ASSOCIATION OF RESPIRATORY TECHNICIANS AND PHYSIOLOGISTS

ISSUE NO 15 FEBRUARY 1982

BREATH

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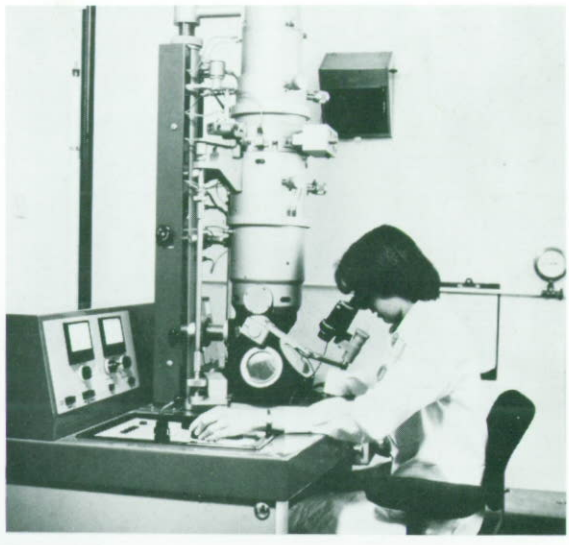

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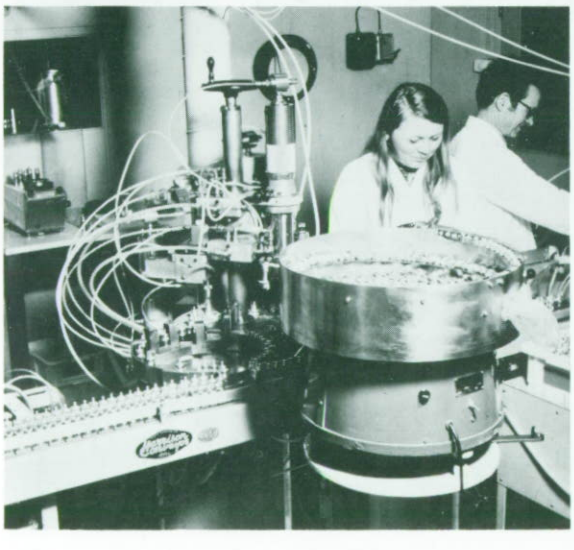

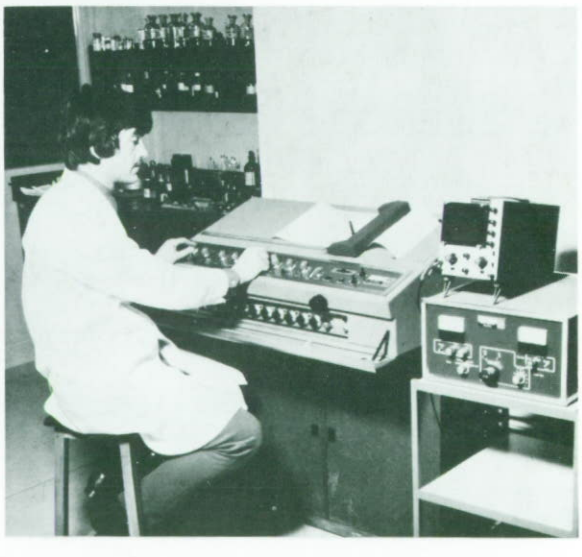

Significant advances in therapy from Original British Research

DIAGNOSIS OF UPPER AIRWAY OBSTRUCTION

D. W. Empey - The London Hospital

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Breath Issue No. 15 **February 1982**

Corrected Version

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DIAGNOSIS OF UPPER AIRWAY OBSTRUCTION

D. W. Empey
The London Hospital

Obstruction of the larger airways can be a life-threatening situation. Most cases in adults arise because of tumours or strictures of the trachea, external compression of the trachea by a tumour or goitre, bilateral vocal cord palsy, or laryngeal tumour. The diagnosis will often be obvious, but sometimes large airway obstruction is unsuspected or misdiagnosed as asthma or chronic obstructive bronchitis.

The patient's history may indicate the probable diagnosis. Breathlessness with stridor may be reported, or the patient may have a history of earlier thyroid or laryngeal disease or of a period of prolonged endotracheal intubation. Hæmoptysis should alert the physician to the possibility of an endotracheal or endobronchial neoplasm. Hoarseness may indicate a laryngeal lesion. In most cases, the onset of breathlessness is insidious.

Stridor may be present on examination and is frequently more marked on forced inspiration; if it is heard in both inspiration and expiration, the degree of narrowing is probably severe. The level of noise, however, is a poor guide, because in severe narrowing there is little air-flow and thus no stridor may occur.

In the first instance, most patients are referred to a pulmonary function laboratory. When the true diagnosis is not suspected and only simple pulmonary function tests are performed, the physiologist may still suggest the presence of localized narrowing of a large airway.

