

Thesis by

Roderick Campbell Macdiarmid,
(M.B., L.M., D.P.H., of
the University of Glasgow)
Linares, Provincia de Jaén,
Spain;

on

"The Anaemia of Spanish
lead miners."

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The Anaemia of Spanish Lead Miners.

Introductory. Since beginning practice at Linares, (Andalucia, Spain) three years ago, I have seen many cases of the Anaemia from which a very considerable percentage of the Lead Miners in this district suffers. I have notes, more or less complete, of fifty cases of this anaemia which I treated last year, and although these cases present nothing very new or striking in pathology, symptoms, or methods of treatment, still as it is very rare to meet with Idiopathic anaemia in Scotland in men, I believe an examination of the causes of so much of it among

the Spanish lead Miners may not be altogether devoid of interest.

Anæmia

caused by is an early consequence of slow poisoning by lead, and it will be at once

surmised that the anæmia of the Spanish lead miner is caused by the metallic poison to which his work exposes him. While lead poisoning is undoubtedly a factor in the marked anæmia of some of the cases I have treated, I shall endeavour to show, successfully I think, that in about 75% ^{of} the cases, other circumstances and injurious influences were the cause of the anæmia and not poisoning by lead. In only 8 cases of the fifty of which I took notes could I satisfy myself

of the presence of some symptoms of lead poisoning. Dr. Oliver, of New York, in his book on "lead poisoning" page

The lead miner, I, says, "the lead miner seldom suffers often sufferers". As medical officer for five large lead mining companies, I have ample opportunities of daily seeing cases of poisoning by lead, and I have no hesitation in saying that the lead miner very often gets poisoned by the metal, or sulphide of lead (galena) which is almost the only variety of ore met with in the Linares district. Yet my opinion is that the anaemia from which so many miners suffer is not, generally speaking, caused by lead.

But before discussing this

a point of some question from its etiological and interest in the clinical aspects, it will be well to consider one or two points of physiology of the blood. Some physiological interest in the normal condition, ^{of the blood itself} and relations of the blood to the other tissues of the body, particularly in its relation to the central nervous system. It would be an easy matter to pass under review data given in such standard text-books as those of Mc Kendrick and Foster which lie before me. But this would serve no useful purpose. There is one point, however, which appears to me of some considerable importance in considering the inroad and progress of pathological changes in the blood in their relation to the whole

organism, namely, that it is the only tissue of the body which is not under the immediate and direct control of the Central nervous system. Dr. John Young in lecturing to his class, on Zoology, used, in my time at least, to emphasize the fact that

The blood con- sidered as a tissue. The blood is a tissue as much as muscle, bone, or cartilage. It is a "tissue of Motion" (Foster). Yet it is a tissue to which nerve filaments are not distributed. This condition is so obvious that, as far as I can remember, none of the text-books mentions it. All the other characteristics are given with such wealth of data and detail, that it seems to me a little strange that the student's attention

Pain absent is not directed to this unique character
in early anæsthesia of the blood. Let muscle, fascia,
bone, or cartilage be injured traumatically or by slow or rapid
microbic or other poison, and pain, located in, or attributed to, the tissue
injured or poisoned, is the result. Let me take rheumatic pain as
an example. Here the muscular tissue, or the fascia which surrounds its fibres, is injured or
inconvenienced by the acidity of the blood or the non-elimination
of waste materials, such as uric acid or bicurate of sodium, &
pain, more or less excruciating follows. When a bone is fractured
severe pain is felt where the nerves of the tissue have been lacerated.

A vein is opened, and abstraction of blood follows painfully. A man is poisoned by Carbonic oxide gas but he feels no pain. It is true that in slow blood poisoning pain is ultimately felt, with much discomfort, but this is referred to other organs which suffer in consequence of mal-nutrition and defective elimination of waste materials. It would be a constant menace and inconducive to the enjoyment of life if normal variations in the composition and quantity of the blood were felt by the organism. Minor pathological changes in the blood are not immediately followed by pain. Thus the presence of a slightly greater quantity or percentage of carbonic acid than

normal causes little inconvenience, and one can sit for a considerable time in a badly ventilated hall or room full of people without discomfort. But let the individual go temporarily into the fresh air, and return to the vitiated atmosphere he had left, and he will immediately feel discomfort. No doubt the blood corpuscles - white and red - have in them nervous materials, although they may be infinitesimal as to quantity.

