Association of
Respiratory
Technicians
&
Physiologists

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# BREATH

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## EXECUTIVE COMMITTEE OFFICERS
for 1979–1980

*Chairwoman*

Sally E. Gough
Respiratory Physiology Department
Papworth Hospital
Papworth Everard
CAMBRIDGE CB3 8RE
Tel: 048-088 541 Ext. 304

*Treasurer*

Jane Jones
Chandler Department of Respiratory Medicine
London Chest Hospital
Bonner Road
London E2
Tel: 01-980 4433 Ext. 320

*Secretary*

Margaret Marples
Anaesthetics Department
Clinical Sciences Building
Hope Hospital
Eccles Old Road
SALFORD 6 8HD
Tel: 061-789 7373 Ext. 115

## EXECUTIVE COMMITTEE MEMBERS
1979–1980

Mr. D. Cramer
Lung Function Unit
Brompton Hospital
Fulham Road
London SW3 6AP
Tel: 01-352 8121 Ext.443

Mrs L. Clarke
Respiratory Unit
Walsgrave General Hospital
Clifford Bridge Road
Coventry
Tel: 0203 613232

Miss G. Lowe
Cardiothoracic Department
Derbyshire Royal Infirmary
London Road
Derby DE1 2QT
Tel: 0332 47141 Ext.621

Mr M. Saunders
MRC Pneumoconiosis Unit
Llandough Hospital
Penarth
South Glamorgan
Tel: 0222 708761

## REGIONAL ORGANISERS
1979–1980

| *Region* | *Name* |
|---|---|
| North West Thames | Mr K. Minty<br>Cardio-Respiratory Laboratory<br>Charing Cross Hospital<br>Fulham Palace Road<br>London W6<br>Tel: 01-748 2050 Ext.2827 |
| North East Thames | Miss J. Jones<br>Chandler Dept. of Respiratory Medicine<br>London Chest Hospital<br>Bonner Road, London E2<br>Tel: 01-980 4433 Ext.320 |
| South East Thames | Miss M. Rusbridge<br>Chest Unit<br>King's College Hospital<br>London SE5 8RX<br>Tel: 01-274 6222 Ext.2490 |
| South West Thames | Mr D. Cramer<br>Lung Function Unit<br>Brompton Hospital<br>Fulham Road.<br>London SW3 6AP<br>Tel: 01-352 8121 Ext.4423 |
| South Western | Mr F. J. Chadd<br>Pulmonary Function Unit<br>R.D. and E. Wonford Hospital<br>Barrack Road, Exeter EX2 5DW<br>Tel: Exeter 77833 Ext.2105 |
| East Anglia | Mrs S. Gough<br>Respiratory Physiology Unit<br>Papworth Hospital<br>Papworth Everard<br>Cambridge CB3 8RE<br>Tel: 048-088 541 Ext.304 |
| West Midlands | Mrs L. Clarke<br>Respiratory Function Unit<br>Walsgrave General Hospital<br>Clifford Bridge Road<br>Coventry, Warwickshire<br>Tel: 0203 613232 |
| Trent | Miss G. Lowe<br>Cardiothoracic Department<br>Derbyshire Royal Infirmary<br>London Road<br>Derby DE1 2QT<br>Tel: 0332 47141 Ext.621 |
| North Western | Ms M. Marples<br>Anaesthetics Department<br>Hope Hospital<br>Eccles Old Road<br>Salford M6 8HD<br>Tel: 061-789 7373 Ext.115 |
| Wessex | Miss H. Gimblett<br>E.C.G./Respiratory Assessment<br>St. Martin's Hospital<br>Midford Road<br>Combe Down, Bath<br>Tel: 0225 832383 |
| Yorkshire | *No Representative* |
| Mersey | Miss D. Pollard<br>Chest Unit<br>Broadgreen Hospital<br>Thomas Drive<br>Liverpool L14 3LB<br>Tel: 051-228 4878 Ext.259 |
| Northern | Dr. J. Reed<br>Dept. of Physiology<br>Newcastle University<br>Newcastle-upon-Tyne<br>Tel: 0632 28511 Ext.4200 |
| Scotland | Mrs P. Reid<br>Respiratory Function<br>Dept. of Clinical Medicine<br>Ninewells Hospital<br>Ninewells,<br>Dundee DD22 1UB<br>Tel: 0382 60111 Ext.2868 |
| Wales 1 | Mr M. Saunders<br>MRC Pneumoconiosis Unit<br>Llandough Hospital<br>Penarth, South Glamorgan<br>Tel: 0222 708761 |
| Wales 2 | Mr K. Houston<br>Thoracic Outpatients Department<br>Llandough Hospital<br>Penarth, South Glamorgan<br>Tel: 0222 705411 Ext.33 |
| Northern Ireland | Mr J. Buick<br>Respiratory Investigation Centre<br>Belfast City Hospital<br>93 Lisburn Road, Belfast<br>Tel: 023-29241 Ext.516 |

## CHAIRWOMAN'S REPORT

The time has now arrived at the insistence of the Editor for pen to be put to paper and the Chairwoman's report produced. There have been few major changes in the Association's activities over the last year, and the business of the Association continues to revolve around the important issues which date back to its foundation.

