

Ankylostomiasis : its cause, treatment and prevention.

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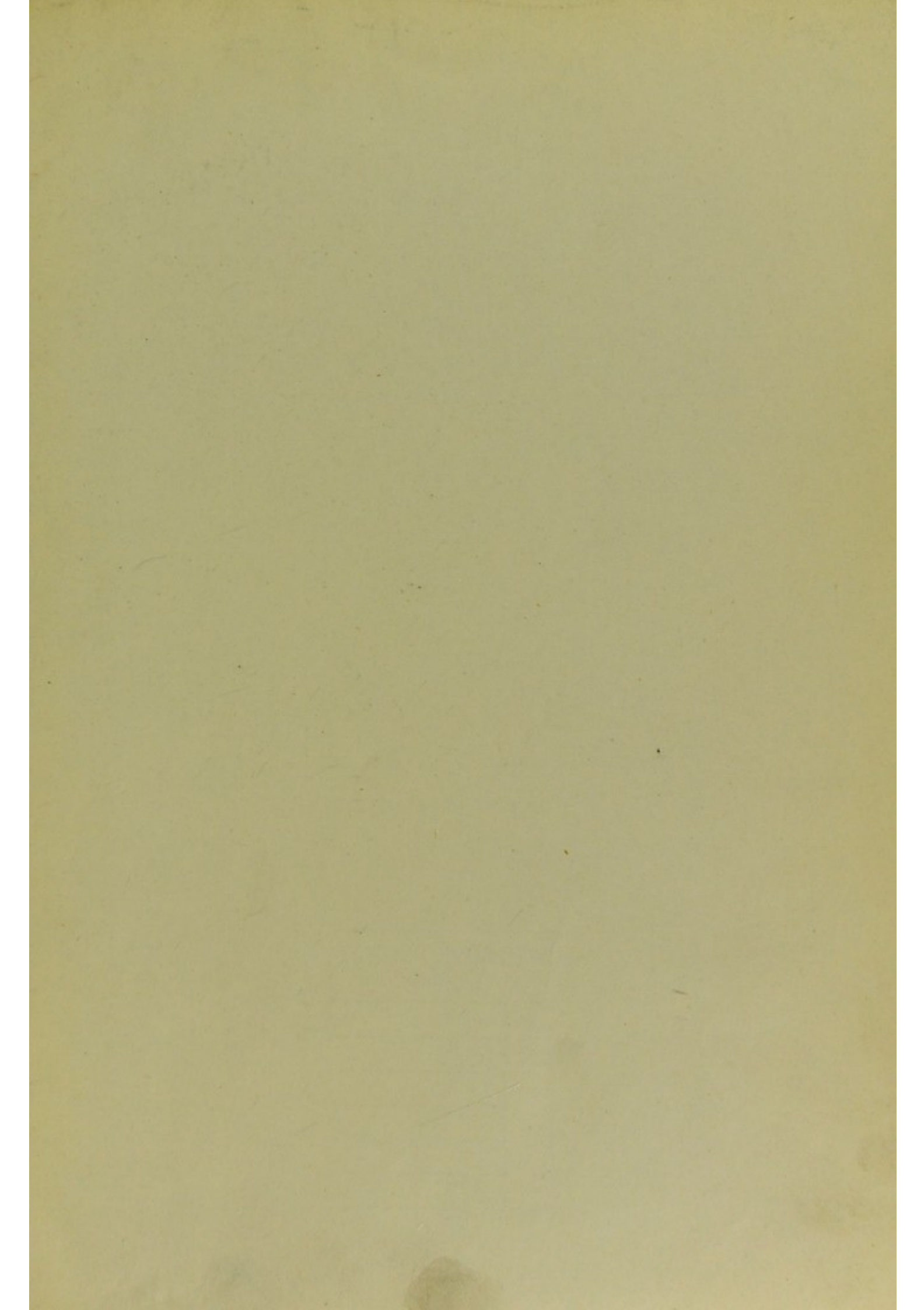


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ANKYLOSTOMIASIS :

ITS CAUSE, TREATMENT, AND PREVENTION.

Supplement to the COLLIERY GUARDIAN, November 6th, 1903.

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ANKYLOSTOMIASIS.

ITS CAUSE, TREATMENT AND PREVENTION.

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INTRODUCTORY.

THE disease known as ankylostomiasis, or "miners' anæmia," is produced by a nematode worm, *Ankylostomum duodenale** (*Dochmius duodenalis* or *Strongylus duodenalis*), (Plate I.) infesting the small intestine, to the mucous membrane of which it attaches itself by a series of hooks (four to six in number, according to the reports of different observers) situated round the mouth of the parasite. The adult male worm is about $\frac{1}{4}$ to $\frac{1}{3}$ of an inch (6 to 8 millimetres) in length, the female being somewhat longer (about 12 mm., or $\frac{1}{2}$ in.) and thicker. The sexual organs of the male are situated at the posterior extremity, and are surrounded by a characteristic bursa†; whilst those of the female are placed a little to the rear of the middle of the body. The female lays a large number of microscopically-small highly-transparent, elongated eggs, about 0.028 mm. ($\frac{1}{350}$ in.) wide and 0.044 mm. ($\frac{1}{225}$ in.) long, which pass away in the fæces. On issuing from the body the eggs are usually in an advanced state of segmentation (division of the contents into cells), and contain two to eight or more cells; so that, given favourable conditions for development, they quickly hatch out into larvæ (intermediate stage of growth). The essential conditions for this development are a very moist, pasty medium, a temperature exceeding 20 degs. Cent. (68 degs. Fahr.), the most favourable being 25 to 30 degrees Cent. (78 to 86 degrees Fahr.), and absence of daylight. The larvæ on issuing from the ova are very active, so long as the medium remains moist, but after a short time develop a thickened integument or capsule, and thus attain their final stage of existence outside the human body. According to Giles, the embryo develops to a sexually

* The name is not strictly correct, since the worm does not inhabit the duodenum.

† Purse-like enlargement.

complete rhabdite form (full-grown worm) in polluted soil and at a sufficiently high temperature; but this observation does not appear to have been confirmed by other workers, and Dr. Tenholt, of Bochum, states emphatically that the larvæ remain asexual and incapable of reproduction until they gain access to the small intestine.

Although Looss states that the larvæ are able to pass into the skin and produce a temporary skin eruption, it seems very doubtful whether they could gain access to the intestines in this way; and, indeed, the attempts made by other workers to imitate his experiments have resulted in failure, so that the mouth appears to be the sole means by which the infection can be transmitted. Owing to carelessness, or perhaps also the absence of proper accommodation, the miners deposit their fæces in the underground workings, where the fæcal matter becomes incorporated with sludge. This, in the course of the ordinary operations of mining, gets on to the men's hands, and, as these are rarely washed previous to meals underground, the eggs and larvæ enter the mouth with the food. While the eggs and young larvæ are susceptible to the action of the acid gastric juice, and are thus destroyed in the stomach the thicker integument of the capsuled larvæ is not dissolved until brought into contact with the alkaline juice of the smaller intestine, and the latter form of larva alone therefore seems to be capable of transmitting the disease and attaining complete development into the adult male or female worm, on reaching its natural habitat. It is worthy of note that, the presence of oxygen being essential for the development of the ova, it is impossible for the complete cycle of reproduction to proceed within the intestine.

With regard to the question whether the worm can be carried by any other host than man, it was believed at

PLATE I.

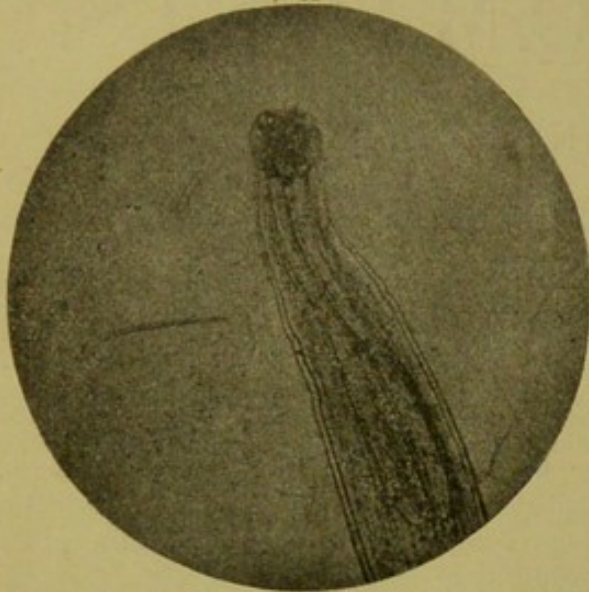
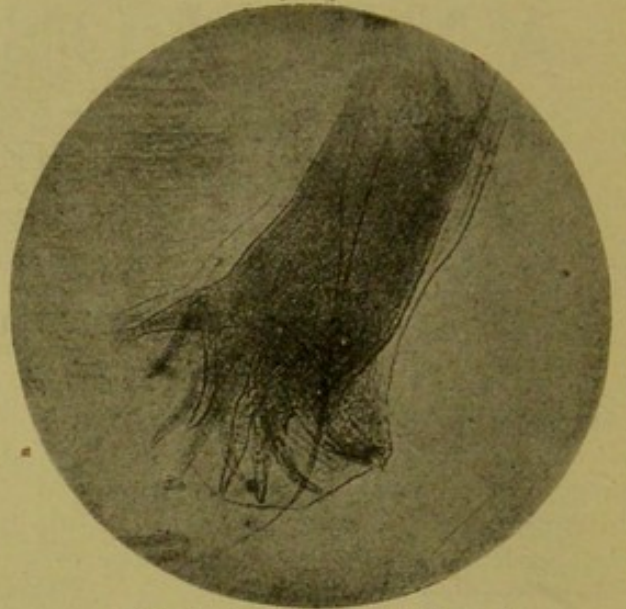
Fig. 1.—Head of Adult *Ankylostome* × 30.

Fig. 2.—Tail of Adult Male × 40.

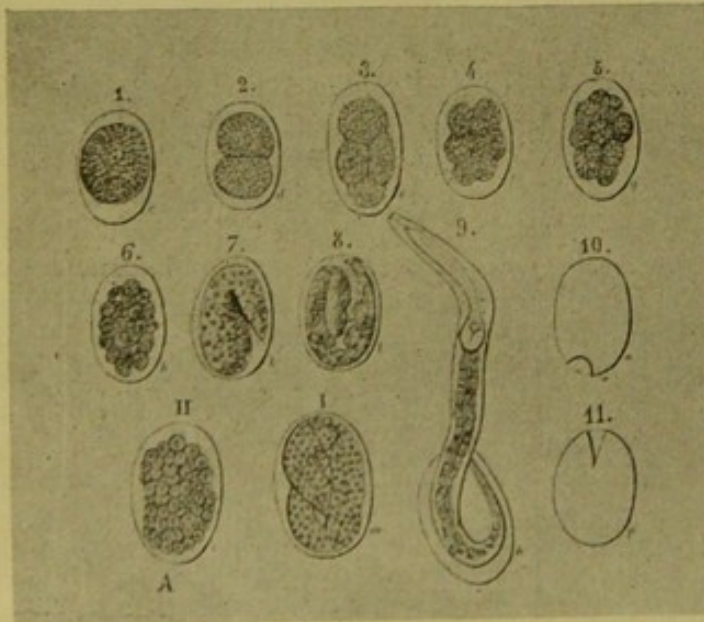


Fig. 3.—Development of Ovum, after Perroncito.

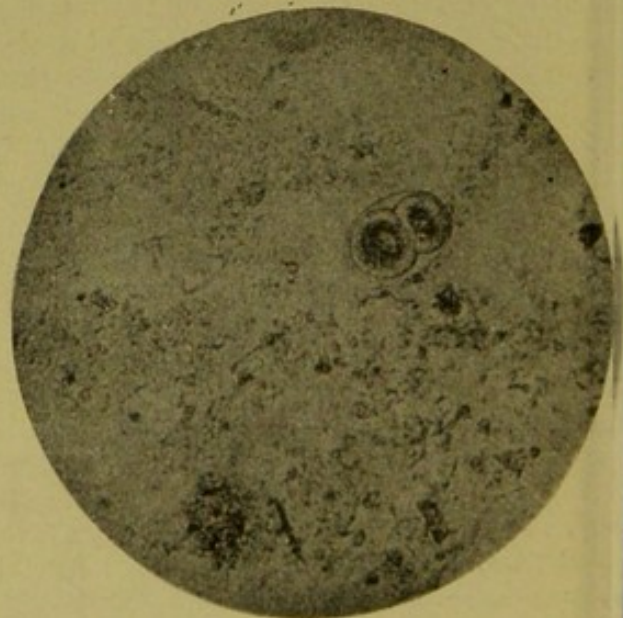


Fig. 4.—Two-cell stage of Developing Ovum × 200.

Figs. 1, 2 and 4 are from micro-photographs by Mr. C. A. Coventon, of specimens from the feces of Dolcoath miners.

PLATE I.

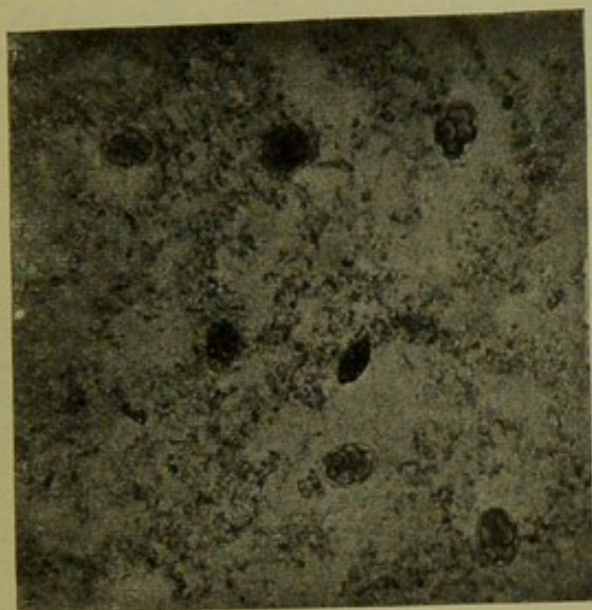


Fig. 5.—Ova at different stages $\times 50$. Near centre an Ovum of *Trichocephalus dispar*.

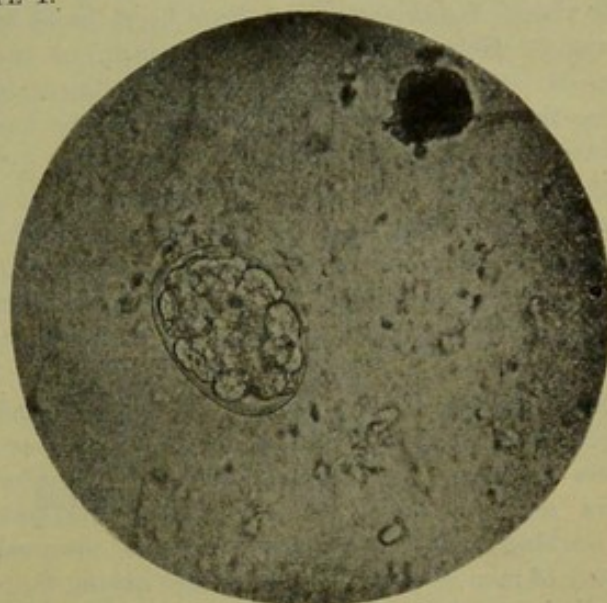


Fig. 6.—Morula Stage of Ovum $\times 400$.

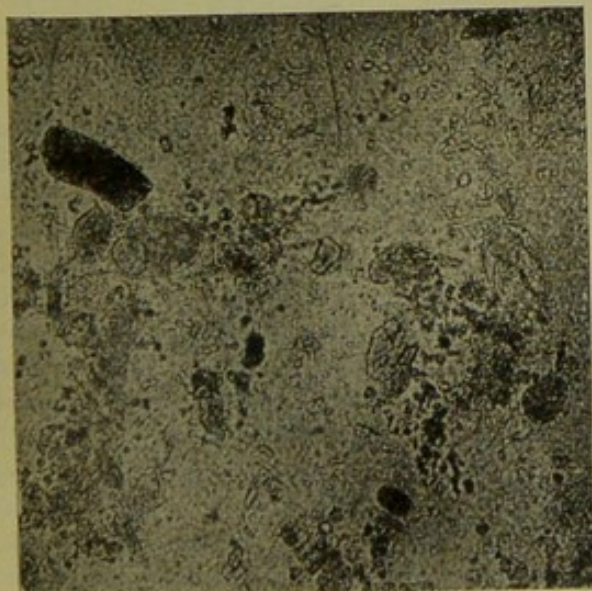


Fig. 7.—Ova nearly ready to hatch, Larval Worm coiled up inside \times about 160.

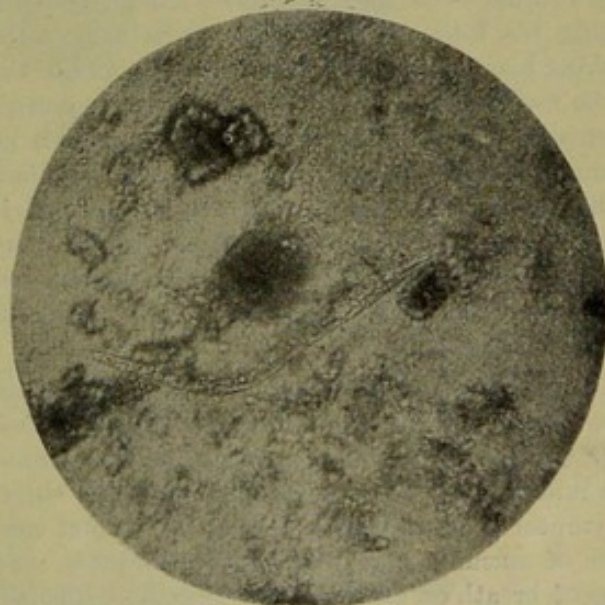


Fig. 8.—Recently hatched Larval Worm.

Figs. 5, 6, 7 and 8 are from micro-photographs by Mr. C. A. Coventon, of specimens from the faeces of Dolcoath miners.

one time that both dogs and horses were capable of harbouring the parasite; but all the investigations made on this point by Tenholt gave merely negative results. On the other hand, ova—producing larvæ similar to those of *Ankylostomum*—have been found by Dr. Bruns, of Gelsenkirchen, in the dejecta of two monkeys, on which he had intended to experiment in this connection; but the absolute identity of the two species has not yet been demonstrated.

The life of the worm extends over several years, a fact which has recently received confirmation in the case of several reservists in the German army, who, after two years' service with the colours, have been found suffering from ankylostomiasis on their return to pit work.

Though the disease is very common in tropical and sub-tropical climates, it is confined in temperate zones to workers in mines, tunnels, and brickworks. So far as miners are concerned, it is restricted to those actually working underground, the few cases observed in Germany of men working at the surface having been traced to their previous employment in the pit. Fear has been expressed that the malady might be communicated to the families of affected men; but the instances in which such transference has been confirmed are relatively insignificant. One recorded case in Germany is that of a miner's son, aged nine, who was in the habit of cleaning his father's dirty boots on Saturdays, the latter taking his working clothes home at the end of the week to be washed; and two or three similar instances have occurred at Anzin, the infection having been no doubt communicated in much the same way; so that, practically, as already mentioned, the complaint is restricted to actual workers underground. Two mining engineers in Belgium have contracted the disease, but this circumstance is attributed to their constant occupation in infected pits.