I do not wish to elaborate this point further. Suffice to say that the absence of immediate and direct control of the blood's composition by the central nervous system is of sufficient importance to receive a passing notice. I do believe

that if the blood per se could command a note of warning by the production of pain when it is injured by oxygen starvation, or by the absorption of deleterious substances in its passage through the lungs, we would not see so many sufferers from blood diseases. At any rate, the patients I see daily would have sought medical assistance at an earlier stage of their illness, if the blood as a tissue were endowed with nervous sensibility capable of producing pain or discomfort.

Scope of this
essay.

My first intention was
not to limit this essay to the

Anaemia so prevalent among the
 miners of this locality, but so broad
 of anaemia in its widest sense,
 including pernicious anaemia,
 and to make myself well acquaint-
 ed with the literature of the
 subject. But I soon found that
 the literature on blood diseases
 is so extensive, the field so
 wide, and the observers so nu-
 merous that the task I had set
 myself was one of much difficulty,
 and involved labour quite be-
 yond my available resources.

Besides, an inland provincial
 town in Spain is not the best
 place in the world for literary
 or scientific research, however
 how humble. —

Dr. Paul Fabre's Another reason which decided the investigations, so limit my observations to the anaemia of the local miners was the recent perusal of a summary of a communication made by Dr. Paul Fabre to the Société de l'Industrie Minière, Paris, concerning the anaemia among miners. The Gazette des Hôpitaux, published in 1884 a résumé of this communication. This is going a little back no doubt, but as far as I could discover nothing of equal importance on the anaemia of miners has been published since. Dr. Fabre's practice lay among the miners of Commeny. He proved, at least to his own satisfaction, that in miners' anaemia

the number of the blood corpuscles & the quantity of haemoglobin they contain is normal. He confirmed this statement by observations made among the miners of St. Etienne, Pas de Calais. Although I have been unable to procure a copy of his article, his conclusions appear to me to be of ~~so~~ much importance, and what I had not expected judging from experience gained here. I may remark in passing that I fail to understand how a blood disease in which the number of the blood-corpuscles and the quantity of haemoglobin they contain are normal, can be called anaemia. Having so much clinical material

2.

at hand it appeared to me that there was room for further investigation of the subject. How far Dr. Fabri's conclusions and references agree with mine will be seen further on.

As I wish to discuss my subject as much from the hygienic as from a clinical stand-point, Nature and extent of the lead mining industry of this district, some of the conditions and circumstances under which it is prosecuted, and certain facts bearing on the daily life ^{habits} of the Spanish lead miner, may be written here, even although they may appear irrelevant.

The town of Linarcos, ^{lies} on an elevated plateau which extends from the Sierra Morena on the north to the Sierra Nevada on the south. Near the town the granite in which the veins or lodes containing lead ore are found, is not far from the surface of the ground. This nearness of the granite to the surface, explains the existence of so many mines being in this district. The average width of a lode may be roughly stated to be about one metre. Their ^(the lodes') underlie in most cases is nearly vertical. How far they extend downwards no one can say. But owing to their tendency to get poor in depth, very few of the mines - indeed, none -

The mines.

are very deep, seldom deeper than
350 Metres. It will be readily under-
stood that the air in the different
levels or tunnels which lie one
above the other along the course of the
Road admits of very little lateral
or vertical movement. In a coal
mine ventilation is naturally
much better, because a thick
stratum - often nearly horizontal
- is followed and removed by the
miners thus leaving a space for a
large mass of air which is kept
in motion, as a rule, by machinery
constructed for the purpose. In none
of the mines here have I seen
apparatus or machinery specially
erected for improving or producing
ventilation. Various shafts are

Sunk from the surface and from one level to another for purposes of ventilation, but these are few and far between. No doubt the ordinary shafts for raising water and mineral and for giving access to and exit from the underground workings help the ventilation. Yet in most mines the ventilation is most defective, especially in long crosscuts. The miner virtually works in a long narrow tunnel closed at one end - a cul de sac full of foul air.

Conditions under

which the miner works.

