Some Observations upon Thirty Cases of Miners' Nystagmus.

by

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Contents

Part I

Introduction

Historical note
Definition and Symptoms
Theories as to Causation
Internal Working and Lighting of a Pit.

Miners' Nystagmus

Historical note

Miners' Nystagmus was first mentioned by Decondé in 1861. In 1877 Dransart published observations on the subject and he has continued to make investigations on it up to the present time. Romiée, beginning the following year, 1878, is doing likewise.
In this country, the late Simeon Snell — recognizing the condition as early as 1875, — began work on the subject in 1884; his book on Miners' Nystagmus appeared in 1892 and his Presidential address at Sheffield last summer (1908) shewed the subject was then still claiming his attention. Only a few weeks ago, he was in private correspondence on the subject.
1891 – 1892 was a period of much animated discussion in which Snell, Statham Thompson, Court and many others took part.
Pechdo, in France, brought forward a theory in 1893, as to its causation.
In Germany Rieden's observations were published in 1894.
In Italy Trombetta drew fresh attention

to Miners' Nystagmus in 1900.
Recently, besides work in this country, including G. C. Reid's contribution to the subject in 1907, it has been widely discussed by Nuel, Romiée, Rutten, Hansart and Famechon, in Belgium.

Definition

Oscillatory, involuntary, rhythmic movements of the eyeballs, having greater or less range, more or less continuous, more or less rapid, following several directions, appearing and disappearing in definite directions of the eye, occurring in miners working in coal pits and especially in those engaged at the coal face.

Symptoms

Objectively — nystagmus, and occasionally blepharospasm and tremors of the head, neck, hands and body.
Subjectively — movement of objects looked at, dazzling and photophobia, night-blindness, disturbance of sight, giddiness, pains in the head and neck and other nervous symptoms.
These will be considered in detail later.

Theories as to the cause of Miners' Nystagmus.

i. The Light theory, supported by Romiée, Court, Thompson and others, who hold that the darkness and insufficient light in which the miners work is the chief cause of the disease and that position has little effect.
Romiée holds special views on the rôle of accommodation.

ii. The Position theory, advanced by Baer, and supported by Snell, Nieden, Mel, Dransart, Jamechon, Jeminski, Graefe, Willbrand and others, who hold that the abnormal direction of the miners' eyes, and the constrained position at work, is the chief cause of the disease which is a myopathic one. Insufficient light is a minor cause.

iii. The Labyrinthine theory, advanced by Trombetta* who holds that the changes in the atmospheric pressure and the noises in the pit give rise to labyrinthine disturbance and hence to nystagmus.

iv. The "Equilibration-Disturbance" theory, advanced by A. C. Reid† recently, stress being ~~also~~ laid on the insufficient light, as well as on the frequent change of posture of the body.

* Clinica moderna. Aug 22. N29. 1900.
† A. C. Reid. Brain. Part CXV. Nov. 1906.

V The "Central" theory, that of a definite central lesion, advanced by Jeaffreson*

VI The "Intoxication" Theory, held by von Renss and Pechdo — that the absorption of the products of coal in the raised temperature of the mine is responsible for the condition

These also will be discussed later.

Before giving details of the thirty cases I have collected, it may be as well to give some idea of the internal working and the lighting of a pit. It is difficult to realize the actual conditions under which miners work without seeing these for one's self. I accordingly have visited two mines and have spent some time in making enquiries. The following remarks and illustrations may help in the realization.

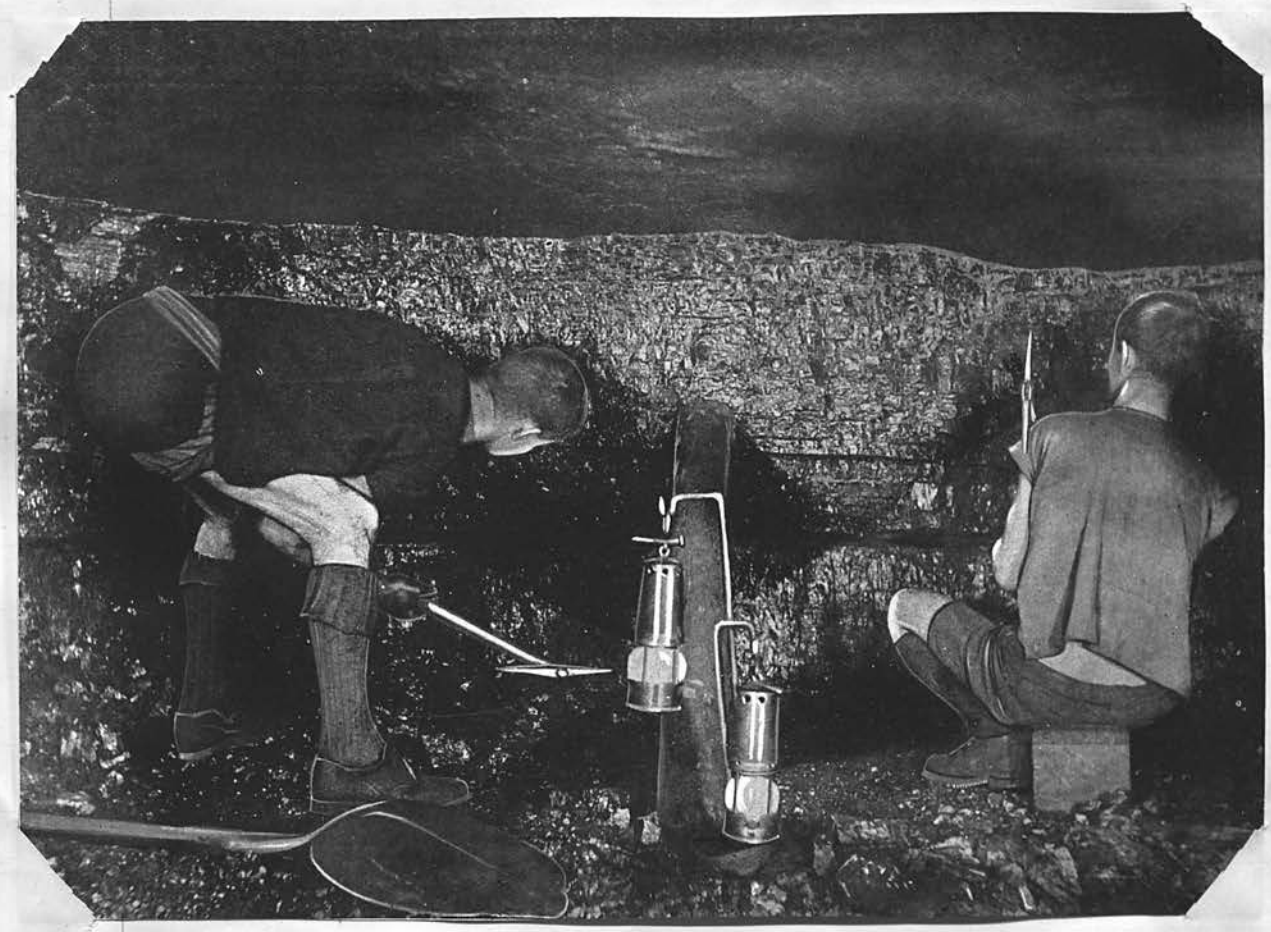
Reference may also be made to a miner's own account of his work. (Page 21-24)

I may say, that I found the mere travelling along the road-ways and the constant stooping & turning up of the eyes to avoid bumping the head against the low roofs, was most trying.

* Jeaffreson. B.M.J. 1887 ii p. 109.

Internal Working and Lighting of a Coal-mine

Coal is "got" by hewers. and in the "getting" two methods are followed in this district. Where the coal is soft, "scalloping" is done. This means that all the coal is brought down directly by the pick. If the seam is sufficiently high, the men can sit to their work, a great part of the time. (as in illustration)



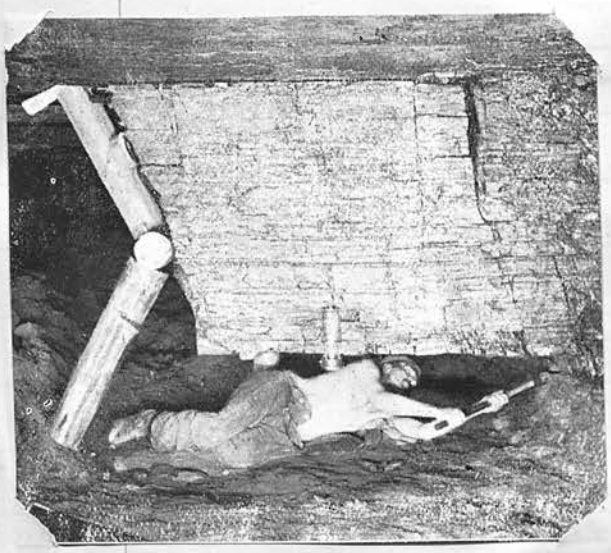
Where the coal is hard, "corving" or undermining, and blasting is done. The under

portion of the seam having been undermined, the upper portion is drilled and then blown down by means of a "shot".

While undermining, the men of necessity work in very constrained positions.

