intestinal epithelium, rice-water stools, ulceration of the nasal septum and other effects follow; but if a dithiol successfully competes with the enzyme for arsenic, such events do not occur and arsenic appears in the urine. Further, if the dithiol be liberated in the body within one or two hours of the invasion by arsenic, it will snatch the arsenic from the very mouth of the enzyme by its sulphur prongs; the monothiols are merely elevator tools and are not so effective. The eventual choice was 2:3-dimercaptopropanol (BAL). This has also been found to be effective in poisoning by certain other metals, although it appears to add to the toxicity of lead. Some non-metallic poisons, such as methyl iodide, are also said to be rendered innocuous.

So, in therapeutics, as in so many other fields of human endeavour, belatedly perhaps, empiricism yields to science. Some substances, like sulphanilamide, compete with a substrate such as p-aminobenzoic acid, for an enzyme in the bacterial cell, the key to the cure of many diseases. Other substances, like BAL, actually compete with the enzyme itself for a substrate such as arsenic. Such knowledge should deflect many research projects from their all too frequent ignominious course, "the long way to the sink." More importantly, it should speed the discovery of more potent therapeutic weapons and so increase our understanding of toxicology that we can plan our preventive measures with greater certainty.

References.


We are indebted to Messrs. J. M. Dent & Sons Ltd., for permission to quote from the Everyman's Library Edition of Chaucer's Canterbury Tales.

The Prevention of Pneumoconiosis Among Coal Miners in Great Britain

DEBATE BETWEEN DR. ANDREW MEIKLEJOHN (GLASGOW) AND DR. CHARLES FLETCHER (CARDIFF)*

Dr. Andrew Meiklejohn.

It is important that all here to-night should realise that the discussion concerns one of the most vital problems of our time, one which touches our whole national life. There are no personalities, no winners, no losers. Ours is one great increasing purpose, namely the health, safety and welfare of the workman and only thus do we justify ourselves as Industrial Medical Officers.

You are already fully aware of the seriousness and magnitude of the question of pneumoconiosis and related problems, particularly in South Wales. Even so our knowledge of the incidence of the disease in the separate colliery divisions throughout the country is still very rudimentary. The only index, so far, is the certification rate according to divisions and the Pneumoconiosis Research Unit (P.R.U.) have emphasised the uselessness of these rates for scientific work. From this we may infer their uselessness as a guide to any practical policy. In the course of surveys it has been possible to estimate prevalence rates among men examined at work and including Category I this rate was often 20/30 times the certification rate. This is the experience of the P.R.U. in South Wales and of Browne and McCallum in Durham.

So I venture to underline that we have no knowledge of the actual incidence of the disease throughout the country. In the divisions certifications are largely a measure of the extent to which the men are pneumoconiosis-conscious and have sought radiographic examination. One thing is clear, however, namely that the incidence of simple pneumoconiosis is high, in some pits amounting to 60 per cent. of underground workers. This is not without serious implications in relation to periodical examinations.

The disease is not curable either naturally or by device; indeed in certain prevalent circumstances the tendency is for progression to occur. Accordingly none can reasonably oppose any valid measure for prevention. Absolute prevention, however, can only derive from the effective control of the dust. Early diagnosis of the disease in a form and at a stage which will not progress to a seriously disabling or fatal form cannot be regarded as prevention. At best it is a safeguard or measure of partial security. Dr. Fletcher and his colleagues, I do not doubt, realise the distinction between prevention and safeguarding, but in their pronouncements they have not always been as precise as is necessary. Thus in April, 1951, they wrote:

"We believe that the introduction of a system of periodic medical examination of coal miners

* Held on November 29th, 1951, at a meeting of the London Group of the Association of Industrial Medical Officers.
would be the procedure which would most quickly and economically lead to the prevention of pneumoconiosis."

As the understanding and co-operation of non-medical men, workman and management, are all-important, it is necessary that there should be no confusion either of words or ideas. Since the beneficial effects of engineering control of the dust must take many years, Dr. Fletcher argues the need for a more instant attack to mitigate the effects in the individual and which will, at the same time, act as a measure of the engineering progress. The weapon which he advocates is a system of periodic X-ray examinations. The theoretical submissions involve irresistible propositions, which I am not fool enough to oppose. This has led to the comment that fundamentally we are not opposed in our attitude and we are merely indulging in academic polemics. If any here to-night share that view then I ask them to believe that up till now we have been in profound disagreement and the gap has narrowed only to the extent by which the P.R.U. have yielded during the past two years. Their recent pronouncements seem to indicate that, at least for the time being, they have abandoned their original position and I venture to think that, with more practical experience, they will not wish to return to it.

You recall how in January, 1948, before the Royal College of Physicians in London, Dr. Fletcher described "the blood on the coal," and how our hands were stained with human sacrifice. "The urgent necessity for the institution of an appropriate system of periodic X-ray examinations, which alone (mark this 'alone') can give our coal miners security from pneumoconiosis cannot be over-emphasised." "The sincerity of the industry's and the Government's concern with the health of coal miners will be judged by the speed and thoroughness with which such a system is instituted in this country."

This vigorous warning was solemnly pronounced by one who has never failed to emphasise the chastity of scientific virtue and who has not hesitated to condemn those outside the continent circle for their meretricious ways; these words surely represented his well-considered thoughts and mature judgment as became a scientist.

But three years later we are informed: "In the organisation of a scheme, such as we have outlined, there would be many administrative and technical problems whose importance cannot be forecast and whose solution could not be suggested in advance of the scheme."