SPIROMETRY

Most laboratories will routinely measure spirometric capacities and peak expiratory flow rate. The first clue that obstruction exists in the larger airways may be in the shape of the spirometer trace from the forced expiratory manœuvre. This is usually curved, but when asthma or chronic obstructive bronchitis is present, a flatter curve is seen. The curve is lost when localized large airway obstruction occurs, and a straight-line trace appears up to the end of expiration (Fig 1).

The vital capacity may be normal in cases of large airway obstruction, unlike the situation in diffuse lower airway obstruction when the vital capacity is usually reduced. One seldom sees any significant changes in the parameters of airway obstruction following the inhalation of a bronchodilator if large airway obstruction is present. An alert pulmonary function technician may spot these points and question the diagnosis.

When peak expiratory flow is measured, it will be markedly reduced in patients with large airway obstruction compared with the degree of reduction seen in the forced expired volume in one second (FEV_1). This can be compared with the normal situation or with the changes seen in diffuse lower airway obstruction by calculating a "site of obstruction index". Thus the ratio

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= 10 or less normally or when diffuse lower airway obstruction is present. This index is usually more than 10 when large airway obstruction is present; with more

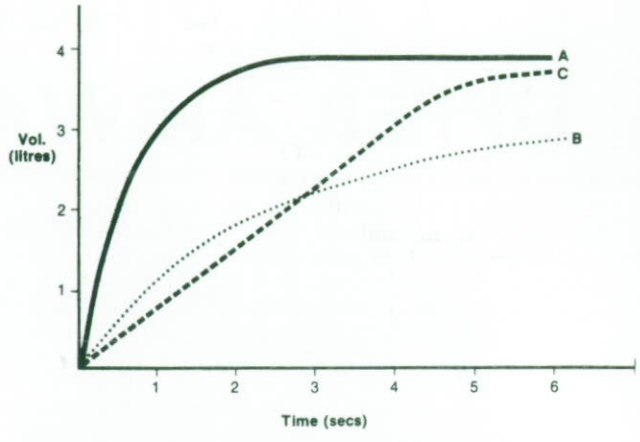

Fig 1. *Forced expiratory spirograms obtained in (A) a normal subject, (B) a patient with chronic obstructive bronchitis, and (C) a patient with upper airway obstruction.*

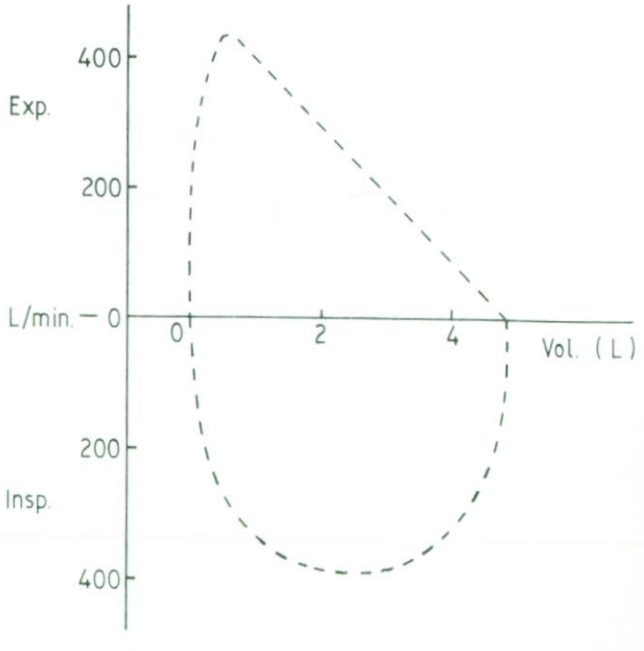

Fig 2. *Diagram of normal maximal flow-volume curve (shown with dotted line in Figures 3-6).*

severe degrees of obstruction, the index is greater[1,2]. It must be emphasized that this is not a reliable method of excluding the presence of large airway obstruction. If such obstruction is suspected clinically, flow-volume curves and bronchoscopy will be necessary. The index is simply a calculation that can be applied to routine tests in the laboratory to ensure that no opportunity is missed to diagnose a serious condition as early as possible.

FLOW-VOLUME CURVES

From the physiological point of view, flow-volume curves are the most satisfactory method of diagnosing and assessing the severity of large airway obstruction[3]. Many pulmonary function laboratories now perform these tests routinely or at least have the facility available upon request.

The key feature in all cases of large airway obstruction is the appearance of a plateau of flow on the inspiratory and/or expiratory loops of the curve. This is in marked contrast to the normal individual or the patient with asthma, chronic obstructive bronchitis, or emphysema (Figs 2 and 3).