The accompanying illustrations shew two types of the position which may be assumed.

Undermining is said to form 20% of the work underground.



Hewers also, in this district, do a certain amount of timbering, and a great part of

their time is spent in filling the tubs with the coal brought down by the one or the other method. The seams may vary both in height and in the facility with which the coal can be obtained. The "places" are usually drawn for by lot, every 3 months. When the tubs are filled, they are conveyed to the shaft; — sometimes a distance, taking 3/4 of an hour, or more, to cover, — and brought back empty to the coal-face by the putters. The tubs are usually drawn along tramlines by ponies, the putter sitting on the shaft or showing behind, his head low to avoid knocking the roof, which in many places does not exceed 4ft 6 in height. The putters often help to fill the tubs and occasionally do some hewing, this being the work they aspire to.

A road-way

The "stone-men", after the coal has been removed, make the road-ways. As has been explained, the minimum height of these is usually 4 ft 9.

Deputy-overmen or "deputies" examine the workings for gas, see that the roofs are safe, over-see the men at work, and give a hand with the timbering.

In some pits a coal-cutting machine is used for undermining and I had the opportunity of seeing one at work.

Figure 1:—Coal-cutting Machine, the Wheel having cut 5½ feet into the Coal, ready to cut forward along a Working Face, 1,920 feet long.

Wedges are temporarily placed under the coal, and these being removed, the coal falls in cubical masses.

Lighting of a pit is usually, in the workings, by candles or by safety-lamps. The safety-lamps are, roughly speaking, of two types (1) the Davy lamp, with a cylinder of wire gauze, encircling a light, and (2) the Clanny type (with many modifications) in which there is a short glass cylinder in place of the lower part of the gauze.

Davy lamp.

The light of a lamp tends to diminish 4-5% with the smoke of the wick and the accumulation of dust on the glass.

Lamps are not allowed to be placed on the ground while being used, but have to be hung up out of danger. If knocked, many immediately go out.

glass

Clanny lamp.

Comparing the light given by candles as compared with that given by safety-lamps:—

Standard candle	100
Naked lights as used in the pit	.61-.77
Clanny type of lamp	.47-.67
Davy lamp.	.28

Naked lights have also the advantage of being able to be placed nearer the work.

Part II

Records of Thirty Cases.

J. Th. Age 56. Height 5 ft 9. Occupation Hewer
Symptoms Nystagmus, first oblique, then rotatory, elicited on looking up, also when light was reflected from the mirror into the eyes in the dark room; starts on a sudden change of light especially on coming in from the dark. To check, the patient stands still and looks down at his hand. Some blinking of the eyelids especially when the nystagmus is beginning.
Lights dance and dazzle, object "first goes back & forwards, then round & round". Photophobia. Sees well at night. Vision — cannot see 6/60.
Duration of Nystagmus 3-4 months — of work in the pit 44 years — of hewing 39 years.
Conditions of Work Does "corving" in a seam 2 ft 4" high, (seam averaging 2 to 6 ft.), this being lower than he has been accustomed to for the last 4 years. Candles chiefly used (Davy and Clanny lamps 20 years previously)
Ventilation good.
General Health and Habits. Has had "boils" on the legs for the last 4 months, otherwise health good. Smoked 4 oz twist a week until 6 weeks ago, since then 1-1½ oz. Used to take alcohol to excess, teetotal for the last 2 months.
Progress Condition getting worse, rather better during the 3 weeks he has been "off" for an injury.

J. M. Age 33. Height 5ft 6. Occupation Hewer.
Symptoms Nystagmus, constant, oscillatory, worst on looking up and out, better on looking down, worse after the gas is lit, does not trouble him much in the pit.
Objects appear to move "up and down".
Photophobia. No night-blindness. No giddiness. Eyes ache. Vision (eyes moving) R & L. 6/60.
Duration of Nystagmus 5-6 weeks — of work in the pit 20 years — of hewing 11 years.
Conditions of Work Does "scalloping", seam is 22 to 24". Candles now always used, (worked with Davy & Clanny lamps. 13 years ago, for 2 years) Ventilation good.
General Health and Habits Former good. Neither smokes nor drinks.
Progress Getting worse, but the condition does not bother him when in the pit.

S.J. Age 54. Height 5ft 8½. Occupation Hewer.
Symptoms Nystagmus, rotatory, elicited on looking up and on change of light, especially on going from the dark to a brightly-lit room. Does not trouble him much in the pit and is not worse at the end of the shift. To check, the patient has to stand still and to get gradually accustomed to the light.
Objects move "backwards and forwards".
Photophobia. No night-blindness. No giddiness
Vision. L Cataract (no letters) Rt V_a = 6/12.
Duration of Nystagmus — about 6 years — of work in the pit 40 years — of hewing 18 years.
Conditions of Work. Does "scalloping", where he works seated; he finds clearing the lower part of the coal most trying. Candles always used except for 1½ years, 14 years ago, when a Davy lamp was used. Ventilation fair, some "black-damp".
General Health and Habits Former good.
Smokes 3 oz a week. Teetotal.
Progress Has got used to the condition.

H. H. Age 44 Height 5 ft 4. Occupation. Hewer.
Symptoms. Nystagmus, continuous, rapid, worst on looking up and out or on looking steadily at anything, better on looking down, worse at the end of the shift. Drooping of the upper eyelids, head is thrown back. Very marked blepharospasm. Occasional tremors of the head. Objects move. Photophobia. No night-blindness, No giddiness. Eyes ache, especially after reading. Vision 6/36 — eyes moving. The patient tries to catch sight of the letters between the blinks, if he stops blinking the nystagmus becomes more marked.
Duration of Nystagmus 3-4 years — of work in the pit 32 years — of hewing 23 years.
Conditions of Work Seam 3 ft 2", averaging 2 ft 6" to 3 ft 2". "Scalloping" done. Candles always used. Ventilation good.
General Health and Habits Former good. Occasionally gets inebriated at the pay week-ends. Does not smoke.
Progress Getting steadily worse. Advised to leave the pit.

J.B. Age 39 Height 5ft 5. Occupation Hewer.
Symptoms Nystagmus, slight, elicited on looking up but not on a sudden change of light. Comes on on stooping or on exertion, worse at the end of the shift. To stop, patient closes the eyes and rests.
Dancing of objects which appear to move "both ways – if the right eye is closed, in a circle from left to right, if the left eye is closed, in a circle the opposite way". Photophobia (for lamps, but not broad daylight) Sees badly in the dusk. Pains in the eyes & head especially at the left side. No tremors or giddiness.
Vision Rt = 6/6; L = 6/12.
Duration of Nystagmus 2 months — of work in the pit 27 years — of hewing 20 years.
Conditions of Work Seam 5ft 6 to 6ft. "Scalloping" done, Clanny lamps for the last 10 years.
Ventilation Bad — "a lot of gas."
General Health and Habits. Former good. Has not smoked for 6 months (formerly 2oz a week) Does not drink.
Progress Has left the pit and gone to a better-ventilated pit to do "stonework", seam 4ft 6. The same lamp is used but the light is better for this work.
Previous Attacks said to have occurred (?) 10 years ago. He was working in a 4ft seam with lamps & changed to a 4ft seam in a candle-lit pit where he got better.

H. Mas. Age 33 Height 5 ft 8. Occupation Hewer.
Symptoms. Nystagmus, at first vertical, then violently rotatory, elicited on looking up, on sudden change of light, on catching sight of a light, & on stooping. Patient could not sign his name as nystagmus began as soon as he leant over the paper. To steady, shuts the eyes. Blepharospasm. Tremors of the head. Lights dance. Marked photophobia, Sees well in the dusk. Some aching of the eyes. Pains in the head. Giddiness. Vision "as good as ever unless the eyes are dancing". Va. Rt = 6/12. L = 6/9.
Duration of Nystagmus 1½ years — of work in the pit 12 years. — of hewing 7 years.
Conditions of Work. Seam 27 to 30 inches. Undermining and blasting. Improved lamps for 1½ years, Davy lamps for 5½ years previously. Ventilation good.
General Health and Habits. Former good but patient "nervous". Smokes 2oz a week, takes a little alcohol.
Progress Knocked off work. After 10 weeks worse if anything. Nystagmus very easily elicited & painful to watch as the patient became so excited.
After 15 weeks, improving, nystagmus less easily started & more easily stopped. Less pain in the head. Still some giddiness.

M.Br. Age 36. Height 5 ft 8. Occupation Hewer.
Symptoms Nystagmus, chiefly oblique, started on looking up & out, especially to the left, or on sudden change of light. Worse at the end of the shift or when the patient is flurried. No steady, closes the eyes.
Lights dance, objects move "back & forwards", Photophobia especially in electric light, sees badly in the dusk. Aching of eyes, No giddiness.
Vision 6/36. — eyes moving.
Duration of Nystagmus 15 months — of work in pit 20 years —— of hewing 18 years.
Conditions of Work For the last 11 years has worked in a 2 ft 4 seam, "scalloping". Candles used, (~~one~~ 14 years ago worked with Clanny lamps for 3 years) Ventilation good.
General Health and Habits. Former not very good of late. Smokes 3oz a week and is a heavy drinker.
Progress Worse after a drinking bout.

