development or adult state.

Previous to arriving at the present conclusion regarding the penetration of the skin, various, and in some cases contrary, opinions were held by scientists regarding the modes of contracting the disease. Various experiments were made on animals which gave rise to the idea that the germs of the disease penetrated the skin, and many other experiments were made by Monsieur A. Looss, Professor of the School of Medicine at Cairo. It is now proved that the disease is largely contracted in the manner stated (*i.e.*, by the penetration of the skin), and it is held by some persons that the ankylostome is the only parasite having two modes of entering the human body, viz., by the mouth and by penetration of the skin.

Further and very important experiments were made by Doctor Herman, who inoculated himself with ankylostomiasis by means of placing a drop of liquid containing a large number of larval germs of the parasite in contact with his flesh; and in a short space of time he discovered that the larvæ had left their covering shell and penetrated through the skin. After a lapse of some weeks he had absolute proof of complete inoculation with the disease.

Until the discovery of this disease numbers of workers were yearly attacked in the Belgian mines, their illness being put down to other causes.

With but few exceptions, all the mines in this country are infected to a greater or lesser extent, the germs of the disease having sufficient warmth and humidity to live in the coal dust and mud in the pits. The germs never, however, arrive at the mature state in the mines, and it is in the human body only

* Extract from the Bulletin de l'Académie Royale de Médecine de Belgique.—Note by Doctor Herman.

that they can reach the adult stage. In working in the mines the miners naturally become covered with dirt of various kinds in which the ankylostomiasis germs have become deposited in many ways. It has been said above that this germ enters the human body in two ways. The former is when the miners, covered with dirt into which the germs have found their way, eat their meals and swallow possibly some of the germs which then find their way to the intestines; the second and more common way is when the miners are at work, the germs in the mud and dust with which the men are covered finding their way through the pores of the skin, thence to the veins, and are carried in the blood to the heart, whence they pass to the lungs, and finally to the intestines, where they thrive and grow into adult worms. This description is, of course, but a very rough one, and is not intended to treat the question in a technical way from the point of view of a medical expert, but it is sufficient to give a general idea of the manner in which the germs of the disease enter the intestines and there thrive.

After entering the intestines the larvæ of ankylostomiasis when grown leave their "cyst" or covering and live upon the blood of the patient. These worms, as they then become, have a varying length of from 10 to 18 millimetres, and are of the male and female sex, the latter being of the larger size. The worms then breed, the female laying an enormous number of eggs, which are eventually carried from the body of the miner in the usual manner, and go to propagate the malady.

These eggs require in Europe the heat and damp warmth of the mine in order to bring forth the germs of the disease, and thus it is seen that in the mines only the disease can be contracted, as in the purer and colder air at the surface the conditions are such that the germs are harmless to infect, and further that miners are the only classes which can be attacked by ankylostomiasis in these colder latitudes.

The miner, therefore, although himself suffering from the disease, is unable to pass the infection to his wife and family, the germs of ankylostomiasis being harmless to infect without the necessary heat, which, as said above, is not found on the surface in Northern European countries.

The action of ankylostomiasis in regard to miners.

The ankylostomiasis parasite is known to medical men to be a filiform worm of separate sex, the male having a length of 10 to 12 millimetres and the female of 15 to 18 millimetres. The junction of the two takes place in the human intestines, and the female lays a very large number of eggs, frequently numbering several millions. As long as the ova remain in the intestines practically no change in them takes place. In order to hatch they require a temperature not exceeding 30 degrees, but exceeding 14 to 15 degrees centigrade. They also require air, and a certain degree of humidity. The intestinal cavities of the human body do not contain the necessary air, and the temperature is too great to

permit of the hatching of the ova. The required conditions of temperature and dampness are only found in those warm climates in which ankylostomiasis is frequently discovered. As the climatic conditions become colder towards the north, the required temperature is found less often, and in the latitudes of Northern and Central Europe exists only in the coal mines. Therefore it is obvious that the disease can only be contracted by workers in the pits.

The ova being only sensitive to a given degree of heat, the embryonic formation of the worm from the ova cannot take place except where that given condition of temperature is to be found, viz., in the coal mines. It is clear, then, that although the workmen in the mines may be infested with the ova of ankylostomiasis, the eggs are powerless to harm unless they are deposited in the mine in the motions of the workers infected, where they find the necessary conditions of temperature, air and humidity for their propagation. The only way, therefore, by which ankylostomiasis can be increased in mines is through the action of the workers themselves in depositing their dejections in the mines, where the conditions are such as to produce the embryo formation of the ankylostome or worm.