### EDUCATION

Education is progressing just a little faster but it is unlikely that the O Tec as proposed by the Member Associations of FAMT will be adopted by the Technical Colleges in 1979; however, it is hoped that, in 1980, Technical Colleges will recognise the In-service Training Programmes of each Physiological Measurement specialty and that a diploma course will be set up.

The Association is going to need its members help on two points concerning education – firstly for specialised centres in each region willing to help with the In-service Training of technicians taking Respiratory Physiology as their specialty during O Tec, and secondly for help with the organisation of a syllabus for an H Tec course. YES, Mr Gregory has informed the Education Representatives on FAMT that they should ask the Member Associations to prepare a syllabus and the Association therefore needs volunteers for the Education Sub-Committee. Please remember that the type of technician you employ in the future depends on the amount of time and hard work you are prepared to give the Association *now*.

We are asking that the technicians of the future should have a solid basic background in all aspects of technical work and the enthusiasm and knowledge to wish to train for higher qualifications and a career. There must be, amongst our members, technicians who have recently taken their HNC and can offer positive criticism or suggestions for inclusion in an H Tec syllabus. It has been established that as a member of an Education Sub-Committee you are entitled to take time off from your duties for discussions on education and the Association is able to cover travelling expenses – so the only thing you need is the willingness to offer your services to the Association!

### IN-SERVICE TRAINING

For the In-service Training Programme, the Association needs a number of Respiratory Physiology Departments in various regions in Great Britain to act as specialised centres where a technician can gain experience in the more sophisticated aspects of lung-function measurement. Please do not feel unable to put forward your own department because it does not have a full range of equipment; no doubt facilities that you lack can be found elsewhere in your region. This is your chance to see that technicians of the future get the best possible training; if they do not, then it is the Association–which is all of us–that has failed them.

### THE FAMT

Len Smith has resigned as representative and as his deputy I continued with Dr J Reed as representatives of the Association. Discussion still goes on about insurance and this is becoming more and more complicated as insurance brokers find that each Member Association might need a separate insurance cover and that personnel employed by Universities will need a different policy from those employed in the Health Service. No decision has yet been reached but members will be kept informed.

FAMT has still to decide on its Constitution and members present at the so-called AGM of the Federation will remember the chaos caused by the subtle interpretations by Member Associations of the old one. It is hoped that the new Constitution will be agreed in the near future.

One of the main concerns of the Federation is education and the co-ordination of the views of the Member Associations and Societies. Some of these members feel at the present that they are not being represented fully during discussions with the DHSS but no doubt these small differences will be ironed out. The Federation has succeeded in amalgamating most of the disciplines within Physiological Measurement and Medical Physics and hopefully it will eventually succeed in representing all views as a body without too much friction between its Member organisations.

### THE WHITLEY COUNCIL

An important matter that concerns us all is the discussion now taking place between the Management Side and the Staff Side of the Whitley Council. PTB Committee E is concerned with claims for new grades at the top of the present PMT/MPT structure. A discussion document that has been prepared by recognised negotiation bodies, proposes changes also in the existing PTB handbook definition. Most of the changes are referred to as 'tidying-up' amendments but some clearly have more fundamental implications. Under Physiological Measurement a 'unit' is referred to, and the interpretation of this 'unit' is given as:

> A 'unit' means that part of a department which provides a service in one of the main branches of physiological measurement, e.g. audiology, cardiology, neurophysiology and respiratory function.

At last Respiratory Physiology has been recognised! I suggest that members interested in the document approach their recognised negotiating bodies and obtain a copy of this. The Executive Committee would be pleased to receive constructive criticism of this document but proposed alterations or amendments can only be made through the members' negotiating bodies.

### NEXT MEETING OF THE ASSOCIATION

We hope to go to Harefield Hospital for the 1980 Spring Meeting and we are grateful to Peter Lockwood for offering to arrange the programme.

#### Breath

The Association Newsletter, 'Breath' continues to need the support of the members; in addition to scientific articles and reports, I would like to remind you that the Editor will accept material relating to hobbies, travel, adventure or local gossip. How about an article on Toxophily?

#### Lighter matters

The ducks round the pond at Papworth have increased in number but gave a great deal of concern early in the year due to the inclement weather; a number of ducklings died

even though they were at times receiving the full attention of doctors, nurses, technicians and ancillary staff of the hospital. The survivors are now giving a great deal of pleasure to patients, staff and visitors; and for the connoisseur not interested in the feathered bird the warmer weather induced from hibernation the colourful bikini-clad species; the latter have either moved on to sunnier climates or taken on warmer apparel now that the season of 'mists and mellow fruitfulness' has arrived. it is to be hoped that the former will not decrease in number as Christmas approaches.

*CONGRATULATIONS!*

Due to the arrival of a new member in her family, Ann Watson who has been Treasurer of the Association since it was formed has resigned from her duties. I am sure that you will all join with me in sending congratulations from the Association to Ann on the birth of her son and a big vote of thanks for all the time and hard work she has put into performing her duties as Treasurer.

SALLY GOUGH
*Respiratory Physiology Department*

Papworth Hospital
Papworth Everard
Cambridge.



## VACANCIES

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# DOMICILIARY OXYGEN CONCENTRATORS

*Keith B Minty*

DEPARTMENT OF MEDICINE
CHARING CROSS HOSPITAL
LONDON W6

In April 1973 the British Medical Journal published an article by Stark and Bishop describing a new method for oxygen therapy in the home, using an oxygen concentrator manufactured by Rimer-Birlec Limited. Two years after the appearance of this article our department purchased two of these concentrators and installed them in the homes of two patients who required continuous home oxygen therapy; today we have five concentrators available. The purpose of this article is to outline briefly our findings after four years experience with the Rimer-Birlec machine.