Martin B. Age 41. Height 5 ft 8½. Occupation Hewer.
Symptoms Nystagmus rotatory, started by shaking the head and looking up & to the left, also starts in a dim light.
Dancing of lights, object is "round, moving from left to right." Marked photophobia. Sees badly in the dusk (apparently due to street-lamps) Vision 6/24, said to be good previously.
Duration of Nystagmus 5 years — of work in the pit 30 years — of hewing 13 years.
Conditions of Work Works in a seam of 2 to 4 ft with a Clanny lamp, previously worked with candles. Ventilation poor — has had two "doses" of black damp and fire-damp.
General Health and Habits Former good. Hard worker. Smokes 3½ oz a week. Teetotal.
Progress While at work exacerbations frequent without apparent reason. After 5 months rest he writes:— "the eyes are much better and I have not noticed any trembling for the last two months. Lights and all objects appear quite natural & steady and I can see a good long distance now in twilight"
Has started work at another colliery where candles are used.

S.Y. Age 37. Height 5ft 8⅞. Occupation Hewer.
Symptoms Nystagmus, chiefly oblique, elicited on inclining the head to one side & stopped by fixing the glance to the right. Takes longer to stop in the mine than above ground.
Lights dance, object moves "from left to right in an ellipse at an angle of 45°" ↗↙ & cannot be localized. No photophobia. Sees badly in the dusk. Eyes ache after day's work. No pains in the head or neck. No giddiness.
Duration of Nystagmus 2 years — of work in the pit 14 years — of hewing 2 years.
Conditions of Work. Works, chiefly on the right side, in a seam 1ft 9 in height. Eyes usually directed up and to the left.
Candles used, but patient has worked with lamps. Ventilation good.
General Health and Habits Former good. Is a hard worker & a fairly heavy drinker.
Progress Varies, but on the whole progressively worse. While under observation, patient went to a seam 3ft - 3ft 6, worse lit and worse ventilated, where he improved.

A. McA. Age 27. Height 5ft. 6½ Occupation Hewer
Symptoms. Nystagmus, chiefly oblique, elicited on looking up and out, a sudden change of light "bothers the eyes", worse at the end of the shift. To stop, patient closes the eyes and looks straight in front.
Dancing of lights. Object moves "backwards & forwards, fatter at the ends"  . Photophobia. Giddiness when the head is hanging down
Sees badly in the dusk & at a distance.
Va. Rt = 6/24 L = 6/18. Myopia.
Duration of Nystagmus 2½ years — of work in the pit 13 years — of hewing 8 years.
Conditions of Work. Height of seam 2ft. Does both "corving" and "scalloping". Has always used candles. Ventilation good.
General Health and Habits. Former good. Smokes 2oz a week (used to smoke 5oz), drinks some beer at the week ends.
Progress. Gradually getting worse. Finds "undermining" most trying.

J.T. Age 32. Height 5ft 7. Occupation Hewer.
Symptoms Nystagmus, rotatory, elicited on getting into position of work in the dark room, comes on after any violent exertion e.g. football, worse at the end of the day's work. To stop, patient puts his finger on the end of his nose and looks at it.
Dancing of lights, object moves "round, left to right". Eyes tremble. Sees badly in the dusk. Giddiness. Vision "as good as ever except for distance" Va R & L = 6/12.
Duration of Nystagmus 18 months — of work in the pit 20 years — of hewing 13 years.
Conditions of Work. Seam varies from 2 to 7 feet, averaging 3ft 6. Layer or "band" of stone in the middle. Undermining & blasting. Pattison & Clanny lamps used (candles used 12 years previously). Ventilation good, "a little gas occasionally".
General Health and Habits. Former good. Works hard, smokes 4oz a week, gets inebriated occasionally on "pay Saturday" (fortnightly)
Progress. Varies according to the seam he is in. Worse after a drinking bout. Improved after 2 days & 7 days rest.

J. McK. Age 25 Height 5 ft 8. Occupation Hewer.
Symptoms Nystagmus, slight, chiefly vertical, elicited on looking up & out, comes on at a sudden change of light especially light to darkness and on a sudden movement of the body. Not worse at the end of the shift. Slight blinking.
Objects appear blurred. Dazzling. Slight giddiness. Vision "as good as ever it was" R & L = 6/9.
Duration of Nystagmus 4-5 months — of work in the pit 13 years — of hewing 5 years.
Conditions of Work Seam 2-4 ft — does undermining and blasting. Clanny lamps used. Ventilation fair.
General Health and Habits. Former good. Does not smoke but takes a little alcohol.
Progress Condition gradually getting worse. Has continued work & been successively treated with Formic Acid. Sod. Formate & Tinct. Nuc. Vom. for 3 months. The eyes "feel stronger" and he is less troubled with the movements but he thinks that is because he is getting used to them.

This patient, unasked, sent a written account of his symptoms which I append. It also serves to give an idea of the intelligence of many miners.

J. McK's account.

"I am what is known as a Hewer. I am working with a Safety Lamp, the seam in which I work averages about four feet in height. The work of a Hewer is to get the coal, and the manner of getting it is, as a rule, this (at the pit I am working in and generally throughout Northumberland where shots are fired) — a man starts in the first place to hack or hew the bottom part of the seam out, that is, he takes about six inches or one foot of coal out from the bottom part of the seam, he continues doing this until he has got a yard or more beneath the upper part of the seam (while one is doing this, he is looking for the most part in a downward direction) — now, after a man gets the bottom part of the seam out, he drills a hole in the upper part of the seam, above where he has taken the bottom part out, into this hole, he puts powder, which shoots the whole of the coal down, after this is done, he starts to fill his coals into small wagons or tubs, in the operation of filling these tubs, a man is constantly moving his eyes in a downward, and then in a sort of upward direction, when he digs

his shovel into the heap of coals, he is looking downward, when he is throwing the coals into the tub, he is looking in a sort of upward direction.
After he has got his coals filled away he starts timbering, that is, he starts to set props, which are to secure the roof and make the place safe, in doing this there is not much strain upon the eyes, and there is not much time occupied in doing it, but in doing it there is a tendency to look in an upward direction." .....

1) "The seam in which I am working has what is known as a "band" in it, this "band" is about three inches thick, it runs in the middle of the seam of coal, and when one fires his shots, this band gets all mixed with the coal and it has to be picked out and thrown away, now since the trouble commenced with my eyes, I feel the strain upon them when I have to look for this "band" and separate it from the coal.

2) The second thing I have noticed is, when I get a tub to fill, I have to put a token on it; this token is a small piece of leather attached to a string, the leather is about

an inch square with a number stamped on it, the number in many cases is badly stamped, and when I take the lamp to see whether the correct number is on or not, I find that the lamp being so near to the eyes, it sets the eyes or eyelids in motion, and I can barely make the number of the token out, if it is poorly stamped.

3) If through accident, my lamp gets knocked out, which sometimes happens, I am then transformed from the dim light of my lamp into total darkness, now under such circumstances I cannot say that I have felt any unnatural affection of the eyes whatever.

4) The shaft bottom is lighted with electricity. When my work is done at the "face", I come out to the shaft bottom, consequently when I get to the shaft I go from the dim light of the lamp I work with, into the electric light ~~with~~ which the shaft bottom is lighted. Under this circumstance I find the eyes or eyelids are set in motion and the movements seem to last from three to five minutes.

5) When I have been at the shaft bottom for about ten or fifteen minutes and the eyes.

have got accustomed to the electric light and are therefore steady and natural, I have then got into the cage and have ascended to the surface and daylight. Now in this case I have gone from electric light into daylight, and I find that the eyes are affected by this change also, from three to five minutes.

6) I have also found in daylight that some motions of the head will cause a deficiency in the light for a second or two.

7) I also find that if I stoop my head for any length of time, say half a minute, when I straighten myself up again, I find that the eyelids are in motion for a few seconds.

8) In conclusion, there are men who tell you that lights jump and dance about. I never noticed or found this to be the case with me, but to-night (Sunday) when going towards some bright lamp-lights on the foot path, I found the eyes were beginning to be affected and also that there did seem to be a sort of movement or jumping of the lights. I would be about 150 yds away from the lights when I noticed this, but the general impression wh. I have got under such circumstances has been, that there seemed to be a glitter on the lights and the lights have a depressing effect on the eyes."

J.D. Age 39. Height 5ft 6½. Occupation Hewer.
Symptoms. Nystagmus, chiefly vertical, elicited on looking up, or up & out, or by gazing hard at anything. Formerly started on entering the house at night. Worse at the end of the shift. Lights dance. Object "flickers". No photophobia. Used to see badly in the dusk. Formerly some giddiness. Vision Rt = 6/60. L = 6/36. Vitreous opacities. Eyes moving.
Duration of Nystagmus 2-3 years — of work in the pit 29 years — of hewing 21 years.
Conditions of Work. Seam varies from 2ft 2 to 10 feet. Patient has worked 5 years in a seam 5-10 ft and 6 years in a seam 7-14 feet. Candles used for the last 2 years, lamps for several years, also electric light. Ventilation good.
General Health and Habits Former good until an attack of typhoid a year ago when he was off work five months. Smokes 2oz a week. Now teetotal but used to drink a good deal of beer.
Progress Improving. Has been treated for the last five months for vitreous opacities.