Often as many as ten miners may be working in one of these drives or tunnels for several hours. When they come to the surface the soot of the Candilas or tin lamps in which crude olive oil is burnt

can be removed in flakes or bits from
 their nostrils. Some Companies allow
 only two men to work at a time
 in a cutting in which the ventila-
 tion is very bad, and insist on
 on as much of the blasting operations
 as possible to be made at the end
 of the shifts, so that the miners need
 not come back till next day, thus
 avoiding to some extent the inhalation
 of smoke and gases from the ig-
 nited dynamite. The most of them,
 however, are so impatient and curio-
 :ous to see the work done by the
 "holes" discharged, that they push
 back into the thick of the smoke
 and fumes rather than wait
 till next day. They are paid
 by measure, or according to the

quantity of work done. So they work
Very hard indeed, and their impatience
to see the effects of the blacks is in-
telligible.

It would be difficult to say
how many lead mines are within
the lead mines a radius of seven miles from
in the district. Linares. One or two of them are
Very large, and it is supposed that
the Romero mine, 3 Kilometres from
the town, is the best, or at least one
of the best, silver-lead mines in
Europe. Linares has a population
of over 40,000. Upwards of 5,000
Men are engaged in the under-
ground workings of the lead
mines, and a very considerable
percentage of them, it is certain,
suffer from anaemia, perhaps 1 in 4.

Number of
Miners engaged
in them.

Miner.

The average height of a Spanish lead miner is about 5 ft. 3 in. He is very proportionately, although slimly, built - not quite what Goethe would call *ein wohlgebildeter Mensch, but an active wiry little man. His daily wage seldom exceeds 3 pesetas, equal to 1/10th to 2/4 English money. On this pittance he maintains himself and family which is often large. It can be easily and correctly surmised that his daily fare is any^{thing} but sumptuous.

His diet.

Indeed, the Miner's daily food is, generally speaking, ^{deficient} in quantity and quality. He is practically a vegetarian, not from choice but from necessity. He may occasionally have a morsel of

with his bread - often a bit of
 salt cod - and the universal Acido
 [Every thick kind of Scotch broth
 Made with beans and other vegetables]
 May sometimes boast of a little
 mutton. Goat's milk which is
 abundant in Spain and of excellent
 quality, he seldom drinks. When
 working in the Mine his food almost
 entirely consists of dry bread which
 he eats with fruit, such as oranges
 He drinks very or grapes. He gets drunk very
 little alcohol. Seldom - hardly ever - although
 his daily rations include a
 quantity of cheap wine which
 he drinks with his meals. Not-
 withstanding his hard life he
 is a happy and cheerful per-
 son. -

Veneral
diseases

Veneral diseases are far more common in Spain than in Scotland. Gonorrhoea is almost always as severe as we see it at home, but syphilitis is much less so. Yet the syphilitic taint, either acquired or inherited, is almost universally met with in Spain.

Malaria.

Malarial fevers generally of a mild type are rife, more so years ago, I am told, than they are now. How far malarial poison is a factor in the etiology of the miners' anaemia need not be discussed now.

Effects of high
temperatures.

Nearly all the textbooks on medicine mention heat and ^{the} high temperature of tropical and subtropical countries as a cause of anaemia. This guide

possible, nay, highly probable, that the excessive heat to which furnace men and stokers in our large steamers, for example, are exposed, has a deleterious effect on the composition of the blood. But I have never seen data to prove this in a conclusive manner, nor do I know if the subject has been carefully worked out. As to the influence of climatic heat in the causation of diseases, especially diseases met with in tropical and subtropical areas, I rather think the accepted views and conclusions of the profession on the subject must now be modified or suspended, as the remarkably able and elaborate essay on the influence of climate

Dr. Luigi Sambon's on public health by Dr. Luigi
Recent paper. Sambon, published in the "British
Medical Journal", January last,
has attracted much attention &
favourable criticism, not only
within the ranks of the profession
all over the world, but also in
the lay press of England. His
dieta will not, of course, be
accepted as final, but the
whole matter must be considered
as sub judice, and requiring
long and careful investigation.
My own residence in a sub-
tropical district for three years
hardly entitles me to express
an opinion. But I may, perhaps,
venture to say that I have not
yet seen any illness or disease,

the cause of which I could wholly or partly attribute to excessive heat, nor do I attach any importance to heat as a factor in the etiology of Miners' anaemia. The mines, as I have already observed, are not very deep, and the temperature to which the Spanish miner is exposed while he is underground is lower than it is in the shade in his own shingly constructed house.

absence of
light as a
cause of
anaemia.