The domiciliary oxygen concentrator is designed to produce two litres per minute of 90–92% oxygen from atmospheric air. The air is taken in by a small compressor and passes via a system of valves to one of two vessels containing artificial zeolite. The nitrogen is stripped from the air and is retained in the zeolite, as molecules are retained in gas chromatography, leaving the oxygen to pass through and out via a reducing valve and flowmeter to the outlet. The air passes through the vessel for approximately 1½ minutes after which time the vessel is saturated with nitrogen. The valve system then switches the air to the second vessel whilst the first vessel is reactivated by means of a vacuum pump. Since there is a short period of time during each cycle when the machine is not producing oxygen, storage is built in to cater for this and so give a continuous supply of oxygen. The whole unit is mounted in a sound absorbing, fan cooled cabinet fitted with nylon castors for portability.

As pointed out by Stark and Bishop, the unit is not silent but Rimer-Birlec have gone some way towards overcoming the noise problem since the original prototype was described in 1973; in our opinion the noise level is now low enough to allow installation in the home. We normally install the concentrator in the hall or spare room and then run nylon oxygen lines into the living room and into the patient's bedroom. Since only one outlet can be used at a time, the patient needs to switch off the oxygen in one room, by means of a tap at the outlet, before connecting the outlet in the other room.

In terms of patient convenience, the domiciliary concentrator is far superior to oxygen cylinders, for once installed the patient has no need to hold a stock of cylinders or to move these heavy items from one part of the house to another. As for care of the concentrator, all the patient needs to do is to remove and wash an easily detachable air filter every two to three months.

*What about the cost?* The initial cost of the concentrator is £1080 plus about £180 for installation and delivery. As regards running costs, Charing Cross Hospital reimburse the patient for the cost of the electricity needed to run the machine which when calculated by the London Electricity Board in December 1978 came to £36 per quarter. The maintenance of the machine, particularly the compressor is still a problem; with continuous use the compressor needs replacing every six months. However, Rimer-Birlec do offer a twice yearly service visit for £87.60 per visit per unit plus materials, whereby all worn parts are renewed and a service exchange compressor provided which would very much reduce the possibility of an emergency service visit. This means that the yearly running costs should be less than £500 per unit. This is a small sum compared with the cost to the chemist of providing size F cylinders at £3.13 each (+ 8% VAT) with a delivery charge of £3.65 at April 1978 prices. The patients who have been provided with concentrators were using an average of two size F cylinders per day which works out at £2467 per year exclusive of delivery.

So from our experience over the last four years at Charing Cross Hospital we would say that the Rimer-Birlec concentrator is a cheap, safe and reliable method of providing home oxygen therapy and is a great deal more convenient for the patient. Although the compressor still remains a problem, Rimer-Birlec now tell us that they are fitting new compressors to their latest concentrators which are larger and more reliable. The larger compressor has also enabled them to produce a concentrator which will produce 90% oxygen at 3 litres per minute.

## REFERENCE

Stark, D.J. and Bishop, J.M. New method for oxygen therapy in the home using an oxygen concentrator. British Medical Journal. *2*, 105–106, 1973.


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# TO SMOKE IS TO SMOKE IS TO SMOKE . . . . .?*

*Dr Roger G. Rawbone*
*Research Fellow*

DEPARTMENT OF MEDICINE
CHARING CROSS HOSPITAL
LONDON W6

There are demonstrable differences in lung function between smokers and non-smokers in many tests of respiratory function, but the question must arise – are such differences dose related? Smokers are certainly not an homogeneous population, as shown by the scatter of their results which is very large in comparison to the non-smokers. This large variability should occasion no surprise for each individual smoker has a particular smoking pattern. In this paper, the variables affecting the smokers 'total exposure dose' of tobacco smoke will be discussed.

There are three basic interrelated questions which have to be considered – 'Why do people smoke?', 'How do people smoke?', and 'What is the quantity of smoke presented to and retained within the body?'. We must first, however, comment on the 'product specification', an important factor which has a strong influence, particularly on the answers to the last two questions.

## THE CIGARETTE SPECIFICATION

The cigarette is a complex piece of design engineering and differences between the many brands available depend upon:

1 *The 'filler';* This is usually a blend of various types of tobacco (air cured or flue cured) plus a variety of additives and/or tobacco substitutes.

2 *The shape* of the cigarette; That is, whether it is long and thin or short and fat.

3 *The cigarette paper;* its burn rate and porosity.

4 *The filter;* If present, we are interested in its *efficiency* in removing particulate material and, in some cases, gaseous and vapour components; also important is the presence of associated *'ventilation'* where small holes are punched in the cigarette paper close to the filter allowing air to be drawn into the cigarette, thus diluting the smoke.

5 *The overall pressure drop* down the cigarette, although dependent on the previous factors, will in its own right influence the dose of smoke obtained by the smoker.

### Variation in smoke constituents

It is also important to recognise, particularly in long term studies, that the features of any individual brand are unlikely to remain constant. This can be confirmed by comparing the tar and nicotine yields of individual products from year to year in the tables issued by the Health Departments of the United Kingdom since 1973.