A few hours only are sufficient for the hatching. After one and a half or two days many of the eggs hatch and the larvæ are at liberty. These larvæ develop rapidly, and in about four days have formed a covering cyst or film which augments considerably their resistance to any destructive agent. In order that the evolution may continue, the larvæ must enter the human organism and arrive at the stomach, and then enter the intestines, where they undergo certain transformations which, after from five to six weeks, produce adult worms.

From the researches of Doctor Herman it appears that these larvæ possess great resistance to dessication, and that acids, alkalis and the majority of disinfectants used in bacteriology have but little action upon them. Dessication, unless carried too far, does not destroy these larval germs; if a drop of liquid is placed under a microscope containing these larvæ, the latter show considerable animation, the movements losing their vivacity as the preparation dries. When dry the larvæ are again immobile. A drop of water only is required for them to recommence their movements.

In the mines, and above all in damp pits, pools of stagnant water are frequently found in which the larvæ remain alive for a considerable time. As has been said, the propagation of ankylostomiasis is largely caused by the miners when taking food conveying these larval excrements to the mouth, whence they enter directly into the digestive organs. This may also happen by the inhalation of contaminated dust, but this latter method of infection is not accepted by all scientists.

Many mines present the most favourable conditions for the development of the ankylostomiasis germs, and in dry and dusty

mines it is frequently necessary to water the roads, which course provides the necessary humidity to revivify the larvæ.

In the report of the commission appointed to study the growth of ankylostomiasis in the "Bassin de Charleroi" it is stated that the chief symptoms of the disease consist of an impoverishment of the blood and a loss of strength, leading to physical breakdown. The malady resembles very closely that of progressive anæmia. In the initial stages the patients suffer from various digestive troubles; later they complain of oppression and pain in the epigastric region. Symptoms of pyrosis, vomiting and meteorism are also evident, and alternating diarrhœa and constipation. The anæmic symptoms succeed one another more or less rapidly, and the patients become more and more pale. After a certain time loss of strength ensues with palpitation of the heart and a feeling of suffocation, and in addition giddiness, singing in the ears, and even syncope. The lungs undergo no essential alteration, but there is frequently a dilatation of the heart. Digestive troubles are the most common, caused to a certain extent by the direct action of the parasites.

Frequently many other, and, in some cases, more serious symptoms than those enumerated occur, which are too numerous for mention in this report.

Precautions taken against ankylostomiasis in Belgian mines.

The Belgian Government realised some two or three years ago the necessity for taking steps to check the progress of this disease, and instituted at that time a commission of inquiry to examine all the mines in Belgium with a view to the detection of the presence of the disease. This commission published the following results respecting the percentage of miners infected in the various districts. In the Liége district, 25 per cent. of the total workers; in the Centre and Borinage district, 7 per cent.; in the district of Charleroi, 1 per cent. This occurred some years ago, the results being published about 1904, and since then in the Centre, Borinage and Charleroi districts the disease has spread rapidly. Furthermore, I am informed by Doctor Herman, the principal authority on the subject in the province of Hainaut, that the Government inquiry, so far as the province of Hainaut (Centre, Borinage and Charleroi) was concerned, did not bring to light one half of the actual cases of ankylostomiasis, and the doctor himself has treated numerous cases emanating from mines classified as uninfected.

As a result of this inquiry the Belgian Government, by a Royal decree dated November 4, 1904, inaugurated certain rules applicable to the province of Liége only—that being the district enjoying the unenviable reputation of having the greatest percentage of infected men—which are as follows:—

Art. 1.—The coal mines in the province of Liége are submitted to the following regulations with a view to combating ankylostomiasis, the various mines being divided into two categories.

Category A.—Mines known to be infected.

Category B.—Mines considered free from infection and those

which, not being considered entirely free from infection at the time of inspection, can furnish proof within six months of the passing of the decree that they are, in the opinion of the Minister of Industry and Labour, no longer infected.

Art. 2.—The classification is subject to revision.

Art. 3.—Clinical and microscopical examination, with a view to discovering ankylostomiasis, may be required by the Administration of Mines. The cost of these examinations, and also the wages forfeited by the workmen examined, are chargeable to the mine owner.

Art. 4.—The results of these examinations shall be recorded in a special register, which will be at all times at the disposal of the Administration of Mines.

