a farm where there had been no case of anthrax among the animals.

The low incidence of anthrax is indicated by infectious diseases returns. According to the annual report of the Chief Inspector of Factories and Workshops only 30 cases were notified in 1936, and the average mortality in the cutaneous form over a period of thirty years has been from 3.3% to 24.3% (Legge, 1934), hence the importance of recording individual cases in order to assess the value of therapeutic measures.

The question of sulphanilamide therapy in anthrax has recently been brought to the forefront by the work of Cruickshank (1939), Bonnar (1940), and others, and it was intended at the outset to treat the case by sulphapyridine alone in order to attempt to support the contention that cases of cutaneous anthrax could be successfully treated by this means (Thrower, 1941). "As the conditions essential to clinical trial are almost impossible to fulfil," and one has to consider treatment primarily in the interests of the patient as his life is at stake, the line of treatment adopted included arsenicals, which the literature appears to indicate as being of distinct value, and also Sclavo's serum. The latter can probably be disregarded on account of the small quantity given, the available supply being limited.

Osgood, Joski, and Brownlee (1940) have shown that arsenic and sulphathiazole form the most effective combination against *Staph. aureus* in bone-marrow cultures, and this suggests that the combination of arsenic and sulphanilamide may be worthy of further clinical trial in the treatment of cutaneous anthrax.

My thanks are due to Mr. J. N. J. Hartley, under whose care this case was treated, for permission to publish this paper, and to Dr. J. Steven Faulds, who confirmed the diagnosis by film, culture, and guinea-pig inoculation, and by whom the photographs were taken.

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DARK ADAPTATION AND MINERS' NYSTAGMUS

BY

IAN CAMPBELL, M.B., Ch.B.

The association between failure of dark adaptation, or night-blindness, and miners' nystagmus has long been recognized, and has been commented upon by many observers. C. Turner Thackrah (1831), writing of colliers, remarks: "Their eyes . . . are intolerant of full light." Court (1891) states: "A definition of the disease [i.e., miners' nystagmus] should include night-blindness, nystagmus . . . because these symptoms all occur together in miners working with the inferior light." The First Report of the Miners' Nystagmus Committee, 1922, states: "This failure of dark adaptation, or night-blindness, is undoubtedly one of the most characteristic symptoms of the disease"; whilst Roche (1931) states: "One of the first symptoms of nystagmus is deficient vision at twilight. All miners suffering from nystagmus complain of twilight blindness."

That hemeralopia is found in the "pre-nystagmus" stage is observed in the Departmental Committee's Report on the Workmen's Compensation Acts, 1938: ". . . there are some men who ultimately develop oscillations of such extent as to become cases of miners' nystagmus who have complained of earlier subjective symptoms such as mal-projection,

intolerance of light from lamps of other workers, difficulty of seeing on entering the mine workings or leaving them."

Weekers in 1910 even suggested that failure of dark adaptation was the cause of miners' nystagmus (First Report of Miners' Nystagmus Committee, 1922). Oglesby (1880) stated: "I was at first impressed with the idea that pigmentation of the retina lay at the root of the mischief," but discarded his theory on negative ophthalmoscopic findings. Ohm in 1916 considered that "disturbances of dark adaptation have proved factors which *predispose* to nystagmus" (First Report of Miners' Nystagmus Committee, 1922).

Though most observers have noted the occurrence of night-blindness in miners' nystagmus, few have suggested an explanation of it. Jeaffreson (1887) states: "The interference [i.e., obstruction of the blood flow through the vertebral arteries] with the nutrition of the visual centres may be one of the chief features in the production of hemeralopia, which is almost always present." Roche (1931) suggests that it is probably due to two causes: (1) "The stratum pigmentum produces visual purple. As a result of continuous over-production these cells become defective and nearly cease to secrete altogether, or they secrete a visual purple which is too diluted and ceases to stimulate the rods on exposure to light." Or: (2) "Normally, several rods have only one central nerve connexion, and continued use provokes fatigue, and consequently poor transmission of impulses." The Third Report of the Miners' Nystagmus Committee, 1932, on the other hand, considers the night-blindness of miners' nystagmus to be one of the psychoneurotic manifestations of this disease.