It is also important to note, particularly if carrying out acute studies on the effects of tobacco smoke, that the dose of smoke constituents within each puff of smoke taken from the cigarette is not constant, even if all puffs are otherwise identical. As the cigarette is smoked there is an increase in the concentration of smoke constituents. This is due to several factors:

1 There is, with each puff, a reduction of smoke condensation within the tobacco rod as the cigarette length shortens; on the other hand, an increased amount of previously condensed material is transferred into the smoke as the more proximal tobacco burns.

2 There is a reduction in the length of cigarette paper thus reducing smoke dilution due to the paper porosity.

3 There is a decrease in the filter efficiency as the quantity of deposited material increases.

## Why do people smoke?

A complete discussion of this question is outside the scope of this paper, though it is important to form some classification of the reasons why people smoke. This is because each category of smoker may smoke an identical cigarette in entirely different ways, thus presenting themselves with a different dose of smoke and so running a different health risk.

Very detailed classification systems have been devised, but for our purposes a two point classification may be adequate:

1 The 'dissonant' smokers or 'trough maintainers' who smoke predominantly for pharmacological rewards and attempt to maintain blood levels above a threshold value, and

2 The 'consonant' smokers or 'peak seekers' who smoke predominantly for sensory rewards and the impact of each cigarette.

## How do people smoke?

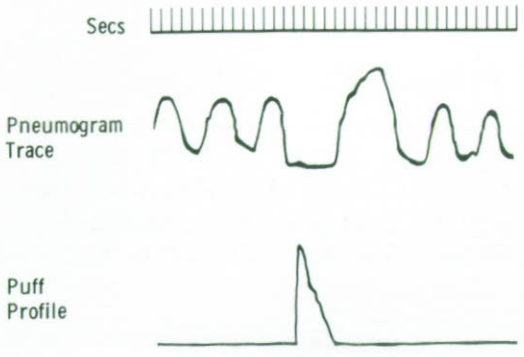
Here we are concerned with the physical 'smoking profile'. The dose of tobacco smoke constituents available to the smoker depends upon the cigarette specification, but for any given cigarette it is the smoking profile which determines how much of the dose is delivered to the smoker.

Quantitative measurements of the smoking profile which can be made, are the number of cigarettes smoked, inhalation, cigarette butt length, and the 'puff parameters' (puff volume, puff duration, number of puffs and inter-puff interval).

The puff parameters can be readily obtained from measurement of the pressure drop across a small resistance, inserted into a cigarette holder between the cigarette and the smoker, which, being related to flow, enables puff volume to be derived by integration. Inhalation can be studied by recording chest wall movement using a pneumogram system – measuring for instance, changes in transthoracic impedance, changes in pressure within a rubber tube applied around the chest, or changes in the electrical resistance of a mercury-in-rubber strain gauge fixed across the anterior chest wall.

* *With apologies to Gertrude Stein*

The shape of the puff and the inhalation profile can also be observed as in the figure where the two stage process of smoking, puff followed by inhalation, can be clearly seen.




### What is the smoke uptake and retention?

In considering this question we are trying to quantify the smoke uptake and dose absorbed as a result of the physical smoking profile. Usually one attempts to estimate the dose of tobacco smoke from an analysis of certain smoke components or their markers. Thus the dose of smoke presented to the subject can be estimated from butt analysis for nicotine whilst the dose absorbed can be derived from measurements of the smokers' carbon monoxide levels (blood or expired air), nicotine or nicotine metabolites (blood or urine) or thiocyanate (blood, urine or saliva).

It is important to appreciate, when attempting to assess the dose-exposure to tobacco smoke, that the various markers indicated above may give totally different answers in any particular case. At the most basic level it can be readily be appreciated that the different phases of tobacco smoke – the *particulate* phase (which includes nicotine) and the *gas/vapour* phase (which includes carbon monoxide and indirectly thiocyanate) may behave differently in terms of their distribution within the respiratory tract. Their deposition and the time spent within the tract may both affect absorption. There are considerable differences in the behaviour of the two gas phase markers; carbon monoxide (as carboxyhaemoglobin) with a half life in the body of four hours will reflect 'recent' exposure whilst thiocyanate with a half life of fourteen days will tend to reflect 'average' exposure; carbon monoxide is not absorbed from the dead space of the respiratory tract whilst blood thiocyanate, derived from a water soluble smoke component (hydrogen cyanide), may be significantly raised by absorption from the buccal mucosa. Thiocyanate being a metabolite of cyanides in the smoke will tend to be affected by the body metabolism whilst carbon monoxide, present as such in the smoke, will not be affected. All these factors need to be borne in mind, in addition to the more practical questions of measurement technique, when defining which smoke marker to use in any particular study.

### Conclusion

I have tried in this paper to present in broad terms some of the complexities of smoking and the factors which should at least be considered, if not measured, when carrying out respiratory studies in smokers. More detailed reference to some of the techniques mentioned, together with their inter-relationships and application to studies of the effects of smoking products of differing tar yields, have been presented elsewhere (Rawbone et al, 1978). Smokers are by no means a homogeneous group and this must be taken into account in the design and the interpretation of any smoking related study.