Rules for Mines under Category A :

Art. 5.—The following are required to be placed at the disposal of the workers :—

At the surface, properly fitted closets to the number of at least one to every 25 workmen. These closets are to be placed in accordance with the directions of the Administration of Mines. They are to be in positions easily accessible to the workmen and close to the pit's mouth, and are to be covered in from exposure to the weather.

Beneath the surface, portable buckets, with watertight linings, fitted with hermetically closed covers, and having a receptacle to contain deodorising powder. These buckets must be placed in a position easily accessible as directed by the Administration of Mines. The above mentioned installations must be placed in position as soon as possible, and at the latest three months after the classification is notified to the management of the mine.

Art. 6.—The closets and buckets must be kept perfectly clean. The closets must be cleaned after the descent of every gang of workmen. The buckets are to be brought to the surface at least once every 24 hours ; after being emptied they are to be cleaned by means of steam or hot water, and their watertightness must be verified before they are sent down again to the galleries. The cleaning of the closets and the emptying and cleaning of the buckets, &c., is to be superintended by persons specially designated for the purpose.

Art. 7.—The rules of the mines must impose upon the workmen the obligation, under penalty of a fine, of undergoing the examination set forth in Art. 3, and must also absolutely forbid them (a) to soil the closets at the surface, or the buckets in the pits ; (b) to use any place in the mines other than those provided for the purpose.

These regulations must be stringently enforced.

Art. 8.—The Minister of Industry and Labour is authorised in case of necessity to insist upon the removal of mud and the checking of running water in the galleries.

Rules for Mines under Category B:

Art. 9.—The mine owners are required to notify the Administration of Mines of any case or cases of ankylostomiasis brought to their knowledge.

General Regulations:

Art. 10.—The Minister is empowered to exercise his discretion as to the degree in which these regulations are applicable.

Art. 11.—Persons committing any offence against the above regulations will be prosecuted and judged in accordance with Art. 3 of the law of July 2, 1899, respecting the security and health of workmen employed in commercial and industrial enterprises.

I have given above a translation of the law respecting the precautions to be taken by mine owners, which, up to the present time, represents the whole action taken by the Belgian Government with a view to checking ankylostomiasis, and it therefore remains for me to give particulars respecting not only the manner in which these regulations are carried out, but the results which have been arrived at in the mining districts of Belgium in regard to the combating of this disease, either directly or indirectly resulting from the law.

In the first place, prior to the Government inspection of the mines in Belgium, a movement had been set on foot by some persons, among whom may be specially mentioned Doctor Malvoz, who is now Director of the Bacteriological Institute for the examination of miners at Liége, with a view to persuading the owners of mines to grant permission for the men in their employment to be examined. This was done with some success, and during the period of this semi-official examination the Government decided that an investigation into the condition of the workers in all the mines in Belgium should take place in order to determine which of them were infected with the ankylostomiasis germs, and to what extent.

As has already been stated, this inquiry took place some years ago, and the mines in the Liége district having been found to be infected with ankylostomiasis to a greater extent than other districts, the law quoted above was brought into force in regard to the Liége district only.

In considering the present state of the disease in Belgian mines I will begin by referring to the district of Liége, as being the first locality into which Government rules on the subject were introduced.

The 25 per cent. of the workers referred to as being infected with the disease is an average of the total number of workmen and the total number of mines, so that it is obvious that in some mines there were far more and others less than the average. In one mine, I am informed, in the Liége province, over 90 per cent. of the workers were infected with the disease at the time of the in-

spection, but it is not a matter of any importance to give the details respecting the degree of infection in particular mines, as the average figure will suffice.

The step taken by the Government in passing the law was undoubtedly of considerable utility in combating the disease, but at first the necessity of the examination of the workers in the mines met with some opposition on the part of the owners and still more on the part of the men themselves. Further, no funds were voted by the Government to assist in defraying the necessary cost of medical assistance and other expenses.

At this time the provincial authorities of Liége came forward and granted a subsidy towards the expenditure amounting to a sum of about 20,000 fr. (800*l.*), which was greatly augmented in subsequent years. With this subsidy an institute for the care of miners infected with ankylostomiasis was established, and an effort was made to get all men suffering from the disease to come to the hospital for treatment.

The chief difficulty which had to be overcome in the inauguration of the system of examination was the slight feeling of animosity which existed both on the part of the owners and of the workers—but more especially the latter—towards what was looked upon as an interference with their freedom and liberty. In regard to the miners themselves very cautious measures had to be taken to convince them that the examination was for their own good, and that the curing of the disease would render them more easily capable of performing their work. With the owners the task was, of course, more easy, and it was only necessary to prove to them that by keeping the disease well within bounds, they would obtain infinitely more efficient individual labour from their men.

