which is intended to prepare for the oncoming toxæmia, and alkalization, both general and local, will probably figure in future schemes of burn treatment.

Protective Methods.

The Paraffin Method.—The various methods of treatment hitherto mentioned have acted either as a chemical antidote or as a fixative of cells and their toxins; the value of the paraffin method lies in the protection and mechanical fixation of the part. The original "ambrine," or No. 7 paraffin, is the best application. Its constitution is as follows:

Resorcin	...	...	...	...	...	1 part
Eucalyptus oil	...	...	...	...	...	2 parts
Olive oil	...	...	...	...	...	5 "
Soft paraffin	...	...	...	...	...	25 "
Hard paraffin	...	...	...	...	...	67 "

The combination melts at 48° C.

There are various ways of making the application. The part may be first brushed over with absolute alcohol, and the surface thoroughly dried by a current of hot air. The burnt area is then covered with the fluid wax, which has previously been brought to the proper temperature in a water-bath. The wax is applied as a spray, or painted on with a sterile brush. Over this a thin layer of sterile cotton-wool is applied, and, when the application has hardened, a further layer of wax is added, followed by an additional layer of wool, and so on until sufficient thickness has been obtained.

Souttar employs a simple and efficacious technique somewhat different from that described above. The part having been prepared with alcohol, strips of ribbon gauze one inch wide are provided. These are passed rapidly through the molten paraffin, held for an instant until the edges begin to whiten, which is the sign that the correct temperature has been reached, and then firmly applied over the affected area, the strips being laid in series edge to edge.

Whichever method is employed, the after-treatment is important. After twenty-four hours, when the application is examined, it is found that the protective covering has been raised in various places by local accumulations of serum; these are punctured with a hot metal point and evacuated. A further layer of paraffin is then added, and the process is repeated when necessary.

If the burn has been in a reasonably aseptic condition a paraffin dressing may remain *in situ* for ten to fourteen days or even longer. Theoretically the original dressing may remain in place until the sloughs separate; actually, reapplications are almost invariably necessary before this aim is achieved.

The After-Treatment.

While the development of granulation tissue is proceeding and healing is advancing, care must be taken to guard against the development of contraction. Its appearance is insidious, and we have yet to perfect a method for its prevention. Much, however, can be done by massage and movement and the wearing of suitable appliances.

As soon as the granulating stage is sufficiently far advanced the raw area is grafted by Thiersch grafts or pedicle grafts, but these are details not within the scope of this lecture.

The surgeon's responsibility does not cease, however, with the application of the graft. The tendency to scarring continues, and a close watch is therefore kept upon the part, and any sign of contraction is combated by such means as massage, exercises, ionization, and cautious x-ray therapy.

I confess it was with a measure of trepidation that I chose the subject of this lecture. I dare say there are some of you who may have thought the subject a somewhat sterile one; I trust I have succeeded in dispelling any such opinion. A severe burn in a young child is one of life's catastrophes, and you and I can do much to avert disaster if we are alive to the possibilities.

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MINERS' NYSTAGMUS.

BY

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IN the BRITISH MEDICAL JOURNAL of April 30th (p. 809) there appeared a report of a contribution by Dr. Haldane to a discussion on miners' nystagmus, which discussion has now been going on in the *Transactions* of the Institution of Mining Engineers for over a year, and to which, through the courtesy of that institution, I contributed the opening paper; on several other occasions I had the privilege of making other remarks, the last being a reply which I made to Dr. Haldane's lecture in Glasgow on April 23rd, 1927. I will now state concisely my reasons for rejecting Dr. Haldane's defective light theory, or at any rate for holding it as not proven.

Several points demand discussion, such as the fact that the introduction of electric light has, in many pits, aggravated the disease. Then, again, his theory does not seem to explain why the disease is more frequently seen at certain periods of the year than at others. Neither Dr. Haldane nor the Nystagmus Committee takes any notice of the paroxysmal nature of the disease. A patient who has had the disease, but who has to all appearances recovered, may keep well for days or even weeks, but may then suddenly have a very severe attack. If a man has apparently recovered and is living above ground, and is not exposed again to the defective lighting, he should on Dr. Haldane's supposition keep well. As a matter of fact he is far from being immune and will certainly have subsequent attacks, some of them as severe as the first. This liability to relapse may last for years; I am now seeing cases that have been victims of the disease for five or six years. They have not been exposed to defective lighting during the whole of that time, and some of them are suffering quite acutely from the disease.