"Because of these uncertainties it is our view that periodic examinations should first be introduced on a pilot basis."

From this it would appear that the scientific difficulties have been resolved and only administrative and technical details remain. If they are satisfied about this—are you? I shall return to this presently.

"Drink deep or taste not the Pierian spring! There shallow draughts intoxicate the brain And drinking largely sobers us again.—Pope.

Despite this radical change from an immediate mass offensive to a few local reconnaissances, Dr. Fletcher and his associates on every possible occasion, in essay, in lecture, in reports in the lay and medical press, on the wireless, in conferences at home and abroad, have never neglected an opportunity to promote their idea of a system of periodic X-ray examinations in coal miners. And here we reach our first fundamental clash. By their skilful propaganda, while seemingly according primary place in prevention to dust suppression, they have, purposely or otherwise, subtly suggested the predominance of periodical examinations and doctors, and have degraded engineering control and engineers to second place. Nor have they been reticent as to whose empire it is and who are the only persons fit to rule.

I can but repeat my 1950 summing up: "The real tragedy of pneumoconiosis is that all along there has been too much emphasis on disease and doctors and far too little on dust and engineers. The urgent need is not so much for more extensive medical exploration but for more intensive engineering practice."

Of course you may respond that the engineers are fully aware of the task and are quietly getting on with the job. Don't drug yourself with that dope. The layman is not yet convinced that the disease is a real problem outside South Wales, and until we cease this siren chorus from the valleys about periodic X-ray examinations, the dangerous rocks will continue to exact their toll of human life and suffering. I don't ask you to accept my word for it. In 1948 H.M. Chief Inspector of Mines wrote in his annual report: "There is no doubt that one result of the adoption of many of the present methods of machine mining is that the production of dust in mines has increased in recent years and is still increasing."

At the same time from Scotland, Steele reported that "officials and workmen do not always show the necessary spirit of co-operation to make the measures a success."

Recent pronouncements by international experts reveal that for the control of fine dust water is not a panacea—as we are too inclined to believe. "The dawn of reason and good sense begins to break. In August Mr. Crews, area vice-president of the South Wales area executive of the N.U.M. stated that the Union intended to draft regula-
tions for submission to the Coal Board and the Ministry of Fuel and Power, which would make dust suppression compulsory. The Union wanted dust subject to the same stringent regulations as gas.

On 15th October, 1951, Leigh said that it was pleasant to record a change of attitude to dust control in the past twelve months. Moreover, new allies have appeared in the disasters at Cresswell and Easington; dust must be reduced if we are to avoid severe explosions and fires.

Our undeviating and relentless purpose must be to keep dust control in the very forefront. The need exists in every coalfield, indeed in every single pit and colliage. At the same time we must be clear about the job—it is less dust production rather than more dust laying and collection. Professor Hatch, of the United States, spoke nothing more than simple truth when he said at Sydney that hitherto "we had paid too little attention to the characteristics of the process that gave rise to the dust."

Finally in this connection let us put the prime responsibility fairly and squarely where it belongs. Firstly on the National Coal Board, chiefly on the production and mechanical engineers, and secondly on the National Union of Mineworkers, chiefly on the deputies and colliage workers.

As the contribution of the medical members of the team, Dr. Fletcher proposes a system of periodical examinations, which would have three main values:

1. Through early diagnosis give miners affected by simple pneumoconiosis, low category 2 or less, security from seriously disabling and fatal progressive massive fibrosis.

2. As a biological test of the efficiency of dust preventive measures.

3. As research into fundamental problems of the disease.

If this were a world of marionettes manipulated by the P.R.U. these submissions would be irresistible. But alas! all of us have to conform to the exigencies of life as they are in Great Britain in the year 1951 and are likely to be for many years to come. It's an old story. Here is the record, of evidence of Mr. P. J. O'Keefe, St. Helens, before the Samuel Commission of 1906:

"Have you known men who left the work at 35 and taken up other work? No, they will not do that. You will not get a collier to leave his employment. There are so few branches of employment for them—only labourers' work which is badly paid, so they will not go into that; and even if they go into chemical works they require training for it."

"Do you think a periodical examination of these workers every six months, with power to suspend men who are beginning to show signs of the disease from the work, would be useful? I think it would.

"Except that there is difficulty about their finding other work? Yes, there is that to contend with."

There nearly fifty years ago is the story in a nutshell: early detection of the disease, the young man, compulsory suspension from work, alternative employment and sacrifice of earnings.

Lest we should be timid and undecided, Dr. Fletcher has cited systems already operating or proposed in other countries all over the world. While he attempts no appraisal of these, it would appear that we are expected to accept them as effective systems. Judged by the single criterion of adequate radiology, technique and interpretation according to P.R.U. standards, I invite him to name a single system worthy of serious study.

A statutory system, developed over the last 30 years, at present exists in Great Britain in certain sections of the sandstone, pottery, refractories and asbestos industries. The scheme of these examinations certainly does not accord with Dr. Fletcher's ideas. Is there any evidence that, in any of these industries, the examinations have contributed directly to the control of silicosis? In my experience their value was threefold:

(1) As one thread of a financial screw on the employers to induce them to take some preventive action. Such action as was often taken might appropriately be described as self-preservation.

Men over 40 became unemployable: one factory had a similar system to that which I recall was known locally as the kindergarten school. This is a well-established technique—casual labour—the short contract system for natives in metalliferous mining. Indeed as a control measure—if that is the sole consideration—it may be more effective to retire men at 35 than to engage in systems of periodical medical examinations. This idea was seriously considered, but rejected, by the South African Commission. 1943.