The symptoms of ankylostomiasis are those of an anæmic condition of the blood, the lips, tongue, gums, and inner surface of the eyelids becoming pale, whilst the face and tips of the ears assume a greyish tinge. These symptoms are accompanied by the usual concomitants of anæmia, viz., palpitation, dizziness, and shortness of breath on exertion, the appetite is affected, and other symptoms of gastro-intestinal disturbance are observed; and in the case of the men attacked at Dolcoath, irritating, pustular skin eruptions, locally known as "bunches," are reported. In advanced stages of the malady the slightest exertion produces intense lassitude and fainting. It is but seldom, however, that

fatal results ensue, the cases observed up to the present having been complicated by pneumonia or other maladies exercising a contributory influence. Nevertheless, where the disease has gained a firm hold the consequences are so serious, as regards the diminution of energy, that we may have, to quote the words of Director Meyer, of Gelsenkirchen, with reference to the epidemic at Brenberg, "an entire working population incapable of labour."

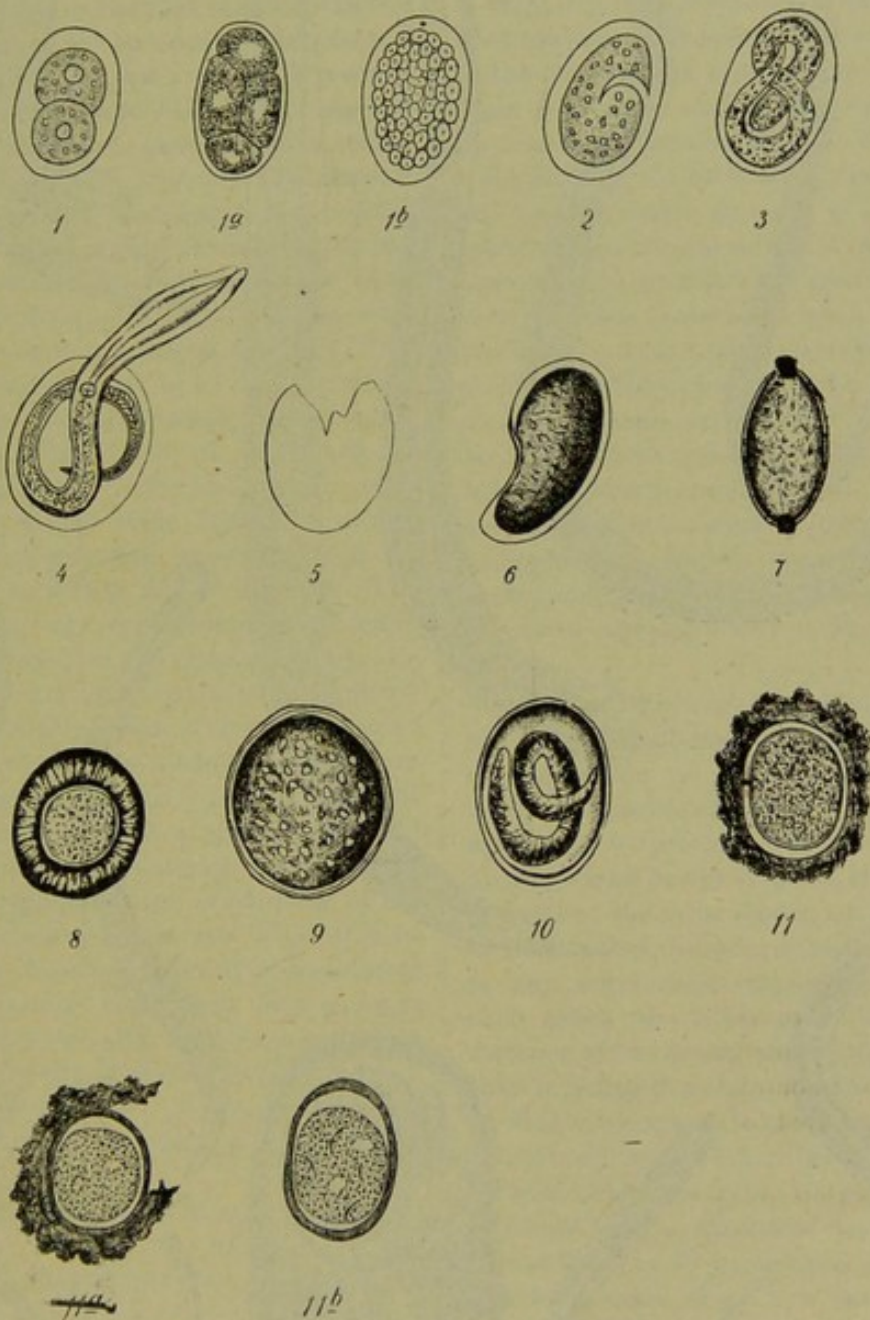
One curious feature of ankylostomiasis is that the symptoms are not in proportion to the degree of infection, there being (in Germany especially) numerous instances of men who are found to be infested with the worm ("worm carriers"), and yet do not experience any marked degree of inconvenience or exhibit the characteristic pallor and weakness. For this reason it was at one time proposed to discriminate between such men and those who are actually rendered ill by the disease; but it is now recognised that the former constitute an equal danger as regards the transmission of the complaint to others, and they are therefore subjected to the same regulations as the rest.

The investigations of Dr. Haldane show that the pallor and other main symptoms are due to a deficient percentage of hæmoglobin (red colouring matter) in the blood, whilst the fainting, palpitation, &c., are caused by the defective aeration of the tissues, and in particular of the heart, just as happens in cases of poisoning by carbon monoxide. Measurements of the total volume of the blood show that the anæmia is due to a great increase in that volume, with a corresponding dilution of the hæmoglobin, and not, as hitherto supposed, to actual loss or destruction of blood. According to Dr. Tenholt, the poisonous metabolic products of the living worm may in some cases gain access to the blood of the infected person and set up decomposition therein, attended by alteration of the red blood corpuscles and the percentage of hæmoglobin. Dr. Haldane has shown that the disease is accompanied by the presence of *Eosinophile leucocytes** in the blood.

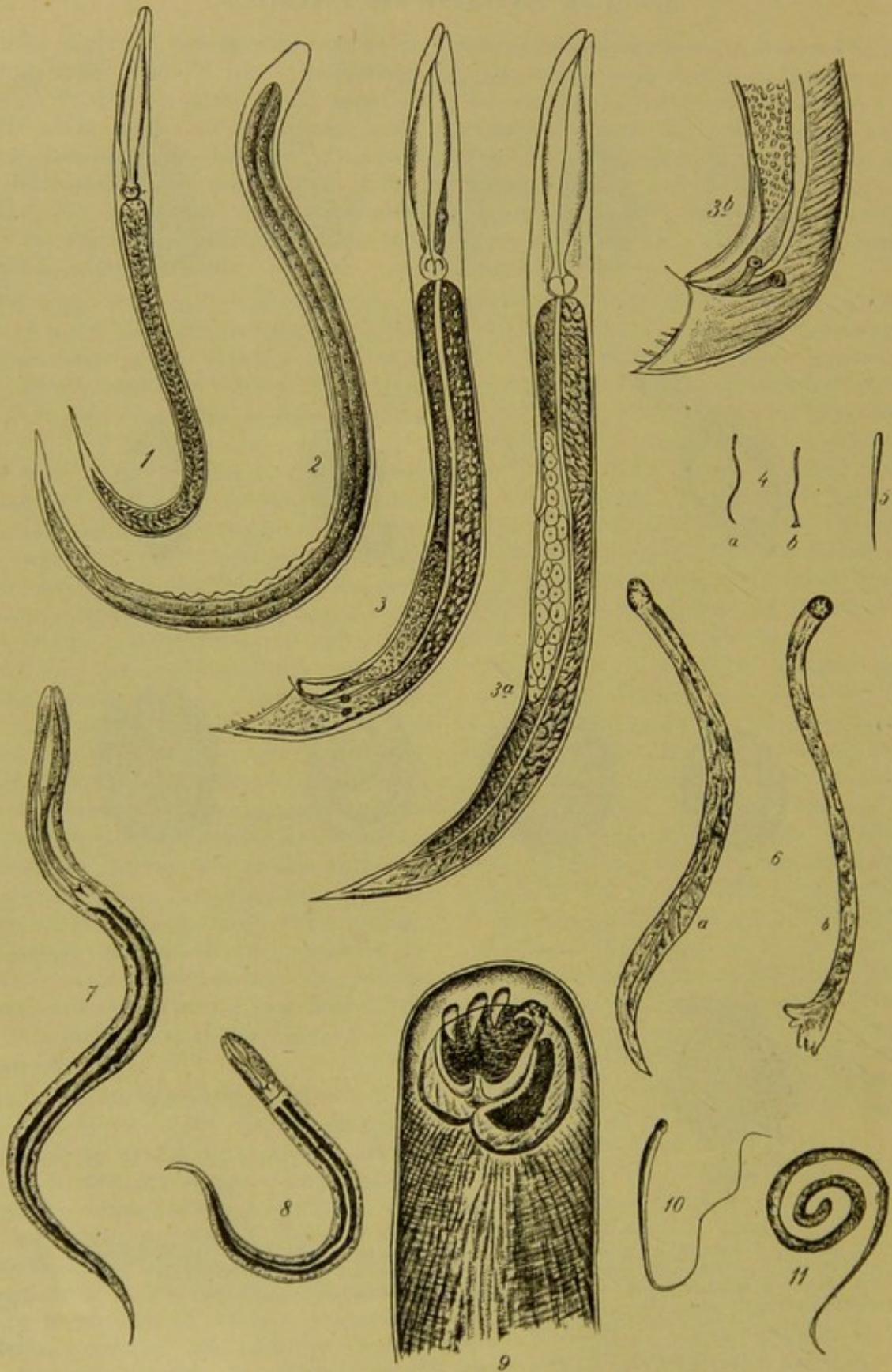
In view of the variable intensity of the external symptoms, the only reliable means of ascertaining the existence of infection is by microscopic examination of the fæces, to determine the presence of ova, the adult worm never being found except after the exhibition of some vermifuge. The method generally adopted is to make three cover-glass preparations of the undiluted fæces on a single slide, and examine them under a

* White bodies distinguished by their capacity for absorbing eosine dye, which stains them a pale red.

PLATE II.



- 1, 1a, 1b.—Progressive segmentation of *Ankylostomum* ovum (Leitz Obj. 6, Eye-piece 1)
 2. Initial; 3, complete development of embryo (Leitz Obj. 6, Eye-piece 1).
 4. Embryo escaping from ovum (same magnification).
 5. Empty envelope do. do.
 6. Ovum of *Oxyuris vermicularis* do. do.
 7. Ovum of *Tricocephalus dispar* do. do.
 8. Ovum of *Taenia solium* do. do.
 9. Ovum of *Bothriocephalus latus* do. do.
 10. Ovum (not of *Ankylostomum*) from the faeces of a pit horse (same magnification).
 11. Ovum of *Ascaris lumbricoides* with envelope; 11a, envelope partly, 11b entirely disappeared (same magnification).



- [1. Young; 2, encysted *Ankylostomum* larva (Leitz Obj. 6, Eye-piece 1).
 3. Male; 3a, female, free and sexually mature *Rhabditis* (do., do.)
 3b. Sexual organ of male, more strongly magnified.
 4a. Female; 4b, male *Ankylostomum*, natural size.
 5. *Oxyuris vermicularis*, natural size.

6. *Ankylostomum*; a, female, b, male.
 7. Larva of *Rhabditis stercoralis* (Leitz Obj. 6, Eye-piece 3).
 8. Larva of *Anguillula intestinalis* do. do.
 9. Head and mouth of *Ankylostomum*, highly magnified.
 10. *Tricocephalus dispar*, female, natural size.
 11. Do. male, slightly magnified.

moderately high power, stronger magnification being resorted to in the event of any doubt as to the character of the ova. This examination entails a certain amount of familiarity with the worm on the part of the operator; so, in order to afford facilities to those doctors who are not accustomed to the task, Dr. Tenholt has issued a series of illustrations (see Plates II. and III.) of the ova and larvæ of the worm and analogous parasites with which it might be confounded, notably the ovum of *Ascaris lumbricoides* when freed from the characteristic outer envelope. In making examinations of dejecta for the presence of *Ankylostomum duodenale*, care must be taken to identify the sample examined, cases having been known where men submitted specimens obtained from admittedly exempt comrades, in order to avoid the necessity for making the somewhat disagreeable cure; whilst, on the other hand, it is stated in Belgium that men infected with the worm have made a practice of selling their fæces to others desirous of securing sick pay and allowances (practically full pay) in order to lead a life of idleness. The best means of preventing any deception of this kind is to have the sample deposited, in the presence of a trustworthy attendant, direct into a small enamelled cup, fitted with a hinged lid and provided with a label for identification. This method prevents any mistakes, such as are likely to arise when the samples have to be transferred from one receptacle to another. The examination should always be performed on fresh samples, since storage either results in the development or destruction of the ova, according as the circumstances are favourable or the reverse. Experience has shown that it is inadvisable for any operator to examine more than fifty samples (150 preparations) in any one day, as the eye and brain become tired and the faculty of discriminating between different forms of ova is weakened. A large microscope with revolving objectives and mechanical stage should be used.

Treatment.—Various medicaments have been proposed from time to time for securing the expulsion of the worms from the body of the sufferer; but practically the issue has been narrowed down to two—namely, extract of male fern (*extractum filicis*) and thymol, though a new preparation compounded of

Terpine	50 centigrammes
Levigated sulphur ...	2 grammes
Condurango powder ...	1 gramme

has been successfully tried at the Cockerill Hospital, Seraing, within the last few weeks. Another remedy, favourably reported upon by Dr. Goldmann, of Brenenberg, is an infusion of the bark of *Acacia anthelmintica*,

which comes from Abyssinia, and is said to be largely used by the natives as a vermifuge, but is extremely difficult to procure in Europe.

With regard to thymol, Dr. Haldane, in his report on the outbreak at Dolcoath, favours this remedy in view of the difficulty of obtaining a reliable preparation of male fern; but Continental experience is adverse to its use, on the ground that the drug produces dangerous collapse. On the other hand, several instances of partial loss of sight, and one of complete blindness, are attributed to the employment of male fern extract. In Germany, 10 grammes of *extractum filicis* are given in several doses, associated with calomel; as, however, the actual practice adopted varies, the particulars will be found in the accounts, given later on, respecting the several collieries and hospitals visited. This applies also to Belgium, where male fern extract is used in conjunction with chloroform and castor oil. Generally speaking, the cure takes about a week or ten days; but a good many instances are known (especially among those only slightly affected with the disease) where the cure has had to be repeated many times, and even then without success.

Practical Prophylactic Measures.—Since the sole means of propagating ankylostomiasis in a mine is by the deposition of fæcal matter in the workings, it becomes a matter of primary importance to prevent such deposition, by providing suitable retiring accommodation above ground (water or earth closets), and portable pails in parts of the mine readily accessible to the workers. It is evident that, in order to induce the men to conform to any regulations respecting the compulsory use of such pails, the latter must be situated within easy distance of the actual working places, so that the loss of time in going to and fro may be reduced to a minimum. In this connection it is of interest to cite the system introduced by Director Meyer, at the Shamrock Pit, Gelsenkirchen, namely, of placing the pails in such positions that no man need travel more than 300 yards on the level, or 30 yards up or down inclines, which will not take more than five minutes. These pails, of galvanised iron, cost about 18s. each; and, assuming that the provision is made of one pail per four men, the outlay on this head in a pit employing 1,200 men per shift would be £270.

The cost of the w.c. accommodation varies according to the class of installation provided. For example, the automatic flush w.c.'s, with marble partitions and backs erected at the Erin Pit and several other collieries in Westphalia, by the firm L. Oplaender Wwe., of Dort

mund (figs. 1 and 2), cost £600 (sixteen seats); but a less expensive pattern by the same maker is installed at the Von der Heydt Colliery, the slabs in this case being of wired glass. Another pattern, used in certain Belgian collieries, is the "ever-clean seat" w.c., by L. Lambert, of Brussels (figs. 3, 4, and 5), in varnished pitch pine,

Lagache Colliery, near Liège, and is said to give satisfaction.

Douche Baths.—As a measure of general hygiene, baths have long been in use in the Westphalian collieries and in some of those in Belgium. At one time plunging baths were used, but in consequence of the prevalence

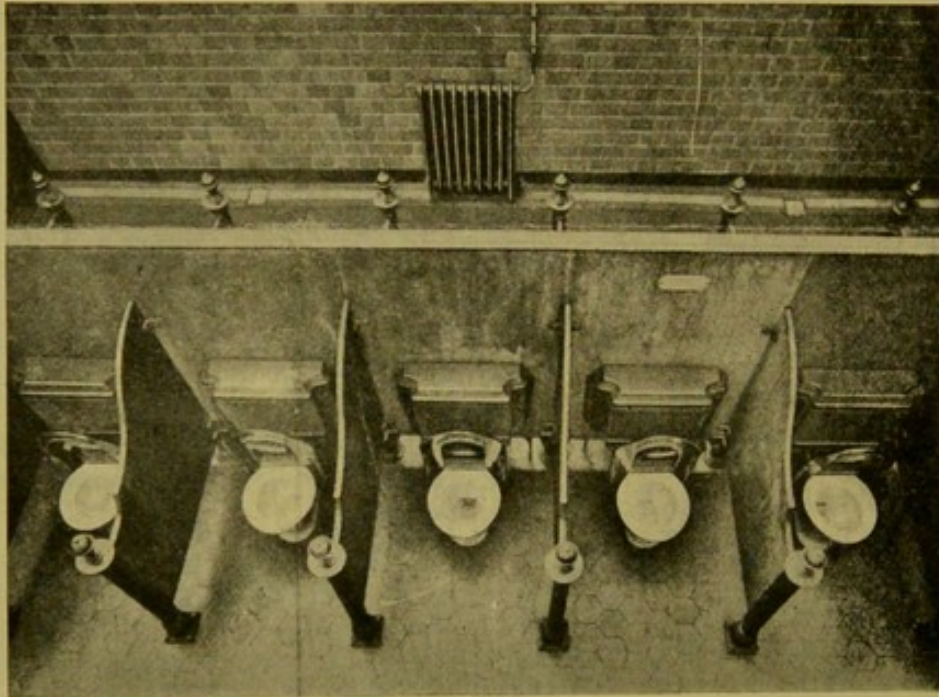


FIG. 1.—W.C.'S AT ERIN COLLIERY.

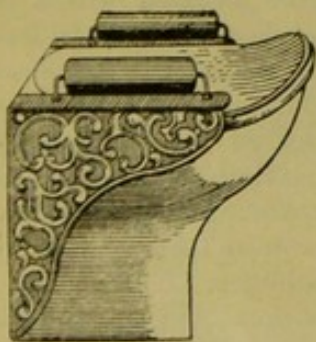


FIG. 3.