Absence of light is also frequently mentioned as a cause of anaemia and blood deterioration. I do not doubt it is so. Yet I do not remember ever having seen the beneficial influences of light on the blood, nor the path-

biological changes in the blood caused by the absence of light fully & satisfactorily discussed from a scientific stand-point. Light, as we all know, is only a form of energy such as heat, electricity, etc. A plant won't thrive without light nor produce the substance so essential to its healthy life, namely, Chlorophyll. A German text-book lying before me puts this point very forcibly — "Sie bekommen vom Licht erst Saft und ein kräftiges selbständiges Leben. Ohne Licht werden sie wohl grösser, aber bleiben geschmack- und geruchlos." It has been proved that a part of the energy of light is stored up by

Effects of light
on plant life.

The plant in its Chlorophyll. Spectroscopic examination of a solution of Chlorophyll in alcohol reveals the fact that only certain rays of the spectrum have been absorbed. But has any animal the power of deriving energy & vitality directly from light? The blood circulating thro' the body is never much exposed to light even in the capillaries of the skin which in the case of civilised ^{is} man, nearly all covered with clothing. So the blood-corpuscles which are the only living elements of the blood practically live in darkness. I am of opinion, therefore, that the influence of light on the

Influence of light on animal life.

~~as~~ the blood, per se, is infinitesimal. It is a matter of common observation and experience that an animal thrives better in light than in darkness. Why? I am inclined to believe that certain animals, now included, live better under the influence of intermittent sunlight owing to the tonic or invigorating power sunlight has on the nervous system, mainly due to the stimulation of the cerebrum by the rays of light which impinge on the retina, the energy of which is conveyed by the optic nerve to the brain which dominates the whole nervous mechanism. And thus the whole organism,

blood glands included, is influenced for good. It may be argued that blind persons would be unhealthy if this were the case. Blind people as a rule, as far as my observation goes, are not healthy — certainly neither strong nor energetic. There is an extraordinary number of blind persons in this town & certainly they look sickly enough, although it must be admitted that this state of indifferent health may be attributed to the chronic poverty they suffer and may not light influence, ^{to} a certain extent at least, the brain thro' the medium of eyes which may have become useless as organs of vision? What is the

effect or influence of light on various
 blood exposed to it in a vacuum?

Dr. Haig's theory. He maintains that is published an elaborate paper
 Anæmia is by Dr. A. Haig in which he endeav-
 produced by ours to demonstrate that an-
 uric acid in æmia is caused by the abnormal
 the blood. presence of uric acid in the blood.
 He made several experiments on
 himself by taking doses of uric
 acid, and noting the effects of
 the acid so taken on the blood.
 These experiments are of some
 physiological and pharmaco-
 logical interest certainly, but
 of little pathological or clinical
 value. It is admitted by all ob-

answers that the more alkaline the blood is the more uric acid it will dissolve. But Dr. Haig forgets to add that every molecule of acid dissolved reduces the alkalinity, and, therefore, the dissolving power of the blood. Even if there were abnormal quantities of sodium bicarbonate deposited in the tissues after fevers - Malarial fevers included - which is doubtful, - there would ^{be} very soon a lowering of the alkalinity of the blood by the urates taken up in solution, and thus an equilibrium established, and no further quantity of urates would be removed from the tissues. In fevers there is undoubtedly more

Katabolism - more tissue waste - but it has not been proved that these waste products (urates, etc.,) are stored up in the tissues. The urine of fever patients as we all know is abnormally rich in ura, etc., which so far disproves the storage ~~storage~~ of debris in the tissues. With fevers there is nearly always great thirst, and the water which nature demands and which ought to be freely given, helps to eliminate waste materials by the skin and kidneys. Haig would explain the post-febrile anaemia as being caused by uric acid contained in the blood, and derived from the solution of the urates stored up in the organism during the progress of the fevers. This uric

acid destroys the red corpuscles & diminishes the haemoglobin. The "post febrile uric acid aemia" may or may not be present after fevers of this kind, it will not explain the pathological changes in the blood or in the tissues caused by a fever working in genere, nor the complex chemical and vital processes concomitant with and depending on a specific poison causing a continued fever or even a temporary rise in the body temperature.