Thus, after some trouble on the part of the inaugurators of the scheme, the provincial medical authorities, the mine owners and the workmen themselves were, in a great measure, of one accord that steps should be taken in their own respective interests to prevent the spreading of the disease.

The difficulty then arose in regard to those men who, knowing they were infected, could not afford to give up their work and undergo a cure on account of the loss of wages entailed. This difficulty was at length met by the mine owners and from the subsidy of the provincial council.

After the general examination of all the mines it was decided, in order to encourage the men afflicted with the disease, to make the fact known to the authorities, that during the time of any man's enforced idleness from work while undergoing the cure he would be paid out of the provincial subsidy a sum of 1 fr. 50 c. a day, in addition to free hospital expenses. Later this sum, which scarcely permitted the workman to keep his family while undergoing the cure, was augmented by many of the owners of mines by 2 fr. a day on an average, which brought up the amount received

by the workmen during his enforced idleness to 3 fr. 50 c. a day (say 2*s*. 10*d*.), or about 17*s*. a week. Thus, when a man felt that he was suffering from the disease he applied for permission to absent himself, and underwent examination by the qualified doctors. If he were found to be infected he was treated accordingly, and received remuneration during the period of his absence, the cure lasting, as a rule, upwards of one week, as follows :—On a workman being examined and accepted for treatment at the hospital or institute, the mine in which he is employed is informed of the case by the doctor of the institute and the allowance accorded to him paid. By this means cases of malingering are avoided, as men not presenting themselves for examination do not receive remuneration and in addition forfeit their wages from the mine during their absence. On the patients being discharged from the institute the owners of the mines are informed accordingly, and the allowance stopped from that time.

This system has worked so satisfactorily that the proportion of the workmen in the Liége district afflicted with the malady has been very greatly reduced ; in fact, in a short time the number of cases of ankylostomiasis will have been doubtless reduced almost to a minimum.

Another point which may occur to the reader of this report is that miners are continually changing from one mine to another—indeed it is estimated that in the Liége district alone about 50 miners change from the employment of one owner to another every day. It would appear, therefore, very probable that a miner coming from an infected mine will introduce the disease to an uninfected one in which he has obtained employment, but this occurrence is obviated as follows.

In the first place every miner in Belgium must be provided with a book (similar to the discharge book used in the British mercantile marine) stating his services in the mines in which he has been employed, and giving various other personal particulars. In the Liége province, as well as in others, this book is signed by the management of the mine and countersigned at the Town Hall of the Commune, the reason for the workman's discharge and other details being specified. In addition, an understanding has been come to by the owners of mines at Liége that they will not accept any new hands without examination ; more especially if the men according to their workmen's books have previously been engaged in an infected mine. For this examination the workmen deposit their dejections under supervision, which are then sent to the hospital and examined microscopically for the ova of the ankylostome. If the dejections are found to contain these ova the men are refused engagement in the mine to which they have applied unless they undergo the cure. In these cases, when the men are not in the employ of any mine, they do not, of course, receive the remuneration of 2 fr. a day from the employers, but they nevertheless receive the 1 fr. 50 c. a day from the provincial grant.

Several of the larger mines have hospitals or dispensaries of

their own where workmen applying for engagement are examined by the mine doctor, and can also undergo treatment, but in most cases the dejections are sent to the provincial dispensary for examination.

In the province of Hainaut the position with regard to the combating of ankylostomiasis is somewhat different to that of Liége. At the time of the general examination the mines in the Hainaut district were found to be infected with the disease to a much less extent than the Liége mines, and the decree enacted with reference to the latter district was not enforced in any way in Hainaut. I am informed by Doctor Herman, who has given me many details on the subject, that the disease has been rapidly increasing in the Hainaut district in spite of certain precautions which have been taken, and that in his opinion the increase is mainly due to the lack of cohesion among the mine owners, who are loth to admit that the disease is gaining ground in their mines.

Until quite recently, in the month of September, 1906, there was no legislation in the province of Hainaut in regard to the examination of workmen infected with ankylostomiasis, and it was impossible to compel any man to undergo examination under the penalty of not obtaining work were he to fail to do so. The Provincial Government, however, assisted by some influential persons in the medical world of Belgium, did everything possible under the circumstances to suppress the growth of the disease, and a provincial dispensary hospital was established, having 12 beds for the use of miners undergoing cure, in connection with the Bacteriological Institute at Mons, where men might receive treatment free of charge. The cost of this hospital was and is defrayed by the province, which gives an annual grant for its upkeep, and also (as in the case of Liége) makes a daily payment of 1 fr. 50 c. to all workmen undergoing treatment, in addition to defraying the cost of their railway journeys from their homes to the dispensary at Mons.