W.M. Age 52. Height 5ft 5. Occupation Hewer.
Symptoms Nystagmus. rotatory, elicited on looking up and to the side, at the same time inclining the head, or on stooping and looking up — any sudden movement starts it. It is stopped on looking in front. Worse at the end of the shift. Lights dance. No photophobia. Some giddiness. Vision Rt = 6/6 partially. L = 6/18.
Duration of Nystagmus 20 years — of work in pit. 38 years — of hewing 32 years.
Conditions of Work. Seam varies from 1½ to 3 ft. Clanny lamps used. Ventilation good.
General Health and Habits. Former good. Smokes 2-4 oz a week. Heavy drinker until the last 2 months when he has been teetotal.

W. C. Age 61. Height 5 ft. 7. Occupation Hewer.
Symptoms. Nystagmus, chiefly rotatory, elicited on looking up and to either side, soon stopped on looking down, worse towards the end of the shift, as easily started above-ground as down the pit.
Dancing of lights, object appears "round", sight misty, Photophobia. Some giddiness.
Vision R & L = 6/24.
Duration of Nystagmus 3 months — of work in the pit 50 years — of hewing 30 years.
Conditions of Work. The present seam is 22 inches, average being 2 ft 6. Work is all "scalloping". Candles used for the last 12 years, previous to that lamps occasionally but chiefly candles. Ventilation good.
General Health and Habits. Former good except for some "tightness in the chest". Smokes 3/2 oz. a week & used to smoke 5 oz. (Possibly has some tobacco amblyopia) Drinks very little. Slightly dull in hearing.
Progress Getting steadily worse. Put on Tinct. Nuc. Vom. m v t.i.d — some improvement.

T.D. Age 30 Height 5ft 4½ Occupation Hewer.
Symptoms Nystagmus, rotatory; elicited on looking up, of late, has appeared when brushing the hair. To stop, patient closes the eyes, he finds it easier to steady them in the pit. Lights dance, especially at the end of the shift and in the twilight. Objects move "in a circle" Photophobia. Sees well in the dusk unless the eyes are moving. Some giddiness.
Vision R & L. = 6/9 partially. (Astigmatism)
Duration of Nystagmus 1 year — of work in pit 16 years — of hewing. 10 years.
Conditions of Work. Seam is 6ft 6. Candles used, except for 6 months once when Clanny lamps were used. Ventilation good.
General Health and Habits. Former good. Smokes 2oz a week & is teetotal.
Progress Exacerbations and remissions, worse latterly. Has knocked off work.

J.R. Age 52. Height 5ft 10. Occupation Hewer.
Symptoms Nystagmus, oblique, slight, elicited when eyes turned up and out, stops in any other position.
Lights dance a little especially when they are a long way off. No other symptom complained of. Vision. Rt=6/18. L=nil (hypopyon ulcer) leucoma.
Duration of Nystagmus 2 years — of work in pit 42 years — of hewing 32 years.
Conditions of Work. Seam varies from 3 to 5 ft. Clanny lamps used, patient has worked with candles. Ventilation good.
General Health and Habits. Former good. Smokes 2 oz of tobacco a week and occasionally takes beer.
Progress 10 months ago, patient developed a hypopyon ulcer on the left eye, he lay idle for 6 months and then started stone-work. Nystagmus is "much the same and is no bother".

J.D. Age 42. Height 5 ft. 6¾. Occupation Hewer.
Symptoms. Nystagmus ? oblique, elicited with difficulty (very evident 6 months previously) Lights dance "in a circle". Some photophobia, Aching of eyes. Vision — myopic astigmatism.
Duration of Nystagmus about 6 months (first evident after blow with coal) — of work in pit 28 years —— of hewing 22 years.
Conditions of Work Seam averages 3 ft. Clanny lamps used. Ventilation good.
General Health and Habits. Former good. Smokes 2-3 oz a week. Teetotal for 6 years.
Progress Out of pit for several months enjoying compensation for the blow on the eye. With difficulty persuaded to undertake light work. Nystagmus almost cured.

T.L. Age 23. Height 5ft. 7½. Occupation Hewer.
Symptoms. Nystagmus oblique, elicited chiefly on looking up and to the right, worse on stooping, patient cannot play football. To steady the eyes, the patient throws the head back and looks down.
Lights dance "back and forwards". Photophobia, especially for lamps. Eyes "burn". Sees badly in the dusk. Vision. Rt=6/18 (Nebula from childhood) L=6/60. Myopia.
Duration of Nystagmus 2½ years — of work in pit 8 years — of hewing 2½ years — of hewing & putting 2 years.
Conditions of Work. Seam 23-24 inches for the last 6 months, 2ft 8 before that.
Clanny lamps always used, Ventilation good.
General Health and Habits. Former good. Neither smokes nor drinks.
Progress. Exacerbations & remissions. "Better in a higher seam".
Put on Boric Acid m.v. t.i.d. & ordered weak Pagenstecher ointment for the nebula. "Improved" after six weeks

G.E. Age 24. Height 5 ft. 9½. Occupation Hewer.
Symptoms Nystagmus oblique, slow & slight, elicited on looking up and out, stopped on throwing the head back. or on bringing the eyes down. Dancing of lights especially at the end of the day's work. Object moves "all ways". Slight photophobia, sees well in the dusk.
Vision R & L = 6/6.
Duration of Nystagmus 2 months — of work in pit 13 years — of hewing 4 years.
Conditions of Work. Seam varies from 4 to 5 ft. Clanny lamp used. Ventilation poor, has had one or two "doses" of gas.
General Health and Habits. Former good, until an attack of influenza — 3 months previously. Smokes 2 oz. a week, takes very little alcohol.
Progress Improved after a rest from work.

Matt. B. Age 23. Height 5 ft. 9. Occupation Hewer.
Symptoms Nystagmus chiefly oblique, elicited on looking up and out; to check, the head is thrown back. Worse at the end of the shift.
Object moves "backwards and forwards"
Lights dance. Some photophobia. Aching and mistiness of the eyes when in the pit.
Sees badly in the dusk. No giddiness.
Vision R. & L = 6/6.
Duration of Nystagmus 6 weeks — of work in pit, 11 years — of hewing, 4 months — of hewing and putting 9 months.
Conditions of Work Seam varies from 2 ft 6 to 5 ft, averaging 4 ft 6. Clanny lamps now used, — formerly Davy. Ventilation good.
General Health and Habits Former good. Smokes very little (cigarettes) & is teetotal.
Progress Improved after a month on Formic Acid. m v t.i.d.

J.R. Age 25. Height 5 ft. 7. Occupation Hewer.
Symptoms. Nystagmus, vertical & slightly oblique, marked and constant in the right eye, elicited slightly in the left on looking up and out, stopped on looking down or on covering either eye.
Objects move "up and down". Dancing of lights, not worse towards the end of the shift. Slight giddiness. No photophobia or night-blindness.
Vision. L = 6/6. Rt = 6/36 (astigmatism)
Duration of Nystagmus Right eye ever since patient can remember, did not know left eye oscillated — of work in pit 12 years — of hewing 7 years.
Conditions of Work Height of seam not ascertained. Has always worked with candles. Ventilation good.
General Health and Habits. Former good. Is morbidly conscious of the nystagmus. Smokes 1oz a week & drinks a moderate amount of alcohol.

W.L. Age 49. Height 5ft 7. Occupation Hewer.
Symptoms. Nystagmus elicited on change of light, stopped on closing the eyes for a few seconds, worse at the end of the shift.
Drooping of the upper lids.
Dancing of the lights, objects "blurred". Photophobia. Marked night-blindness. Occasional pains in the head and back. Vision "as good as ever". Va R & L = 6/6. Retinitis pigmentosa.
Duration of Nystagmus 4-5 years. — of work in the pit 18 years — of hewing 4-5 years — of stone work 14 years previously.
Conditions of Work. Present seam 3ft 6, average height 2-3ft. Work is "scalloping". "Stone work" used to be done in a seam 2ft 2. Candles used for 15 years. Ventilation poor.
General Health and Habits. Former good. Smokes 3oz a week, drinks beer & occasionally spirits.
Progress Exacerbations and remissions but getting steadily worse. After 6 weeks on Sod. Formate gr v t.i.d., the eyes were a little steadier but pains in the back and neck were still complained of..

R.Y. Age 55 Height 5ft 10. Occupation Stone-man.
Symptoms Nystagmus lateral, then rotatory.
To chait, eyes are turned out as far as possible, to stop, patient puts the head down and covers the eyes with his hand. Some blepharospasm. Object appears to "flicker". Photophobia - patient wears a peaked cap as shield from the sun - prefers the dusk. Slight giddiness. Vision poor, eyes moving Va Rt = 6/60. L = 6/36.
Duration of Nystagmus 14 weeks — of work in pit 46 years — of stone-work several years, has done that and hewing. 36 years.
Conditions of Work Works in a seam 2ft - 4ft 6, using a Clanny lamp. Has occasionally worked with candles. Ventilation good.
General Health and Habits Former good. Used to smoke 6oz a week, now smokes 2oz. Teetotal for several years.
Progress Exacerbations and remissions Off work 3-4 weeks — a little improved.