### REFERENCE

Rawbone, R.G., Murphy, K., Tate, M.E. and Kane, S.J. The analysis of smoking parameters, inhalation and absorption of tobacco smoke in studies of human smoking behaviour. In: Smoking Behaviour – physiological and psychological influences. ed. Thornton, R.E. p.171. Churchill Livingstone 1978.

## SPRING MEETING OF THE ASSOCIATION

The Spring Meeting of the Association took place on Saturday 28 April 1979 at Papworth Hospital, Papworth Everard, near Cambridge.

We are most grateful to Sally Gough for organising the meeting and arranging the programme and refreshments and to all the speakers for their excellent contributions.

We are indebted to the following firms who put on demonstrations and contributed to the costs of the meeting:

Centronic

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The following papers were given:

The Clinical Problems of Identifying Asthma
***Dr J E Stark***

Interpretation of Increases in kCO
***Dr D Lipscomb***

Lies, Damned Lies and Statistics
***Dr J M Collis***

State Registration – A Laboratory Experience
***Mr D W Finch, Chief Haematological Technician***

The papers were followed by a Business Meeting.

## CORRESPONDENCE TO THE EDITOR

### PROMOTION TO SENIOR TECHNICIAN – DOES THE ARTP LACK TEETH?

Over the past two years I have received many telephone calls from technicians seeking advice on how to convince the authorities of their eligibility for promotion to Senior Physiological Measurement Technician status. There is no standard answer as each authority appears to have a different interpretation of the grading definitions in the Whitley Council Conditions of Service – which is perhaps not surprising as they do not even refer to Respiratory Physiology Technicians, but only to Neurophysiology, Cardiology and Audiology Technicians! As a result many technicians are experiencing difficulty in gaining promotion.

The Executive Committee were aware of this problem in January 1978; at that time the Secretary of the Association wrote to the Management side Secretary of Committee E (which deals with Professional and Technical Staffs B) drawing his attention to this anomaly and to the ARTP view that grading definitions should be written *either* to include all nine different physiological measurement disciplines *or* in a general form for all disciplines.

Six months passed with no apparent action and on receiving what seemed like my 50th telephone call on the very same problem, I was prompted to pursue the matter again. I received exactly the same reply from the Management Side Secretary in September 1978 as did our Secretary in January 1978, the only difference being a suggestion that I should persuade the *Staff Side* of the Whitley Council to seek the changes I was looking for. I therefore telephoned the Staff Side of the Whitley Council only to find that they were quite uninterested – because I was not in a Trade Union!

So the Management Side of the Whitley Council was seemingly unwilling to respond to what I thought was a perfectly reasonable request from a professional association and the Staff Side would not talk to anyone who is not a Trade Union Member. Furthermore Trade Unions do not listen to professional associations either, only to their individual members.

I have since joined a Union and found (through the Union) that the Management Side of Committee E have in fact put forward proposals for new grading definitions (March 1979) which do go a long way to satisfying the ARTP request and it looks as though Respiratory Technicians will at last be recognised. Perhaps they did listen to the ARTP after all! But why didn't they tell us so? Why were the Executive Committee not consulted and why did it take sixteen months to reach only the discussion stage of Committee E?

The grading definition problem serves to illustrate the difficulty and frustration experienced by the ARTP when trying to bring about a change. There will be other problems in the future and I feel that the ARTP teeth could be sharpened by putting forward our proposals not only to the Management Side but also to the Staff Side of Committee E. One way to do this would be for ARTP Members to feed ARTP approved material through the District Health Committee of their Union in their particular area. An ARTP "Union Network" would have to be devised but how many of us are willing to go to this trouble in order to speed up the process of bringing about a particular amendment or change?

KELVIN HOUSTON
CHIEF PHYSIOLOGICAL MEASUREMENT TECHNICIAN
REGIONAL ORGANISER
(WALES NHS)

Thoracic Out-patients Department
Llandough Hospital
Penarth
CF6 1XX

*Please address correspondence to The Editor:*

DR D C S HUTCHISON
Chest Unit
King's College Hospital
London SE5 8RX

## COAL WORKERS' PNEUMOCONIOSIS

Coal workers' pneumoconiosis has been an important industrial disease since the 19th century when coal production was the hub of the Industrial Revolution in the United Kingdom. Coal continues to be a vital energy source for industry, but its production is not without cost in terms of the life and health of the miners. In South Wales, Coal Workers' Pneumoconiosis (CWP) and other associated chest conditions have affected a major part of the population. It is rare to find a native of the area who does not have at least one relative affected.

There are two forms of CWP, simple and complicated.

### Simple CWP

This is the commoner form of the disease. It results from the inhalation of large amounts of coal dust over long periods, usually longer than ten years. Diagnosis and classification are on the basis of chest X-ray appearances. These appearances are classically described as small rounded opacities scattered throughout the lung fields. Categories one to three are defined with increasing number of small opacities *(Fig 1a)*.

Not all coal-miners develop X-ray changes despite very long periods underground, and it is not clear why some men develop changes whilst others do not.

There is disagreement on the question of disability and simple pneumoconiosis. Some studies have shown no relationship between category of simple pneumoconiosis and mortality or reduction in FEV1, but many miners and ex-miners are breathless whether they have X-ray changes or not. This breathlessness is thought to be due to chronic bronchitis and emphysema. Whether these diseases can be attributed to industrial exposure remains a source of debate.