Lastly, why is nystagmus not present in all pits lit by oil safety-lamps? I am informed by a gentleman of the highest authority, Mr. G. L. Kerr, that he knows of six pits in the area in which he works in which the oil safety-lamp is used, but there is no nystagmus. Is that to be explained on the supposition that the oil safety-lamps in these pits are at all times in excellent condition and that in the others they are habitually unsatisfactory? Dr. Haldane's theory does not seem to offer any explanation.

Nor has any feasible explanation been given as to why there should be, as one of the symptoms, rotational movements of the eyes. Neither Dr. Haldane nor any of his colleagues on the Nystagmus Committee has said anything about the nerve centres which must be irritated or disturbed before the rotation takes place. In neither of the reports is there any mention of disturbance of nerve centres, nor is there any discussion as to the centres likely to be involved. The two reports are extremely disappointing. I except from that criticism, however, the work done by Dr. Haldane on the chemical side. That must be taken as authoritative. The oblique muscles must be involved in any rotational action, such as that which takes place in miners' nystagmus; their action is simply secondary to the superior and inferior recti muscles. In ordinary life they have almost no independent action of their own, yet, when there is nystagmus, the movements are chiefly rotational. To me it is absolutely unthinkable that the muscles are in violent action without any disturbance of the centres supplying the nerves to these muscles, and yet the Committee does not make any suggestions as to the nuclei and centres involved in miners' nystagmus. Because such matters are left out I think that when there is another investigation a member of the committee should be a neurologist of the highest standing.

Another feature that must be taken into account is that the disease seems to appear in epidemic form. Some years it is very frequent, in others it is not nearly so common. That is a matter which, in my opinion, should be considered by persons who are in the habit of dealing with vital statistics. The twelve months preceding the coal dispute were extremely bad; so far as the area in which

I work was concerned cases were very numerous. But for the first six months after the dispute was over there were scarcely any new cases, and my work as referee during that period was almost entirely the re-examination of miners who had been certified long before the dispute took place, some of them years before it. Now the absence of fresh cases is open to at least two explanations. In the first place we may, when the cases were very numerous, have been passing through an epidemic, or, on the other hand, the long absence from work may have been physically beneficial to the men and brought on a kind of immunity.

In the two reports issued by the Nystagmus Committee no mention is made of the chief symptom of the disease—namely, great disturbance of the innervation of the heart. I cannot help thinking that had the investigation been made by medical officers of health such a condition would have almost at once attracted their attention. Pulse rates up to 120 are by no means uncommon. The only reference I can find to the cardiac condition is contained in a report by the late Dr. Rivers, subsidiary to the first report. At page 13 of the first report the following words are to be found: "The modern teaching is that the disease is either a general fatigue of the whole oculo-motor system or a general neurosis with special local manifestations in the oculo-motor apparatus." Certainly cardiac instability is much more frequently present than rotation of the eyeballs. Why has no mention of that been made in the above definition? On page 20 of the second report we find a grouping of cases relative to compensation. The principal symptom, according to this classification, is oscillation, and we have at line 17 from the top the following words: "Oscillation is regarded as the primary sign; lid spasm, head tremor, objective giddiness, and photophobia as secondary signs." Here again there is no mention of the quick and generally weak and irregular pulse. So, too, at the foot of page 17, we have a paragraph entitled "Severity of attack on certification." This concerns the examination of 128 miners—a number inadequate to justify any conclusion. But the classification is again based on oscillation and no reference is made to any irregularity of the pulse. The failure to take notice of a condition which is one of the most prominent symptoms of the disease does not inspire me with any confidence in the thoroughness of the examinations made. Dr. Haldane's work as a chemist is, of course, of the most authoritative kind, and I take it as such, but he is not a clinician, and I do not think the clinical side of the case has been at all well done.