C.L. Age 22. Height 5ft 6½. Occupation Stone-man.
Symptoms Nystagmus, rotatory, constant, least marked on looking down.
Objects said to move "in a circle". Sees badly in a bad light. Vision poor, left eye has a thick nebula, present since childhood.
Duration of Nystagmus 1 year — of work in pit 4 years
Conditions of Work. The seam is 3 ft, tramways made to 4ft 9. Davy lamps used. Some "gas" in the mine.

D.H. Age 35 Height 5 ft. 5. Occupation Stone-man.
Symptoms. Nystagmus, oblique, elicited on stooping as in the position of work. To stop, patient says he turns the eyes as far out as possible.
Some tremor of the hands.
Object appears ~~at first~~ to move "wildly back and forwards at first, and then round a sphere" ↻
Giddiness, especially on stooping and on going into the dark, when he reels about. Photophobia.
Pains and "creeping sensations" in the head.
Vision Rt = 6/6 ; L = 6/18 (Hypermetropia)
Duration of Nystagmus 2 years — of work in pit 19 years — of work as stoneman 4½ years (worked 7 years as hewer previously.)
Conditions of Work Height of seam varies, tram-ways made from 4 ft 6 upwards. Clanny lamps chiefly used, candles used 4 years ago for 1½ years. Ventilation good.
General Health and Habits. The former not good, patient has decayed teeth and suffers from indigestion and "gravel". Is very nervous and excitable, says that he was so bothered with the eyes, he felt inclined to commit suicide. Neither smokes nor drinks.
Progress "Worse every day"
Ordered to bank-top.

J.H. Age 49. Height 5 ft. 6. Occupation Stone-man.
Symptoms Nystagmus elicited on looking up and to the side.
Object moves "backwards and forwards". Photophobia. Sees badly in the dusk. Vision — ~~right~~ eye has choroiditis (blow 1½ years previously)
Va. Rt = 6/36, L = 6/6.
Duration of Nystagmus 3-4 months — of work in pit 38 years — of stone-work 24 years.
Conditions of work. Seam 2 ft 6, tram-ways made to height of 4 ft 9. (his son does the low work) Candles used for the last 19 years. Ventilation fair.
General Health and Habits. "Nervous" since typhoid 30 years ago. Has lumbago. Smokes an occasional cigar & ~~takes~~ a little beer.

J.L. Age 23. Height 5 ft 6. Occupation Engine-man.
Symptoms Nystagmus, chiefly oblique.
Object moves "backwards and forwards".
Photophobia – prefers the dusk.
Duration of Nystagmus 1½ years – of work in pit 11 years
Conditions of Work Works chiefly at the shaft where the light is good (electric) Usually directs eyes up and to the left. Occasionally works in a seam of 3 ft 6, with a Clanny lamp among a great deal of coal dust.
General Health and Habits Former good. Smokes very little and is teetotal.
Progress Ordered out of the pit, 6 weeks later reported "improving".

J.D. Age 20 Height 5ft 6. Occupation Putter.
Symptoms Nystagmus chiefly vertical, elicited on stooping and looking up, starts on going into the pit or if flustered; stops on looking straight in front.
Lights dance, more so on exertion. No photophobia or giddiness. Sees badly in the dusk. Vision "as good as ever" Va R & L = 6/6 partially.
Duration of Nystagmus 2 years — of work in pit 7 years — of putting 3½ years.
Conditions of Work. Putting — works with a Davy lamp. Ventilation good.
General Health and Habits Has decayed teeth and suffers from indigestion.
Neither smokes nor drinks.
Progress Getting worse.

H. Mor. Age 32 Height 5ft 5. Occupation Deputy.
Symptoms Nystagmus at first vertical, then oblique slightly, elicited on looking up and stopped by throwing the head back and looking down.
Lights dance, objects move "in a circle" Dizziness especially in the pit and on stooping. Photophobia, Sees badly in the dusk, Headaches. Pains from the bregma down the spine. Vision – myopic astigmatism ~~With~~ correction Va. Rt & L = 6/12.
Duration of Nystagmus 14 months – of work in pit 17 years — of work as deputy 5 years with 5 months in the open.
Conditions of Work. The seams vary from 2 to 7 feet, averaging 4 to 5 ft 6". Patient has to examine the roof frequently and to test for gas. An improved lamp (Clanny type) used. Came above ground for 5 months and re-started in a candle-lit pit. Ventilation good in the first pit, not quite so good in the second. Patient has also been studying 4-5 hours a night after his 8 hours shift. (was reading for holy orders)
General Health and Habits Former usually good but patient has overworked. Smokes 2oz a week, takes a very little alcohol.
Progress Patient was better after his 5 months rest but was as bad as ever in 3 months, after going to a candle-lit pit.

Part III

Discussion of Cases reported.

Symptoms

Frequency of Nystagmus. Incidence.

Predisposing Causes

Alleged Causes

Mechanism of Nystagmus

Differential Diagnosis

Prognosis

Treatment.

Symptoms of Miners' Nystagmus.

Oscillations of the eyeballs occur from 60 to 500 times a minute and the rate may vary in each eyeball.

The type of nystagmus may be vertical, horizontal, oblique or rotatory. In my series in the slighter, shorter-lasting cases among the hewers, and in the younger men, nystagmus was usually vertical or oblique. This variety also prevailed among those hewers working in higher seams, — often at "scalloping", and also in 2 out of the 4 "stonemen", the "deputy-overman" and the "engine-man" included in my cases. The rotatory type was more frequent in the severer longer-lasting cases and was almost entirely confined to the hewers. One "stone-man" had this variety, — the light in which he worked was very poor (Davy lamps) and he had very poor sight owing to a thick nebula.

On being elicited nystagmus often began as the vertical or oblique type and then became rotatory.

Movements may be confined to the one eye or may be intermittent. In one of my cases

nystagmus was constant in the one eye and could only be elicited with difficulty, for a short time, in the other eye.
To elicit nystagmus, various devices have been suggested. The most ordinary method is to direct the gaze of the patient upwards or upwards and outwards. In a shorter or longer time nystagmus usually appears Romiée declares that "height is everything" and the obliquity of the glance has no influence* This is not usually admitted and my own experience is that it is easier to induce nystagmus by causing the patient to look up and out than by merely looking up, and that occasionally it is possible to tell whether the patient is right or left-handed, by the greater ease with which the nystagmus is elicited on looking up and to the one or the other side. One of my cases was thus found to be left handed and two to be right handed; many miners are however ambidextrous.
Merely fixing the gaze in two cases produced nystagmus.
The position of the body also assists in the

* Romiée. Bull. de la Soc. Belge d'Ophtalmologie. Nov. 1908.

production of nystagmus. As pointed out both by Snell* and Rieden†, putting the patient in the attitude of work is usually effective. Inclining the head to one side, sudden movements of the body, stooping, or exertion may bring it on. In one of my cases nystagmus began when the patient was brushing his hair, and several men have been obliged to give up playing football. One or two also complained of movements of the eyes whenever they were flustered or nervous.

The degree of illumination has also much influence on the production of nystagmus. Too bright or too dim a light may bring it on, but, even more markedly, a sudden change from light to darkness or vice versa. Rieden† suggests reducing the illumination suddenly as a means of eliciting it.

While in a few of my cases, change of light seemed to make little difference it was not so with the majority; more especially was a change from darkness to light complained of, e.g. going home into a brightly lit room; in one case an attempt to examine the fundus produced nystagmus and in

* Snell in his book on Miners' Nystagmus.
† Rieden. Der Nystagmus der Bergleuten (1894)

another, merely catching sight of a small gas-stove in the dark-room, caused violent oscillations.

Street-lamps may also provoke nystagmus and where the "evening-light" or "dusk" is complained of, one must enquire carefully whether distress is not really caused by the lights. Nystagmus, when present, may be aggravated by any of the above conditions or by bad general state, intercurrent illness and trauma, as pointed out by Dransart and Famechon*, and also by the use of alcohol. It is often worse when the patient is tired, at the end of his "shift" or day's work, most of my patients acknowledged this.

One of my cases was distinctly worse after the formation of a hypopyon ulcer. Of six of my patients who occasionally took alcohol to excess, all agreed that the nystagmus was worse "when they were in drink and after" Three men considered the first transient effect of alcohol was to steady the eyes. To check the movements, the glance is usually directed downwards, while at the same time the head may be thrown back. One man placed

*Dransart & Famechon. Bull. Belge de la Soc. d'Ophtal. No. 24. 1908.

his finger on the end of his nose and steadily looked at it. In some cases the nystagmus was checked more easily while in the pit and on closing the eyes, in others while above ground and by looking steadily at some object. Two men turned the eyes outwards to check the movements and in one case these stopped on covering either eye.