"Rheumatism
& Gout"

We are all agreed, more or less, that in Rheumatism and Gout the blood is less alkaline than it should be, and we find concretions and deposits of ^{bi}urate of sodium in certain tissues. There is imper-

fect elimination of urea and its com-
pounds or its derivatives; but are
sufferers from rheumatism and gout
generally more anaemic than other
people in indifferent health? There
is, no doubt, considerable anaemia
met with occasionally in gouty
patients, but if Haig's theory
were correct there should be
much more. He further affirms that
a Vegetable diet, as it contains
few elements or compounds that are
convertible into urea, tends to
prevent anaemia, and that animal
food being rich in nitrogenous
substances facilitates degene-
rative changes in the blood by fur-
nishing material easily changed
into uric acid. "Again," he adds,

"it is easy to explain the effects of hot weather and of tropical climates in producing anaemia for heat increases the alkalinity of the blood and the more it will hold in solution". But hot weather per se does not cause disease nor per se dispose to it. Dr. Stephen Mackenzie also affirms that a meat diet increases the destruction of the "red cells". That may be so, but I am sure that if the Spanish lead miner had more nourishing food including more "meat diet" he would suffer less from anaemia and other ailments.

Before discussing the clinical and other observations and investigations I have made on the

anaemia from which so many ^{minors} in this
town suffer it will be well to de-
fine the disease so as to show clearly
what I mean by the term anaemia.

I hold it is essentially the same,
Definition ⁱⁿ from its clinical aspects at least,
of anaemia as the anaemia or chlorosis we meet
with so extensively in young women
at home. This being my view, it
would be an act of presumption
on my part to try to improve on
the definitions given in stand-
ard text books and works on
medicine. Bristow includes
deficiency of the white corpuscles
in his definition. To this there is
the objection that the number of the
white corpuscles varies very con-
siderably, even in health, there

being more shortly after the ingestion
of food, while some writers deny
that there is diminution in the number
of white corpuscles in simple an-
aemia. Dr. Friedrich Taylor's defini-
tion (Brit. Med. Journal, Sept. 10,
1896) is a good one. Dr. Mitchell
Bruce's definition (Quain's Dict. of
Medicine) which is purely pathologi-
cal is the neatest, certainly the
shortest and tersest, I know - "De-
ficiency of blood in quantity either
general or local; also deficiency
in the most important constituents
of the blood, particularly albumi-
nous substances and red corpuscles".
He obviously includes haemoglobin
in the term "albuminous substances".
Then he adds - "from the clinical point

of view anaemia is a condition of the system in which impoverishment of the blood whether from want or from waste is associated with symptoms of imperfect discharge of the vital functions". These definitions are very comprehensive, and include all kinds of anaemias. I can do no better than abide by these as clearly embracing the miners' Anaemia. I have not yet seen a case of pernicious anaemia in Spain, and of it I say nothing here. Further on Dr. Ponce observes - "Anaemia is generally recognised with great ease, and the chief question of diagnosis relates to its cause". Precisely so! As easy, or apparently easy, indeed, the

Case of diag:
Noting
Anæmia.

Whenever an anæmic patient enters my consulting room, I see at a glance the most prominent signs of his ailment, as easily as if it were a pronounced case of jaundice. The extreme pallor - the pale-yellow, blanched face - the slow, languid, uncertain step and gait - the dull, listless, weary demeanour - the sighing and somewhat spasmodic respiration - the bloodless lips, gums and conjunctivæ - are not all these symptoms and signs recorded in the Clinical Chronicles of - the Western Infirmary of Glasgow? When I ask one of the patients what he complains of, he replies, in a "La fatiga". Cases out of 10, - "La fatiga - fatiga

Prominent
Symptoms.

Muy grande, that is, "weariness - very great weariness" - or extreme weakness - sheer exhaustion of animal strength and vigour. This for alleviation of this fatiga that they have come to seek asistencia facultativa as the Spaniard calls Medical advice or help in his own grandiloquent style. The fatiga is the prominent symptom. The patient has no pain, or at any rate pain worth speaking of in comparison with his distressful condition of exhaustion and weariness. This only when it incapacitates him from following his daily occupation that he comes to the doctor. This is a little interesting, for his friends must have told him several

weeks before how pale he looked - que
palido estás, Pedro! But Pedro is
 poor, and as long as he can drag along
 after another he continues to work.
 It is this inability to work that
 makes him come to the dermier
recort - el medico inglés, that is,
 the English doctor, as they call the
 writer in Linares.