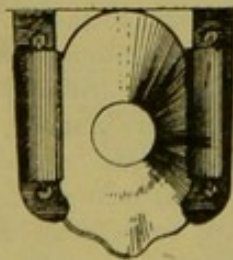


FIG. 4.

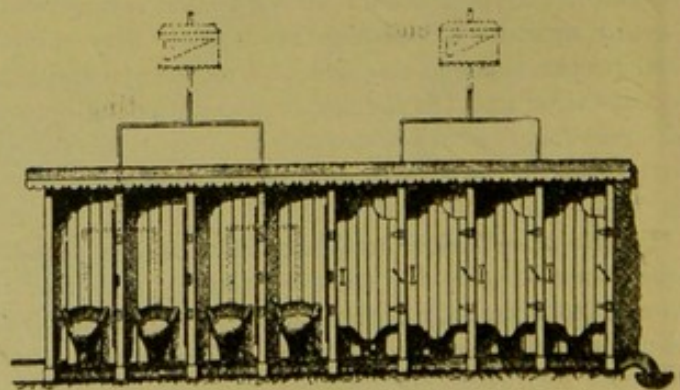


FIG. 5.

LAMBERT'S EVER-CLEAN SEAT W.C.

costing £6 per cabinet (in Brussels); and the same firm provides a dry-earth closet for use with peat, &c. (fig. 6), the cost of which is about 8s. less per cabinet. An installation of this latter class is in use at the Gosson

idea that these baths increased the risk of infection with the worm, they have now been replaced by douches, a typical example of which is represented by the installation at the Erin Colliery, Castrop. The vestuary

shown in fig. 7, and the douche room in fig. 8. The usual practice in Germany is for the men to wash in public, a separate compartment being provided for youths under sixteen; but in Belgium greater privacy is ensured by means of cabinets, separated by partitions of either glazed tiles or painted iron, and screened in

450 hooks, has been erected at a total cost of £800, including the safety lamp room.

In the Westphalian collieries it may be said that the whole of the underground staff make use of the douche baths; but in Belgium a large proportion of the men shirk the bath, on the plea that they prefer washing at home; and in some places complaints have been made by the men's wives that those who wash at the colliery go off and spend too much time in the local public-houses, instead of returning home direct from work.

Drinking Water.—The practice of drinking pit water is unknown in German, Belgian and French collieries, the men being accustomed to take coffee (more rarely water) with them in bottles. In Westphalia the water used for sprinkling the workings, to prevent coaldust explosions, is derived either from the mains or the marl rock, and is of good quality, so that it may be consumed

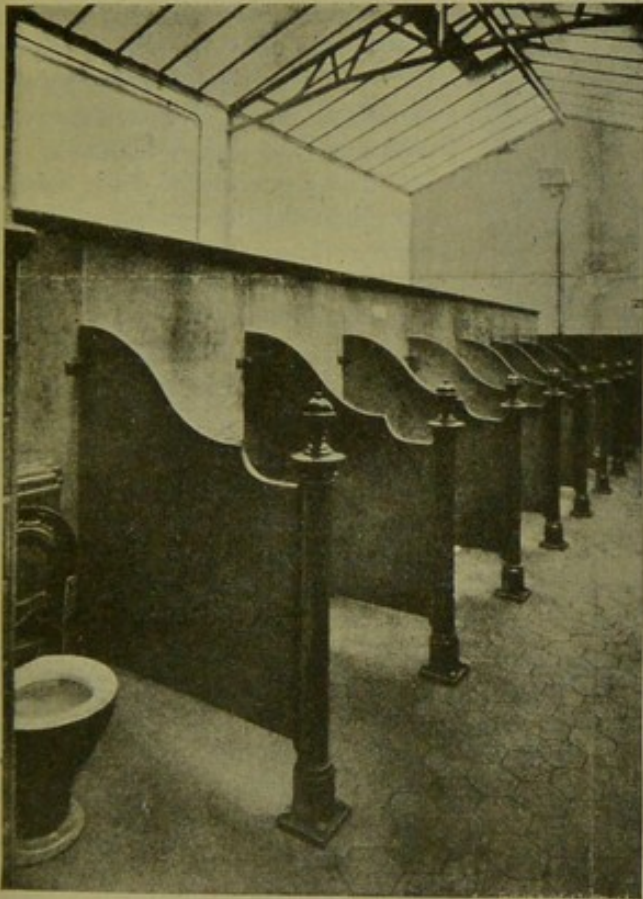


FIG. 2.—W.C.'s AT ERIN COLLIERY.

front by curtains or painted iron doors. At Gosson-Lagache the washing hall, which is 65 ft. long and 16 ft. wide, is fitted with thirty-three douches in cabinets 3 ft. wide, 5½ ft. deep, and 6 ft. high, provided with hooks for the men's underclothing. The floor is of asphalt, which is warmer than cement, and is sloped to drain off the water. Suitable provision is made for heating the room. The cost of this installation, which is used by 300 men daily, was £1,750, including a vestiary 65 ft. long by 32 ft. wide, baths for the overmen and officials, and eight dry-earth closets. At the neighbouring colliery, Espérance, Montegnée, a similar washing house, containing thirty sheet iron cabinets and a vestiary with

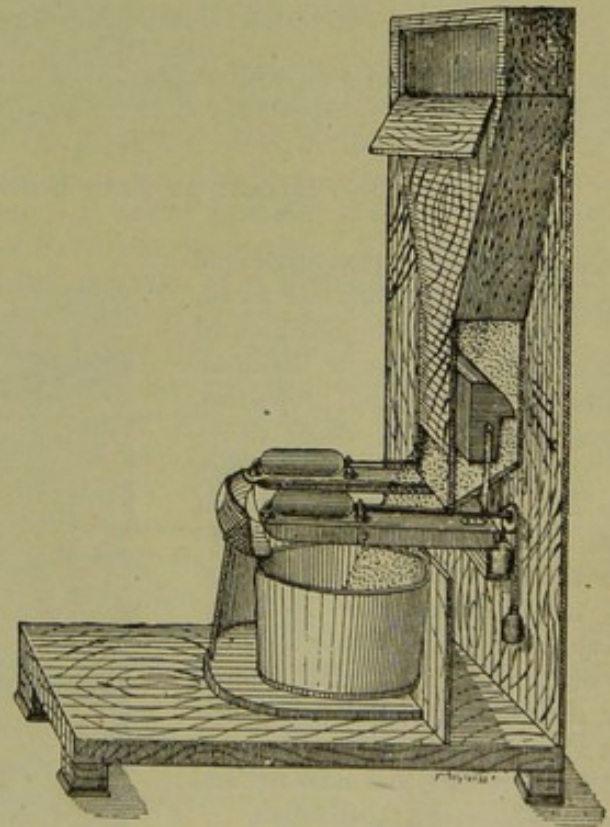


FIG. 6.—LAMBERT'S DRY-EARTH CLOSET.

without danger by the men when their own supply of beverage is exhausted. In Hungary Dr. Goldmann recommended the addition of a little citric acid to the drinking water, believing from his experiments that this acid kills the larvæ of *Ankylostomum*; but later

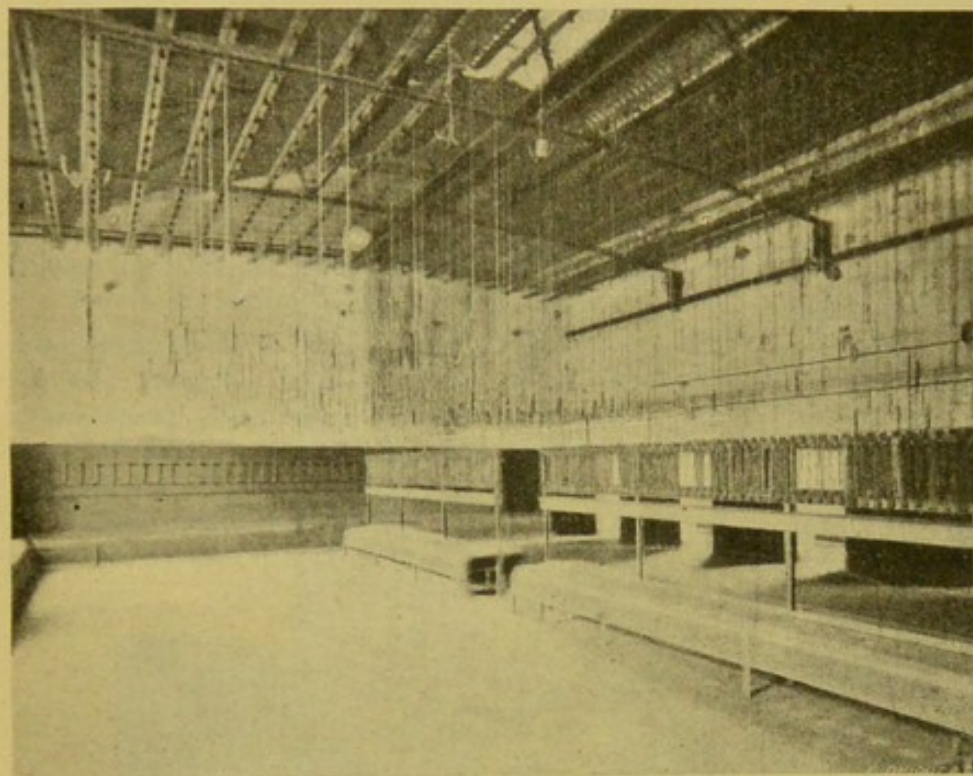


FIG. 7.—VESTIARY AT ERIN COLLIERY.

researches have shown that citric acid has no action on the encysted larvæ, which form the sole medium of infection, and its value is therefore restricted to its refreshing properties.

Washing Water.—In order to reduce the risk of infection through eating or drinking with dirty hands (wiping the mouth of the coffee bottle before drinking), the management of the Patience Beaujonc Colliery, near Liège, provided the men with tins filled with filtered water, so that they might rinse their hands while in the pit; but the men failed to appreciate this measure, and it has therefore been abandoned.

Disinfectants in the Workings.—Even in the laboratory the ova and larvæ of ankylostomum exhibit a considerable power of resistance to disinfectants; in fact, they almost seem to enjoy immersion in mercury bichloride (2 per mil solution), one of the most powerful germicides; and

though trials have been made with milk of lime and with carbolic acid for washing the workings of infected pits, no practical result has been obtained. Consequently, in view of the considerable expense involved by the employment of the large quantities of lime, carbolic acid, &c., that would be necessary to wash the whole of a mine, with at best only a very problematical benefit, it is not surprising that all efforts in this direction have been abandoned.

Other precautions that may be recommended for adoption by the men working in infected pits are: Wrapping their food in clean paper and placing the packages where they cannot become fouled; holding the food in paper instead of in the dirty hands when eating; keeping the hands out of contact with the mouth; not to place the lamp hook in the mouth when obliged to use both hands in the course of work or transit im-

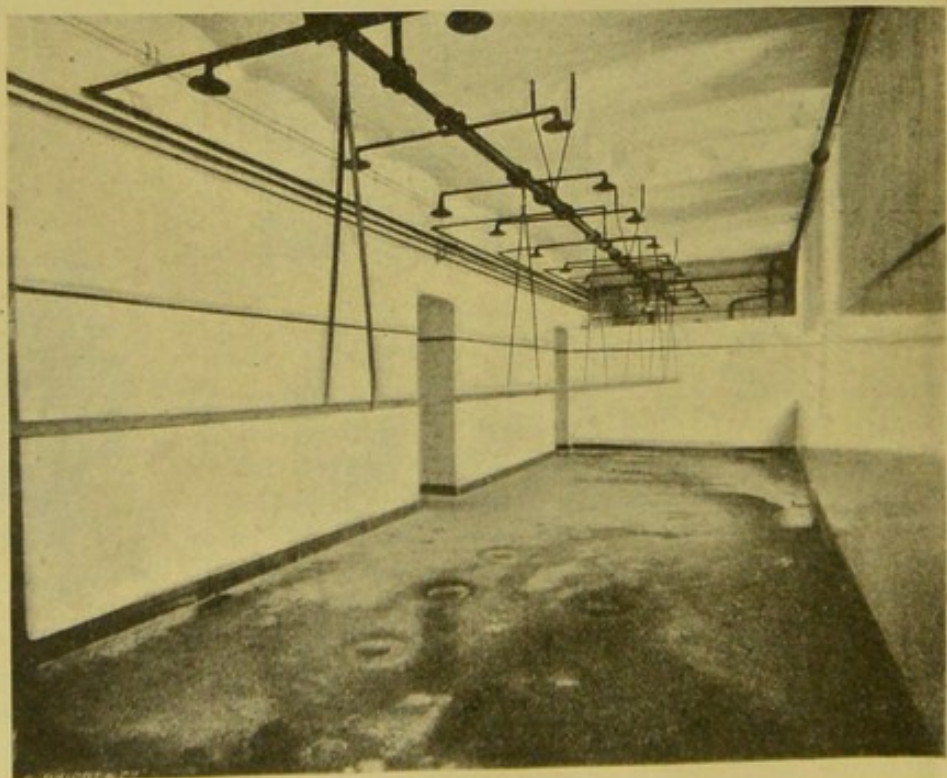


FIG. 8.—DOUCHE BATH AT ERIN COLLIERY.

the pit; and to be sure to wash and change their clothes before eating after work is over.

Means of Preventing the Transmission of Infection from one Pit to another.—The new regulations issued by the Mining Board at Dortmund prescribe that no miners seeking work at collieries may be allowed to enter the pit unless they can produce a recent medical certificate of immunity from ankylostomiasis, or are found to be free from the disease when examined by the medical man attached to the colliery. Though such a precaution may appear excessive when universally adopted, it seems to be indispensable in the case of men coming from pits that are already known to be centres of infection; and the introduction of a similar regulation is being advocated by the miners in the Nord and Pas-de-Calais (France), in view of the anticipated influx

of Belgian miners to meet the demand for labour in the various new collieries (some twenty in number) that will shortly be ready for working in those districts.

Ventilation and Drainage.—It having already been conclusively demonstrated that the worm cannot develop except in presence of warmth and moisture, the spread of infection in a mine could be prevented by eliminating either of these conditions: reducing the temperature below 20 degs. Cent. (68 degs. Fahr.) by improved ventilation, or removing the water by drainage, more particularly in the case of accumulated pools in the workings. By this means a pit can be rendered practically immune from the disease, but if these conditions cannot be secured, then the adoption of the other precautionary measures mentioned above will be necessary.

PREVALENCE OF ANKYLOSTOMIASIS IN EUROPEAN MINING CENTRES.

AUSTRIA.

The earliest recorded discovery of *Ankylostomum duodenale* in Europe was by Dubini, of Milan, in 1838, but it was not until the outbreak of anæmia among the workmen engaged in driving the St. Gothard tunnel in 1879 that the worm was recognized as a dangerous parasite, the credit for this discovery being due to Perroncito. The transmission of the disease to the Austrian, German, and Belgian collieries is frequently attributed to the fact that Italian workmen, who had been engaged in the St. Gothard tunnel, were afterwards employed for driving headings in the collieries on account of their superior skill in this work, but apparently the disease already existed in Hungary some thirty years ago, though its nature was unknown and no extensive development took place until the final decade of the last century, the maximum being attained in 1896, in which year 85 per cent. of the miners at Brennborg were found to be affected. According to the report of the German Commission of Enquiry, consisting of Professor Dr. Loebker and Directors Luethgen and Meyer, who visited Brennborg in the early part of the present year, the improvement in the condition of affairs coincided with the superseding of horse haulage by mechanical traction (horse-dung forming a very favourable medium for the development of the ova), the supply of potable water to the miners and the establishment of a hospital under the charge of Dr. Goldmann, so that the percentage of sufferers has declined through 47 per cent in 1898, 26 per cent. in

1899, 23 per cent. in 1900, and 12 per cent. in 1901, to 8 per cent. in 1902. It was stated that *Ankylostomum* larvæ had been discovered on the pit timbering at some height above the floor, but in the light of subsequent research it seems probable that the identification of these larvæ was incomplete. The curative treatment adopted consists of a preliminary dose of calomel, followed by 8 to 16 grammes of *extractum filicis*, in proportion to the assumed degree of infection. One half the dose of vermifuge is given in 1 gramme capsules every five minutes, the remainder being administered every ten minutes after an interval of one or two hours, provided no unfavourable results have attended the first dose. Finally, a mixture of calomel and jalap is given, and effects the expulsion of the worms; and a few days afterwards the patient has to take ten grammes of purified oil of turpentine, in half-gramme capsules, this being credited with an injurious action on the vitality of any worms left behind in the intestine. Castor oil is not used, Dr. Goldmann considering that it facilitates the absorption of the poisonous extract of male fern into the system.

GERMANY.

The first discovery of the disease in Germany was by Lichtenstern, in 1882, at some brickworks near Cologne, employing a number of Walloons, who were accustomed to work in Belgian collieries during the winter months. In the Rhenish-Westphalian coalfield the earliest recorded cases occurred in 1885, and the infection is believed to have been brought into the district by rock-

drillers from the St. Gothard tunnel and miners from Hungary. At one time the blame was laid on Walloons, but Dr. Tenholt states that the men referred to were really Dutch, from an entirely immune district; whilst the examination of some Walloon miners at a subsequent date (1896) in a Westphalian colliery gave totally negative results. On the other hand, a Hungarian miner, working in the same coalfield, was found to be infected later on in the same year. Between 1885 and 1889 a number of Hungarian miners were employed at the Graf Schwerin Pit, Castrop, and other collieries in the vicinity; and it was from the pits thus infected—namely, Graf Schwerin, Westhausen, Erin, Victor, Lothringen and Shamrock—that the disease spread throughout the district, its extension being facilitated by the constant migration of miners from one colliery to another. The subjoined figures give an idea of the increase within the past few years, it being premised that there are 289 pits in the district, and that the total staff numbered 256,000 in 1902:—

Year.	Number of pits infected.	Number of cases reported.	Proportion of cases per 10,000 miners in work.
1896	15	107	6.4
1897	31	113	6.2
1898	23	99	4.9
1899	26	94	4.4
1900	40	275	11.7
1901	63	1,030	40.6
1902*	66	1,355	52.9

* Including October.

The sudden rise in the figures in 1900 coincides with the introduction of compulsory regulations for sprinkling the workings with water, in order to diminish the risk of coaldust explosions, which were formerly numerous. The appearance of this factor of moisture on the scene placed many of the pits in a highly favourable condition for the development of the worm, owing to the high temperature (20 to 30 degrees Cent.=68 to 86 degrees Fahr.) prevailing in the workings. Furthermore, the connection between sprinkling and the worm disease is clearly shown by the figures published by the Knappschaftsverein (Miners' Insurance Society), which established that in 1901, out of the sixty-three pits infected, fifty-seven, representing 1,021 cases of the disease, were shafts in which sprinkling is practised, whilst only nine cases were reported in the other six infected but unwatered pits.