Lung-function tests are often performed in men with simple pneumoconiosis in connection with claims for disability compensation. However, unless the disease is diagnosed on X-ray then no compensation will be paid no matter how disabled the man may be. There is no specific pattern of lung function abnormality associated with simple pneumoconiosis and some men with very abnormal X-rays have normal lung function, whilst others with minimal X-ray changes show lung function abnormalities. The commonest findings are degrees of obstructive ventilatory defect, sometimes with large lung volumes and reduced transfer factor suggesting emphysema. Some cases show a lone gas transfer defect, particularly when the X-ray reveals irregular opacities.

### Complicated CWP–Progressive Massive Fibrosis (PMF)

This more serious type of disease fortunately only affects a few of those with simple pneumoconiosis. The reasons for progression to complicated pneumoconiosis are still not known. Total dust exposure is one factor, and if this is high progression is more likely. The possibility of Tuberculosis being the precipitating agent has been studied, but this is now known not to be a major factor. A trial of anti-tuberculous therapy made no difference in a group of cases of complicated pneumoconiosis.

Progression to complicated pneumoconiosis can occur after removal from the dusty atmosphere, particularly with the higher categories of simple pneumoconiosis. Fortunately, if a man leaves the mines with category one disease, progression is very unlikely. Progression is usually relatively slow, although when there has been heavy exposure over a short time, especially in young men, it can be rapid.

In Progressive Massive Fibrosis there are large masses present on the chest X-ray predominantly in the upper and middle zones. Again, three categories are defined depending on the area covered by the large shadows *(Fig 1b)*. At post-mortem large black areas are found, consisting mostly of denatured blood protein and coal dust. During life the contents of one or more of the masses may be expectorated as a large volume of black liquid (a melanoptysis) leaving behind a cavity.

There is no doubt that PMF leads to disability and mortality. The masses produce defects of lung function by acting as space-occupying lesions, by producing distortion and irregular emphysema in the remaining areas of lung, and by compressing large airways. The conditions gradually progresses to death in cardio-respiratory failure.

### The Management of Coal Workers Pneumoconiosis

The management of CWP and its complications involves medical, social and legal factors which are inevitably inter-related.

The medical management in its narrow sense of "treating the disease" is limited. There is no cure for pneumoconiosis and the effects of dust in the lung cannot be reversed or even halted. The aim of medical treatment is to preserve the best possible function in the remaining lung areas. Airways obstruction may be partially reversible using bronchodilators (such as inhaled Salbutamol) and corticosteroids. Diuretics help to control the oedema of cor pulmonale. Antibiotics are used for intercurrent chest infections. Oxygen therapy in the home becomes important in the later stages of the disease.

One social aspect of the disease is the effect of the disability on the man and his family. They have the burden of the day to day coping with the disease, and their attitude towards it can alter its effects and progression. Ideally they should be well-informed and have a realistic, positive attitude. Unfortunately, many men take a pessimistic view of themselves, and this is often a reflection of the attitude of the medical and paramedical staff with whom they come into contact. Chronic incurable illness is not considered medically exciting and this reaction may be communicated to the patient, together with a feeling of frustration that therapy does not produce much improvement.

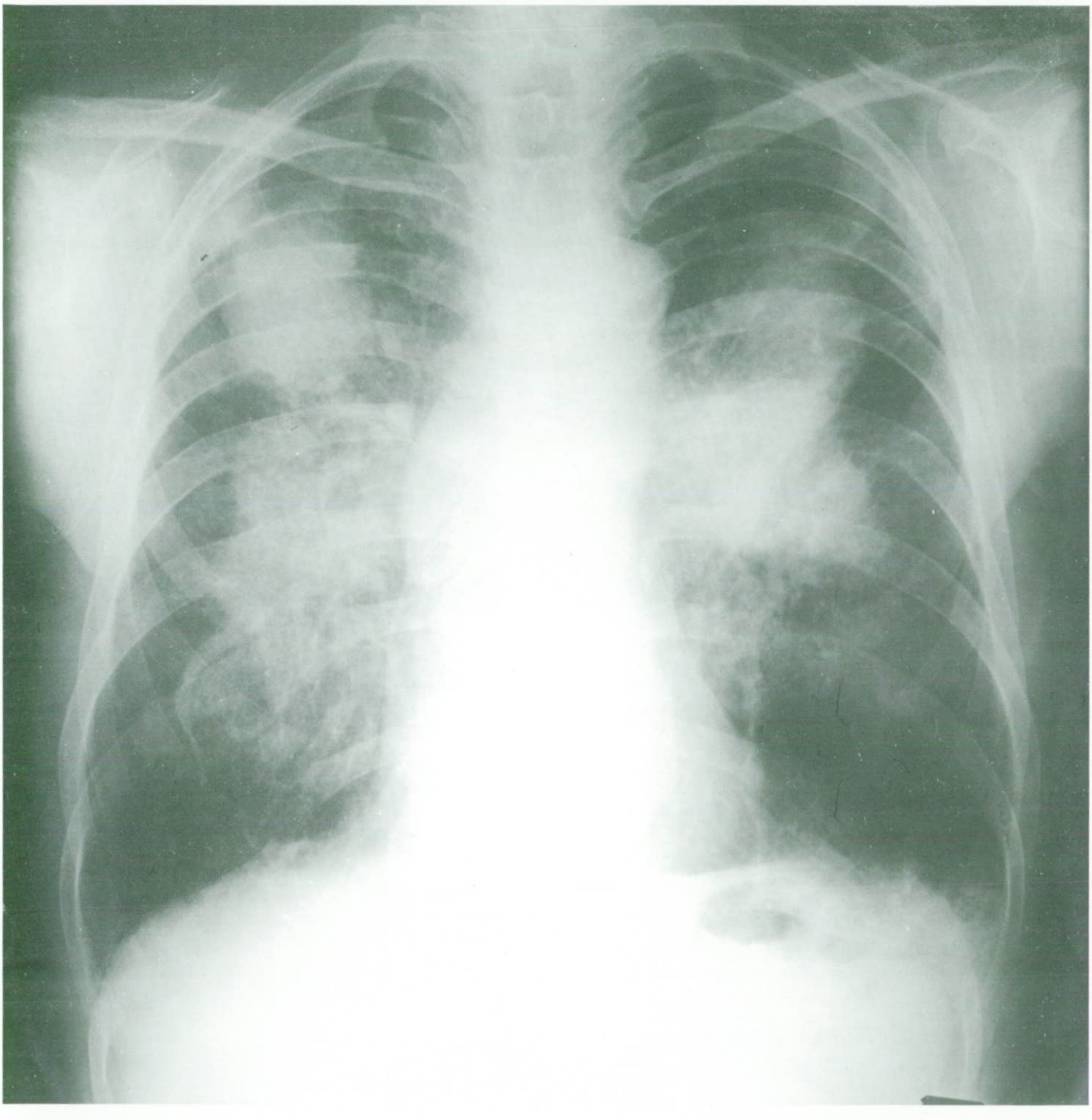
A second social aspect is the transfer of our knowledge of pneumoconiosis to miners, ex-miners and prospective miners. This is an important role for medical and paramedical staff in the field of occupational health.