Association of Diet and Miners' Nystagmus

Recent work done on the association between deficiency of vitamin A and night-blindness leads me to consider the association of diet and miners' nystagmus. On this subject Martin (1920) believes that "exhaustion, due to want of food and prolonged physical strain, is the most important, most effective predisposing cause of the disease"; while Stephens (1932) considers the *nature* of the miners' food all-important. His views he expresses thus: "Since the introduction of tinned foods and preserved meats, the feeding of the collier is much below what it used to be. Formerly the Welsh collier used to live on good home-grown produce, with *milk, eggs, and cheese* . . . [*italics mine*]. To-day ill-feeding tinned foods are the chief features of the household board in a large number of homes, and it is from these homes that the army of nystagmus patients is recruited."

Investigations of the diet of miners in this area show that with the improvement in housing conditions, giving most miners a garden of their own, in which they are keenly interested and proficient, the supply of vitamin A (or its precursor) from green vegetables, carrots, etc., is in the summer months plentiful, but in the winter months, when this home-grown source is at a minimum, the intake of vitamin A is greatly reduced. It is just at this time also that the seasonal variation in the vitamin A value of dairy produce manifests itself. As stated in *The Vitamins* (Crookes Laboratories), "the vitamin A value of milk, butter, and eggs tends to be at its lowest in the early part of the year." Further, when the intake of vitamin A is at its lowest the demand for it, in the interest of vision, is at its highest, for the miner in the dark winter months has a greater need for dark adaptation *apart* from the time actually spent below ground.

It is interesting to note that many observers have found miners' nystagmus to be more prevalent in the dark winter months. The following table, from the First Report of the

Miners' Nystagmus Committee, supports this view. For the last entry I am indebted to Mr. W. E. Gillhespy. I have converted the numbers into percentages.

Cases Arranged according to the Quarter of the Year in which Failure Took Place

	No. of Cases	1st	2nd	3rd	4th
Dransart and Famechon	201	33.33%	17.91%	17.41%	31.34%
Ohm	521	30.51%	26.29%	20.34%	22.64%
Llewellyn	1,649	34.26%	18.79%	22.61%	24.36%
Yorkshire Coal Owners Indemnity Society (1930-9 inclusive)	1,847	30.44%	26.06%	22.19%	21.24%

These figures in each case show that more failures occur in the first quarter of the year.

Deficient Illumination the Essential Factor

It is now generally recognized that the chief factor in miners' nystagmus is deficient illumination, and that "during all the years when the miner is working at the coal face his macular vision is in more or less complete abeyance" (Departmental Committee's Report on the Workmen's Compensation Acts, 1938). This means that vision is mediated by the rod elements of the retinal periphery, calling for an adequate secretion of visual purple, which, in turn, demands an adequate blood supply of vitamin A.

The following experiment was carried out with the use of Crookes's dark-adaptation tester (for description of tester see *Trans. ophthalm. Soc.*, 1938, 58, 103). Three people living on an ordinary mixed diet were tested and an average curve taken. This was accepted as the normal for the instrument used. Ten miners, all working, were selected at random apart from being of a "nystagmus age." The average age for the group was 38, and the average number of years worked underground 23. An average curve was plotted for this group. Three were selected from this group, one of whom, it was noted, had oscillations in daylight, at the horizontal level, before exercises. These were put on intensive vitamin A treatment until each was able to see the arrow at the lowest finger-post position used. An average curve was then plotted for this group. (See Graph. At finger-post position 30 and 10, in Curve B, two and five

Graph showing results of dark-adaptation tests.
Curve A = Average 3 normals.
Curve B = Average 10 colliers.
Curve C = Average 3 colliers after additional vitamin A.

colliers respectively were unable to see the arrow after 40 minutes. To arrive at an average time for the ten, these were included as *having* seen the arrow at 40 minutes, so that, properly, this curve should go further to the right.)