(2) An opportunity to inform small groups of the risk, without alarming them. This was achieved by the simple friendly chat at the examination.

(3) An opportunity for the doctors to gain a knowledge and understanding of the risks in different processes and occupations. I sincerely wish that my simple faith would enable me to accept the statement of the P.R.U. that "Dr. Fletcher cited these similar systems to the effect that he advocated in order to show that the relevant administrative problems should not be insuperable." That word similar bothers me, as does the P.R.U.'s knowledge of the relevant administrative problems.

And on this general consideration of periodical examinations it was interesting to note in the letter of 14th July: "In criticising our advocacy of periodic examinations Dr. Meiklejohn makes the curious assumption that a research-worker should not enter a plea for administrative action
in the control of a disease without agreeing the blue print of an appropriate system. This was
the monkeying with my words which nearly drove me insane, but we'll let it pass. I recall Dr.
Fletcher:
“The sincerity of the industry’s and the Government’s concern with the health of coal miners
will be judged by the speed and thoroughness with which such a system is instituted in this
country.”
If this is a plea and not a damning threat, then it is in the Miltonian sense:
“...So spoke the fiend and with necessity. The
tyrant’s plea excused his devilish deeds.”
Now let us examine briefly the purpose and values of an appropriate system of periodic
examinations.
A. To Give the Workman Security from
Pneumoconiosis.

The scheme is to be confined to radiological examination because, as stated by the P.R.U.,
"...we know of no evidence to suggest that clinical examination can assist in determining the pro-
gnosis in simple pneumoconiosis, whereas we have good evidence of the prognostic value of radi-
ology.” Well, this good evidence has been amply discussed elsewhere and I shall leave individual
industrial medical officers to raise the question of the scope and content of examinations of work-
men by medical teams. There is one matter, however, which I cannot pass, namely, this recurring
smug assumption of some scientists, not merely the P.R.U., that because they do not know or have
not observed any indications, then there are and can be none. Oh, for a few more F. M. R.
Walters in medicine! How shall we ever discover the prognostic value, if any, of clinical
examinations, if we confine our practice to radiology?

Submission to examination is to be voluntary and, based on experience, the P.R.U. claims that
there should be no difficulty in obtaining practically universal examination without any form of
compulsion. If this is true (and my experience does not support it—wince the British Steel Founders’
Association scheme) what is the difficulty and why all the delay of proceeding with a pilot
scheme especially as suggested in South Wales? Is it finance or equipment, is it the N.C.I.D. or
the N.U.M., or are the P.R.U.’s conditions not acceptable to Government Departments? Is it
possible for the man to accept and follow it, or are they seldom easily transferable.

The fundamental concept on which this colossal of periodic examinations is based is the
single fact that if a miner will agree to be removed from the risk before he has reached the
“critical stage of simple pneumoconiosis” he will not become seriously disabled or die from
progressive massive fibrosis or indeed from the disease.

Here is what they have to say of the critical stage:
“...in coalfields outside South Wales...we have
knowledge of the relation between the degree of
simple pneumoconiosis and chance of contracting
P.M.F. is slight.”

The system is radiological and the significant range of change to be precisely identified is be-
tween 0 and lower category 2. Dr. Fletcher reminds us that provision of sufficient sets of standard
films for use in practice will not be easy. Furthermore, can we be assured that these standards, if
and when available, are of universal applicability for pneumoconiosis throughout the coalfields?
In Scotland we have found some difficulty but, of course, we have shaggy eyebrows. If you
succeed in placing a film in the proper category a new problem, as explained by Dr. Gilson, im-
mediately presents:
“...So far the assumption has been made that the
X-ray abnormality is synonymous with disease.
This, however, is not necessarily true, because
what worries the miner is not whether there are
spots on his X-ray, but whether he is in any way
disabled—disability being chiefly breathless-
ness.”
Surely there is something wrong here—the workman concerned with spots in relation to present disablement. The problem, which by their own claim belongs to Dr. Gilson and his colleagues, is for them to decide the significance of these "damned dots," not now, but in the future. Dr. Gilson concludes:

"We are left with the humbling thought that we are still unable in many cases to answer the simple question, 'Has this man a disease?'"

To jump this hurdle of simple pneumoconiosis, category 1, Dr. Fletcher has invented the term "phanerosis." There is no truth in the report that the classical department of the N.U.M. have translated this as "Sweet Fanny Adams."

B. Periodical Examinations as a Biological Measure.

If conducted by scientific methods this is indisputable and I wholeheartedly support the idea. The test, however, is surely no more than a measure by which the dust, quantity and quality, is related to the disease as a function of time. I do not pretend to impress on the scientists the need for precision in framing the experiment. Presumably it will be necessary throughout the period to have some measure of the dustiness, and this is what Dr. Fletcher had to say in 1950:

"We have to count particles. This is a very laborious process, but it is the only method readily available at the moment. If we make such counts we soon find there are enormous variations in dust concentrations in the mine from moment to moment and from day to day. You will appreciate that the estimation of dustiness underground is difficult and is very imprecise."

The pilot scheme is to operate at mines which are representative of various areas in the different coalfields; are any two mines reasonably comparable; by what criteria may any be adjudged representative?