The late Dr. John Brownlee, certainly a man very authoritative on vital statistics, and who himself was a widely experienced and well trained clinician, said to me when we happened to meet in London on March 1st, that he had been looking into my views on miners' nystagmus and had come to the conclusion that I was probably right in saying that it was not a disease due to the illuminants used.

For the above reasons I think that a reinvestigation is necessary. The disease may be due to a toxin or to a micro-organism, but the very fact that the number of new cases recorded in one year differs very much from the number of cases recorded in another year, the differences being wide, seems to indicate that the disease is not due to illumination, for then the number of new cases occurring each year would be nearly constant.

Similarly, it is to be remarked that very little attention is given in either of the reports to the practically invariable presence of hemeralopia and nyctalopia in association with miners' nystagmus. The committee seems to have fixed its attention on one thing only—the presence or absence of eye movements—and has not even noticed what is to me the most important symptom of all, cardiac irregularity.

One or two cases have been seen in men working at the screens, not underground at all. That seems a very significant fact. I do not think the committee is in any way responsible for missing out such cases. I have not seen any myself, and I have seen many hundreds of patients with miners' nystagmus; but the few that have occurred tend to confirm my conviction that the disease is not due to defective illumination. I am an agnostic as regards the origin of miners' nystagmus, except that I feel con-

fident that it has not been proved to be due to defective illumination. On the contrary, the evidence which I personally have got points very strongly in the opposite direction. Unfortunately, no *post-mortem* examinations have been obtained; they might have yielded good results. Pathologists and medical officers of health and epidemiologists have done a great deal to unravel many diseases, and, in consideration of the serious economic position to which the disease has given rise in the coal-mining industry of Great Britain, I think further investigations are urgently required, neurologists, public health authorities, and pathologists being called in to assist.

I shall conclude by giving a few illustrative cases.

W. B., aged 37, miner, seen on March 31st, 1927, had no trouble with his eyes till three or four days before he left off work (on March 2nd). He had been working entirely with the electric light for the preceding five years and had no symptoms whatever of the disease before he used electric light.

W. D., drawer, seen on March 31st, 1927, had worked with the oil safety-lamp till 1916, and then with the electric from 1919 till 1920. In 1925 he first suffered from symptoms of nystagmus and that very severely. For some years before the attack he had used nothing but electric light.

A. McK., aged 37, brusher, seen on April 27th, 1927. When he first suffered from the disease he was in a pit lit with electricity, and had been in it for several years; the disease began on March 19th, 1926. He was compensated till September 16th, 1926, but was unable to get work till March 29th, 1927, and then he obtained employment in a pit which was particularly well lit with electricity. In this case there does not seem to be any history of his ever having worked in a pit lit by oil safety-lamps.

J. B., aged 21, brusher, seen on May 2nd, 1927, had been in coal pits for seven years. He began in one pit which was chiefly lit by electricity, but in which oil safety-lamps were sometimes used. He was for four and a half years in that pit and then moved to another lit entirely by electricity. He was in this second pit for fully three years, and first noticed symptoms six weeks ago. He saw objects rotating in front of him.

R. C., a miner, aged 47, seen on May 2nd, 1927. The symptoms in this case began not more than a year ago. He is quite clear on that point. He has been using nothing but electric light in the pit for three years. He expressed the opinion that electric light is extremely bad for eyesight.

J. C., a stone miner, aged 42, seen on May 5th, 1927, had been in various pits. I will distinguish each pit by a numeral. He began mining at the age of 14 in pit number 1, a naked-light pit. He was there a year and then removed to pit number 2, which, at that time, was worked with oil safety-lamps. He was there for about twelve or thirteen years, and during that time had no trouble with his sight. Then he removed to pit number 3, where he was only twelve months, still using the oil safety-lamp and still without any trouble. Then he went to pit number 4, where he used sometimes an electric head lamp, and on other occasions an oil safety-lamp. The oil safety-lamp was carried only as a protection; he used the electric light for working. He was in this pit for about thirteen years and, for the first time, while working with the cap electric lamp, felt some symptoms of the disease. Then, about two years ago, he went to pit number 5, entirely lit with electricity. He states quite distinctly that for coal mining the oil safety-lamp is much superior to the electric because it gives less strain to the eyes.