The same technique was followed in each case: half an hour seated in the dark, four minutes' "bleaching," and up to 40 minutes' examination. All the tests were done in January or February of this year, and between 8 and 10.30 p.m. The finger-post positions used were: light neutral glass, 75, 50, 30, 10, 5; dark glass, 30, 10, 5—corresponding to an intensity of illumination of 0.7, 0.47, 0.28, 0.093,

0.047, 0.028, 0.0093, 0.0047 millifoot candle respectively. The results are shown in the following table:

Table showing Results of Dark-adaptation Tests (Time in Minutes)

Case	Age	Occupation	Finger-post Position								
			Neutral Glass					Dark Glass			
			75	50	30	10	5	30	10	5	
3 Normals :											
A	38	Housewife	3.25	5.45	7.40	9.40	13.50	14.20	16.20	17.35	
B	16	Clerk	3.35	6	6.15	9.25	11.20	13.20	14.55	18.20	
C	31	School teacher	2.55	3.45	3.57	4.18	6.10	6.50	10.30	24.25	
10 Colliers :											
1	35	Collier	9.15	9.30	12.10	13.55	24.30	27.20	—*	—*	
2	36	„	7.55	9.03	9.30	12.40	35.10	36.30	—*	—*	
3	36	Onsetter	8.35	8.55	10.10	12.10	14.59	15.55	23.15	—*	
4	43	Shot-firer	8.02	10.05	10.40	12.55	18.10	19.40	30.35	—*	
5	30	Loader	5.55	7.30	8.35	9.35	17.29	—*	—*	—*	
6	61	Packer	13.25	13.55	14.20	19.30	30.10	—*	—*	—*	
7	36	Trammer	4.28	5.10	6.50	8.43	11.55	12.20	21.10	—*	
8	42	Haulier	6.30	8.10	8.25	10.25	12.55	13.45	39.30	—*	
9	29	Collier	5.45	6.55	8.35	10.55	15.25	16.30	34.55	—*	
10	40	„	7.05	7.40	8.25	12.50	15.10	16.15	—*	—*	
3 Colliers after Treatment :											
1	35	Collier	3.30	5.02	5.32	7.10	15.10	16.10	20.20	27.10	
2	36	„	5.30	7.10	7.45	11.10	13.05	17.20	20.50	38.50	
9	29	„	3.15	4.10	5.30	9.20	11.50	12.25	15.30	38.10	
Average for 3 Normals			3.18	5.10	5.57	7.47	10.26	11.30	13.55	20.06	
„ „ 10 Colliers			7.47	8.41	9.41	12.17	19.35	23.49*	34.55*	—*	
„ „ 3 Colliers after treatment			4.05	5.27	6.15	9.13	13.06	15.18	18.53	34.43	

The average results are shown in the graph.

Cases A and B each had for two days before the test 4 capsules vitamin A (oral) a day. Case C neither had, nor was taking, any vitamin preparation.

The times marked * signify that the arrow was not seen up to 40 minutes. To estimate an average time, the dark glass being used and the finger-post at 30 and 10, those failing to see the arrow after 40 minutes were counted as *having* seen it at 40 minutes. The last two average figures given should therefore be greater than shown.

Case 9 results were given after taking 6 capsules vitamin A (oral) Crookes a day for seven days; Case 2 results after 3 capsules a day for three days followed by 6 capsules a day for a further nine days; Case 1 readings were given after 6 capsules a day for 27 days. He was examined weekly, and, as mentioned, had the oscillations of miners' nystagmus in daylight, at the horizontal level, before exercises.

These observations show that in the group of miners selected a deficiency of vitamin A, as demonstrable by the dark-adaptation test, was present, and by the administration of vitamin A over a limited period the power of dark adaptation was considerably improved.

As the miner depends for his working vision, and safety, on his retina periphery, and must continually adapt to low illuminations and sudden changes in light intensity, it seems desirable that he should receive an optimum supply of vitamin A. This need is further enhanced, in my opinion, by the peculiar tendency of the collier to develop miners' nystagmus.

I am indebted to Dr. Edith Hatherley for her useful advice, and to Crookes Laboratories for the use of a dark-adaptation tester.

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S. Wolff (*Ann. Pediatr.*, 1941, 4, 155) records an epidemic of streptococcal disease, apparently unparalleled in the literature, which occurred in the Children's Hospital at Eisenach. Of eight children affected two died. All the patients fell ill on the same day (September 26, 1935) and almost at the same hour. Seven started with a throat infection. The course was identical, especially as regards the temperature. Sulphanilamide was very effective except in the two fatal cases. The cause of the outbreak could not be discovered.