The P.R.U. acknowledge that new entrants and young men would derive the greatest benefit from examinations, but in a biological test we are not primarily concerned with benefits; our purpose is to obtain accurate measurements. Of what scientific value, as a biological test, are men already dusted to an unknown and unmeasurable degree, even if the original radiograph is normal—category 0? We must start with workmen whose lungs, so far as it is possible to determine, are healthy and not dusted. These are the young recruits.

Since 1944 these lads—about 20,000 annually—have been subject to pre-employment medical examination, but only in South Wales has this included radiographic examination of the chest. During these seven years I have nowhere noted any agitation by the P.R.U. to have the system unified (to include X-ray) throughout the country.

Nor have I heard them protest against the futility of the present arrangements. Is it not their opinion that the radiographs are not of good technical quality and so, in effect, absolutely useless as a base-line measurement of the onset of the disease? Seven years of waste, seven years of biological futility. Despite the annual labour wastage, fifty per cent., this is the real biological material and it is high time that this statutory system was made efficient and effective.

C. Periodical Examinations in Relation to Fundamental Research.

I am not aware of the reasons which require the institution of a system of periodic examinations to enable doctors to conduct fundamental researches. Furthermore, the difficult question as to whether or not the relationship of researcher to workman is as doctor to patient is not really germane to our discussion to-night.

After all this negativism, you may rightly ask, have I a definite policy? Here are five points.

1. Use all our power to impress on the N.C.B. and N.U.M. that there is a dust problem in every coalfield in this country.

2. Insist that the engineers and miners get on with the job and by unrelenting supervision ensure that they do not relax.

3. Doctors to provide the biological control by an effective scheme of efficient initial and periodic medical examinations for all men (under 21) entering the industry.

4. Allocate the supervision of the present generation of miners to the medical service of the N.C.B., their work to be advanced and fulfilled by a social service for the industry; this to enable the workman to accept the advice of the doctors. It is not intended that these services should be restricted to pneumoconiosis.

5. The compensation aspect to be left with the Pneumoconiosis Panels.

In conclusion I wish to suggest that Dr. Fletcher has never really intended or desired a system of periodic medical examinations. His concern is for a system of periodical surveys untrammelled by the discipline of research workers and to be modified or even abandoned in whole or in part at will.

Mr. Chairman, Ladies and Gentlemen, I apologise for occupying your time. The P.R.U., through Dr. Cochrane, have said it so concisely, so clearly and with such finality. Radiology is the Hinge of Fate—so Dr. Cochrane underlines:

(1) The unreliability of mobile X-ray apparatus.

(2) The difficulty of taking several comparable X-rays of the same man.

And his memorable words at Lisbon, September, 1951: "The only possible solution to the problem is therefore to study the rate of progres-
sion of disease in miners and at the same
time, measure the concentration of dust to which
they are exposed. This will not be possible until
both the radiological and dust sampling tech-
niques are much improved.

As I began light-heartedly may I likewise say
farewell, at this dusty corner of "The Rolling
English Road":

"For there is good news yet to hear and
fine things to be seen.

Before we go to Paradise by way of Kensal
Green." — G. K. Chesterton.

Dr. Charles Fletcher.

The contrast between the tall thin protagonist
and the short stout protagonist has been some-
what evened up by the hospitality I have received
this evening, for which I am most grateful. I am
extremely pleased to have the opportunity to-
derive the hospitality I have received
and the short stout protagonist has been some-
other, and to answer some of the criticisms that
may perhaps be levelled by the hospita-
tortured views of myself and my colleagues in the
Pneumoconiosis Research Unit, as to how we
believe that coalmers' pneumoconiosis in this
country could most quickly be brought under
control and to answer some of the criticisms that
have been made of our proposals. We are
research workers; we are not therefore hide-
bound; we are not afraid to retract statements
that we have made when we find evidence that
controverts them; we attempt to give the best
opinion we can on the evidence that we have at
the moment. If, from time to time, as Dr.
Meiklejohn suggests, we have changed our views
because we respect the truth, we are not afraid
to admit that we have previously misinterpreted
our evidence. You may think that as research
workers we may be theoretically and statistically
meticulous in our approach, but that we have
our heads in idealistic clouds. To-night I wel-
come the opportunity of seeing if our views do
appear to be sound practically to people who
are concerned with the day-to-day supervision of
the health of workers in a variety of industries.
You may not have first-hand experience of the
medical problems of coalmining, but I do not
believe that the principles of the maintenance of
health are very different in one industry com-
pared with another, and so I welcome the oppor-
tunity of hearing your views.

I do not propose to go into too many details
or figures. I am just going to tell you, as simply
as I can, the basis of our proposals and answer
a few of Dr. Meiklejohn's comments, and I shall
then be happy to hear from you what significance
you can find in our arguments. I hope that you
will not interpret our views as skilful propa-
ganda. We try to discover the facts and we are
most seriously concerned with the relevance of
those facts to the health of mineworkers.

How, then, can pneumoconiosis be prevented?
First and foremost by the control of the dust
which we know to be the cause of the disease.
We all agree that if there were no dust there
would be no disease. If you will read the actual
statements we have made (and not only isolated
extracts quoted by Dr. Meiklejohn) you will see
that we have always placed dust prevention first
as the main requirement in the prevention of
pneumoconiosis, but we believe that the engineers
need help from the doctors. I particularly want
to know whether you people agree with us that
doctors have an essential part to play in miti-
gating the hazards of industry. Of course, if
dust could be abolished from the mines there
would be no problem. But, unfortunately, you
cannot mine coal without producing some dust
and so the most important question of safe levels
of dust concentration arises. The difficulty is
that we do not know the answer to that question.
We do not know the maximum concentration of
dust which may be allowed in the mines without
producing any risk of pneumoconiosis. Dr.
Meiklejohn advocates "... instead of Medical
Panels engaged on periodic examinations,...
Colliery Panels representative of all concerned
relentlessly examining and promoting dust con-
trol." What Dr. Meiklejohn does not tell us is
how these Colliery Panels are to know when they
have done their job. How can they know unless
doctors can show them that as a result of their
efforts no new cases of pneumoconiosis are
arising?