T. G., a miner, aged 55, seen on May 5th, 1927, began in a naked-light pit at the early age of 12. He was only two years there when he went to another pit, where he remained for nineteen or twenty years. This second pit was entirely lit by oil safety-lamps, and he had no nystagmus nor had any trouble of the eyes; two and a half years ago he went to a pit lit throughout by electric light. After being some time in this pit he felt his eyes and head beginning to trouble him. There was intense pain, chiefly at the back of the head, but frontal pain also. The important points in this case are that the patient was for twenty years in an oil safety-lamp pit without having the disease, but had it after he had been three years in an electrically lit pit.

T. K., aged 44, brusher, seen on May 5th, 1927, felt no inconvenience with his eyesight down to the beginning of the strike of 1921. Shortly after resuming work he for the first time noticed defects. The first symptom was that everything appeared in motion at the bottom of the pit. The lamp at that time was the oil safety-lamp. He took a lump sum of money in 1922. He does not seem to have begun work till a considerable time afterwards, and first began with work above ground. Ultimately he went to an electrically lit pit, and was only able to stand the bright light for five weeks, when he again became severely ill with the disease and had once more to apply to the certifying surgeon.

These are only a very few cases taken within the last six weeks. I have records of many hundreds of cases, but the above will, in the meantime, I think, answer my purpose, which is to show that electric light is by no means a preventive of miners' nystagmus. Not infrequently it is found that men who have worked for many years with a moderate amount of nystagmus in pits lit by oil safety-lamps have been attacked very severely by the disease on

the introduction of electric light. There is no gainsaying these facts. No doubt we may be told that it is because the best type of electric lamp has not yet been procured, and the coal owners may be called upon to face further great expense on that head. I think that, before any such demand is made of them, there should be a much more thorough investigation into the cause of the disease, which investigation would include a well organized collective investigation throughout the entire coal-fields of the United Kingdom. Such a research ought unquestionably to be in the hands of persons competent to deal with vital statistics and with public health.

MINERS' NYSTAGMUS.

NOTES FROM THE SOUTH WALES COAL-FIELD.

BY

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CARDIFF.

MINERS' nystagmus continues to be a cause of much concern, both to workmen as a disabling event in the life of underground workers, and to their employers as an economic factor. It is one that exhibits itself in different ratios among men employed in different places, and it has some connexion with coal and the variations in gaseous contamination of mine air. This fact is brought into prominence by the high incidence of the disease in parts of the coal-fields where a kind of coal that has much volatile matter in its composition is worked. The fact that more cases take origin in certain coal seams than in others should induce authorities to inquire into the composition of those kinds of coal in which highest and lowest incidence of nystagmus is observed. The number of men affected with the disease in each pit or district chosen should be ascertained, and compared with the total number of men employed in these areas. The introduction of electric lamps has not brought about the much desired result; it has not diminished the number of cases, and such lamps may have actually induced the condition in cases that were quiescent, or aggravated it in others that were evident both to the man and the medical examiner. The time has more than arrived when other possible causes should be inquired into. These are pit environments and the condition of the air at the coal face, the gob, the workings, the main roads, and the return airways. In all of these situations cases of nystagmus arise. In some pits, possibly in most, the collier is the workman who suffers most, but there are seams in which cases of nystagmus arise in parts distant from the face, and show an equal percentage with face workers. In a series of years ending in 1926, out of thirty-two protracted cases contracted in South Wales, 75 per cent. occurred in miners, and 25 per cent. in four other grades. Doctors practising in different parts of the coal-fields differ in their conclusions as to whether the disease is or is not present, and are often at variance with medical referees in this respect. Clinically miners' nystagmus is a very complex condition to diagnose, and to determine whether it has ceased so that the man is fit for work. It is no easy matter either for him or for his doctor to decide this point.