In consequence of the spread of the disease, the management of some of the pits most affected (*e.g.*, Graf Schwerin, Shamrock, and Erin) began to take measures at the close of 1902 for determining the actual

extent of the complaint on their premises, and to cure the sufferers. Shortly afterwards, the Government despatched the Commission already mentioned to Hungary, to investigate the state of affairs there; and the impression produced on the members of that Commission was such that the managers of the largest Westphalian collieries—chief among them being the Hibernia, Gelsenkirchen, and Harpen companies—impressed on the Government the necessity for adopting compulsory regulations to try and stamp out the disease. In April last a conference was held in Berlin, under the presidency of the Minister of Commerce, at which the whole question was discussed by representatives of the State Board of Health, the Dortmund Mining Board, the Knappschaftsverein, the Mining Association, and the directors of the Miners' Hospital at Bochum and the Bacteriological Institute at Gelsenkirchen.

The next step was the issue of a circular to the infected mines by the Mining Board at Dortmund, calling on the proprietors to have the faces of their men examined (at the expense of the colliery) by an authorised medical man, and directing that no miner found suffering from the disease should be allowed to work underground until certified as cured. In addition orders were issued respecting the disinfection of the pit pails, the provision of a special staff for attending to the pails, and the prohibition of pit water, otherwise than that taken direct from the marl, for coaldust sprinkling. Subsequently, on July 13 last, the Board issued a further set of regulations, applying to all mines in the Westphalian coalfield and prescribing the microscopical examination of the faces of at least 20 per cent. of the underground staff (including officials), by authorised medical men, and directing the results to be reported to the Board, on official forms, within two months from August 1. The men selected for the examination had to be chosen with the assistance of the medical officer, and be representative of all classes of underground workers, preference being accorded to those engaged in the warmer and moister parts of the pit. The proviso as to a medical certificate of cure before re-entering the pit was repeated, and was extended to fresh applicants for work, these latter having to be examined beforehand, and re-examined within six weeks, by the aid of samples of dejecta taken on three different days. Where pits are known to be infected, the whole of the staff must be examined, and this rule also applies to pits in which the presence of infection is revealed by the partial examination aforesaid.

To provide suitable accommodation for the men obliged to undergo a cure, the Knappschaftsverein has

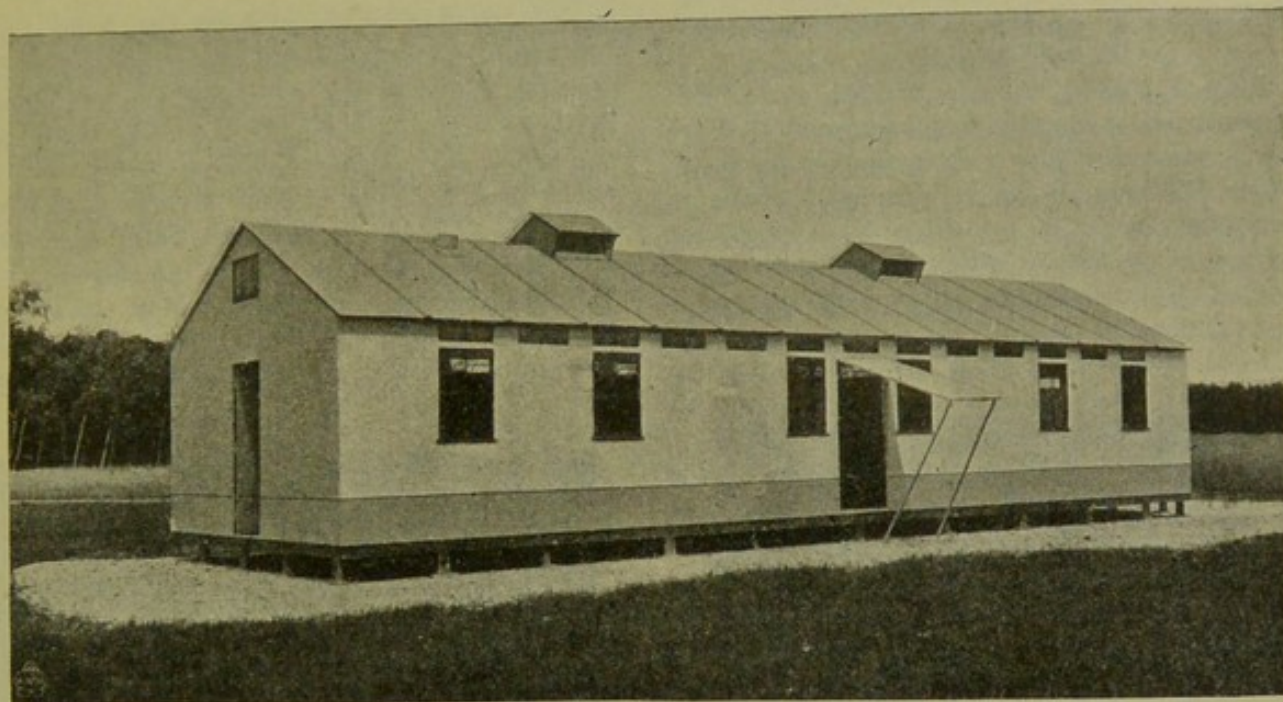


FIG. 9.—PORTABLE HOSPITAL.

supplied portable hospitals (fig. 9), manufactured by Messrs. Christoph and Unmack, of Niesky, and costing £200 to £250 exclusive of the internal fittings. These have been set up at the collieries having the largest number of cases for treatment; but the patients from the pits that are only slightly affected by the disease are sent, to save unnecessary expense, to the hospitals in Bochum, where there is sufficient accommodation. Except where the collieries have installed a medical man for the purpose, the examination and cure are in charge of the assistant doctors provided by the Knappschaftsverein to attend to cases of accident at each pit; and these assistants are instructed in the detection of ankylostoma ova at the Bochum hospital, under the supervision of Dr. Tenholt, chief medical officer to the Knappschaftsverein. They receive from the colliery owners a fee of 1s. per case examined, unless a special arrangement is made.

Under the rules of the Knappschaftsverein, miners compelled to cease work on account of illness do not begin to receive their sick pay until the third day, but the men who were obliged to stop work against their wish, on account of being infested with the worm, protested against the loss to which they were thus exposed; and the state of feeling among them grew so strong that a strike was only averted by an abrogation of the rule in favour of ankylostomiasis patients. The latter now receive their sick pay from the day on which they

cease work, and the difference between the sick pay and the ordinary earnings are made good by the colliery proprietors, additional assistance being afforded by the larger companies to the men with large families.

Though the statistics* for the present year have not yet been made up, and it is therefore impossible to give exact figures for the whole of the district, those cited later on in connection with the pits chiefly affected show that considerable improvement has been made, in consequence of the new regulations; and the officials of the mining board at Dortmund express great satisfaction at the progress made within the short time that these regulations have been in force. Dr. Tenholt states that out of 18,000 sufferers examined since January last, only 3 per cent. have had to be discharged without being cured, and of these latter not more than $4\frac{1}{2}$ per cent. exhibited symptoms of secondary anæmia, such symptoms, moreover, having been found in only 7 per cent. of the total sufferers.

Early in the present year a few cases of ankylostomiasis were reported in the Saarbrück district: but the prompt measures adopted seem to have been crowned with success.

* Since the above was written official advices from Westphalia give the actual extent of the malady in the district as 17,161 cases out of a total of 188,730 men, i.e., 9.09 per cent. The number of cases under treatment has considerably diminished, the figures having fallen from 7,763 to 4,049 (thirty-seven pits).

ARRANGEMENTS FOR COMBATING ANKYLOSTOMIASIS IN WESTPHALIA.

Bacteriological Institute, Gelsenkirchen.—At this establishment, which is under the management of Dr. Hayo Bruns, researches have been carried out at the instance of the Hibernia Company, in connection with the life history of the worm, its resistance to disinfectants, and other points, the result being to afford valuable information to the mineowners in their endeavours to stamp out the disease.

The Knappschaftsverein, Bochum.—This institution has, as already mentioned, provided portable hospitals for use at several of the infected collieries, and has instructed its own medical men in the detection of worm ova in fæces. It has issued a circular to the miners, impressing on them the necessity for cleanliness and for using the pails set up in the pit; and recommending them, in the general interest, to denounce such comrades as commit a breach of the regulations by depositing their fæces in the mine (a breach which is, moreover, punishable by fine on being brought to the notice of the Lower Court). The association also advises the various colliery doctors as to which hospital can receive ankylostomiasis patients, and provides forms for recording the history of each case, the result of the general examination of the underground staff, forms of admission to the hospitals for treatment, and certificates for patients cured or found incurable, as the case may be. These forms are given in full in the appendix. The chief medical officer, Dr. Tenholt, contributed a report on "Ankylostomiasis" to the Brussels Congress of Hygiene.

The Elisabeth Hospital, Bochum.—This hospital receives Roman Catholic miners, and has a special wing for ankylostomiasis patients, where from sixty to 200 are treated at a time by Dr. Deilmann. On entering the hospital the patient has, as soon as is practicable, to furnish a sample of fæces, which is collected in a covered enamelled iron cup placed in the pan of the w.c. Each cup is passed through a hole in the wall into the next room, where it is labelled with the man's name, pit, and No. I, II., or III. to indicate the first, second and third day of the test respectively. The cups are then stored in a covered box on wheels, in which they are conveyed to the laboratory for examination. Some fifteen to thirty samples are examined every day, but, being fresh, no inconvenience is experienced from the smell. If necessary, the samples may be deodorised with potassium permanganate.

The cure at this establishment consists in administering 0.3 gramme of calomel the first day, followed next

morning by 8 to 12 grammes of extract of male fern, and repeating the dose twice afterwards with an interval of one day between, the treatment and examination of the dejecta thus occupying about a week. This examination is made by pouring the sample, mixed with running water, down an inclined plate of blackened glass (see fig. 10) on which the worms are clearly discernible. It is at this hospital that the doctors appointed by the Knappschaftsverein are instructed in the detection of the worm and ova; and it was here that the writer saw a "worm carrier" who exhibited all the external

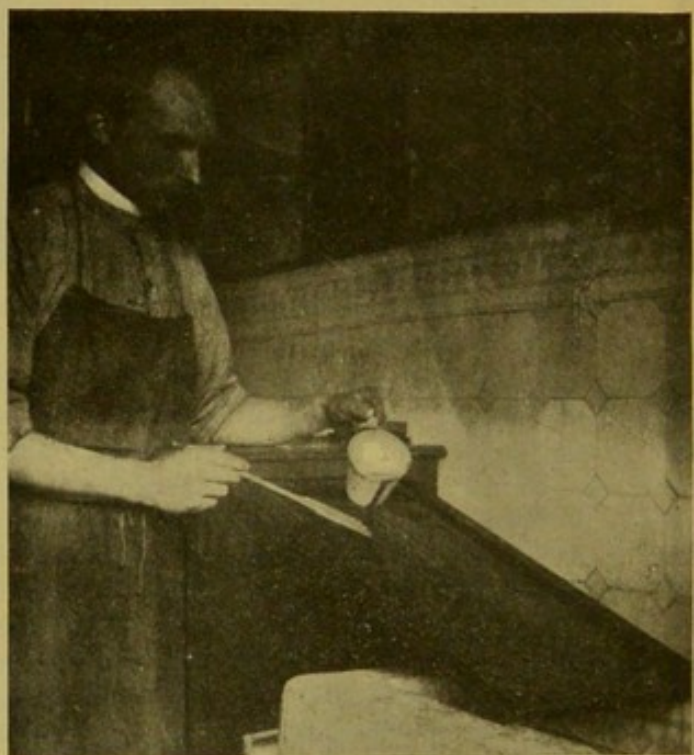


FIG. 10.—EXAMINATION OF DEJECTA FOR WORMS.

symptoms of anæmia, but, nevertheless, did not feel at all unwell.

Erin Colliery, Castrop.—This pit is one of the original centres of the worm disease in Westphalia, and belongs to the Gelsenkirchen Company, one of the pioneers in introducing prophylactic measures to combat the disease. The managing director, Herr Bingel (Rheinelbe Colliery, Gelsenkirchen), favours stringent regulations prohibiting the employment of "worm carriers" underground, believing them to be a potential source of infection equally with the men who are actually rendered ill by the worm. At the Rheinelbe pit only three cases have been observed, the mine being cool

and producing only gas coal; whereas, at the Erin pit, bituminous coal is mined, and a high temperature prevails, owing to the spontaneous heating of the coal by the influence of pyrites. The men do not drink pit water, their usual beverage being coffee, which they take with them in cans, and in case of need they can use the water employed for sprinkling the coaldust, this water being

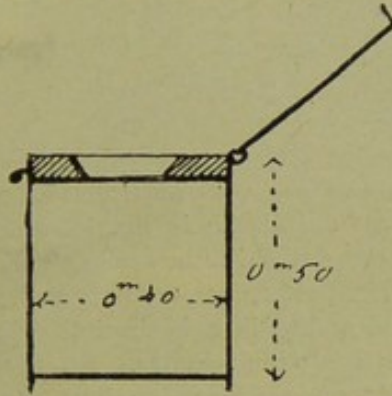


FIG. 11.—PAIL USED AT ERIN PIT.

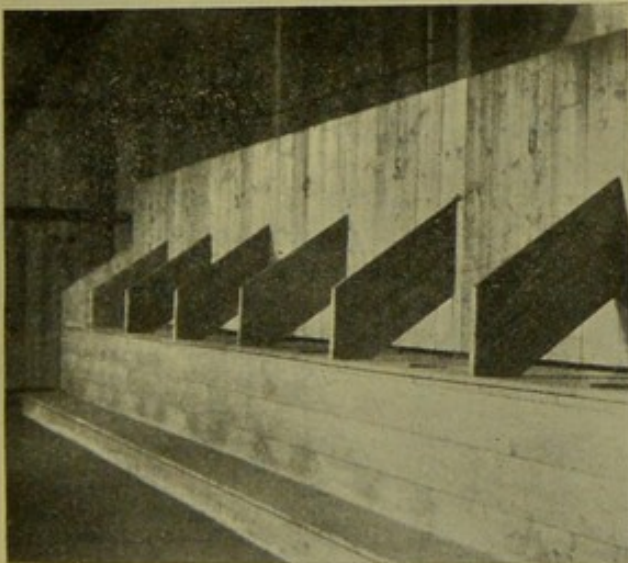


FIG. 12.—INTERIOR OF SAMPLING STATION, FRONT VIEW.

from the district mains, or else filtered through the marl, and in either case of good quality.

An important feature at this pit is the installation of w.c. accommodation of the kind already illustrated (figs. 1 and 2), this installation having been found cheaper than the provision of improved accommodation at the miners' homes, except where new workmen's colonies are built. There are sixteen compartments, and

as the number of men in the largest shift is 800, there is thus one w.c. for every fifty men employed. The accommodation is used by about 500 men daily.

The pit pails in use are of the pattern shown in fig. 11, and about 200 of these are placed in the workings. These pails are looked after by ten men, who go round the workings, wipe the pail seats, throw in a small quantity of milk of lime, fasten up the lids and place them on trucks for conveyance to the surface. On arriving at bank, the pails are emptied, washed out with hot water, and sterilised in an upright cylindrical vessel by

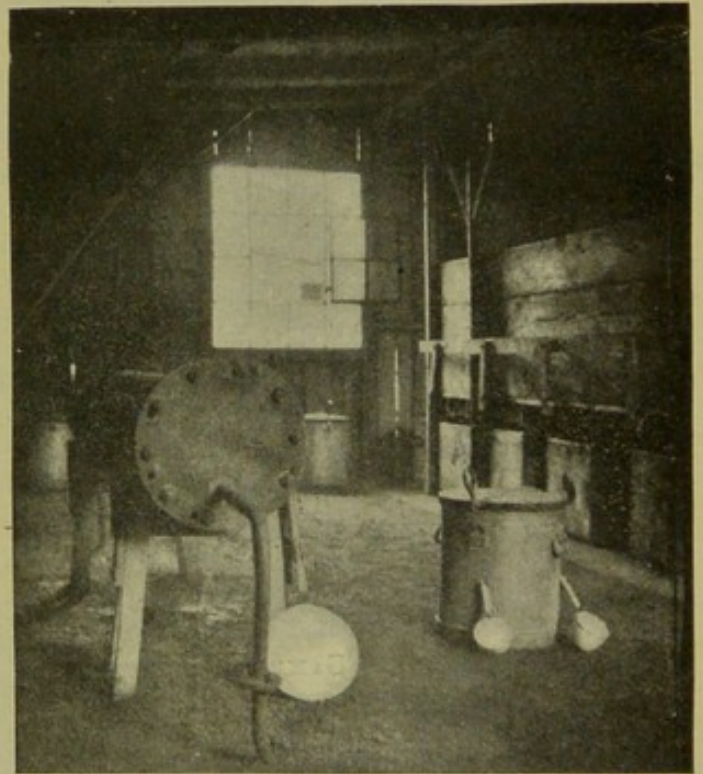


FIG. 13.—INTERIOR OF SAMPLING STATION, BACK VIEW.

exposure to steam at a pressure of one atmosphere (15 lb.) for several minutes.

For the periodical examination of the faeces of the underground staff, a sampling station has been constructed on the premises. The internal arrangement of this sampling station is typical of the others visited by the writer, and is illustrated by the accompanying photographs (figs. 12 and 13), which, however, were not all taken at the same colliery. Fig. 12 represents the front view of the seats, and fig. 13 the back view, with the sampling pans (the large one with long handle), the small saucepans into which the samples are trans-

ferred for examination (at the Erin pit the covered enamelled cups, already mentioned, are used), and the steriliser. The long-handled pans are inserted in the recesses provided underneath the seats, and after their contents have been transferred to the small pans, are

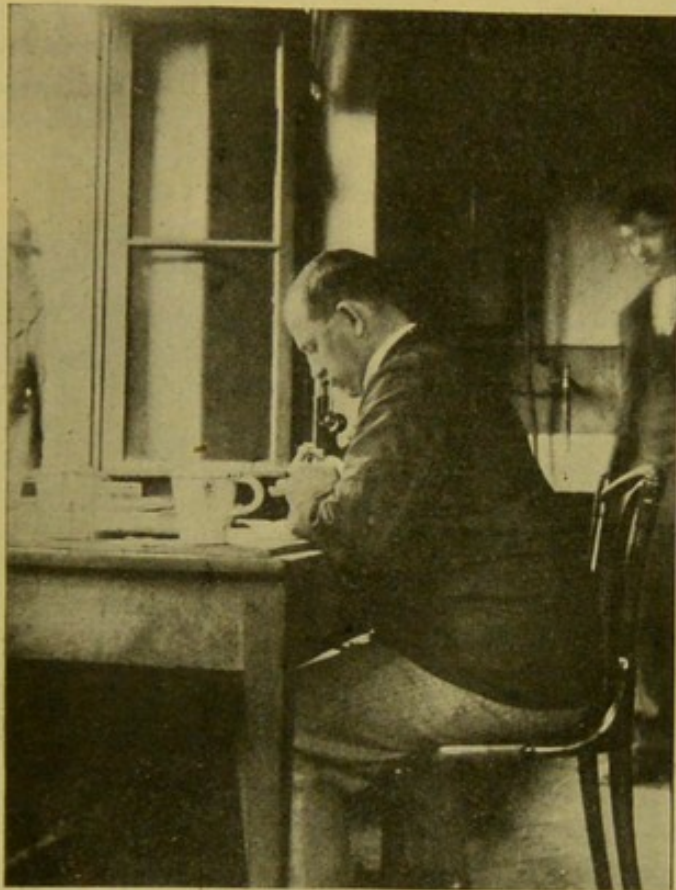


FIG. 14.—EXAMINING SAMPLES UNDER THE MICROSCOPE.

washed and then sterilised in the horizontal cylinder by steam. The examination of the samples is illustrated in fig. 14 (this photo. representing the room at the Lothringen Colliery), which shows some of the enamelled cups containing the samples.