For purposes of exact or pro-
 longed clinical observation it
 will be readily admitted that a
 short visit by a patient to one's
 consulting room is unsatisfactory
 - not to be compared to the oppor-
 tunities afforded by the wards
 of an hospital. A very consider-
 :able proportion of these anaemic
 miners after they get some re-

relief, which they invariably obtain
after a course of iron - in nearly
all cases Bland's pills - do not
return if they can resume work,
unless with a relapse after
some months.

My written
notes:

At first I took full notes
of all the cases I treated with
a ^{view} to use them in the preparation
of this essay, but as they pre-
sented such similarity, I have
now ceased to do so, unless a
case happens to have points of
special or exceptional interest.
Such as that of a man markedly
anaemic with signs of lead poisoning
whom I saw two or three
days ago. This man I found to be
suffering from Diabetes Incipiens

57
a Case of Diabetes. He was passing urine in abnor-
Inosipidus caused small, large quantities with
by lead poison. Specific gravity 1,010, but
:mg. there was neither sugar nor al-
bumen in it. This was, in my
opinion, a case of Diabetes In-
sipidus caused by lead poison:
:mg.

"Fifty cases."

The analysis of these fifty
cases does not show anything
of permanent interest. This is not
complete because I could not
follow the cases sufficiently long,
and a considerable percentage
of them was only seen once.
The notes are those of fifty consecutive
cases, i.e., in the order in which
they came to consult me, and are not
selected. In the fifty, therefore, cases

of anaemia caused by lead and malarial poison are included, but I eliminate these however, viz, 8 in which there were clear symptoms & signs of plumbism, and 4 in which there was a history - no matter how incoherent - of Calcutarum or malarial fever. So there remain 38 cases of anaemia without any obvious cause except the insanatory conditions of their employment, particularly defective ventilation of the mines in which they worked, and it is interesting to note that 54 per cent of these cases came from two mines in which the ventilation is notoriously bad - admitted by the miners themselves to be the worst there.

in that respect. My remarks & notes are now exclusively confined to these 38 Cases, and my inferences are confirmed by my experience of many other similar cases of which I took & take no notes. Some of the facts recorded may be stated as follows:—

Tabulated
Symptoms.

Number of cases	38
Average age	^{yrs.} 34.75
Average no. of yrs. working underground	10.2

Nervous System—

Headache & giddiness.	28
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Circulatory System—

Abnormal heart murmurs, } Chiefly A.S. & V.S. (Mitral)	22
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Bruit de Diabie	21
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Palpitation & faintness	31
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Oedema of legs or feet	4
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Oedema of hands shortly after commencement of treatment.	3.
Albumen in urine.	4.
Epi-staxis (occasionally).	4.
Enlargement of Spleen.	7.

Respiratory System —

Breathlessness on exertion	38.
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Digestive System —

Appetite poor.	34
Sickness (occasionally)	8
Constipation	5

Reproductive organs —

Diminution of sexual desire	30.
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The above ^{list} does not exhaust all the symptoms I have noted, but as they are always present in anaemia they need not be enumerated here. It will be observed that constipation was not

usually present. Three returned 2 or 3 days after commencement of treatment with iron (Bland's pills) to show me some swelling or oedema in the back of their hands. But this passed off in a few days afterwards. I cannot explain satisfactorily the cause of this oedema, unless it was due to the hanging position of the arms, the men in all these instances not working, and moving about with the hands in a dependent position.

The enlargement of the spleen was probably due to old malarial poisoning, although the men themselves denied having suffered from calentures, i.e., malarial fever. I have only succeeded in

Microscopical
examination
of the blood.

making an examination of the blood in ten cases, for I found pricking the finger to obtain sufficient blood very unpopular. Besides the other symptoms and signs were so characteristic of anaemia, that I could not possibly doubt the existence of the disease. The instruments used were Gower's Haemoglobinometer, Potain's Milaquer, with a Zeiss' slide with cell and covers; also a Zeiss's microscope with a lens of 350 diameters power. With the exception of the latter, the rest of the apparatus was supplied to me by Messrs. Maw, son, & Thompson, of London.