But even if we did know safe levels of dust,
would we ensure them? We must be realists
and appreciate the day-to-day difficulties of dust
control, whether these arise from new machines,
from difficult geological conditions or, most
likely of all, from the carelessness of the work-
men. Besides, we have not yet got any satis-
factory dust sampling instrument which would
enable us to ensure that any particular level of
dust concentration was really being maintained.

For these reasons, the engineers cannot at present
agree to universal periodic examinations
which we know to be the cause of the disease.

The scheme we propose is one designed to
prevent disabling pneumoconiosis. It is impor-
tant to realise that the word "pneumoconiosis"
includes anything which a doctor, looking at an
X-ray, may interpret as evidence of the action of
dust in the lung, whether or not it is causing any
symptoms. We need not worry about the type
of pneumoconiosis that causes no symptoms,
whatever Dr. Meiklejohn wants us to call it. A
man does not mind if he has spots on his X-ray.
All he is concerned with is his health and his
ability to continue his work. To be effective,
therefore, a scheme of medical control depends
upon our ability to detect signs of dust accumu-
lation in the lungs before there is any liability
to serious disablement.

8
Now I must come down to a few facts and recount some of the observations we have made and the conclusions we have drawn. First, we believe that in coal pneumoconiosis there are two quite distinct disease processes. First, there is simple pneumoconiosis, which we and the pathologists agree is seldom seriously disabling. Then there is a second, quite distinct, process which results in disabling indication of early pneumoconiosis, which is often seriously disabling, and which we believe is due to infection, probably tuberculous, acting in a lung which is already affected by simple pneumoconiosis. This we call complicated pneumoconiosis or progressive massive fibrosis.

By means of extensive studies of X-rays of men with simple pneumoconiosis, we have been able to determine three radiological categories of simple pneumoconiosis which we believe correspond fairly closely with the amount of dust in the lungs. We have found that disabling massive fibrosis does not arise until at least category 2 or 3 simple pneumoconiosis has become established. We also find that after dust exposure has ceased, simple pneumoconiosis does not itself progress. Therefore if we can detect men with category 1 and protect them from further dust exposure, they will not progress to category 2 or 3 and they will avoid the risk of developing massive fibrosis, which is the chief cause of disablement by pneumoconiosis.

Thus we have what I said we needed, a harmless indication of early pneumoconiosis which may be used as a warning signal that a man is being exposed to dust concentrations which, if his exposure continues, may lead to ultimate total disability from pneumoconiosis. The conception of the nature and progression of pneumoconiosis is one of the basic reasons for our advocacy of periodic examination of all coal-miners. These examinations could have three main benefits to confer on the miners:

First, we could detect those who were accumulating dust in their lungs. If they were young, they would have to be advised to work in less dusty conditions, and thus be protected from the danger of premature disablement.

Secondly, we could use this harmless indication of dust accumulation to show where the engineers had failed to bring the dust under control and where they were succeeding. Men who were shown to be developing early pneumoconiosis might be transferred to work at mines where the periodic examinations showed that there was no risk of developing pneumoconiosis. I am informed that the Coal Board are at present spending over one million pounds a year on dust suppression in the mines. Should all this effort be expended without regard to the risk of pneumoconiosis? Surely the engineers should be guided to concentrate their efforts on the places where the doctors had shown that disease was appearing?

Thirdly, if these periodic examinations were combined with routine dust sampling at all working places, it should ultimately be possible to define safe levels of dust concentrations under which disease would not arise. When this has been done it might be possible in the future for doctors to retire from the field and leave the engineers to be guided by their own estimations of dust concentrations, but do not be misled by Dr. Meiklejohn into thinking that this is possible at present.

Lastly, periodic X-ray examinations could also be used for the early diagnosis of tuberculosis and other pulmonary diseases in which early treatment may be important.

What form should the periodic examinations take? We maintain that for our purposes, radiological examination would give us all the evidence we need. There is no need to do a full clinical examination, which Dr. Meiklejohn seems to advocate (although he has produced no evidence that the palpating or percussing finger, the stethoscope, the knee-jerk hammer or the ophthalmoscope would be of any assistance in the early diagnosis of pneumoconiosis). We do not suggest that full clinical examination might not be of value for other purposes, if the Coal Board Medical Service could achieve it. We only say that radiological examination by itself would give us all the evidence we need for the early detection of pneumoconiosis.