When the microscopical examination shows positive results, the affected miner receives a certificate, which entitles him to draw sick allowance, and he is lodged in the barrack (fig. 15) provided by the Knappschaftsverein. There are forty beds, twenty in each wing, with a central hall where the inmates feed and which they use as a sitting room, forty being treated every week. The treatment consists in the administration of 5 grams of *extractum filicis*, together with calomel, on Mondays and Wednesdays, and the inmates remain in barracks until the end of the week. The cost of board is paid by the

Knappschaftsverein, food being provided by a contractor at the rate of 2s. per man per diem. The colliery has engaged the services of a medical man, at a remuneration of £150 per annum; and the barrack attendant is paid 2s. a day.

Thanks to the remedial measures employed, the percentage of sufferers from ankylostomiasis at this colliery has been reduced from 80 per cent. to 15 per cent. within a few months.

Von der Heydt Colliery, Herne.—This pit, which is the property of the Harpen Company, employs 1,000 men underground, and is provided with a sampling station, barracks, and a small w.c. installation consisting of ten cabinets with partitions of wired glass. The pails in use are shown in fig. 16, and are of the same type as those at Erin, the smaller pails on the left being an older pattern, now discarded. They are sterilised by steaming in a horizontal cylinder, about 12 ft. long, for five to ten minutes.

The resident manager, Herr Luethgen, states that the company employs the services of a medical man for two to three hours a day, in return for an honorarium of £12 10s. per month, and two barrack assistants at £5



FIG. 15.—BARRACKS AT ERIN PIT.

each per month. The microscope cost £10, fitting up the sampling station £15, and sampling pans £5.

The cure in barracks (fig. 16A) lasts ten to twelve days, and any men not cured on their third sojourn in barracks are employed above ground. At the first examination

of the whole staff the percentage of sufferers was found to be 19.52 per cent., including three men working at bank, but formerly employed in the mine. By the second examination these figures had receded to 13.19 per cent., by the third to 8.06 per cent., by the fourth to 3.63 per cent., by the fifth to 4 per cent., by the sixth

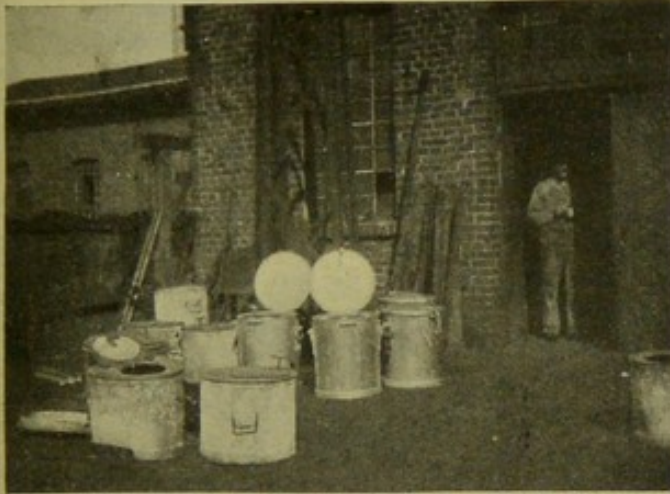


FIG. 16.—PAILS AT VON DER HEYDT PIT.

to 4.67 per cent., and by the seventh to 4.04 per cent. (28 men out of 693 examined up to end of September) Seventy-five of the men treated after the first examination were cured before the second, leaving 32 uncured, and only 3 from the first batch were still uncured when the seventh examination was made. Permission was obtained to suspend sprinkling in the mine between the first and second examinations, and experiments were made with regard to the resistance of ankylostoma ova to drought, the results of which confirmed the view that moisture is an essential factor in the vitality and development of the ova and larvæ.

The cost of feeding the men in barracks is 2s. 6d. per diem, and the company pays the difference between the sick allowance and full earnings, as well as a gratuity to men with large families. On this latter score, the disbursements from January to September last totalled £235. The chief source of expense, however, is the loss incurred by the reduced output of the pit, this loss being estimated at £3,500 to £4,000 in the last twelve months.

Shamrock Colliery I. and II., Herne.—The proprietors of this colliery, the Hibernia Company, were among the first to take steps to fight the worm disease in this district, and the resident manager, Herr Meyer, engaged

the services of Dr. Bruns to investigate the life history of the parasite, and the best means of preventing the spread of infection. Herr Meyer was also an active supporter of the movement which culminated in the introduction of the present compulsory regulations, being convinced that some such measures were essential in order to prevent widespread disaster.

The sampling station is of the same kind as that described above, and w.c. accommodation is shortly to be erected in place of the ordinary cesspool closets now in use. An innovation in connection with these w.c.'s will be the provision of a supply of roll sanitary paper, the cost of which is estimated to work out at about 1s. per diem. This plan is adopted with the idea of preventing the obstruction of the pans and pipes by the coarse paper otherwise likely to be employed.

There is a barrack, containing forty beds, of the usual type (fig. 17), but the central hall was constructed of brick, so as to be available for other purposes when no longer required for its present object. The services of a doctor have been engaged, at a fee of £15 per month, to superintend the examination of dejecta and the cure.

The cost of erecting the sampling station and central hall of the barrack, together with the provision of 388 portable pails for use in the pit, amounted to a little over £1,900. There are sufficient pails to supply one to every four men in the pit during the morning shift;

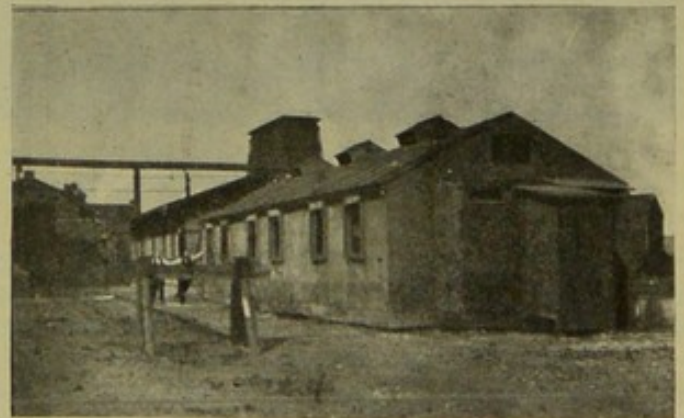


FIG. 16A.—BARRACKS AT VON DER HEYDT PIT.

and at each loading place in the shaft there is a group of several pails for the use of the men at work there. The pails are of two sizes: a larger kind, holding 16½ gallons, for use in the road, and a smaller type, holding 12 gallons, to be set up near the working face. The pails are placed in recesses cut in the walls, and over each

is fixed a sloping roof of boards, to prevent the men standing on the tops of the pails themselves. The latter differ somewhat from those already described, the loose wooden ring inside being replaced by two pieces of wood fixed on the outside, as shown in fig. 18. The pails are numbered differently for each district of the pit, and one man in each district is charged with the task of visiting them in turn, wiping the seats, throwing in a certain quantity of milk of lime kept in an adjacent half barrel, and placing them on the tubs for conveyance to the pit bottom. On reaching bank the contents are discharged into a deep cesspool, and the pails, after being washed out, are sterilised in the steam cylinder shown in fig. 19, and washed over with milk of lime. The contents of the cesspool are sold to local cultivators for manure. The fear having

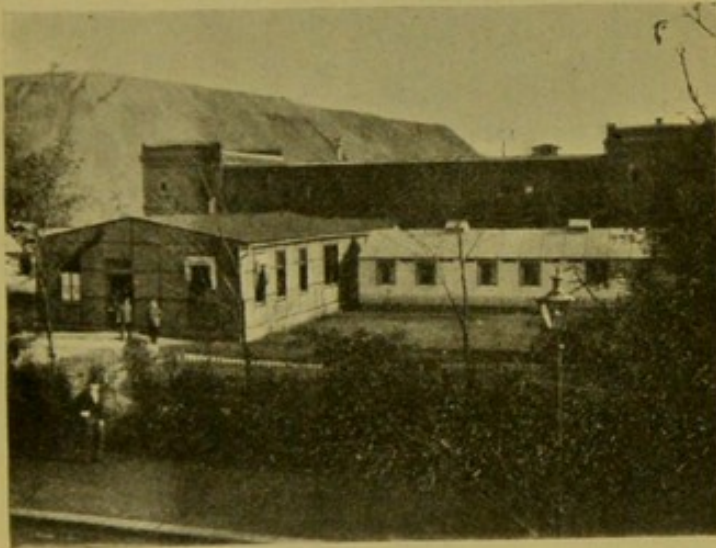


FIG. 17.—BARRACKS AT SHAMROCK PIT.

been expressed that infection might be spread through the use of this fertiliser, the condition of the cesspool contents was investigated by Dr. Bruns, who found that any larvae or ova present perished quickly through lack of oxygen, especially in the deeper layers, and that, in any event, the subsequent exposure to sunlight would infallibly ensure their destruction, so that no danger could accrue.

Any men detected fouling the pit with dejecta are summoned before the Court and fined 30s. to 50s.; and should it be discovered that any overman has failed to notify any case of breach of the regulations that has occurred within his knowledge, he is deprived of a portion of the usual premium.

Of the 2,100 men employed underground, 32.06 per cent. were found to be suffering from the worm at the time of the first complete examination of the staff in December to May last. On the second examination (May-August) the proportion had fallen to 28.42 per cent., and out of over 1,000 examined up to the end of September, for the third time, only 15½ per cent. of infected cases were discovered. In selecting the men for examination every week, regard is paid to the necessity for not unduly depleting any one class of workers in the same part of the mine, and thereby retarding the work

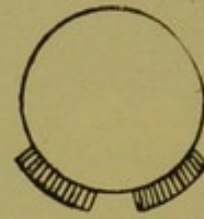


FIG. 18.—TOP OF PAIL USED IN SHAMROCK PIT.

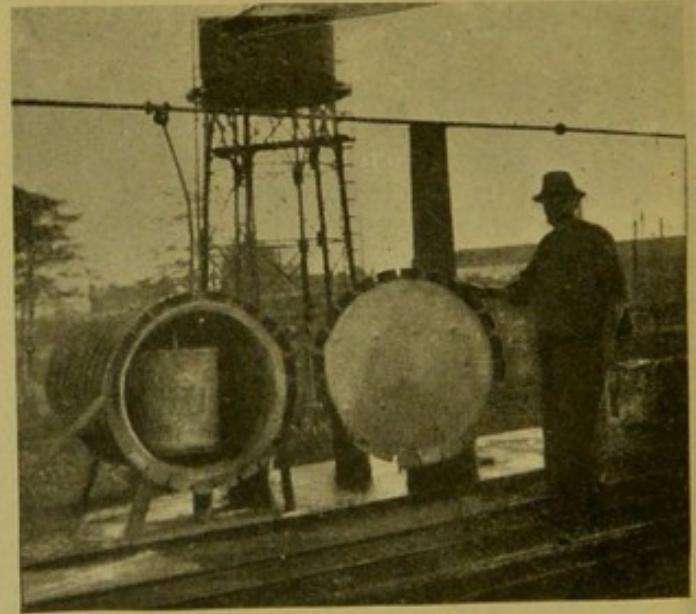


FIG. 19.—DISINFECTING PAILS AT SHAMROCK PIT.

of the other men. For example, not more than one shot-firer is taken from each district. Furthermore, in order that any men who are actually ill may have the earliest possible chance of cure, the whole shift passes in review before the doctor, who then picks out those apparently anemic.

In addition to the extra clerical labour entailed by the compilation of the necessary statistics, the expense

of making up the difference between the sick allowance and full pay of the men undergoing the cure is borne by the company, an extra allowance being made to men with large families. On this score the expenditure in the month of August amounted to £450. The Knappschaftsverein provides board for the men in barracks.

It is estimated that about 23 per cent. of the underground staff work in a temperature lower than 20 degs. Cent. (68 degs. Fahr.), 60 per cent. in temperatures between 20 and 25 Cent. (68 to 77 Fahr.), and 17 per cent. in temperatures between 25 and 29 Cent. (77 to 80 Fahr.). In order to ascertain the effect of drying the pit, permission was obtained from the Mining Board to suspend sprinkling operations in two districts at a time for a period of two to three months, except for local spraying just at the time shots are being fired. Samples of fæces were placed in dry parts of the workings, and examined every two or three days, with the result that by the middle of September no ova or larvæ could be found alive. This suspension of sprinkling will be extended to all the fourteen districts of the mine in turn, the experiment being expected to last about fourteen months.

In connection with the question of sprinkling only while shot-firing is in progress, the little booklet of instructions issued to the shot-firers at the Shamrock pit enjoins that, when the shot-holes are charged, the sprinkling apparatus provided in the vicinity must be set to work by the foreman blaster at least three minutes before the shot is fired, and kept going for not less than ten minutes after the blast or miss-fire. The arrangement of the spraying device is such as to ensure a thorough drenching of the face and the surrounding atmosphere.

Lothringen Colliery, Gerthe.—This pit was one of the originating centres of the disease in Westphalia, and at the first examination of the staff of 1,334 men employed under ground, 758, or 43 per cent., were found to be infected with the worm. In consequence, however, of the systematic treatment of the sufferers, the percentage was reduced before the second examination (in September) to 24.5 per cent., there being then only 404 sufferers out of a total of 1,636 men employed. Attempts have been made to disinfect the workings with milk of lime, but in view of the problematical value of this operation they have been discontinued.

The assistant doctor appointed by the Knappschaftsverein examines about twenty samples of dejecta daily, in the ambulance room (fig. 14); but though the smell

is rather unpleasant in the hot weather, no special method of ventilation has been adopted, the covered cups shown in the illustration being merely placed outside the window and handed in, one by one, as required. In order to prevent the men going away to other pits before their examination is completed, and thus causing unnecessary trouble to the doctors, they are charged a fee of 2s., which is returned them by the Knappschaftsverein on production of the certificate of immunity or cure.

The treatment consists in the administration of 10 grammes of *extractum filicis*, in doses of 2, 4, and 4 grammes on three successive days. The first dose is given in the evening, without a purgative, and the second on the following morning, this time with purgative. The sufferers remain for the three days in barracks and are then re-examined in accordance with the new regulations. The barracks contain twenty beds (see fig. 20, outside view, and fig. 21, interior); and the



FIG. 20.—BARRACKS AT LOTHRINGEN PIT.

cooking-room attached to this temporary hospital was erected at a cost of £500. Since August 15 the men confined to barracks have received full pay, the difference being paid by the colliery; w.c. accommodation, of the same class as at the Erin pit, is in course of erection, at a cost of about £150. Portable pails have been placed in the pit, and five to six men in each district are charged with the duty of keeping them clean and sending them up to bank to be washed and disinfected.

It was at this pit that the discovery was made that reservists, who had been serving their time with the colours, were still carrying the worm.

Graf Schwerin Colliery, Castrop.—This pit, which belongs to the same proprietors as the Lothringen pit, namely, the Gewerkschaft Graf Schwerin, has the unenviable distinction of being about the most seriously infected pit in the whole district, a condition un-

doubtedly due to the moisture and high temperatures prevailing in the workings (27 to 30 degrees Cent. or 81 to 86 degrees Fabr.). Out of 1,200 men employed underground, no less than 86 per cent. were found suffering from the parasite at the time of the first examination between December and May last. Fortunately, however, a considerable amelioration has taken place since then, the figures having receded to 35 per cent. (1,000 examined) on the second examination in September. The first attempts at coping with the malady were made in December 1902, and the disinfection of the workings with quicklime and carbolic acid was tried. Whether any good effect was produced, however, remains unknown.

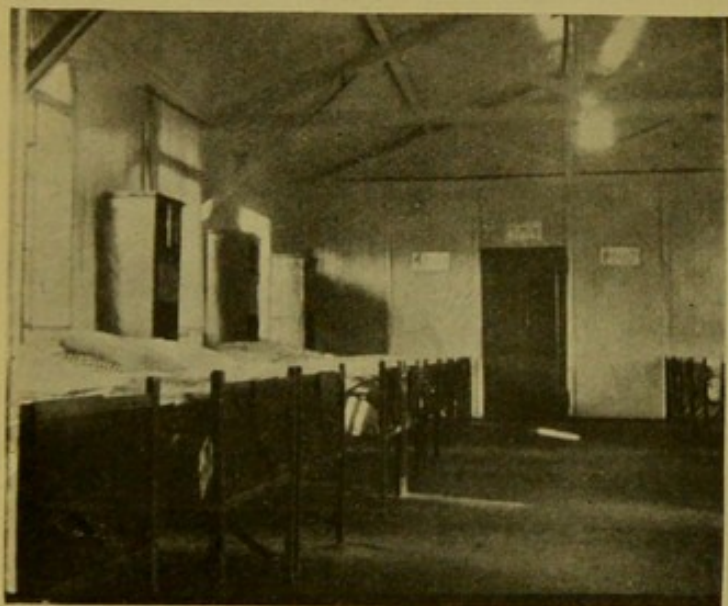


FIG. 21.—BARRACKS AT LOTHRINGEN PIT.

No special sampling station has been erected, an ordinary (primitive) closet on the premises being utilised for that purpose. A small building, opening on to a fair size garden, has been fitted up as a barracks, holding fifteen beds, the men feeding and sitting in the same room. Unlike the regulations in force elsewhere, the men in barracks are allowed to go where they like in the afternoons until 7 p.m. The cure occupies five to six days, the examination of the dejecta being performed on the last three days. If the cure does not succeed the first time, it is repeated after an interval of two or three days, a third cure being given if necessary. Pails are provided in the pit, one man in each district being appointed to look after them, and at the pit eye there is a latrine of

ten stalls fitted with similar pails. No w.c. accommodation has been installed at the surface, and altogether the arrangements seem to be of an inferior order (in external appearance) to those of the other pits visited.

BELGIUM.

As long ago as 1884 the presence of ankylostomes was discovered in a fatal case of anæmia, by Professor Masius at the Hôpital de Bavière; and later on, in 1885, Dr. Kuborn, of Seraing, investigated the case of certain anæmic Italian miners, who had previously worked in the St. Gothard tunnel, and whom he found to be attacked by ankylostomiasis. Subsequently the secretary of one of the provident Socialistic organisations in the Liège district noticed that claims for sick pay were particularly frequent in the case of men working at certain pits: he consulted Professor Malvoz, of the Bacteriological Institute at Liège, and investigations were made which showed an extensive prevalence of worm disease in the district. The interest of Dr. Barbier, president of the Liège Provincial Medical Council, was enlisted in the matter, and an enquiry on a large scale was instituted in order to definitely ascertain the topography of the disease and discuss the most suitable prophylactic measures to be adopted. In this enquiry the council, having no powers to pursue its researches, was dependent on the goodwill of the mine-owners for the supply of samples of fæces and particulars as to the condition of the mines; and it was only in certain instances that the requisite facilities were afforded by the owners. Notwithstanding the difficulties thus encountered, important results were obtained, the presence of the disease being detected in a number of pits which the owners and local doctors had declared to be immune.