The degree of nystagmus is estimated by the relationship to the horizontal in which the movements stop — the higher this is, the less severe is the nystagmus. Nystagmus without oscillation has been described by Bransart and Famechon* and Snell in his book referred to an "incipient" form of Nystagmus where, although subjective phenomena are present, oscillations cannot be elicited. He considered however that these might be seen on examination immediately after leaving the pit, and Romiée strongly denies a form of Nystagmus without oscillation†

Blepharospasm etc. Paresis of the elevators (denied by Romiée), producing slight ptosis,

* Bransart et Famechon. Bull. de la Soc. Belge d'Ophtalm. no 24. 1908.
† Romiée. Bull. de la Soc. Belge d'Opht. Nov. 1908.

may occur. Those affected have a somewhat sleepy appearance and walk with the head thrown back; one of my cases could not otherwise recognize acquaintances. Blinking and twitchings are also complained and occasionally initiate the nystagmus. In grave forms there are clonic fibrillar contractions of the orbicularis and cramps of the elevators, synchronous with the oscillations and worse on looking up; one of my cases had this symptom and suffered from blepharospasm very severely.

Tremors of the head and hands also occur and were present in three of my cases, and Cocking* describes an interesting case with a spasmodic affection of the left arm, torticollis and head-shaking.

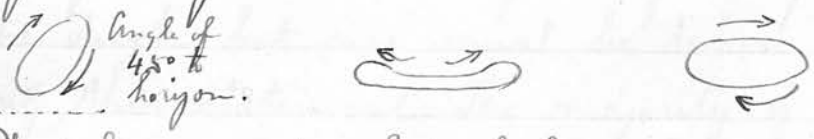
Diplopia has been mentioned as sometimes occurring.

"Movement of objects."

The most common, and often the first symptom complained of, is "dancing of the lights" in the pit. This may be a mere blurring or flickering, or the objects may appear to move in a definite direction, usually either "backwards

* W.J. Cocking. B.M.J. Oct. 15. 1892.

and forwards" or "in a circle", sometimes beginning as the former and ending as the latter. Some of the more observant men were able to describe definitely the lines taken by the objects and even to draw them.



Dazzling and photophobia.

This was present in the majority of the cases though not in all. Lamps, gas and electric light were most complained of, also a sudden change to a bright light e.g. going into a brilliantly lit room at night. One patient habitually wore a peaked cap to shield his eyes. In one or two of the more severe cases there was a literal "dread" of bright lights.

Night-blindness.

This is a symptom about which there is much dispute. Dransart and Pamechon* think it is present in about 5% of cases but acknowledge that the question is still sub judice. Latham Thompson† recognizes it and Duel of Liège⊙ thinks there is more or less night-blindness owing to the alteration in

* Dransart et Pamechon. Bull. de la Soc. Belge d'Ophtal. No 24. 1908.
† Latham Thompson. B.M.J. Oct. 1892.
⊙ Duel. Bull. de la Soc. Belge d'Ophtal. No 24. 1908 (Preface)

the function of the rods and cones. The condition is denied by Rieden, Snell and Romiée†, the latter affirming that he does not know a single case in Belgium.

Many miners will complain of seeing badly in the dusk but care must be taken in accepting this statement. The majority of them have photophobia and on further questioning it may be found that, in reality, it is the street-lamps or other lights that causes difficulty in seeing — either producing dazzling or nystagmus. Or, the mere change from light to darkness may also produce nystagmus, when of course the sight is poor. In only one case was I satisfied that there was present a true condition of night-blindness, and on subsequent examination, this patient was found to be suffering from retinitis pigmentosa. Some of the men stated they preferred the dusk and felt easier in ~~it~~. a dim light.

Disturbance of vision.

In the slighter cases at all events, the visual acuity is unaffected. The field of vision is probably always normal, but

† Romiée. Bull de la Soc. Belge d'Opht. Nov. 1908.

where nystagmus is present at the time of testing, it is impossible to take it correctly. Colour perception, according to Dransart, is always normal.

Dransart and Famechon* have recently described a true amblyopia, or pronounced weakening of vision for distance, and accommodative asthenopia, in grave cases. There is no organic alteration. This condition is not acknowledged by Roniée, Snell, Rieden, Duel and others who consider that difficulty in seeing is due solely to the movements of the eyeballs, in such cases visual acuity being 6/60; 6/36 or less.

In 11 of my cases Va = 6/6 or 6/9 in one or both eyes. In 6 of them nystagmus was present and Va = 6/60 or 6/36.; others had various errors of refraction or other visual defects. It is possible that accommodative asthenopia was present in one grave case, in another amblyopia was probably due to the excessive use of tobacco.

Giddiness

This symptom was present in a considerable number of the patients and was often

* Dransard et Famechon. Bull. Soc. Belge d'Ophtal. No 24. 1908.

especially marked on stooping, when the head is hanging down or on changing the position of the body. As has been previously mentioned, some men were unable on this account to play football; in one case the patient stated that while the eyes were moving, he reeled about like a drunken man.

Aching of the eyes. Pains in the head, neck & back.

Several of the patients complained of a dull aching of the eyes, a few of pains in the head and neck. Two also suffered from pains down the back.

Effect of nystagmus on the mental condition

Rutten of Liège* has pointed out that extreme cases may shew mental defects and become irresponsible and that in slighter cases a neurotic state may be present. Several of my patients were nervous and excitable, one man was morbidly conscious of the nystagmus and imagined that everyone was commenting on it and another said "he felt inclined to commit suicide, he was so bothered".

* Rutten. Bull. Belg. de la Soc. Belge. d'Ophtalmologie. Nov. 1908.

Frequency of Nystagmus Incidence.

This has been very variously estimated. It is recognized as occurring chiefly in hewers — 98% of cases are those occupied at the coal face. Of my cases 23 were hewers, 4 were "stone-men", 1 was a putter, 1 a deputy-overman and 1 an "engine-man". Two, at least of the "stone-men" had previously done hewing regularly and probably all had done hewing occasionally. The "engine-man" occasionally worked in the seams.

Bransart and Famechon place the percentage among the hewers at 1-27%. Rieden places it at 5%; Ruel (Liège) and Pohl (Jemappe) at about 20% — Romiée at even higher, hewers 20-65% and putters 3% (in Belgium) The probable reason for such wide divergence of opinion is that there is no satisfactory basis on which to estimate the frequency. In Germany, I believe, there are periodical examinations for nystagmus, but in other countries conclusions are chiefly drawn from observations made in scattered pits and from the number of cases attending at clinigues. No satisfactory statistics can be

thus made. Many men are not aware of the nature of their trouble, others do not bother about it, and others "do not see the use of coming just to be told to knock off work". On the other hand, at present in England, owing to the recent inclusion of Miners' Nystagmus in the schedule of Industrial diseases for which Compensation can be claimed, it is likely (and is our experience at the Newcastle Eye Infirmary), that many more cases present themselves than formerly. Until periodical examinations are universally held, the frequency with which Miners' Nystagmus occurs, cannot be accurately determined.

21 pits were represented by my cases; 11 of the patients knew of one or more men who had a similar complaint, others had never heard of the condition — and pitmen as a rule take an intelligent interest in such subjects.

The <u>age</u> at which nystagmus is most common is probably 25-45. J. H. Bell gives as an average, 38; the average of my cases was 33·6.

18 - 25	25 - 45	45 - 61 years of age
6	18	5

thus, the earliest age at which nystagmus occurred was 18, and the latest age at 61.
The height of the men varied from 5ft 4 to 5ft 10 — the average being 5ft 7.
The number of years the patients had worked in the pit before the development of nystagmus was as follows :—

3-10	10-15	15-20	20-30	30-50 years
3	10	5	5	6

and the number of years spent at the particular form of work the patient was engaged in when nystagmus was developed was:-

1-5	5-10	10-15	15-20	20-40 years.
9	4	4	4	6

Nystagmus had been present in the various cases from 5 weeks to 20 years when they presented themselves for advice.
It must be borne in mind however that if the theory of a "latent nystagmus" be accepted, the condition might have been present in the patients for a much longer time than they were aware of.

Predisposing causes

Errors of refraction are considered by many observers to bear no causal relation

Dransart found 9/10 of his cases to be emmetropic. Others think that hypermetropia and hypermetropic astigmatism pre-dispose but it is difficult to prove whether cases with these errors are proportionately more frequent. In 11 of my cases the vision unaided was 6/6 or 6/9, 4 were myopic, 2, at least, astigmatic and one, at least, hypermetropic. Vision was defective in the other cases from various causes (nebulae, 3 cases; choroiditis (in one eye) one case; vitreous opacities, one case; cataract (in one eye) one case; retinitis pigmentosa, one case; tobacco amblyopia? 2 cases) and in 6 cases nystagmus was present, at the time of testing the visual acuity.

Intercurrent illness is said to predispose though Romiée* denies that the general health has any influence on nystagmus. Influenza is particularly mentioned as a cause and I know of two cases developing soon after an attack. Another case came on about the same time as an attack of "boils on the leg"

Traumatism either general or above all trauma of the skull may bring on or aggravate existing nystagmus, according to Dransart

* Romiée. Bull. de la Soc. Belg. d'Ophtalmologie Nov. 1908.

and Famechon*. They also point out that slight wounds of the eye or surgical interference may make evident nystagmus which may be confined to the injured eye. Romiée has not noticed that injuries have any effect. It is very difficult to get an accurate history about traumatism and one case who dated his nystagmus from a blow with coal, probably did so with a view to compensation Dransart & Famechon* consider that in such cases there is probably a form of "latent nystagmus" which is thus made evident. Rieden also recognizes this form.