The decree which has been quoted in regard to Liége came into force and was published on September 8, 1906. It places the legislation in the province of Hainaut on the same footing as that of Liége, and no doubt in a short time, with the law to uphold them, the authorities in the province of Hainaut will take similar steps to those in force at Liége for the checking of the disease. It is, of course, too early at the present time to form an opinion as to what result has attended the change in the circumstances in regard to Hainaut.

With regard to the general question of precautions, the Provincial Medical Commission appointed in the Liége district recommended the following measures :—

" Precautions to be taken by workmen—

" 1. Only drink pure water. Drink neither the mine water nor above all stagnant water.

" 2. Do not place on the ground articles to be conveyed to the mouth (*i.e.*, glasses, spoons, handkerchiefs, &c.), or food.

"3. Never use any of these articles with dirty hands; in addition, before every meal the hands should be washed in pure water (not mine water) and dried by shaking if towels are not available, and not on the clothes, which are usually covered with germs of the disease.

"4. Become accustomed to retiring before leaving home or before descending the pit. This habit alone will be advantageous to the health. In cases of necessity the buckets provided for the purpose, which are brought to the surface daily and properly disinfected, should be used.

"5. In order to avoid infection as far as possible the workman should change his garments and wash the entire body on his return home before taking his meals.

"The clothes should be boiled and washed.

"If the workman is infected with the malady he should disinfect his motions by pouring powdered peat over them.

"NOTE.—Miners, in the common interest, should see that their fellow workers take these precautionary measures."

In theory these suggested precautions are undoubtedly good, but in practice the impracticability of the workmen carrying them out is obvious, principally on account of the loss of time and labour which would be involved. Most of the workers in Belgian mines are paid a daily wage of a certain amount, but in the majority of cases this fixed wage can be augmented on the sliding scale by the men doing more than a certain amount of work, so that by conscientious labour they are enabled to gain considerably more than the actual daily wages; thus the system practically amounts to piecework. Again, it is contrary to human nature to expect men working in coal mines to stop work and wash before taking their meals and also to be continually considering the hygienic principles of their every action. The only practical means of endeavouring to induce the men to use the proper closets established would be for the management of the mines to inflict a fine on those men found to have used other than the proper places. This course too would give rise to endless difficulties. The chief step to be taken should be to endeavour to persuade the men that the precautions are for their own benefit and leave it to themselves as far as possible to see that the rules are carried out.

"Precautions recommended to be taken by mine owners:—

"1. The use of portable buckets in the mines.

"2. The placing at the disposal of the workmen of pure water for drinking and washing purposes. The water should be placed in large barrels, from which it can only be drawn by taps, and not by dipping tins or other receptacles into it.

"3. Mines should be kept clean and mud removed after watering muddy and damp parts with lime wash. Props and woodwork should be washed with lime.

"4. Directors should insist upon the medical examination for ankylostomiasis of all the workers in the mines, and the treatment

of such as are infected, and all new hands should be examined previous to engagement."

The commission insisted most particularly upon the use of portable buckets.

The conclusions and advice of the commission of inquiry were brought before the superior council of hygiene, at which all the principal doctors in the various provinces of Belgium were invited to be present. The council particularly insisted on two points, viz., the use of buckets in the pits and the examination of all workmen.

The following is a translated quotation from the report of the council :—

" Under no circumstances can any doubt exist as to the urgent necessity for underground closets, sufficiently numerous and as accessible as possible, placed in niches in close proximity to the galleries which are being worked and at places where the wagons are loaded. They should be closets in which may be used powdered turf or other dry absorbent, such as earth or coal dust ; which do away with all odour and the transport of which is not difficult.

" An excellent measure from a sanitary point of view would be the installation, in close proximity to the mines, of shower baths, where the workmen could clean themselves before returning home."

Upon these recommendations a Bill was drafted and submitted to the various mining sections of the councils of labour, the majority of which were entirely in favour of the proposed regulations, with the exception of the obligation for the installation of portable buckets in the mines. The regulations in regard to closets at the pit head, baths and the use of pure water were unanimously approved.

Upon the representations of this and of a further commission of inquiry the law already quoted was passed in regard to Liége, which, as has also been stated, has quite recently been made applicable to the district of Hainaut.