In 1899 the Belgian Government appointed a Commission to continue the work begun by the Medical Council—in fact, three Commissions were nominated, one for each of the colliery districts of Liège, Charleroi, and Mons. Even then, no power was given to any of the Commissions to obtain the material for their researches, but they were left to proceed as best they could. The consequence is that, although the Commissions of Mons and Charleroi endeavour, by the offer of a small fee, to induce the medical men at the various collieries to send samples of dejecta for examination, they have not, so far, received more than 3,000 samples, and as the number fixed in the terms of appointment was 10,000 it is expected that the enquiry will take another two years. The Liège Commission has been more fortunate, having been able to complete its task, but the Govern-

ment is apparently taking advantage of the delayed reports from Mons and Charleroi to put off the consideration of any legislative action, in view of the opposition which it is believed would be offered to the introduction of compulsory regulations. Unlike Westphalian mineowners, those in Belgium are, to a large extent, either indifferent or hostile to any projects for combating ankylostomiasis, some of them indeed going so far as to allege that the Government has seized on the matter as a pretext for harassing the colliery industry, so as to be able to acquire the mines for the State. Where underground pails have been provided in the Liège district, no serious attempt seems to have been made to persuade or compel the men to make use of them, the excuse for this supine policy being that the miners are too independent to submit to any regulations of the kind, and that they have absolutely refused to see after the conveyance of the full pails to bank. Hence the pails are no longer sent down into the pits, but may be seen lying about and rusting away at the surface.

With regard to legislation, it is true that the Government in 1899 drafted a set of regulations, in which it was proposed to divide collieries into four classes, ranging from highly-infected pits to those found totally exempt. In pits of the first class it was proposed to insist on the introduction of portable pails in the workings, and the provision of water for drinking and for washing the hands before meals. In the case of other pits the intention was to prohibit the engagement of men unprovided with a certificate of immunity. It was also proposed to render the installation of surface w.c. and douche bath accommodation obligatory at all mines.

These projects met with such opposition that a modified form was substituted, in which the classes of mines were reduced to two—infected and immune—while the clause relating to certificates was suppressed. Even this smaller measure failed to secure the adhesion of the representatives of employers and miners to whom it was submitted, and the whole project was therefore abandoned, the Ministry of Industry then appointing the aforesaid investigating commissions at Liège, Charleroi and Mons, to accumulate material for future regulations.

The subject of ankylostomiasis engaged the attention of the International Hygienic Congress and the International Congress of Miners, both held in Brussels during the present year. At the first-named, papers were read by Monsr. Victor Watteyne, and by Drs.

Barbier, Breton and Tenholt; and a resolution was adopted recommending compulsory examination of all miners applying for work, compulsory notification, by the mineowners, of all cases of the disease among their staff, and the provision of suitable w.c. accommodation at the surface and of portable pails underground. Other points recommended by the Congress to the attention of mineowners and managers, included the advisability of thoroughly ventilating and cleaning the workings, erecting special dispensaries for the treatment of ankylostomiasis patients, and spreading information as to the benefits of personal hygiene among the miners by leaflets, lectures, &c. At the Miners' Congress it was stated that some 10,000 miners round Liège, or nearly 70 per cent.* of the whole, were suffering from the worm; and it was resolved that legislation should be introduced to compel the mineowners to provide baths and other sanitary appliances, to safeguard the health the men, and also to employ all the known efficacious means for combating the disease. It does not, however, appear that this resolution has had much effect in inducing the men to avail themselves more largely of the washing and w.c. accommodation already provided at the collieries visited by the writer, a large proportion of the men still preferring to go home unwashed.

LIEGE.

In this district the researches of the Commission under the presidency of Dr. Barbier have shown that out of seventy-two pits in the vicinity, forty-nine are infected, and twenty-three immune or have only a single case of the disease. The degree of infection amounts to below 10 per cent. in thirteen pits; from 11 to 25 per cent. in twelve pits; to 25–50 per cent. in fifteen; and over 50 per cent. in five pits. The total number of men engaged at the twenty-three immune pits amounts to 5,000, whilst the forty-nine infected pits afford employment to 22,000 men. Altogether it is computed that nearly 7,000 men, or about one-fourth of the entire mining population of the district, are affected by the disease. From the enquiries made as to the conditions of temperature, moisture, &c., prevailing in the various pits, Dr. Barbier has compiled a tabular statement, which confirms the view that warmth and moisture are essential to the propagation of the worm. This is somewhat strikingly exemplified in the case of the Herve district, on the eastern bank of the Meuse. Here the pits are cool, the temperature being almost everywhere below 20 degs. Cent. (68 Fahr.), and mostly dry; whereas those

* This figure seems erroneous, there being 30,000 miners in the Liège district.

on the opposite bank and to the westward are warmer and moist, pools of water being frequently found in the workings. At the Colard pit, Seraing, in particular, where 75 per cent. of the men examined were found to suffer from the worm, the temperature is 24 to 27½ degs. Cent. (76 to 82 Fahr.), and the workings damp, with numerous pools, and the same applies more or less to the other most seriously infected pits in the district.

The prevalence of ankylostomiasis has proved very expensive to the local friendly societies, which are for the most part somewhat badly organised, so that the men are compelled to work when they are really unfit. The mineowners do not support the men's societies, but prefer to allow sick miners 80 c. (8d.) a day for the first three months, and 60 c. (6d.) for another four weeks, after which the allowance ceases. As, owing to the heavy drain on the funds in case of illness, the local friendly societies began to refuse application for membership from men working in infected pits, the Liège Provincial Council has for the past four years voted an annual sum of £800 for the purpose of providing an allowance of 1s. 3d. per diem to men invalided through ankylostomiasis. In addition to this, the Council has devoted £200 a year to the furtherance of research work in connection with the worm.

Formerly no payment was made from the Council fund until the invalids had been out of work for a month; but as this was recognised as a hardship, the rule has been withdrawn. On the other hand, it is said that certain unscrupulous miners obtained medical certificates on the basis of infected dejecta purchased from actual sufferers, and were thus enabled to lead an idle life for a practically indefinite term. However this may be, the Provincial Council on October 1 last issued amended regulations stating that no miner shall in future be entitled to receive an allowance from the ankylostomiasis fund unless he can produce a certificate from a hospital, the Miners' Dispensary, or the medical man of some other approved institution, which certificate must state the period he will have to abstain from work in order to go through the cure and attain convalescence. This precaution ensures that the reports will be based on *bonâ fide* samples of dejecta.

Thanks to the energy of Professor Malvoz, assisted by a donation of £120 from the Provincial Council, and a similar amount collected from some of the colliery owners in the district, it has been found possible to establish a miners' dispensary at Liège (Rue Lambinon), under the care of Dr. Lambinet. This little hospital, which is fitted with fifteen beds, treats

ankylostomiasis patients gratis, a general invitation being issued to all miners who believe themselves affected to visit the dispensary for examination on Thursdays. The preliminary examination consists in administering a suppository, which acts in a very short time; and, if the microscope shows the presence of ova, the patient is admitted for cure.

The medicine consists of a dose of jalap and calomel (30 centigrammes each), given in the evening, and followed the next morning by—

	Grammes.
<i>Extractum filicis</i>	4
Chloroform	3
Castor oil	40

in two doses, with an hour's interval between. This mixture is found to be quite safe, and does not produce vomiting. The patient sleeps for about five hours, and takes another dose the next day. The motions are collected in a fine sieve, which retains the worms and enables their number to be ascertained. The particulars of each case are entered on forms (see appendix), so that a complete record of the work done is obtained.

Since the opening of this establishment in May last, 630 miners have presented themselves for examination, and of these, 150 cases have been treated on the premises. The cost of the establishment is estimated at about £280 to the end of the current year. Next year it is hoped that the attendance will be greater, and that assistance in the matter of the extra funds required will be forthcoming. During the time the men remain for the cure, the assistant converses with them on the question of personal cleanliness while at work, and indicates the precautions that should be taken to avoid re-infection. Thanks to this information, and the not altogether pleasant character of the cure, it is believed that a considerable moral influence is being exercised, inasmuch as the patients spread the information among their comrades; and it is hoped that the educational value of the establishment will increase with the sphere of its operations. In addition to the dispensary, Professor Malvoz has under consideration the establishment of a sanatorium for convalescents on similar lines to the one already existing for tuberculosis patients.

Speaking on the question of Government regulations, Professor Malvoz advocates the compulsory provision of portable pails in all mines, unless the owners can satisfactorily demonstrate within a period of six months by the certificate of an approved medical man, that their premises are quite free from infection. This, he considers, would save many collieries the unnecessary

expense of providing pails where the need for them does not exist. At the same time, no mineowner should be allowed to discharge a man on account of being infected with the worm.

Colard Pit, Seraing.—According to the report of the Liège Commission, 75 per cent. of the men examined at this pit, which belongs to the Société Cockerill, were infected with the worm, the conditions of the workings as regards warmth and moisture being highly favourable to the development of the ova.

The company has provided a number of pails for use underground, and has recommended the men to use them, and also to wash the hands before eating or drinking; but the men are said to make no use of the advantages offered. Being very independent, they refused to see that the full pails were forwarded to the bottom of the shaft; and then when a premium was offered to some of them to attend to this task, the others complained of favouritism, so the system was dropped.

Subscribers to the sick fund club attached to the works receive an allowance of 1s. 8d. per diem when ill, and this is supplemented by 1s. 2d. from the Provincial Council fund. They are treated in the Cockerill Hospital, which accommodates 80 to 150 ankylostomiasis patients per month. The treatment consists in administering a dose of Duhourgan's *Venifuge français* (male fern, chloroform, and castor oil), which is, however, a somewhat expensive remedy, the dose costing 4s. 10d. Jorissen's preparation (condurango, terpine and sulphur) is also administered, and is said to be efficacious. The sufferers only remain one day in hospital, but as they receive a glass or so of tonic wine in addition to the medicine, the cost of the cure, including medical attendance, amounts to about 8s. per case, the total expenditure on this head having been £160 in the last six months. The percentage of men ill from the attacks of the worm is said to be very small; and it is stated that men addicted to the practice of chewing tobacco are more badly affected than others, the symptoms of anæmia being more pronounced. One of the engineers at this mine has been infected with the worm for some considerable time, and has been through the cure several times already without success.

The washing accommodation at the Colard pit consists of fifty-six cabinets containing circular basins sunk about 2 ft. below the floor level. Formerly these were filled with water, but recently douches have been fitted and holes made in the bottom of the basins for the water to run away freely. Hot and cold water are laid on, a

steam heater being fitted up in the washing room, so that the temperature can be regulated according to the requirements of the bathers. At this colliery, also, a number of the men decline to avail themselves of the accommodation provided.

Gosson-Lagasse Colliery, Montegnée.—This colliery is one of those in which the partial examination of the underground staff by the Medical Commission revealed the presence of 50 per cent. of sufferers from the worm (based on the number actually examined). The conditions are favourable to the development of the ova, the workings being damp and warm (about 70 degs. Fahr.), and there are frequent changes among the men. The premises are fitted up with the washing house and vestiary already mentioned (see introduction), sufficient for the entire staff of 800 men, but used by only about half that number. Eight Lambert dry-earth closets (fig. 6) are also provided, in addition to those used by the officials and a couple of cabinets for the women engaged at the pit mouth.

Espérance-Bonn-Fortune Colliery, Montegnée.—More earnest attention seems to have been devoted to the question of ankylostomiasis at this colliery than at any of the others in the Liège coalfield. Already in 1899 the management circulated among the miners a small pamphlet calling the attention of the men to the gravity of the disease, the method of its propagation, the necessity for preventing the deposition of feces in the pit, the desirability of cleanliness, and the advisability of consulting a doctor and following his directions in the event of any feeling of lassitude or weakness. Previous to May 1902, the examination of the dejecta of nearly the whole staff showed that 50 per cent. were affected with the worm. Pails were provided for the use of the men underground, and a supply of quicklime was also provided for sprinkling in the pails after use. The men, however, disregarded the advice given, and, in addition, threw stones and dirt into the pails, which they also declined to draw to the shaft bottom; consequently the effort was abandoned.

In order to obtain an idea of the general state of health among the miners in the district, all men applying for work are obliged to furnish a sample of their dejecta for microscopical examination; but, owing to the relative scarcity of workmen, it has not been found possible to reject any applicants merely because they have the disease. At the present time it is believed, on the basis of this examination, that the percentage of sufferers has diminished, the more so because there are no longer any men compelled to stop work

through illness, whereas last year there were always three or four laid up with the malady.

The installation of douche baths and closets, already described in the introduction, is used by about 70 per cent. of the men. The resident managing engineer (M. Gervers) is himself suffering from the worm, and has undergone the cure several times without success.

Patience-Beaujonc Colliery, Montegnée.—It was at this colliery that the men were supplied with cans of filtered water for washing their hands before eating or drinking; but they objected to the trouble involved, and the system has been discontinued. The same applies also to the pails for use underground. No washing-house or w.c. accommodation has been erected.

Charleroi Coalfield.—The secretary of the Commission, Dr. Van Geersdaele, says that very few cases of ankylostomiasis are known in the district. The mining population numbers about 15,000, and of these some 15 per cent. have been examined. The medical men at the various collieries are requested to send samples, for each of which they receive a fee of tenpence. The samples are placed in small earthenware pots, tightly corked, and enclosed in tins with friction-tight lids, these being then forwarded through the post. The percentage of infected samples is very small, being less than 1 per cent. These cases have been traced to men coming from the Liège district, and in one instance to a soldier who had served in the foreign legion in Africa.

The pits in this coalfield are generally dry, and the coal of a semi-bituminous character, so that the temperature is usually moderate. Enquiry at several collieries yielded only negative results, nor did the secretary of the local friendly society know any cases of the disease. No provision of douche baths or w.c. accommodation seems to have been made anywhere except at Bascoup and Mariemont. At this last-named colliery there are about forty baths, in separate cabinets, made of slate slabs; the baths are circular iron tubs, provided with hot and cold water taps; but these are to be replaced by douches early next year. There are twenty dry-earth closets at the back of the washing hall. In place of the German style of vestiary, the men's clothes here are placed in lockers in a large room; and it is not impossible that this system would lend itself better to sterilisation of the working clothes by means of steam pipes passing through the lockers. The pit is said to be free of ankylostomiasis, the washing accommodation having been provided for general hygienic reasons and not with the idea of combating the malady.

Similarly at the Bois-du-Luc Colliery, a few miles from Mariemont, an installation of 115 douche baths is shortly to be erected by Arend and Co., of Brussels, as a general hygienic measure, although the worm disease is unknown.

Mons Coalfield.—The Government Commission here has, for secretary, Dr. Herman, of the Bacteriological Institute, who has done a good deal of experimental work in connection with the development of the worm, its resistance to antiseptics and the treatment of affected miners. There are about 30,000 miners in the district, and the Commission has distributed a large number of leaflets among these men, to impress on them the necessity for cleanliness in their habits, and pointing out the serious nature of the malady. It is intended to deliver a number of popular lectures on the subject, in order to bring the matter home to those most nearly concerned, and with this object Dr. Herman has had a series of lantern slides prepared from his own fine collection of micro-photographs of the different organs of the worm.

There are ninety-five collieries in the district, but the conditions favourable to the development of the parasite are present in only about half-a-dozen pits, which are of great depth (up to 3,800 ft.) and very warm and moist. Up to the present, infection has been detected at twenty-nine pits, but the examination of the whole number has not yet been completed.

The examination of the samples collected in the Charleroi and Mons districts is performed at the Bacteriological Institute. Within the last two years nearly 3,000 samples have been received; but as the task of the Commission includes the examination of 10,000 samples, it is evident that the report will not be issued for some considerable time. The results obtained so far show that about 6 per cent. of the miners in the Borinage district, to the west of Mons, are infected, but that in the Central Hainault district and Charleroi the proportion does not exceed 1 per cent.

The Bacteriological Institute charges a fee of 1s. 3d. for each sample examined, and the medical man forwarding the sample receives a similar fee, both sums being paid by the Government.

For the purpose of treating sufferers from the parasite, the Provincial Council of Hainault has recently voted a sum of £400 for the establishment of a dispensary on the model of that at Liège. This will be opened on January 1 next, and in the meantime treatment is given at the Bacteriological Institute and at the Mons Hospital free of charge. The medicine is the same as that used at Liège.

With regard to the question of douche baths, some colliery owners say that water is too scarce to use for this purpose; but Dr. Herman mentions in his pamphlet on the prophylaxis of ankylostomiasis that the consumption of water in the douche baths in the barracks at Paris is only $4\frac{1}{2}$ gallons, and the cost $\frac{1}{4}$ d. per head. Again, in the public baths at Frankfurt on the Main (which pay a 12 per cent. dividend), 9 gallons of warm water are supplied at a cost of 1d. per head, including soap and towel; so neither the quantity of water consumed nor the cost need be a deterrent to the establishment of similar baths at collieries.

Concerning the use of pails, Dr. Malvoz believes that, where the thinness of the seams renders the installation of these in the workings difficult, proper security from infection may be ensured if the men will make regular use of the surface latrines, only defecating in the pit in cases of urgent necessity, and then at once giving notice so that the faecal matter can be immediately disinfected and removed.

FRANCE.

It is only very recently that the study of ankylostomiasis has been taken up in France, though the disease has probably existed there a long time. For instance, in 1802 there was an outbreak of anæmia at Arzin, attributed to deficient ventilation, though the symptoms resembled those now recognised as characteristic of the worm. Even as recently as 1875 an analogous epidemic in the Loire coalfield was ascribed by the faculty to the miners breathing air laden with hydrocarbons from the decomposition of the coal.

Attention having been drawn to the matter through the gravity of the situation in Westphalia and Belgium, the Government requested Dr. Calmette, of the Pasteur Institute, Lille, to investigate the subject. The enquiries conducted by Drs. Calmette and Breton, show that about 5 per cent. of the miners in the Loire coalfield are infected, though in general merely to a slight extent. About ten years ago there was a very dangerous epidemic among the miners in this district, where the pits are usually hot, badly ventilated, and damp; but in consequence of the measures then taken, there are now only a very few cases known. The percentage of infected miners in the Herault field is also small (3 per cent.), and there are a few isolated cases in the Aveyron district.

In the Nord and Pas-de-Calais coalfields, where there is a mining population numbering about 80,000, the proportion of sufferers from the worm is estimated at

2 per cent. Though the illness is generally slight, it is considered, in view of the dense population and the frequent changes among the miners, that ankylostomiasis exists in those districts in a latent form, and in relatively high proportion, the potential danger being increased by the absence of any preventive hygienic measures. It is only at new collieries that any provision of latrines has been made at the surface. At the Escarpelle pit, pails were supplied for use in the mine; but the men refused to empty them. In order to prevent the deposition of fæces in the workings, it is a general instruction to the miners in the Nord and Pas-de-Calais to defecate in the full coal tubs. This measure may prevent the spread of the malady underground, but is hardly to be recommended for general application, since it introduces a source of danger to the workers at the surface, especially if the coal is picked by hand.