Alcoholism. Miners have the name of being hard drinkers. When this is the case their drinking bouts are often confined to "pay Saturday" (every other week-end). Of my patients 10 were teetotal; 12 took alcohol occasionally, 4 drank a good deal, and 2 were acknowledged hard drinkers.

Smoking. Tobacco amblyopia is not usually considered a special cause (Pohl-Jennappe) Of my cases 7 were non-smokers; 11 smoked from 1-2 oz twist a week and 10 smoked from 2½ oz upwards. One case probably had

*Dransart et Famechon. Bull de la Soc. Belge d'Ophtalm. No 24. 1908.

tobacco amblyopia and another possibly suffered.

Deafness Attention was paid to this in view of the fact that nystagmus is sometimes produced by labyrinthine disturbance. Only one of my patients appeared to be at all deaf and he was an elderly man. Dransart has not noticed deafness as being common.

Hard work A great number of the men were very good workers, judging by their pay, which, among the hewers, is based on the individual output.

Alleged causes of Miners' Nystagmus.

Defective light. Some observers hold that this condition is almost entirely due to the imperfect illumination of coal mines, the effect being intensified by the extreme blackness of the coal. Statistics have been brought forward to shew that where the lighting is comparatively good, i.e. in candle-lit pits, nystagmus is rare, where lamps are used it is common*. Romiée† states that safety-lamps were first used in Belgium, in scattered pits, in 1851 and became obligatory

* Court. Lancet. May 30. 1891
† Romiée. Bull. de la Soc. Belge d'Ophtalmologie. Nov. 1908.

in all pits in 1876. Only since this latter date has nystagmus begun to appear frequently. Since an improvement in the type of safety-lamps used, nystagmus is diminishing in frequency and intensity. With further improvement in lamps Romiée thinks the condition would no longer exist, as it does not appear to exist in other mines (not coal). The same observer lays great stress on the rôle played by accommodation, which being subjected to great strain, is soon fatigued. Latham Thompson[Δ] also recognizes this as a factor.

These statements have been hotly contested. It has been pointed that if the defective illumination were the sole or even the chief cause, miners' nystagmus should occur in all the workers in the pit and not chiefly among the hewers.

Snell[*] has shown that cases occur very frequently in men working with naked lights and may occur in men working with electric light. Rutten[†] of Liège states that though improved lights have been used in Germany since 1883 the number of cases has not been

[*] Snell. Transactions of Ophthal. Soc. xi. 1891.
[†] Rutten. Bull. de la Soc. Belge d'Ophtal. Nov. 1908.
[Δ] Latham Thompson. B.M.J. Oct. 1892.

diminished, in spite of periodical examinations. He points out that the apparent fewness of cases occurring in earlier days might be due to the non-recognition of the condition.

Coppez* (Brussels) suggests that if the condition were due alone to defective light, it should occur in other occupations with imperfect illumination e.g. preparation of photographic plates. This does not appear to be the case†

Many observers deny also the rôle played by accommodation according to Romiée, certainly cases may occur in miners who have myopia, 4 of my own cases had this error of refraction. Of the lights used by the patients whom I examined, quite a large number was candles.

Candles only	5	13	
Candles chiefly	8		
Lamps only (Clanny 3, Davy 2, Both 3)	8	16	
Lamps chiefly	8		
Electric light	1	1	

Before drawing any conclusions from these figures however, statistics of the relative

* Coppez. Bull. de la Soc. Belge. d'Ophtalm. Nov. 1908.
† Peeters (Courtrai) Ibid.

numbers working with the different lights, should be obtained. The tendency among the men is to blame the lights but several men stated they felt no difference whatever light they used. The deputy, already referred to, changed to a candle-lit pit and was as bad as ever in a short time, another man however said the change to a candle-lit pit cured him and one or two men stated they were better with candles. It must always be borne in mind that change to a candle-lit pit may entail change to a more favourable form of work.

All observers are however agreed, that, other things being equal, the worse the light, the more likely the onset of nystagmus and the more severe the symptoms, and in support Dransart and Famechon* quote an interesting case, where in a certain pit where naked lights were used, 5% of the hewers were affected. Several years later, under the same conditions, except that safety-lamps had been introduced, 15% were found affected. Making allowance for all possible fallacies, it must be acknowledged these figures are conclusive.

* Dransart et Famechon. Bull de la Soc. Belge. d'Ophtal. No 24. 1908.

Position at work.

The majority of observers hold that the condition is due to the constrained position in which the miners work, involving a prolonged straining of the eyes in an abnormal and unusual direction, with consequent chronic fatigue of the muscles. In support of this view is urged the incidence of the disease chiefly among the hewers, who work in cramped surroundings; the common method of inducing nystagmus, viz. by directing the gaze upwards or upwards and outwards; the improvement in the condition on changing the occupation, even while remaining in the same defective light*; and the occurrence of nystagmus in other than miners, obviously due to the nature of their work. These cases are rapidly accumulating and Snell† (has) collected 18 or 19 occurring in compositors, a plate-layer, a fitter, a plank-cutter & others, while Duel△ has met with the condition in 2 compositors and a polisher of black marble; he however is inclined to attribute their condition partly to the blackness of the surface worked on.

* Snell. Transactions. Ophthal. Soc. xi 1891.
† Ibid. B.M.J. June 1896 p. 1503
△ Duel. (Liège) Bull. de la Soc. Belged'Ophtal. 1908.

Posey and Spiller quote an interesting case of nystagmus developing in a baby who had been accustomed to turning her eyes up to look at a light behind her crib,—when the light was removed, the nystagmus ceased.
Of the majority of my cases occurred in hewers, one or two among "stone-men", who however work under fairly similar conditions, one in a putter, one in an "engine-man" (also occasionally working at hewing) and one in a deputy-overman. The height of the seams worked in, varied from 18 inches to 6 ft, and in a great number of the cases coal was obtained by "undermining."
Several of the men complained of the lower seams and stated that they were better when in the higher seams or when working at the upper part of the seam; one of the "stonemen" always made his son do the low work; and men occasionally leave low seams for "easier" work
One man however who worked in exceptionally high seams, preferred a lower seam as a change. Other men have found the height of the seam makes no difference, and as

in some pits the height of the seam does not vary, others have no opportunity of judging.

Pulling the tubs is often found trying work, especially as it entails a good deal of stooping and rising.

The putter was of the opinion that it was the position he assumed when pushing the tubs — the head bent and the eyes looking up — that caused the strain. and several others volunteered the statement that they felt sure the condition was due to the position in which their work was carried out.

Labyrinthine disturbance

Recent investigations by Barany and others shew that this may give rise to nystagmus. If this were a factor, one would expect to find deafness also present, but, as has already been pointed out, this has not been found to be common among miners.

Disturbance of equilibrium.

A. C. Reid* suggests that equilibrium is disturbed by (1) the dimness of the light rendering fixation of the eyes difficult and (2) the constant changing of the position of the body while at work. and thus nystagmus produced

* A. C. Reid. Brain. Part CXV Nov. 1906. Ophthal. Review Aug. 1907.

A "Central Lesion" was suggested as a cause by Jeaffreson* but there is no evidence of this

Absorption of Toxic Substances

It is known that the absorption of certain substances may produce nystagmus — benzine, light carburetted hydrogen†, cocaine, sulphonal, ergot, sewer gas, ether△ — and it has been suggested that Miners' Nystagmus may be caused in this way. There is however no other symptom of poisoning except perhaps anaemia, and the ventilation of the pits is now usually very good. One of my patients blamed the "gas" as causing his condition and another had had two "doses of black-damp and fire-damp" but the majority said the ventilation was good.

Broadly speaking, Miners' Nystagmus may be considered due to excessive muscular strain of the eyes, producing a condition analogous to Writer's Cramp. (myopathic theory) or to some other factor peculiar to the miner's mode of work producing defective central co-ordination.

* Jeaffreson. B.M.J. 1887. ii. p. 104.
† Rollis v Oliver.
△ Posey v Spiller.

Referring to the subject of nystagmus in general, several theories as to its mechanism have been advanced.

Duchenne holds it to be due to a retardation of nervous impulses to one member of a system of antagonized muscles.

Willbrand* thought it due to a want of harmony between the centre for common reflex action of the eyeballs and the volitional impulse

Gowers† bases his theory on Sherrington's researches into the spinal centres and the alternate contraction of opposing muscles, and puts forward the hypothesis that "the alternation depends on a muscle-reflex action in consequence of insubordination of part of the reflex centre, due to a limited derangement of the influences which should keep its elements duly balanced"

Such a derangement may be caused, in the opinion of some, by a disturbance in the central connexions between the vestibular nerve and the nerves supplying the extrinsic muscles of the eye, as in the nystagmus due to labyrinthine disease.