Treatment of ankylostomiasis.

The treatment of ankylostomiasis is set forth in the Bulletin of the Belgian Royal Academy of Medicine, under the system of Doctor Herman, Director of the Provincial Institute of Bacteriology of Hainaut, at Mons, who explains the method of cure by purging by three different mixtures, the following remarks being taken from Doctor Herman's notes on the treatment.

Before explaining the treatment it is necessary to again state that previous to the present method of the free treatment of infected miners in the small provincial dispensaries at Liége and Mons specially set apart for the purpose, and the payment of a certain sum in lieu of wages to the men undergoing treatment, considerable difficulty was experienced in inducing the men to undergo the proper cure, as they would seldom absent themselves from their work on account of the pecuniary loss entailed.

Some five or six years ago the first cases of ankylostomiasis were diagnosed at Mons, and at that time various systems of treatment were attempted. It was found that strong doses of " extract

of male fern" were not always sufficient to remove the parasites from the intestines. An attempt was made with thymol, the dose being 6 grammes taken in several draughts, but the result produced such an alarming state of collapse in the patient that the treatment was abandoned. Again, a further experiment was made with a mixture of chloroform and ethereal extract of male fern (extrait éthéré de fougère male), the dose being only 4 grammes, which originated from a treatment which had been used with regard to other parasites.

The idea of attempting the treatment with a mixture of the above drugs originated from the knowledge of certain successes attained in the treatment of diseases in a certain degree similar to ankylostomiasis, in which both extract of male fern and chloroform were known to have been used (E. Duhourcau, Tœnia et tœnifuges, Paris, 1900).

The Belgian doctors not being acquainted with the exact formula of the mixture known to have been used in regard to these other diseases—though aware of the drugs it contained—decided upon the adoption of a mixture of the following proportions:—

	Quantity.
	Grammes.
Ethereal extract of male fern (extrait éthéré de fougère male)	4
Chloroform....	3
Castor oil	40

To be taken by adults in from 10 to 15 minutes.

Naturally it should be used with prudence, as Doctor Herman remarks. In most cases it would perhaps be better, when administering the mixture to a patient for the first time, to give it in a number of small doses at intervals during a period of one hour, instead of administering the 47 grammes of the medicine in from 10 to 15 minutes.

This formula, which was considered highly efficacious, was used in many hundreds of cases in the provinces of Liége and Hainaut without any unusual consequences arising.

In the course of the cure the mixture (which for the sake of simplicity is called the "green" mixture) was given three times at intervals of a week. Between the doses of the green mixture a saline chloroform mixture was administered, of which the following is the formula:—

	Quantity.
	Grammes.
Chloroform water (eau chloroformée), 1 per cent.	400
Sulphate of soda	40

To be taken in four doses in the course of one hour.

By this method several patients were cured in from 15 days to three weeks.

When the provincial dispensary for ankylostomiasis was first established at Mons, the resources at the disposal of the dispensary doctor were but limited, and the funds were not sufficiently great to permit of the workmen being compensated for their loss of labour while undergoing the cure. Patients were willing to undergo treatment without cost, provided that they were not detained for more than 24 hours.

The workmen entered the dispensary at 6 o'clock in the evening and later were given a saline purgative. Early the following morning the green (or other) mixture was administered, the patient remaining in bed until the effects of the medicine had passed off, returning home in the afternoon.

This treatment was repeated the following week, and after three doses of the medicine the patient was considered as provisionally cured (*i.e.*, it was presumed that all the parasites had been dislodged from the patient's intestines), but after the lapse of a month his dejections were again examined microscopically.

This system of interrupted cure, though undoubtedly of great utility, was in many cases only temporary, as the men returned to the mines and again contracted the disease. In other cases the purgative only removed the parasites lodged in the intestines, and had no effect upon the larvæ embedded in the skin.

Since the funds of the provincial council of Hainaut have been raised, and compensation paid to the men absent from work, these latter have been enabled to undergo the serious cure under medical supervision lasting some six to eight days.

The mode of treatment adopted up to the present time at the Hainaut dispensary has been based upon the system of strong purgatives to remove the ankylostomiasis parasites from the system, together with the administering of strengthening food to counteract the weakness produced by the medicine given.

A certain variation was made later in the drugs used. In order to avoid any possible undesirable consequences from the use of male fern, and at the same time recognising the useful qualities of the mixture, it was thought advisable to substitute for male fern an oil sufficiently active against the parasite and at the same time easily borne by the organism. In previous experiments essence of turpentine had been tried, but the effects were unsatisfactory,

even with chloroform and castor oil, and in addition the mixture produced bad results in the digestive organs.