The French Government has not yet issued any regulations respecting the employment of any prophylactic measures against the spread of the disease; but the writer was informed that a motion to this effect will shortly be laid before the Chamber of Deputies, by one of the labour members, at any rate with a view to the exclusion from work of men unable to produce a certificate of immunity. Such a measure as that already mentioned is believed to be necessary in view of the large amount of foreign labour that will have to be imported to work the numerous new collieries shortly to be opened in the Nord and Pas de-Calais. In the meantime, Dr. Calmette is endeavouring to interest mineowners in the establishment of dispensaries similar to the one he has founded at Lille, for the treatment of tuberculosis, ankylostomiasis, and all other maladies to which miners are liable. At this dispensary about 120 patients are treated per diem. The expenses amounted to £430 in 1902, and, in addition, food was distributed to 178 families at a cost of £560, the total working expenses during the year being thus £990. One of these dispensaries would serve a number of adjacent mines, and would not be very expensive to equip and maintain. As, in France, the employers have to contribute to the workmen's sick fund, it is greatly to their interest to take measures that will minimise the drain on that fund through extensive illness.

In connection with prophylactic measures against the worm disease, Dr. Breton advocates the installation of a laundry at each colliery for washing the men's working clothes, instead of sending them home and

thus running the risk (even though a somewhat remote one) of communicating the malady to the families.

Enquiries made at several collieries, and also of the chief inspectors of mines for the Nord and the Pas-de-Calais, show that there is no great extension of the

malady in those coalfields at present. The pits are said to be generally dry, or too cool for the ova to develop; and the practice of sprinkling to prevent coaldust explosions is infrequent. Douche baths have been established at Anzin.

CONCLUSIONS.

To prevent the extension of ankylostomiasis in mines where the conditions favour its development—namely, the presence of moisture and a temperature exceeding 68 degs. Fahr.—it seems fairly conclusive that the active co-operation of mineowners and men is essential. If the men neglect to make use of the conveniences—baths, latrines, underground pails—which, on account of their general hygienic value, owners should provide, then they have only themselves to blame if the disease spreads and their health suffers.

With regard to changes of work as a cause of disseminating infection, it is certainly advisable, in the interest of the men, that a system of compulsory examination should be introduced, so that none but those who have been provided with a certificate of

immunity from the disease shall be admitted to work in the pit.

Regulations on this head, and also concerning the compulsory use of latrines and pit pails would also strengthen the hand of the employer in the case of careless or obstinate workmen.

In view of the great expense attending on the measures necessary for stamping out the malady when once it has gained a strong foothold—as, for instance, in the case of Westphalia—it will be evident that any outlay entailed on owners by the provision of proper retiring and washing accommodation will be relatively insignificant; and if the two parties concerned, employers and employed, will only work together, there can be no doubt that the scourge of ankylostomiasis can be averted.



APPENDIX I.

(Circular issued to Miners by the Knappschaftsverein Bochum.)

THE MALIGNANT WORM DISEASE

(ANKYLOSTOMIASIS)

is not indigenous, but has been introduced into the country by foreign miners.

In our country it is confined to miners, and with few exceptions to such as are engaged underground.

The embryo worms (eggs and larvæ) can only exist in warm, moist places, out of the sunlight. Consequently the pit presents the most favourable conditions for their development.

When a fully-developed larva—which is too small to be seen by the naked eye—makes its way into the human stomach, and then into the bowels, it develops further into the full-grown worm. This worm immediately attaches itself to the walls of the bowel, and there sucks blood like a leech. In addition, the bite of the worm is poisonous.

The consequence is that the man attacked by the worm becomes gradually weakened, and his face, lips and ears turn pale and livid. The eyes are dimmed, and the inside of the eyelids turns pale and even white. The sufferer is easily tired, a feeling which increases every day, and occasionally swelling of the feet ensues. When this stage is reached, it is urgently necessary that the worms should be got rid of, or life is endangered.

If, however, the illness is detected in good time, it can be easily cured by certain proved remedies which expel the worms.

The chief means of preventing the malady, after all, is to guard against the admission of the embryo worms into the body, and this can be done by the exercise of a little care.

The worms gain entry into the body through the mouth.

The full-grown worms are only met with in the bowels, *nowhere else*. There the female lays a large number of eggs, which, however, cannot develop into larvæ until they have left the body, in the fæces, and are deposited in a suitable place—that is to say, in a warm part of the mine.

A single stool (fæces) from a person infected with the disease may contain many thousands of eggs, and even millions.

If the stool is deposited in a closet or pit pail, then the eggs, and the larvæ which hatch out in a few days, can be removed without danger. If, however, the stool is deposited on the ground, in a corner, in the water gutter, or any other open place in the pit, everyone who afterwards comes in contact with it, either with the hands or the boots, runs a

great danger of himself becoming infected, once the larvæ are on his person.

Furthermore, every place afterwards touched by the polluted boots becomes a source of infection if the worms get on the hands and into the mouths of other miners.

If all miners, without exception, abandon the practice of depositing their fæces on the ground, the disease will disappear of itself, as there will then no longer be any dissemination of the larvæ.

Consequently, every miner should make a practice of relieving himself, at home or at the pit bank, before entering the pit; and, in case of need while at work, should use the pit pails only.

The fear of some miners that the pails themselves form a source of infection are quite groundless. The infection is not incurred at the pails, but only in the manner described above.

The following rules should therefore be observed:—

1. Miners should become habituated to relieve themselves before entering the pit.

2. In case of need while at work, they should resort to the pails only, and ought to use every means to induce their comrades to employ this essential precaution, for the sake of the whole staff. If any man, through carelessness or obstinacy, neglects this most necessary precaution, his comrades should, for their own protection, have no hesitation in denouncing him. He will then be dismissed.

3. The greatest care should be taken to keep the hands out of contact with the mouth while in the pit. This applies particularly to the insertion of the fingers into the mouth, in order to take out a quid of tobacco, and also to picking the teeth, or wiping dust and dirt from the lips and moustache. It is far better to leave this dirt until the time of washing at the end of the shift.

4. Drinking vessels (coffee cans) should be kept, as far as possible, from contamination. On no account should the mouth of the can be wiped with the hand before or after drinking.

5. All eatables should be taken hold of with a piece of paper, so as to keep them out of contact with the fingers.

6. The hands should not be washed in the pit gutters.

7. It is advisable not to carry the lamp by putting the hook in the mouth when going up and down ladders, &c.

8. On entering the washing hall the hands should first be well washed with soap and water before washing the face and the rest of the body.

(A circular of similar tenour is issued by the Mons Ankylostomiasis Commission.)

APPENDIX II.

CERTIFICATE TO BE FILLED UP BY APPLICANT'S FOR WORK.

The undersigned
 born at..... residence.....
 and employed at.....colliery, as.....up to
, has been examined by me for the presence
 of ankylostomes, i.e., ova in fæces (by microscopical exami-
 nation).

Result of examination of fæces on.....Negative. Positive.
 Do. do. do. do. do.
 Do. do. do. do. do.*

Consequently, so far as regards the question of ankylostom-
 iasis, he may.....be taken on to work.
 (Date).....of.....190...

.....
 Doctor appointed by Miners'
 Insurance Society.

* Strike out whichever is inapplicable.

Signature of applicant, to be affixed at the colliery. Signature of applicant, to be affixed in presence of doctor.

CERTIFICATE AUTHORIZING ADMITTANCE TO HOSPITAL.

The miner.....of.....inscribed on the roll as
 No.....of class.....may be admitted to the.....
 Hospital. He ceased work on.....and is under treat-
 ment for.....

Object for admission: Examination for ankylostomiasis.

.....the.....190...

For the Committee of the Miners' Insurance Society, Principal Medical Officer,

The above-named miner was admitted on.....190...

*discharged on.....190...

These dates have also been entered on sick certificate the.....190.....

For the Governors of the Hospital

Marginal note.—The possessor of this certificate is en-
 joined to obey the rules and regulations of the hospital and
 the doctor's orders, on pain of forfeiting all claim to sick
 pay and treatment.

CERTIFICATE OF DISCHARGE FROM HOSPITAL ON COMPLETION OF CURE.

The miner.....of.....admitted into hospital
 on.....to be treated for ankylostomiasis, is hereby
 discharged cured.

Result of examination of fæces for ova on.....negative.
 Do. do. do. do.
 Do. do. do. do.

This.....day of.....190.....

For the Governors of.....Hospital

.....
 Resident physician.

CERTIFICATE OF DISCHARGE UNCURED.

.....the.....190...

To.....

.....Colliery.....

The miner.....of.....last employed at.....
has been found to be infected with ankylostom-
 iasis.

The administration of remedies has failed to effect the
 complete expulsion of the worms.

Consequently, in accordance with the mining police
 regulations the said.....must for the present be
 employed at the surface only.

For the Miners' Insurance Society

.....
 Manager

APPENDIX III.

RECORD FOR EACH PATIENT TREATED FOR ANKYLOSTOMIASIS.

(Issued by Miners' Insurance Society, Bochum.)

Full name.....
 Class : No.....

Residing at.....

BORN.
 Day and year.....
 At.....
 Province (country in case of foreigners).....
CALLING AND RESIDENCE BEFORE ENGAGED AT PIT.

OCCUPATION.
 At..... Colliery. Shaft.....
 As.....
 Under..... Overman.
 Level..... Seam.....
 If engaged at pit bank, in the capacity of.....
 Is sprinkling practised in the whole or part of the workings?.....
 Is pit generally moist or dry?.....
 Are the seams generally level or steep?.....
 Temperature at working face?.....

PLACE AND RESULT OF TREATMENT FOR ANKYLOSTOMIASIS.
 (a) *On First Occasion.*

Hospital.	Date of admission.	Were there any symptoms of secondary anæmia (Yes or No.)	Discharged.	
			Cured on	Uncured on

(b) *On Subsequent Occasions.*

Serial No.	Hospital.	Date of admission.	Were there any symptoms of secondary anæmia (Yes or No.)	Discharged.	
				Cured on	Uncured on

DATE OF ENGAGEMENT AT THE DIFFERENT PITS
 (In serial order).

Serial No.	Pit.	Shaft.	Engaged.	
			On	As

SPECIAL FEATURES OF CASE, TREATMENT, &C.

Date.	Treatment.		
	First Cure.	Remedy.....	Dose.....
	Second Do.	Do.	Do.
	Third Do.	Do.	Do.
	Fourth Do.	Do.	Do.
	Fifth Do.	Do.	Do.
	Sixth Do.	Do.	Do.

Date.	SPECIAL INCIDENTS (COLLAPSE, FAILURE OF EYESIGHT, &C.).

Date.	FATAL TERMINATION OF ILLNESS.
	In consequence of..... (State whether from ankylostomiasis or complications.)

APPENDIX IV.

[STATISTICAL FORM.]

RESULT OF EXAMINATION

Of the working staff at Colliery,
for Ankylostomiasis,
By the Miners' Insurance Society's Doctor
between and 190...

Serial No.	Christian and surname of miner.	No. on pay sheet.	Date of examination.	Result, positive or negative.	Remarks: <i>Tricocephalus dispar</i> , <i>Anguillula intestinalis</i> ?

APPENDIX V.

ENQUIRIES ADDRESSED TO MINEOWNERS BY THE LIÉGE COMMISSION ON ANKYLOSTOMIASIS.

Report on the..... Colliery, at.....,
Shaft.....
Manager, Mr.....

Visited by Mr.....

Present: Messrs.

1. Date colliery opened.....

2. Orographical situation: valley, plateau, riverside.....

3. Quality of coal mined.....

Is the mine fiery, and in what class?.....

4. Depth of various levels.....

5. Are the workings dry or damp (particulars of each level)?.....

Are there any pools of water in the roads?.....

6. Maximum and minimum air temperature in each set of workings.....

7. Is the water running into the pit warm or cold?.....

8. Is the ventilation good?.....

System adopted.....

9. Are horses employed in the pit? If so, how many on each level?.....

10. Number of men employed underground.....
at surface.....

11. Are there frequent changes between this and other pits?.....

If so, name pits.....

What is the average every fortnight?.....

12. Are there any known cases of ankylostomiasis?.....
Has any systematic examination of dejecta been carried on?.....

If so, in what proportion?.....

What classes of men have been examined?—

Sick, anæmic, or taken haphazard from any or all classes of workers?.....

What result was obtained?.....

In consequence of these results have any measures been taken to exclude men from the pit or any part thereof?.....

13. Are the men supplied with potable water and with pure water for washing their hands, &c., in the pit?.....

How is this water conveyed into the pit?.....

Do the men take the water from a cask or other receptacle lowered into the pit?.....

14. Have the men any other available supply of beverage?.....

15. Are there any latrines at the surface?.....

If so, how many and in what proportion to working staff?.....

What system is in use?.....

Is the installation in good order?.....

16. Do the men generally make use of this accommodation?.....

APPENDIX V.—*continued.*

17. Have any regulations been issued (notices, imposition of fines, &c.) to oblige the men to use the surface latrines?

18. What are the average working hours underground?

19. Is there any privy accommodation in the pit?.....

If so, to what extent and proportion to number of men employed?.....

Where situated?.....

What system?.....

Condition.....

How emptied?.....

Has there been any trouble in getting them emptied or raised to bank?.....

Do the men use this accommodation, or defecate on the ground?.....

What regulations have been issued to prevent pollution?.....

20. What is done with the faecal matter from the various latrines, &c.?.....

21. Is there any washing accommodation? If so, of what kind (plunge baths, pans, douches, &c.)?.....

How many, and of what system?.....

Are they used, and by what percentage of staff?.....

22. Are there any vestiaries?.....

Do the men change their clothes on leaving work?.....

Are the working clothes washed at the colliery? If so, by whom?.....

23. What is the report of the medical staff on the general health of the miners?.....

24. Are there any cases of anæmia?.....

" " " miner's anæmia?.....

25. How are the samples of faeces taken? At what dates?.....

No. of samples examined.....

Percentage of total men employed in pit.....

Were the men selected or taken haphazard?.....

Results of examination.....

26. In what state of health were the examined men good, bad, or average?..... No. of each

In what pits have the men been engaged, and when?.....

How many of the miners have drawn aid from the Provincial Council Fund, and to what extent?.....

Remarks.....

(Similar but shorter forms are circulated among mine-owners by the Mons Commission, and also in France by Dr. Breton, of the Pasteur Institute, Lille).

APPENDIX VI.

FORM USED AT THE MINERS' DISPENSARY, LIÉGE, AS A RECORD OF THE CASES TREATED.

1. Full name and address of patient.....

2. Age and status.....

3. Married or single. What family.....

4. Has patient been already examined and treated for ankylostomiasis?.....

5. At what pits has he worked?.....

6. Is he a member of a mutual provident society. If so, what sick pay does he receive?.....

7. Is he a member of a sick fund club?.....

8. Has he received aid from the Provincial Council or any benevolent society?.....

9. When did the malady probably commence?.....

10. Does he work in the pit or at the surface, and in what capacity (hewer, putter, &c.)?.....

11. Are the working places wet or dry?.....

12. Where does the patient generally relieve himself? (In the gates, roads, against timbers?).....

13. Are the food and drink of good quality?.....

14. Does the patient take a douche bath at the colliery, or wash at home?.....

15. What is done with the working clothes, boots, tools, &c., at home?.....

16. Date of examination.....

17. Doctor.....

18. Particulars of case.....

19. Remedies taken by patient.....

20. Results obtained.....

APPENDIX VII.

FORM ACCOMPANYING SAMPLES OF DEJECTA SENT BY POST TO BACTERIOLOGICAL INSTITUTE, MONS.

Name of colliery.....

Pit.....

Level.....

Seam.....

District.....

Miner's name.....

Age.....

Class of work*:

(a) Rock drilling.

(b) At working face.

(c) Haulage.

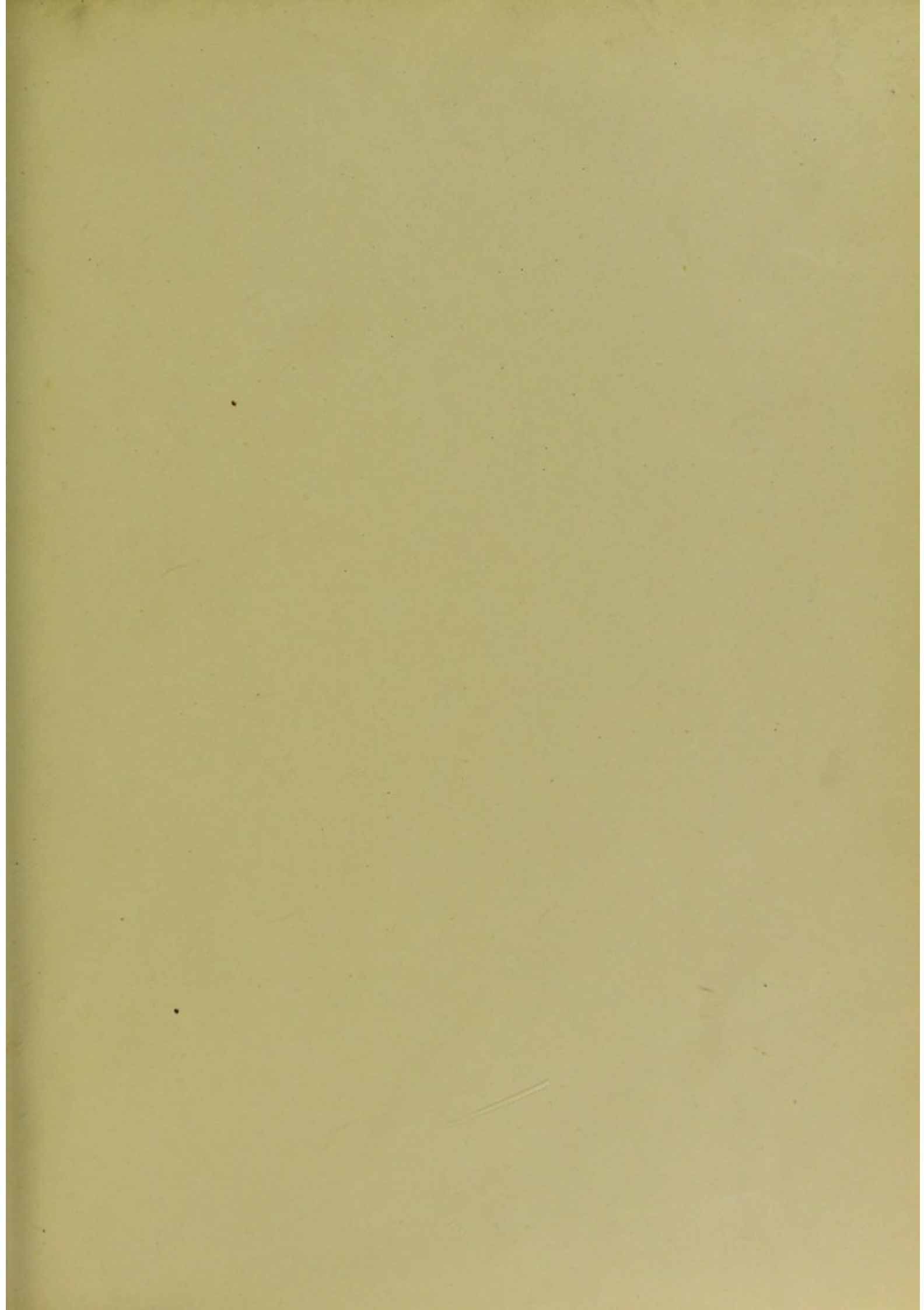
Signature of medical man forwarding sample.....