After radiological examination, each man would have to be offered an interview with the doctor. In the vast majority of cases the purpose of this interview would be to give reassurance. I have carried out such interviews after a radiological survey and I have seen what a powerful thing this reassurance can be. The man comes up with a strained look on his face and sits down in front of you. You put his X-ray on the screen in front of him and find it is normal. You say, "There is no sign of dust in your X-ray." It is a real joy to see the reaction of a man who can be told this. If there is evidence of early pneumoconiosis in the X-ray, most of the men can still be reassured. If they have worked many years underground, they can be congratulated on having accumulated so little dust in their lung, and need to be advised no change of job since further dust exposure of the same order will not have time to have dangerous effects. If a man has severe pneumoconiosis, or has symptoms of disability, then he may be referred to his doctor with a report on his X-ray, or he may be told that if he applies to the Pneumoconiosis Panel he may perhaps derive some financial benefit. But there will be few men who, after only a very few years' work, are showing signs of early pneumoconiosis. These may have to be advised to change their jobs. This is the crux of the whole problem. On what evidence do you advise a man to change his job? We believe that this
should not be done on a single examination. It should only be done when, on review, there is evidence of progression which shows that the man has been working in dangerous dust concentrations during the interval. Such a man must be told to work in less dusty conditions. It is up to the Coal Board to work out a system which would make it possible for the men to act on this advice. Men in the later stages of pneumoconiosis need be given no such advice, for we have not found that further dust exposure greatly increases the risk of disability in such cases. It is only the young man who is showing progression of simple pneumoconiosis in whom the real danger signal arises. These men are not found in great numbers. In a recent survey which Dr. Cochrane carried out at one of the dustiest collieries in South Wales, there were only 13 men out of 600 in the pit who had to be advised to change their jobs.

The next question is how such a system of periodic examinations should be introduced? Should we start by writing out a blueprint of the whole scheme as Dr. Meiklejohn has suggested? In our experiments we usually conduct a pilot trial first and in the light of that trial we design a major experiment in dangerous dust. I think this is the right principle. We should have a pilot scheme confined to a few pits throughout the country to give us experience upon which a universal scheme should be efficiently designed. By this proposal you must not think that I am retracting from my statement that we should judge the country's interest in the health of its mineworkers by the urgency with which a scheme of periodic examinations is introduced. The urgency is as great as ever, but urgency is no excuse for precipitate action and faulty planning.

Dr. Meiklejohn has himself actually advocated periodic examinations, but he would restrict them to new entrants. I wonder whether you agree with him that this would be the right psychological approach. We agree that you should examine men before they enter the industry, but could you go back to a mine a year, or two years, later and re-X-ray all these new entrants but refuse examination to all those others who would certainly want to be examined? Would Dr. Meiklejohn just turn to them and say, "Oh, no, we're not interested in you; we're only interested in the new entrants." Of course the scheme must be open to all the miners.

To come down to details, then, we propose that there should be a pilot scheme started at, say, 20 pits throughout the country, so that after a few years we should learn what the appropriate interval between the examination should be, how many men would have to be advised to change their jobs, and how this advice may be followed. We should discover what sort of staff is required, what sort of X-ray unit is most valuable, what sort of records should be kept, and so on. But do not let such a pilot scheme be called a "pure research scheme." Let us be committed from the start and announce that the pilot scheme is the beginning of a scheme which is going to be made universal as soon as possible.

Next, who should carry out the examinations? The Pneumoconiosis Medical Panel in this country have more experience than anyone else in the diagnosis of early pneumoconiosis and it might be thought that they should do the job, but I do not think that you can have the correct intimacy and frankness in an interview, if the issue of compensation is in the background. The men should have no doubt that they are getting an honest unprejudiced opinion and the doctor must know that he is getting an honest account of the man's working history and symptoms. With compensation in the background, I do not believe that this would be possible. We believe that the job is one for the National Coal Board's Medical Service. The Coal Board are responsible for the health of their employees. If it is agreed that a system of periodic examinations would help to ensure the health of those employees, then the Coal Board's Medical Service must run it.

Now I want to consider some of the objections that have been raised against our proposals by Dr. Meiklejohn and others. First, there is the question of practicability. Dr. Meiklejohn has said that it would be impossible to examine the 700,000 miners in this country at regular intervals. We have carried out surveys at ten collieries in various mines in the country and so we probably know more than anyone else about the practical problems. We calculate that to X-ray and interview all the miners of this country at intervals of 2—3 years (which we believe to be about the right average interval) 10 mobile X-ray units of the type which we now possess, would suffice. It would take 20 doctors to read all the films taken each year and interview the men if they were each able to work at the rate of 300 X-rays and interviews per week. This would be a whole-time job, but the present Coal Board Medical Service is planned to comprise some 80 doctors. Our scheme would only occupy 20 of them.

The next and most important criticism of our proposals is that with present techniques it is not possible to get consistent and accurate diagnosis of the earliest radiological signs of pneumoconiosis. That is to say, our category 1. The accuracy of diagnosis is influenced on the one hand by radiographic technique and on the other by human errors of interpretation.

The problem of getting films of consistent radiographic technique is a formidable one, but recent advances have made it less formidable than it was. In our mobile unit we have recently installed a German device called the Iontamat, which is a mechanism for automatic exposure control. Before he used this instrument on his
and would rapidly deplete the industry of its suppression, would be psychologically disastrous. No wonder that those days, advanced disease was rife in the mines and no attempt at prevention by dust suppression was being made. I quite agree that periodic examinations carry great psychological dangers. In support of this thesis, Dr. Meiklejohn has stated that this consistency is inadequate; for the decisions that will be taken on the films will involve human welfare and happiness. Let us look at this quantitatively and unemotionally. At the very dusty colliery I mentioned, there were 13 men whom we felt should be advised to leave the industry, that is to say, on whom a decision had to be taken involving their welfare and happiness. If 15 per cent. of these men were falsely diagnosed, then two of them were given the wrong advice. Must we really jettison the scheme of periodic examinations because two men out of 600 at one of the dustiest collieries in the country may have been given the wrong advice? There may, of course, have been others who should have been advised to leave, but because of diagnostic mistakes did not receive this advice. At least these men are no worse off than if they had not been examined at all.