It being known that salicylic acid is very active in regard to tænia, the doctors engaged in the experiments substituted for the extract of male fern essence of wintergreen (salicylate de méthyle), the dose being 4 grammes, and the rest of the formula as before :—

	Quantity.
	Grammes.
Essence of wintergreen	4
Chloroform....	3
Castor oil	40

This mixture, known as the " W " mixture, was administered in a similar manner to the green mixture with excellent results.

As a further remedy, a mixture was tried with oil of Eucalyptus Globulus in the following quantities :—

	Quantity.
	Grammes.
Essence of eucalyptus	2
Chloroform....	3
Castor oil	40

to be taken in a similar manner to the two preceding mixtures. This remedy, known as the " white " mixture, is that most employed up to the present time in the Hainaut dispensary.

In regard to the degree of efficacity of the three mixtures, the maximum number of parasites expelled by one dose of each of the mixtures was as follows :—

	Number of Ankylostomes.
Green mixture (male fern)	163
White „ (eucalyptus)	130
" W " „ (essence of wintergreen)	113

These figures would give rise to the supposition that the green mixture is more active than the white, but the results, of course, depend upon the number of parasites existing before the administering of the dose. In the large majority of cases the doctors are satisfied that the white mixture is as effectual as the green ; that

is to say, when the white mixture produces no further effect, the same result obtains with the green mixture.

It was held in a recent work on the subject of ankylostomiasis that chloroform was the drug producing the chief if not the entire effect in the expulsion of the ankylostomiasis parasite, and to demonstrate that this was not the case an experiment was made with seven patients, who were administered a dose of 3 grammes of chloroform and 40 grammes of castor oil. The result was as follows :—

	Number of Parasites Expelled.
Patient No. 1	....
,, ,, 2	....
,, ,, 3	....
,, ,, 4	2
,, ,, 5	....
,, ,, 6	4
,, ,, 7	....

Two days afterwards a dose of the white mixture was given, the result being :—

	Number of Parasites Expelled.
Patient No. 1	3
,, ,, 2	2
,, ,, 3	10
,, ,, 4	8
,, ,, 5	2
,, ,, 6	31
,, ,, 7	14

The Bulletin of the Royal Academy of Medicine states that it is considered that the treatment set forth (*i.e.*, the white mixture) in regard to ankylostomiasis will be of interest to the entire medical world, and more especially to those practitioners brought into touch with and carrying on their work in mining districts.

Expenditure upon the cure.

As the present system with regard to the treatment of ankylostomiasis has been in force in the province of Liége for a much longer time than that of the system in the Hainaut district, and the result being highly satisfactory, I propose giving below some details relating to the expenditure of the funds voted by the Provincial Government towards the alleviation of miners' diseases which will give an idea of the expenses incurred in supplying free treatment to patients suffering from ankylostomiasis and also in giving com-

pensation to those persons obliged to forfeit their wages during their temporary absence from work.

In 1902 the province of Liége granted a subsidy of 782*l.* to be distributed among workmen undergoing the cure for ankylostomiasis. This sum was distributed at the rate of 1 fr. 50 c. (a fraction under 1*s.* 2½*d.*) a day, making 13,033 days at the rate of 1 fr. 50 c. With this sum 229 workmen were relieved, the average sum received by each man being about 3*l.* 8*s.* 4*d.*, or equivalent to some 56 days' work for each man. These figures—that is to say the total relief afforded to each individual—seem high, but they may be accepted as correct, as they are taken from an official publication. The average, of course, is made higher from the fact that several workmen were under treatment for some months.

During 1902 it was decided to establish a dispensary hospital for workmen suffering from ankylostomiasis, where they could be properly treated and where attendants would see that the medicines prescribed were administered at the proper intervals.

In 1903, in addition to the funds voted for payment of compensation, further sums amounting to 222*l.* were granted for the establishment and fitting of the miners' dispensary.

An additional rule was made to the effect that all workmen undergoing treatment should receive compensation for wages forfeited (regardless of the time they were absent from work), at the rate of 1 fr. 50 c. per working day (hitherto only such men as were absent from work for more than 30 days consecutively had received compensation), under the condition that they were treated in a hospital or at the miners' dispensary.