The legal aspects of pneumoconiosis involve the system of compensation for disability arising from an industrial disease. The system is complex. Diagnosis and estimation of compensatable disability is carried out by doctors of the Medical Boards of the Pneumoconiosis Medical Panels throughout the United Kingdom. Compensation is given for disability that is considered to be due to pneumoconiosis and not due to other conditions such as bronchitis or emphysema. The diagnosis of the disease for

*FIGURE TWO* The Chest X-Ray in Coal Workers' Pneumoconiosis

*(a) Heavy Simple Pneumoconiosis*

*(b) Progressive Massive Fibrosis*



compensation purposes requires at least category two simple pneumoconiosis on the chest X-ray. The net result of the system is that some grossly disabled miners and ex-miners may not receive any compensation. A knowledge of the system is vital to medical and paramedical people involved with miners, so that they can offer them informed advice.

### Future work

A number of areas concerning pneumoconiosis require clarification and some are particularly relevant to respiratory physiologists and technicians.

1 *The Assessment of Disability*
There is a need for development and validation of simple methods of assessing disability that have a real bearing on a man's ability to carry on a normal life.

2 *The Relation of Disability to Pneumoconiosis*
Further work is needed to decide whether simple pneumoconiosis itself can produce disability.

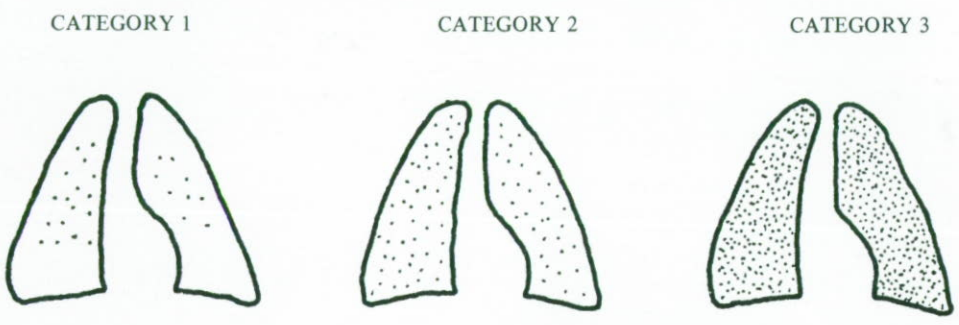
3 *The Evaluation of Therapy*
Physiological testing is required to assess the effects of new forms of therapy.

ANNE COCKCROFT, MB, BS, MRCP.

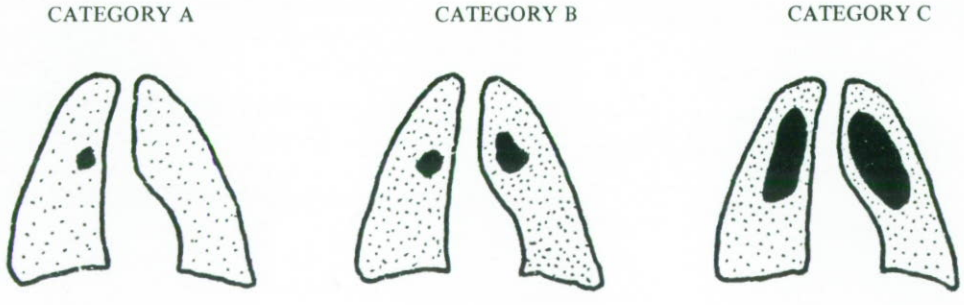
MRC PNEUMOCONIOSIS UNIT
LLANDOUGH HOSPITAL
PENARTH
S. GLAMORGAN
CF6 1XW.