The evidence, so far as it goes, indicates that some pathological entity exists around which many signs and symptoms revolve; in the schedule of disease (III) of the Workmen's Compensation Act, 1925 (No. 17), it is defined as "The disease known as Miners' Nystagmus, whether occurring in miners or others and whether the symptom of oscillation of the eyeballs be present or not." This definition makes for trouble in diagnosing the disease on its kaleidoscopic manifestations; hence the differences in medical opinion expressed at examinations. The disease may manifest the presence of oscillation of the eye, and this movement definitely determines its existence, but subjective symptoms, such as headache, giddiness, and loss of orientation, may be all that is complained of—that is to say, subjective symptoms without objective signs may be the chief determining characteristic; and this is how the fallacy in diagnosis arises.

In the South Wales and Monmouthshire coal-field in 1925, among 157,473 men of all grades above and below ground, there were 621 cases of nystagmus, or nearly 0.4 per cent. In 1926, for 153,738 men so employed (for five months only, owing to the cessation of work in the coal-fields), the number of cases of nystagmus was 263. The estimated number for twelve months would have been 631, so that in 1926 more cases might have been expected to arise than in 1925, though the number employed was fewer by 3,735.

A study of the results of the examination of cases by colliery doctors in this coal-field reveals many facts of interest, such as high blood pressure, chronic nephritis with albuminuria, rapid heart, constant headache in some area of the head, the occurrence of the disease after head injuries not found before such injuries, and many years' standing of some cases, with no evidence of amelioration of signs or symptoms though the men had not resumed pit work. Resumption of work and renewed failure on many occasions is frequently reported. Men at the pit bottom with good light may suffer; one-eyed men get nystagmus. Chief among the signs accompanying oscillation may be photophobia, blepharospasm, conjunctivitis; head tremors alone may replace eye tremors and completely disable the man so suffering. Central vision varies in different cases, and many other defects may accompany the involuntary oscillation of eyeballs which is the chief determining characteristic.

No Act of Parliament can define the degree, range, or definition of the disease—for example, head tremors, which may be the only evidence of the disease, are not included in the schedule of signs. No special inquiry, as far as I know, has been made as to the association of labyrinthine nystagmus with miners' nystagmus, yet it may complicate the pure forms of oscillation. The man as a whole should be examined, as the eye is simply the outpost of the commonwealth of his being. Hereditary predisposition does not, I think, count in the genesis of the disease, but a poor nervous endowment does. The history of men who resume work underground and fail repeatedly should be investigated, since some proclivity to the disease may be disclosed in the man, such as the red corpuscle ratio, or it may turn out that the causative agent is something in the environment. It would be in the men's interest to have all boys examined at 14 years of age, before beginning pit work, so that the weedy ones might be induced to give up the idea of engaging in an occupation so hazardous as mining. Physical robustness should be the standard of acceptance. Some doctors consider that this condition is a form of neurosis from the beginning, and that the special nervous symptoms are secondary. In all neuroses there must be some physiological nutritional derangement of function of brain cells, and such defects may arise where the air is less life-supporting than the healthy stimulus of light and fresh air in the open spaces above ground.

The average duration of cases of nystagmus is uncertain, and cannot be defined in terms of months or years. Some colliery doctors declare that when nystagmus (oscillation of eyes) has once definitely arisen it will reappear on resumption of work underground. There is a good deal to be said for this opinion—that is to say, "once nystagmus always nystagmus." Again, in some instances men have resumed light work on the surface and failed, although they had not restarted work underground. This fact indicated to my mind that the disturbance to the central nervous system is well defined and likely to be permanent.

Some men do resume work underground and do not again suffer from nystagmus. Such men have on my advice been placed on the fresh-air side of the pit, where there is comparative freedom from deleterious environment, but the same safety-lamps are used. Considering the absence of correlative evidence of doctors' reports on nystagmus it is urged that some definite and exhaustive syllabus of its range, including both signs and symptoms, should be published by the Government advisers relative to mines and the diseases arising therein.

Incidentally it may be mentioned that beat-knee has become almost as prominent in some pits as nystagmus, and is steadily growing in ratio to men employed underground. The opinion of medical men of equal experience and ability