Following the directions so clearly given in Finlayson's Manual

and benefitting to some extent by the somewhat more experience and instruction in blood examination received in the wards of the Western Infirmary of Glasgow, I obtained fairly satisfactory results which I give in the subjoined table.

Microscopic Examination of Blood, etc.

Cases.	First examination.		Second examination about 10 days afterwards	
	Number of Red corpuscles	Percentage of Normal Haemoglobin	Number of Red corpuscles	Percentage of Normal Haemoglobin
1 st	3,400,000	47	Did not return	
2 nd	3,200,000	42	3,900,000	54
3 rd	4,100,000	61	Did not return.	
4 th	3,100,000	40	3,600,000	61
5 th	4,200,000	64	4,300,000	82
6 th	2,800,000	37	3,200,000	48
7 th	4,000,000	64	4,200,000	78
8 th	3,125,000	45	3,700,000	68
9 th	3,200,000	47	Did not return	
10 th	3,700,000	51	4,100,000	76.

I should add that the cases whose blood I examined were not consecutively treated, the examinations of the blood being made as opportunity presented itself. Three of the men whose blood I examined did not return again, so I cannot say if any improvement resulted from the treatment begun. The general appearance of the blood corpuscles did not deviate much from the normal. The reduction in the quantity of the haemoglobin is out of proportion in every case to the diminution in the number of the red cells. Whatever may be the value of my examinations, they, at any rate, confirm my diagnosis of anaemia, and it was

only its etiology I purposed discussing.

The etiology of
the Spanish
Lead miners'
Anaemia.

What, then, is the cause—the etiology—of this anaemia? I have no wish to dogmatise in answering this question, for there are still many obscure points in the pathology of anaemia, and in the discussion on it at last year's meeting of the British Medical Association at Carlisle, Dr. Gardner, of Glasgow, clearly stated the difficulty that still exists in determining whether in many cases of anaemia the haemorrhage or haemolysis is originally at fault. In the course of his remarks he said—“Indeed as far as pathological speculation

Etiology (contd.) Can be applied to individual cases
 one feels much in the same position
 in respect to anaemia as regards
 to pyrexia in which..... the question
 is whether the fault in the first instance
 is one of thermogenesis or of thermolysis
 (Brit. Med. Journal Sept. 19, 1896.)

While I wish, therefore, to avoid
 dogmatizing in saying what may
 be the main cause or factors in
 the causation of the anaemia of the
 Spanish lead miners, I have no
 difficulty in holding the opinion
 that it is chiefly caused by the
 faulty ventilation of the mines
 accentuated by insufficient
 diet, hard work, and want of
 sunlight. The red corpuscles in
 the first instance suffer from

8. Biology (cont'd.) oxygen starvation which lowers their vitality and their capability of discharging their physiological functions. This deterioration of the corpuscular elements of the blood powerfully and harmfully affects the condition of all the organs and tissues of the body including the blood glands whose productive activity will, therefore, be diminished, and this to a certain extent explains the deficiency in the number of the red corpuscles, so that it may be safely opined that the haemogenesis is at fault. This is more intelligible when one remembers that besides being starved of oxygen, the cells absorb poisonous gases and other

Etiology (Contin'd).

Substances such as organic am-
 onia. This still lowers their
 physiological value to the organism.
 They fail to assimilate all the
 iron they require, hence their po-
 verty in haemoglobin. If they ever
 multiply by segmentation this
 function will, ^{be} in abeyance to
 some extent, and their number,
 in consequence, will decrease.
 It is also probable that haemoly-
 sis is more active. If the bile
 pigments are supplied, as it is
 often asserted, and has been de-
 monstrated to be ^{the} case, from the
 colouring matter of the blood cells
 destroyed in the liver, it is conceivable
 that in their ^{sickly} depreciated condition
 more of them is required, while ~~in~~

at the same time
 their sickly condition they are less
 able to resist even normal de-
 structive forces. I hold the opinion,
 therefore, that in the Spanish-lead
 miners' anaemia there is defe-
 tive haemogenesis and abnormally
 active haemolysis due to the
 causes I have mentioned.

Treatment.