*FIGURE ONE* **CATEGORIES OF PNEUMOCONIOSIS**

*(a) Simple Pneumoconiosis*




*(b) PMF*



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Dr. Hutchison
Chest Unit
King's College Hospital Medical School
London
SE5

13 February 1979

Dear Doctor Hutchison

I wish to apologise for the very late publication of this issue of BREATH. The delay is due to a series of disastrous mishaps.

All went well at the beginning and the job despatched by "mini cab", but not delivered. I tried to trace the job and driver after you informed me of the non-delivery some ten days later, without success. The driver was part-time, and address unknown.

The weather and rail strikes then took a hand and prevented my staff getting to work so I was unable to reprint. A flu epidemic followed reducing the workforce once again to me.

The reprint was finally completed and the finishing underway – then Presto! the originals turned up – which are herewith.

The "mini cab" was involved in an accident and has been in a garage being repaired until yesterday. The driver forgot the delivery till he found the parcels in the boot.

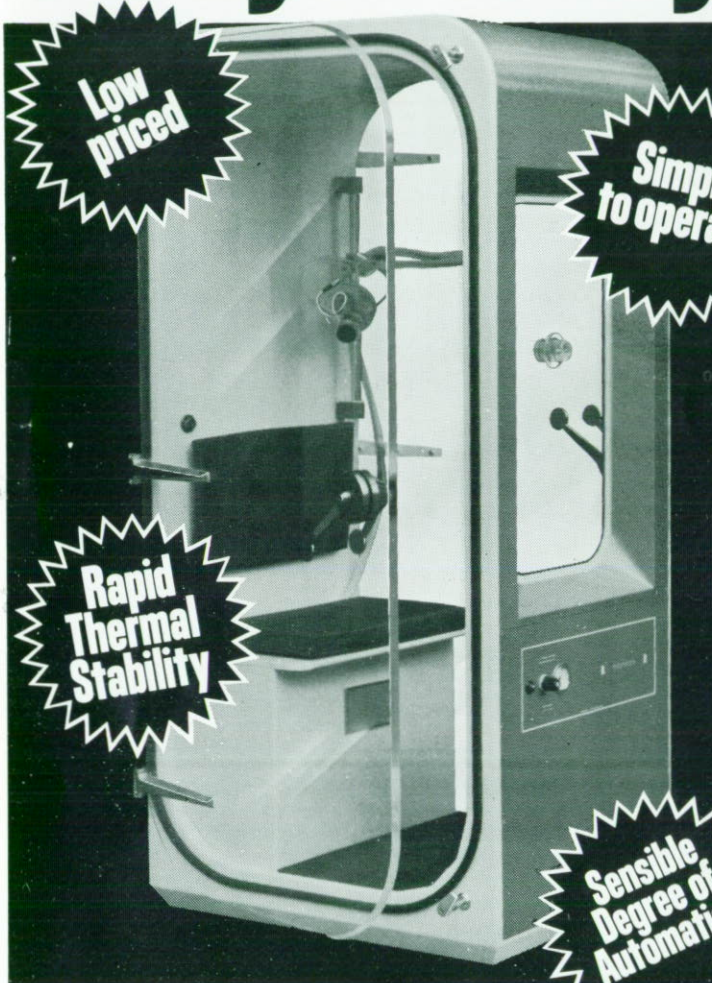
I sincerely hope I will be forgiven this time in view of the above saga.

Yours truly,

K D Welham

*Registration No.* 1064272 England *Directors:* K. D. WELHAM, L. WELHAM

# Morgan
# Body Plethysmograph

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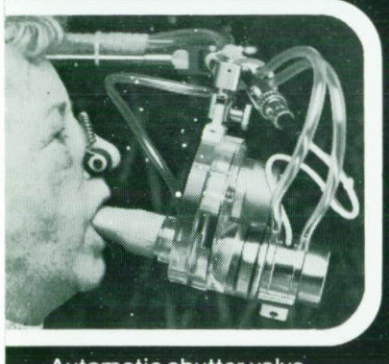

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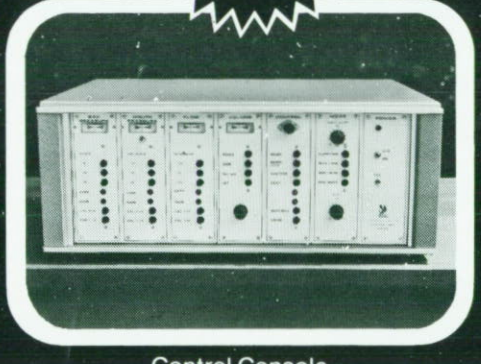
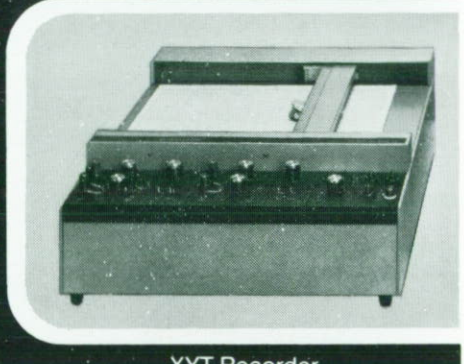


Control Console



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