This leads us on to the important criticism that periodic examinations carry great psychological dangers. In support of this thesis, Dr. Meiklejohn has pointed out that in the early days when the Silicosis Boards were operating, the “valleys became tense, breathless, apprehensive and querulous.” But the conditions then were quite different from those that would pertain to a system of periodic examinations. In those days, advanced disease was rife in the mines and no attempt at prevention by dust suppression was being made. No wonder that there was apprehension! I quite agree that periodic examinations, in the absence of dust suppression, would be psychologically disastrous and would rapidly deplete the industry of its manpower. But that is not what we are suggesting. We are suggesting dust prevention, supported and guided by periodic examinations. Professor McKeown has said, “It will be a poor bargain if for every new case of disease we uncover, we precipitate a further two anxiety states.” I am sorry that he is not here to tell us of the investigations upon which he has based his precise prognosis. If he had been able to witness the effect of the interviews which Dr. Cochrane and his colleagues give to miners after the surveys they have carried out, he would never have made this misleading forecast. I am aware that the experience of those of you here who are in charge of men undergoing industrial risks will lead you to agree that it is possible to examine men who are exposed to a risk, to deal tactfully and firmly with those who need a warning without precipitating neurosis, and to give reassurance to the vast majority who need nothing else. Naturally some men will be alarmed when the diagnosis of pneumoconiosis is made, but such alarm is the inevitable consequence of the diagnosis of any form of disease. Must we then stop all diagnostic practice, diagnose no tuberculosis or malignant disease when it is early and treatable because we may make occasional mistakes or precipitate anxiety neurosis? Should we leave men in the mines exposed to dangerous concentrations of dust to get disabled by their pneumoconiosis? Or should we give them a chance of preserving their health at the possible cost of alarming a few people?

Let us on the other hand look at the positive side of the psychological balance. In South Wales fear of the dust is widespread, and in other coalfields miners are becoming increasingly afraid of pneumoconiosis. Personal medical supervision and reassurance could remove this fear from the vast majority of the miners of to-day and could safeguard all the miners of the future. Fear is a bad thing for recruitment. I am confident that the psychological consequence of periodic examinations would be the exact opposite of those feared by Dr. Meiklejohn and that they would assist recruitment and the maintenance of manpower.

Lastly, there is the criticism that the whole scheme would be futile because the men would not be able to follow the advice they are given. At present, it is certainly true that men will not, and cannot, for economic reasons, follow advice to work in less dusty occupations. They are not willing to leave highly paid jobs on the coal face for less highly paid jobs elsewhere. This is a problem for the Coal Board. They must provide some means by which men may be offered satisfactory employment within the industry in less dusty occupations if they are showing signs of injury from dust inhalation. The alternatives to this would be either compulsion, to which I am opposed, for it would bring endless legal and practical difficulties in its train, or to admit that
owing to economic pressure we cannot use periodic examinations to give personal protection to individuals. But even then we could still use the system to guide the engineers in the effective use of dust prevention.

In summary, then, it seems to me that Dr. Meiklejohn’s main objections are based on a false antithesis between the engineers who should get on with their job and the doctors who should mind their own business. I completely reject this antithesis and maintain that doctors and engineers should work together. His other objections are based on his own personal assessment of unproven eventualities and difficulties. His approach seems to me to be unjustifiably timid. He says that I have maintained the difficulties could be overcome because other countries have introduced periodic examinations, but that I have not looked closely at the circumstances under which they have done this, and that their experience is irrelevant to the coalmining industry in this country. But I only drew the analogies with other countries to show that they had accepted the principle of the supervision of the health of men exposed to dust. Must we, in this country, attempt no such scheme unless the South Africans, the French or the Germans have explored all the difficulties for us? Can we not ourselves be bold and do what we know to be right? If you agree with my advocacy (which you must remember is based not only on my own personal views, but on the experience my colleagues have had in their survey work among the miners), I hope that you will apply your influence to back us up in urging that a pilot scheme should be started immediately—a pilot scheme designed to lead on to periodic examinations throughout the whole industry. And you must urge that now is the time to start. There is nothing to be waited for.

If you have any lingering doubts, let me ask you to imagine that you yourself, each one of you, is a young miner about to enter the industry. You might agree that the engineers should carry out dust prevention, but suppose you find, as you would, that dust suppression was not universally installed—you would certainly find dry drilling in many pits—and that even where it is installed, there was plenty of dust in the air; would you just sit back and say, “I will leave all this to the engineers”? And then suppose that you had heard the evidence which I have given you that it is possible to detect pneumoconiosis at an early stage without risk of disability, but at a stage at which further exposure to dust may bring disabling consequences. Would you then just carry on or would you occasionally go off to an experienced doctor and have an X-ray done and ask him for his honest opinion? If you found no abnormality you would of course go on, reassured and contented, with your anxiety removed. But if he found signs of dust accumulating in your lungs, would you not wish to have some action taken? If your answer is that you would go, just occasionally, or at regular intervals, to get an X-ray, then surely you cannot deny that all the coalminers of this country, upon whom our prosperity depends, deserve to have their health safeguarded in just this very way—by means of universal, periodic X-ray examinations.

Discussion

Mr. A. H. A. Wynn (Safety in Mines Research Establishment).