* Willbrand. Klin. Monatsbl. f. Augenheilk. 1879. xvii. p 419.
† Gowers. The Mechanism of Nystagmus. Royal Soc. of Med. June 1908.

In the case of nystagmus, dating from childhood and due to visual defect, albinism etc., the condition is usually explained by a non-development of the centres for co-ordination. It has been suggested that the condition in Miners' Nystagmus is due to an imperfect stimulation of these centres. e.g. by dimness of light. Fixation of the eye is said to be a reflex, mainly dependant on the higher visual acuity of the fovea. Schäffer has pointed out however that "with dark adaptation, visual acuity is equally good in all parts of the retina except in the fovea, where it is lowered". Thus the imperfect illumination of the pit may make fixation difficult and the movements of the eyeballs tend to escape from control. (A.C. Reid*). The same author lays stress upon defective central co-ordination also being due to disturbance of the equilibrium of the body, by the various positions the miner has to assume.
Nystagmus arising from some "toxic" cause or a "central lesion" would result from some consequent influence on the common reflex centre for the action of the eyeballs.

* A C. Reid. Ophthalmic Review. Aug 1907.

Those observers, and they are probably in the majority, who hold the myopathic theory, regard Miners' Nystagmus as a local affection, the result of prolonged strain in an unusual and constrained position, chronic fatigue results and atony of the muscles being produced, oscillation of the globes is caused. The disease is regarded as one of the Occupation Neuroses, and may be classed with Writers' Cramps and the cramps common in piano and violin players, telegraph operators, milkmaids, weavers, cigarette-rollers and ballet-dancers.
Osler* has described such a condition as "irritable weakness" – there is probably an increase and irregular discharge of nerve energy which gives rise to spasm and disordered movement; muscular weakness, if present, would be explained by an impairment of nutrition accompanying that of function.
It certainly seems probable that abnormal movements of the eyeballs, in directions, as far as I know, peculiar to the form of nystagmus under discussion, should be due to the correspondingly peculiar directions in which the gaze is often fixed, involving continuous and excessive use of the muscles, subsequently affected.

* Osler. Principles and Practice of Medicine.

Differential Diagnosis

Miners' Nystagmus must be separated from:—

Congenital Nystagmus — this may occur in albinism or where the sight is very defective, from leucoma or other cause, In these cases however there is no apparent movement of objects looked at and the history will serve as a guide.

Nystagmus due to congenital or acquired brain lesion. Examples of this may be found in Friedrich's ataxia, disseminated sclerosis, cerebellar tumour. Others symptoms will differentiate it from Miners' Nystagmus.

Nystagmus due to labyrinthine disease. Here one would expect some corresponding deafness.

Prognosis

The condition usually gets better if work is stopped, or in some cases changed. Rest is usually required for at least two months but nystagmus may last for several months or even one to two years after cessation of work (Dransart and Pamechon*) The same authors add that the prognosis is often too favourable; even when apparently cured

*Dransart et Pamechon. Bull de la Soc. Belge d'Ophtalm. No 24. 1908.

the probabilities are that the condition will recur if the patient returns to the old work.
Two of my patients professed themselves cured after five months rest, but one subsequently relapsed and I have not heard from the other since he started work recently; another was very little improved after four months rest and I have heard of several men who were off work from nine to fifteen months.

Treatment.

The obvious treatment, as the disease is an occupational one, is to stop the offending work and come out of the pit — or, as suggested by Snell*, in the less severe cases, to change the nature of the work, or to change the attitude while pursuing the old work. An improvement in the light may also help. A more or less prolonged rest is advisable in any case and then the subsequent occupation may be considered. As a rule however, the men are loth to leave the pit — it remains to be seen, what influence Compensation will have on their attitude. The general health should be attended to — tonics such as Strychnine and Iron, the

* Snell on Miners' Nystagmus.

Bromides and electricity are all used.
Dransart and Famechon* advocate the use of Eserine 2% or injections 1/500, in rebellious cases.
In the Newcastle Eye Infirmary we tried the effects of Formic Acid and Sod. Formate.
Unless the patient stops or changes his work, drugs seem to be of little avail, and while judging the effect of these, it must always be borne in mind that exacerbations and remissions are frequent without any treatment at all. Several of the men themselves remarked that "rest did them more good than any medicine".
With regard to the changing of work Snell† laid stress on the changing of the position and especially on the avoidance of such trying work as "undermining". Others advocate going where better light is obtainable. i.e. to candle-lit pits. Men usually improve on going to the "bank tops" and one or two of my patients found improvement on changing hewing for "stone-work". Another professed to be cured of an attack 10 years before by going to a candle-lit pit but such was not the experience of the "deputy".
Any local condition in the eye should be treated.

* Dransart et Famechon. Bull de la Soc. Belge d'Ophtalm. No 24. 1908.
† Snell on Miners' Nystagmus.

Part IV

Economic Aspect

The effect of Nystagmus upon work

Precautions

Compensation

Prevention

The effect of Nystagmus upon the efficiency of work.

It has been asserted by Juel of Liège* that there is not always even a partial incapacity for work, and three of my cases stated that the movements had ceased to trouble them, although these were still present. The longer nystagmus has lasted, often the less the oscillations seem to trouble, and this may explain a statement made by one or two of the miners, that they had known men who got better as they approached 60.

It seems however more probable, that in almost every case, the work suffers to some extent; time is lost as the men stop to rest their eyes and there is more liability to accidents, especially towards the end of the shift, when nystagmus is more marked.† Dransart and Pamechon△ are of opinion the prognosis of slight abrasions occuring in the cornea is worse where nystagmus is present, as healing may be thus delayed.

In grave cases of nystagmus, work is impossible. Of greater importance is the occurrence of nystagmus in "deputies". As has already been pointed out, these men hold a very

* Juel. Bull. de la Soc. Belge d'Ophtalmologie. (Preface) No 24. 1908.
† Rutten. Ibid Nov. 1908.
△ Dransart et Pamechon. Ibid. No 24. 1908.

responsible position and have to examine the workings carefully to see if they are in a safe condition, and have also to test for gas where this is likely to be present.
Snell * made some very important experiments as regards the capacity for detecting a gas-cap, in men suffering from nystagmus; as a rule it could not be recognized until gas was present in dangerous amounts.
My own case occurring in a deputy, said he was quite unable to recognize a gas-cap, moreover he knew of another deputy who also had trouble in this respect.
Most of the hewers who were interrogated on this point, were sure they could not recognize a gas-cap if this was present.

Precautions.

Slighter cases of nystagmus in others than "deputies" will probably continue to work but bad cases of nystagmus should be, and are in some countries, prevented from working. Such are :—
Those in which nystagmus is elicited on looking below the horizon.
Where oscillations are very numerous, viz.

* Snell. B.M.J. Aug 1. 1908.

more than 150 a minute, especially if the movements are extensive.
Those shewing the following symptoms :—
blepharospasm, trembling of the head, neck and body, nystagmic amblyopia, and diminution of the field of vision.
Those with other marked nervous symptoms.
Still more important is it the "deputies" on whose care the lives of so many depend, should have good sight and should be certified free from any nystagmus.
All deputies and overseers should have a special examination of their eyes at periodic intervals.
Accidents and time off would be lessened by these precautions.

Compensation for Miners' Nystagmus.

Within the last few months, Miners' Nystagmus has been recognized as an Industrial Disease and accordingly scheduled for compensation.
The terms are arranged between the miners' associations and the masters. Roughly speaking, compensation is based (among the hewers, who, as has been before explained, are paid by their output), on the average

county output, which varies from time to time, and on the average number of days worked — in Northumberland, by the individual * — in Durham by the community. Allowance is made for house and coal.

Thus in the case of one of my patients who had no house but who received coal – compensation was reckoned as follows :—

7 " 3 4 3/4 32 " 5 Add 5 " 0 as house allowance 37 " 5 Subtract 2 " 0 for coals still received. 35 " 5.	County average 7/3. Average number of days patient worked = 4 3/4.

Compensation made was 18/- a week.

In the case of <u>light work compensation</u> the average wage before, and after, the change of work is taken into consideration, the amount of compensation will not exceed the difference.

In persons under 21, compensation is reviewed every 12 months and rated on the probable earnings (not exceeding £1.) Uninterrupted Employment and Grade of Work are taken into account as the basis of compensation. A review of payment can always be demanded by owner or workman.

* Northumberland Miners Mutual Confident Association.

Prevention of Miners' Nystagmus.

Universally recognized as an occupational disease, arising from the trying conditions under which miners work, attention must be directed to improving these conditions as far as possible.

Lighting of the mines. It is probably in this direction that most improvement can be made. Much has already been done and more may be expected. Romiée* thinks that with proper lighting all cases would disappear but Dransart† thinks, if the myopathic theory is correct, about 1/3 would disappear.

Introduction of coal cutting machines.— these would do away with the very trying work of "undermining".

Lessening of the hours of work — recent legislation (Miners' Eight Hours Bill) has been busy with this.

Ventilation of the Mines is steadily improving.

The End.

* Romiée. Bull de la Soc. Belge d'Ophtalmologie. Nov. 1908.
† Dransart. Ibid do 24. 1908.