As to treatment, it may
 be summed up in two words -
Blaud's pills. In all the cases I
 obtained striking improvement by
 their use, and in a considerable
 number of the men, a very near
 approach to a cure. They were
 not used in this locality before
 I settled in Linares, and as far
 as I know the formula of the pills
 is seldom or never prescribed.

in the town. I give them in large doses, beginning with 2 or 3 fine grain pills three daily after food gradually increasing the dose to 4, or even 6 pills if there is no contrary indication. They are very well tolerated as a rule, and with the exception of the temporary swelling of the hands to which I have already alluded, I have never seen any untoward result. If there are any suspicions or symptoms of poisoning by lead, I give Iodide of Potassium with the pills. In the few cases in which there was a history of Calenturas, or malarial fever, I give iron and quinine - usually *Sr. ferri puehlor. plus quinine.*

with very good results.

The anaemia
~~is~~ caused by
Anchytostoma
duodenale.

Since the foregoing pages were written, an article appeared in the Revista Minera, of Madrid, entitled "La Anaemia por Anquilostoma" by D.^r Romficio de la Cuadra, of Ubeda, an agricultural town about 20 miles from Linares. This article is of some special interest as it gives the history of the illness of a mining engineer of that town who died there on the 15th of February last, of anaemia caused by anchyllostomiasis, complicated ultimately by pneumonia. This engineer officially visited a lead mine in this district - five miles from this

Anchylostomiasis. down, and was that day some hours
 (a case of) underground. "On the night of the
 following day," translating from
 the article in question, "thirty hours
 after finishing his inspection of
 the mine he felt burning heat in
 the skin, prurigo and great heat
 in the joints," etc. In short the
 article tries to prove that this
 engineer had suffered from the
 anaemia of anchylostomiasis,
 the infection of which he is
 alleged to have caught in the mine
 mentioned above. From the de-
 tails and facts given there can
 be no doubt the man suffered
 from anchylostomiasis, for the
 description given of the methods ad-
 opted to discover the ova of anchyl.

A case of
M. hydrophorum
(Contn?)

ascotoma in the excreta of the patient
and of the appearance and subsequent
hatching of these eggs is clear &
convincing. What Señor Cuadra
fails to prove is that his patient
received the infection of his disease
in the mine he mentions. To produce
such symptoms as those enumerated
in 30 hours after the ingestion of
the parasites the man must have
swallowed them in incredible
numbers. Leickhusen after
careful and elaborate experiments
says that during the first four
weeks after its introduction
into the digestive tract *M. hydrof.*
ascotoma is innocuous. It is only
after the elapse of that period
that it begins to give trouble

Anchylostomiasis having by that time attained full
 (Continued) sexual maturity. The opinion of
 Dr. Cuadra that his patient was
 infected in a mine near Linares
 and showed active symptoms
 produced by the parasite 30
 hours afterwards is untenable.
 But I do not for a moment doubt
 his diagnosis of "anaemia by
Anchylostoma" as he names his
 article. The unfortunate engineer
 may have been infected in a
 mine in this district, but it is
 impossible to say when or where.

I was quite aware of the
 fact that *Anchylostoma duodenale*
 had been met with even as far
 north as Westphalia, and that there
 were very stringent hygienic laws

amchylostomiasis
(Contin?)

in force in Germany to prevent its spreading among the miners in South Germany. But I had never heard of a case of the disease occurring in this locality, otherwise I would have examined the excreta of suspicious patients for ~~it~~ the ova of the autozoon. I cannot believe that any of the 38 cases I have discussed suffered from anchylostomiasis, for there were no symptoms of the disease. My patients seldom or never mentioned that they suffered abdominal pains which are so occasionally wherever the parasite is present. Then the anaemia always rapidly improved under treatment the men returning to their work

Anchylostomiasis
(Continued)

generally in three weeks. I have not seen a single fatal case of anaemia since I came to Spain. If anchylostomiasis were a common disease in this district it would certainly be not confined to the miners alone. Field labourers would also suffer - in fact it would be general, for there is sublime indifference to sanitation displayed in this part of the country. - There are more field labourers in the town than there are miners, and I don't remember having met with marked anaemia in a field worker. For these and other reasons I exclude anchylostomiasis as a factor in the etiology of the anaemia of the

lead miners of this province,
although the publication of D. Cuadras
paper has put me on the
alert for the discovery of the par-
asite in cases with symptoms
suggestive of its presence.

J. C. Macdonald, M.D., etc.

Linares, Provincia de Jaén,
Spain.

13th May, 1894.