It would be very easy for me to suggest that a tall thin man can run faster than a short broad man, but I believe that neither is in fact running fast enough.

An engineering firm has recently developed an automatic stowing machine for use underground in mines, which grinds stone and throws it at a speed of about 100 ft./sec.; it does not grind coal but grinds siliceous rock, and the stone and dust are projected at this high speed into the air. Although water sprays are used, some of the dust is certain to remain airborne and will make its contribution to the pneumoconiosis problem. I suggest that if the medical officers in the industry had the influence they should have, that machine would not have been developed. If that machine is subject to restrictions in use it will be thanks to the Ministry of Fuel and Power. It would be better if the restrictions were due to the persuasion of industrial medical officers.

Medical officers in industry are the men who can most easily persuade engineers of the needs of industrial hygiene. It is not easy to convince a manager by argument that dust suppression measures are necessary. On the other hand if a medical officer discusses each case of pneumoconiosis with a manager as it is discovered the manager quickly appreciates that something has to be done. The medical services in the mining industry need to be strengthened.

As regards the problem of Fletcher v. Meiklejohn or vice-versa, I think a story about a Scotsman which was told me the other day must be true. He was a man who had been invited to dinner and he was then shown the family photograph album; he turned through all the pages very carefully and he then turned back again.
He then put on his spectacles over his shaggy eyebrows, pointed to a photograph at about the middle of the room and said, "That one is the worst." That, I think, sums up a national characteristic. They are, of course, both right. You cannot tell whether a man has got a dose of dust unless you X-ray him. You cannot suppress the dust without putting all your efforts into the engineering side. The chief criticism I have always felt about the set-up of the P.R.U. is that it does not always have engineers on its staff working with the doctors.

From the discussion to-night, I feel that one of the fundamental problems we have to overcome is to get engineers and doctors to work closer together. Again, one comes from a rather up-to-date University (Durham) in which we give lectures to our engineers on the relationship of engineering to health. The initiative came from our Professor of Engineering, but he originally wanted me to lecture his men on workshop hygiene.

If, as has been suggested to us by a previous speaker, British engineers want a lot of persuading, how comes it that in the middle of darkest Africa, it is illegal to use any drill except a wet drill? I do not think I have seen a single wet drill in either coal or stone in Durham. Again, in darkest Africa (Northern Rhodesia) every new entrant to their mines has an X-ray film of his chest taken, irrespective of being black or white; he is then X-rayed periodically. Afterwards, he is stripped every month and he is weighed. This is laid on by the Government and I think we in England are probably paying for it. It seems peculiar to me that we can do this in darkest Africa but we cannot do it in the mines in Britain.

Dr. F. H. Tyrer (Birmingham).

I have had an experience to-night rather like that which one has in attending a Court of Law—being swayed in turn by Counsel for the prosecution and for the defence. I do not feel competent to act as judge in this controversy, but I would like to refer to the suggestion that has been made that when you are a medical officer looking after men exposed to a hazard, in some queer way you precipitate a neurosis. The characteristic of a neurosis is surely the existence of an unreasonable fear which is not amenable to reassurance. Men exposed to an industrial hazard, like pneumoconiosis, have a fear which is perfectly rational and respond well to a frank explanation of the dangers and the way of dealing with them. It has been my experience that managers are rather chary of having workers at risk addressed in this way by their doctor, but in practice their misgivings are not factors in the causation of neurosis, and the worker has a right to be told in language he can understand what risks he is running.

Dr. Gordon Evans (London).

I would like to make three points as an ordinary industrial medical officer and not as a research worker. They are briefly these.

I hope in this discussion that, because of the nation-wide interest in pneumoconiosis, we shall not lose sight of the fact that pneumoconiosis, like specific industrial disease in every industry, forms only a small part of the diseases to which miners are subject. We must realise that the most important thing we can do for the health of coal-miners is to provide them with a full-time industrial medical service to deal with all the diseases from which they may suffer while at work—the everyday illnesses we find in our own industries—peptic ulcer, fibrositis, upper respiratory complaints, and so forth. I am sure that with coal-miners, as with other industrial workers, provision for the early treatment of common ailments would relieve more suffering than the most elaborate arrangements for dealing with specific hazards if, unfortunately, the finances available cannot cover both.

Secondly, I would like to say that I am not an expert in dealing with this problem of pneumoconiosis. I can only draw a parallel with something I had to do during the war, when, in Burma, I had to advise the 14th Army on the evacuation of its sick and wounded. The authorities had to be convinced that the only sensible thing to do was to move casualties by air. I found that you only got anywhere by concentrating on one point at a time. This is where I would come down heavily on Dr. Fletcher's side. I am sure he does not feel that periodical mass X-ray examination is the only valuable approach to the problem, but I think he is quite right in concentrating on that one point for the moment. In fact, the more he can make the authorities feel the idea is their own and not his, the more quickly they will adopt it.

The third point is this. Dr. Meiklejohn said miners are not disposed to take jobs in other places. I have on my right several friends who happen to work in the Slough Industrial Health Service. They tell me they are constantly coming across men who have pneumoconiosis which has developed since they came to Slough. These men, however, left the mines not because of the disease but because of the poverty and misery to which they were subject in the years of depression. Happily we have moved on from those times, but it is untrue to say that people will not take alternative employment. It depends greatly on the pressure of events. Our job is twofold: first to get the sufferer from pneumoconiosis to see that he must leave the industry and, if necessary, the mining community; and secondly, to ensure that suitable alternative employment is provided for him either in the mining valleys or near his new home.