* Strike out those not required.

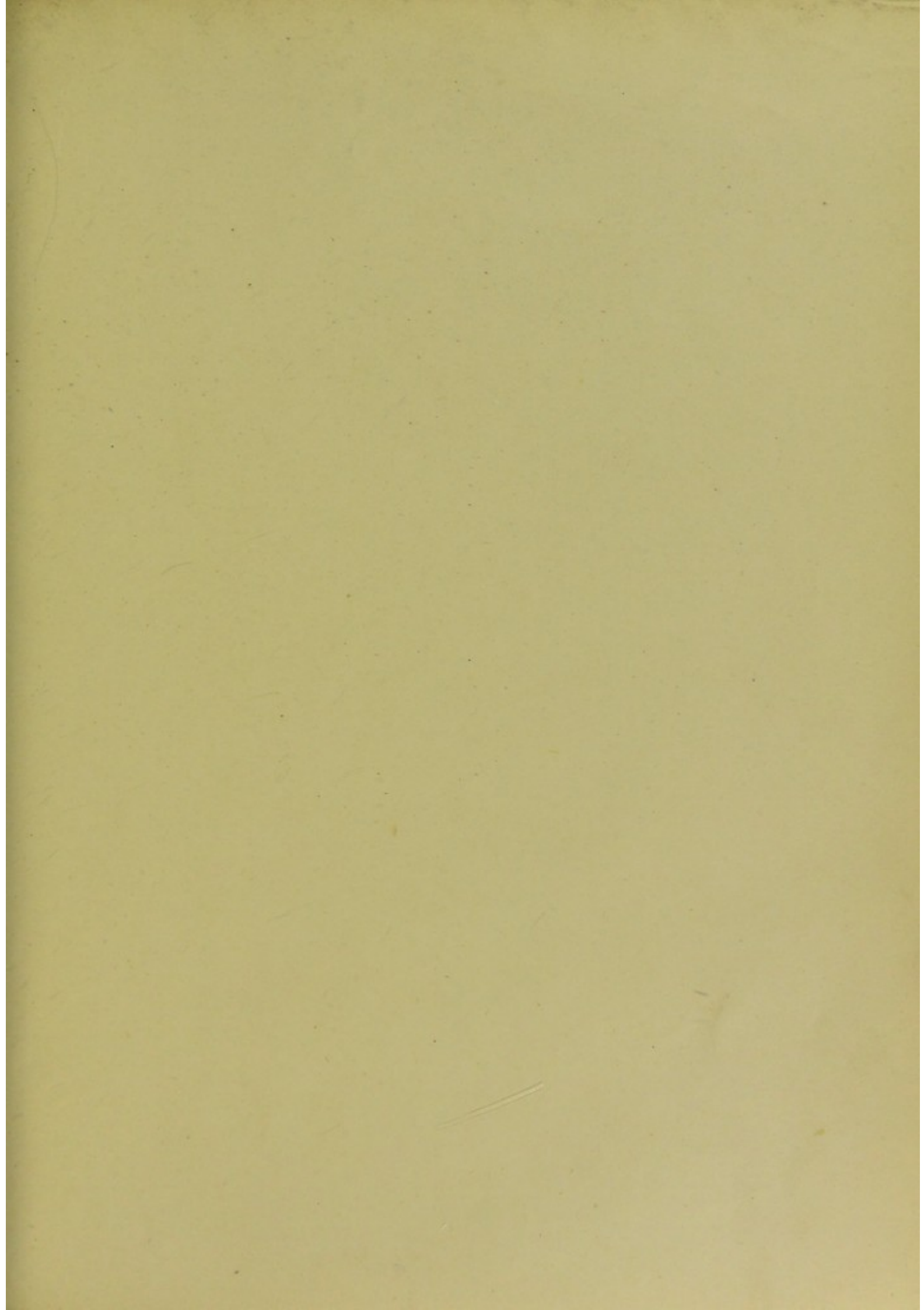
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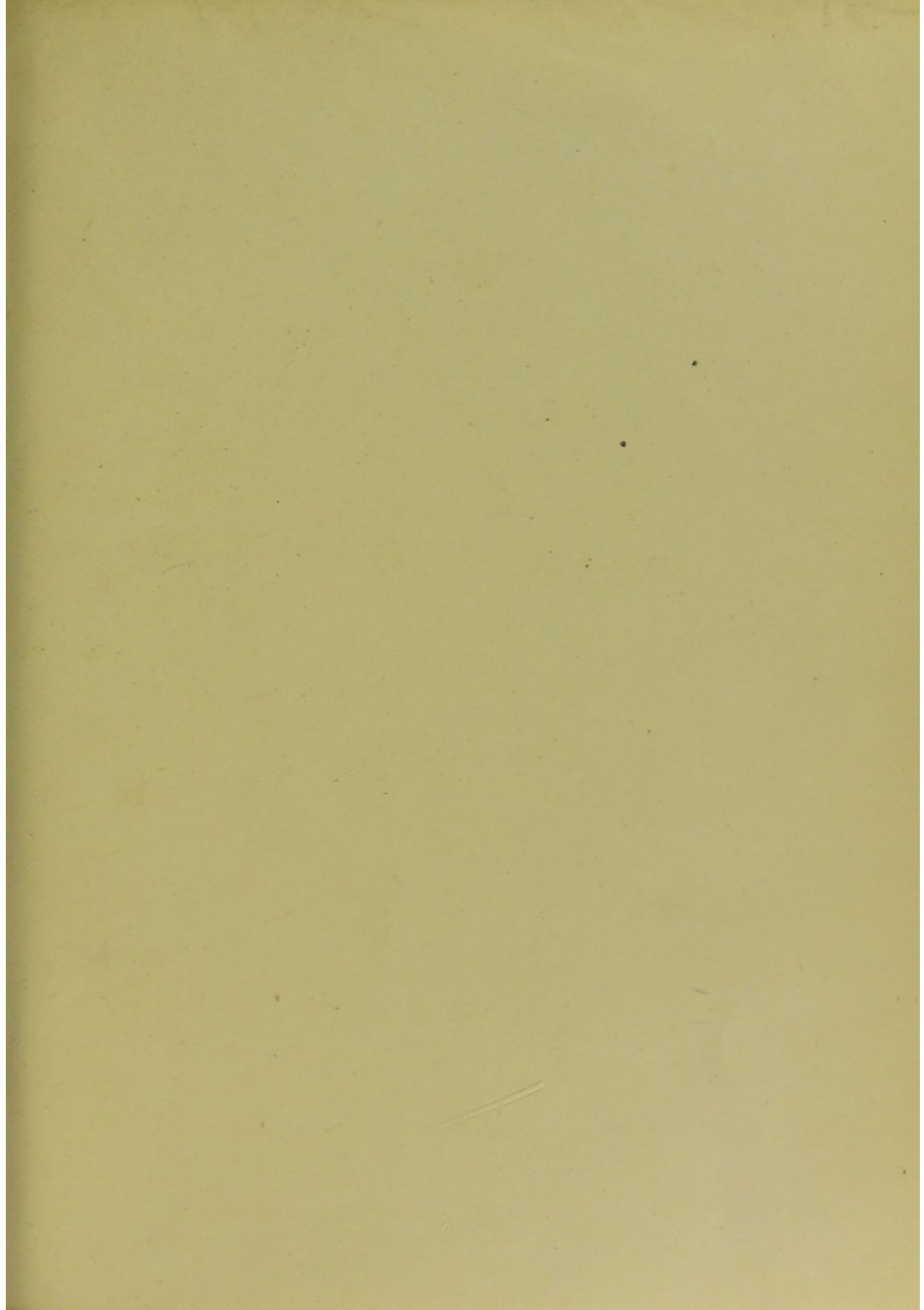
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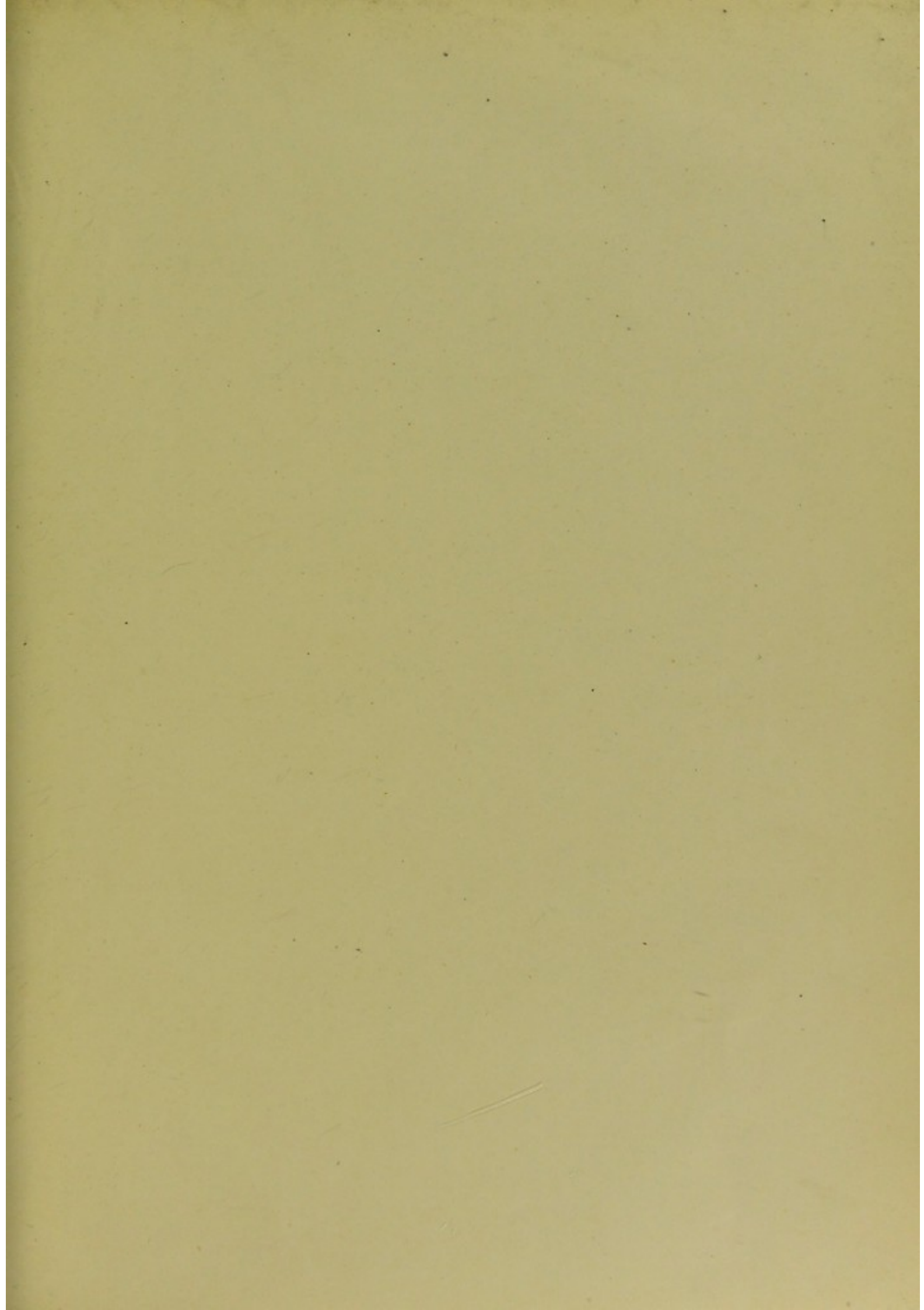










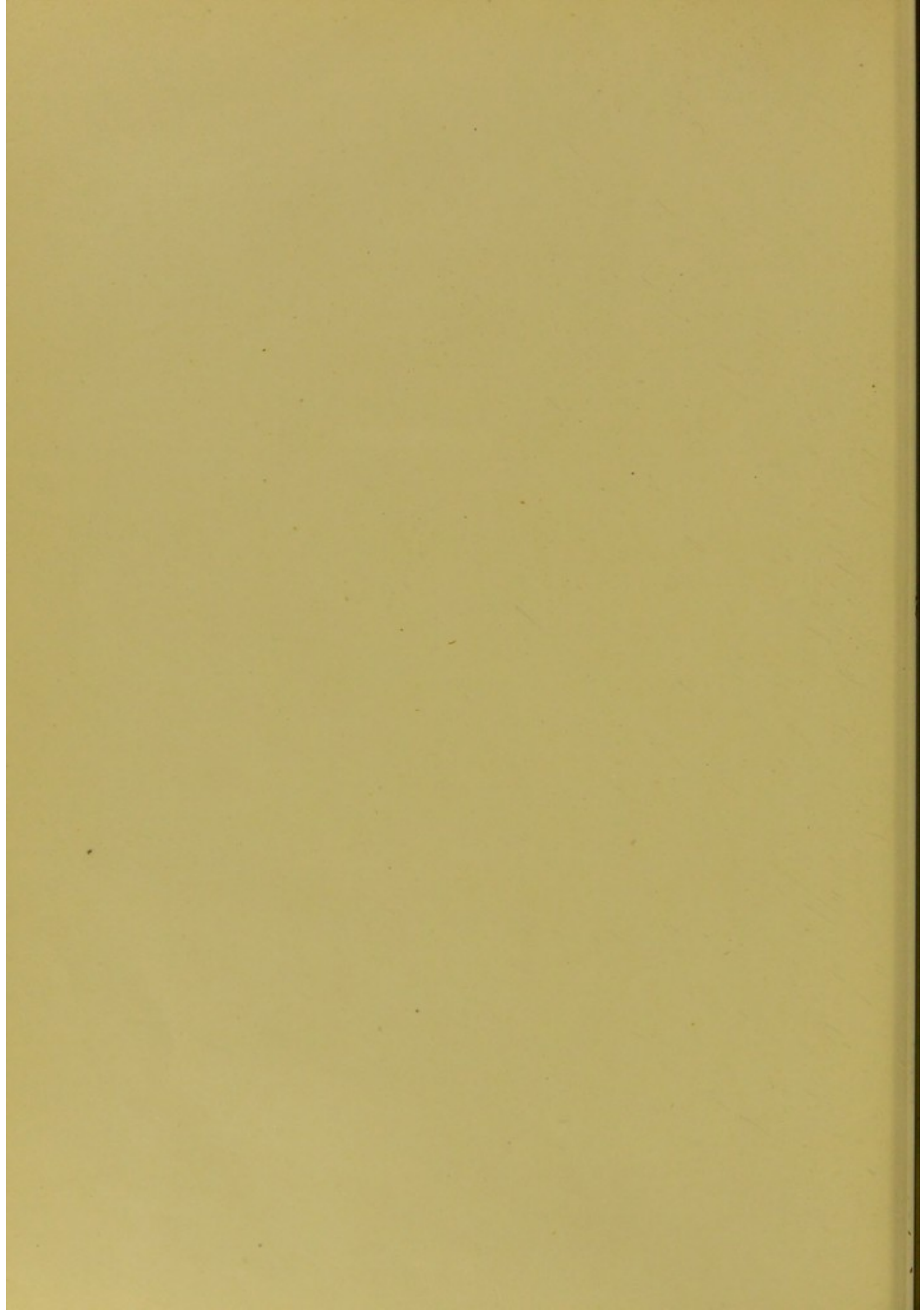


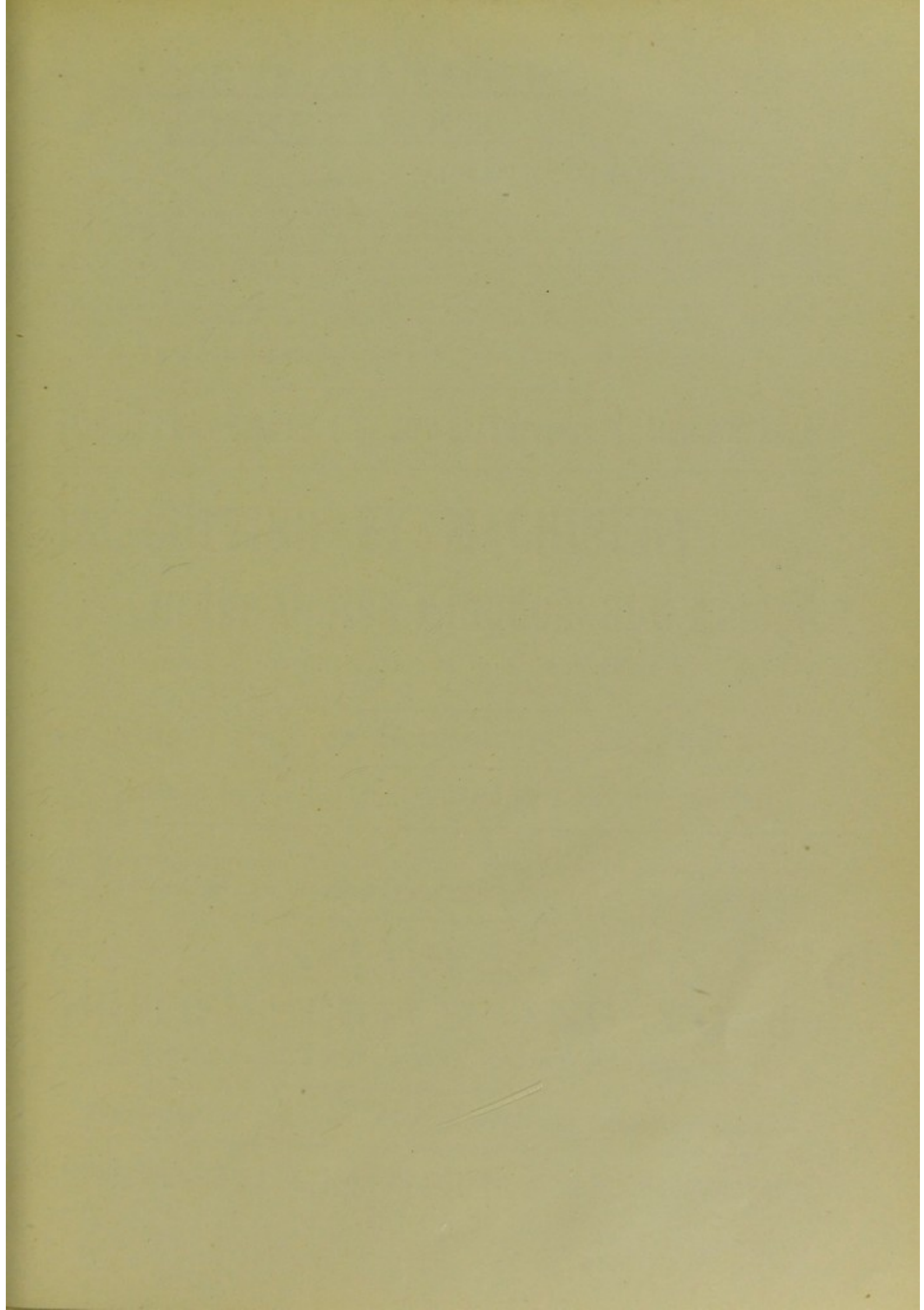














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