During 1903 252 workmen were compensated at a cost of 800*l.*

During 1904 254 workmen were compensated at a cost of 560*l.*

It is unnecessary to go into details with regard to these years, as more will be gained from showing the expenses during the more recent year 1905.

It must be remembered that in addition to the above outlay expenditure had to be made for the hospitals and for treating and feeding the men undergoing cure.

In 1905 the grant of the province amounted to 1,445*l.*, which was divided as follows for the various purposes of treating the disease :—

	Amount.
	£
1. Compensation to workmen	817
2. Subsidy to dispensary	500
3. Subsidy for building and furnishing rooms for the use of patients	128
Total	1,445

During the year 1,251 men were treated, receiving compensation

at the rate of 1 fr. 50 c. a day at the total cost of 817*l.*, equal to 13,616 working days. The average number of days for each man undergoing treatment therefore works out at 11, the men receiving an average of about 13*s.* 6*d.* each.

In addition to this most of the mines in the Liége district pay 2 fr. a day to each of their workmen undergoing cure. From the return it appears that about three-fifths (say 750) of the men treated at the dispensary were sent from various mines, the remaining two-fifths being men unable to obtain employment until they had been cured of the disease.

These 750 men would, therefore, receive—taking an average of 11 days at 2 fr. per day—about 660*l.* from the mine owners, bringing up the total expenditure in 1905 for workmen's compensation to about 1,477*l.*

It must be understood that these 1,251 men actually underwent cure, but many hundreds of others were examined for the parasite.

The total number of workmen in the mines of the Liége district, according to the official returns published in 1906, is 34,152. Therefore, out of the total number of workmen employed in all the mines of Liége 3·66 per cent. underwent the ankylostomiasis treatment in 1905.

With regard to the province of Hainaut, I have not such detailed particulars, but I am informed by Doctor Herman that the province granted at the beginning of this year a subsidy of 720*l.* for the upkeep of the dispensary—which has 12 beds—and the payment of compensation. The expenses may be roughly worked out as follows, taking for granted that the hospital is always full, which is usually the case :—

	Amount.
	£ *s.* *d.*
Cost of upkeep of dispensary per day	1 12 0
Average cost of compensation to workmen and railway fare per day	0 16 0
Total	2 8 0

The cure is estimated to last six days, the workmen entering the dispensary on Monday mornings and leaving on the following Saturday. The expenditure is, therefore :—

	Amount.
	£ *s.* *d.*
For each workmen, per day	0 4 0
Cost for each cure	1 4 0

It may be calculated that an average of some 400 men are treated at the provincial dispensary at Mons in the year, and that

these men relieved receive a total sum of about 250*l.* per annum in lieu of wages and in payment of travelling expenses, so that, as compared with Liége, the system is but in its infancy.

Further, as before stated, no assistance is given to the provincial authorities in the Hainaut district by the mine owners, who, for the most part, disclaim the idea that the disease of ankylostomiasis is prevalent in their mines. The law, which has now been made applicable to the province of Hainaut, should be very beneficial in its effect, and it is to be hoped that the mine owners of this district will follow the example of their colleagues of Liége in giving both money and energy in untiring effort to stamp out this scourging disease from the mines of Belgium.

TABLE showing the Cures effected in 1902 and 1904 in certain of the Mines in the Province of Liége

Name of Mine.	Percentage of Miners Infected with Ankylostomiasis Parasite.	
	1902.	1904.
Corbeau-au-Berleur	92	36
Bonne-Fin—		
Bâneux Branch	60	19
St. Marguérite et Aumônier Branch	36	13
Gosson-Lagasse	50	26
Patience et Beaujonc	48	34
Concorde	31	20
*Abhooz et Bonne-Foi-Hareng —		
Milmort Branch	29	4
Abhooz „	13	1·3
*Marihaye—		
Vieille Marihaye Branch	9·5	3
Many Branch	8·6	11
Flémalle Branch	24	4
Fanny Branch	7	3
*Grande Bacnure	16	7
*Horloz—		
Tilleur Branch	14	7
St. Nicolas Branch	14	5
*La Haye	10	3

* Since the details given in the above table were compiled all the workers in the mines to which this note refers have undergone examination and cure at the Liége provincial dispensary, and according to later particulars none of the men employed in these mines are now infected with ankylostomiasis.

In the other mines mentioned in the table, the average percentage of miners infected decreased from 53 per cent. in 1902 to 25 per cent. in 1904, and, although I have not been able to obtain the subsequent figures in regard to these particular mines, it may be taken for granted that a corresponding, if not a greater, proportionate decrease has taken place since the return was compiled.