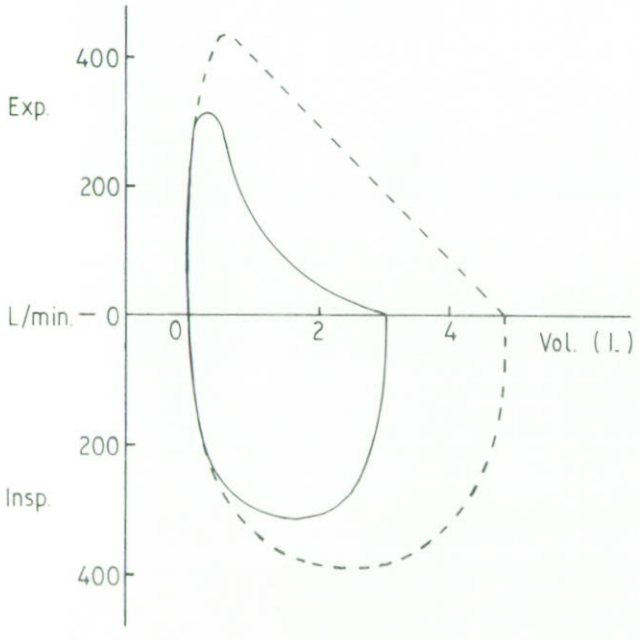

Fig 3. *Flow-volume curve in a patient with chronic obstructive bronchitis.*

The curve shown in Fig 4 is the typical pattern seen in a case of large airway obstruction that is "fixed". This means that the severity of the narrowing is not influenced by the phase of respiration, and the reduction in flow rate is uniform throughout inspiration and expiration. An infiltrating tumour constricting the trachea or a heavily scarred stricture might produce this type of pattern.

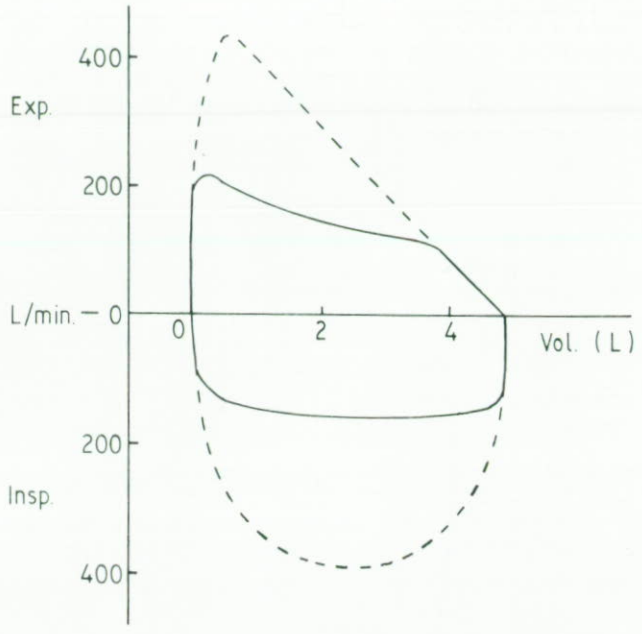

Fig 4. *Flow-volume curve in a patient with fixed large airway obstruction.*

The situation may be complicated by the effects of forced inspiratory or forced expiratory manœuvres on the degree of narrowing at the site of the obstruction. In some cases of bilateral vocal cord palsy or extrathoracic narrowing of the trachea, the airway is kept open during forced expiration but collapses inward during forced inspiration. This means that the lesion is variable in size and has the effect of producing an asymmetrical flow-volume curve that is quite characteristic in its shape (Fig 5).

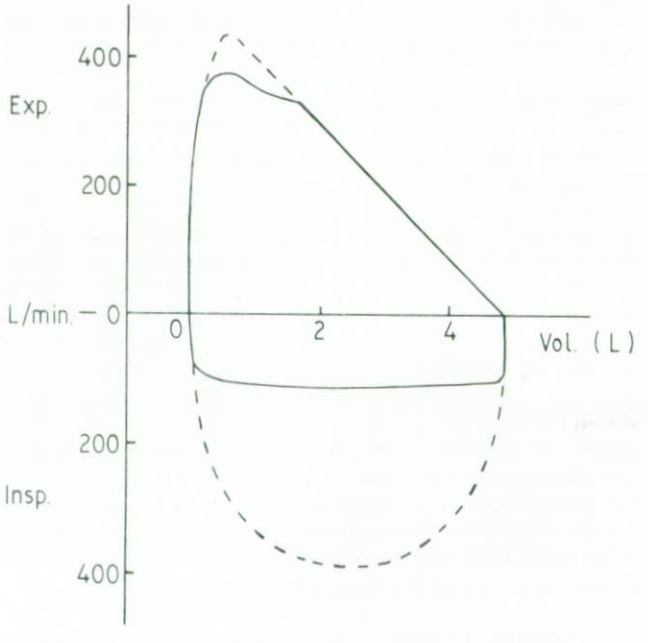

Fig 5. *Flow-volume curve in a patient with variable extrathoracic large airway obstruction.*

The opposite situation may occur when the lesion is intrathoracic so that expiratory flow rates are reduced by compression of the narrowed area and inspiratory flow rates may be improved by the negative intrathoracic pressure, tending to pull the airway open. Again, this produces a characteristic asymmetrical curve (Fig 6).

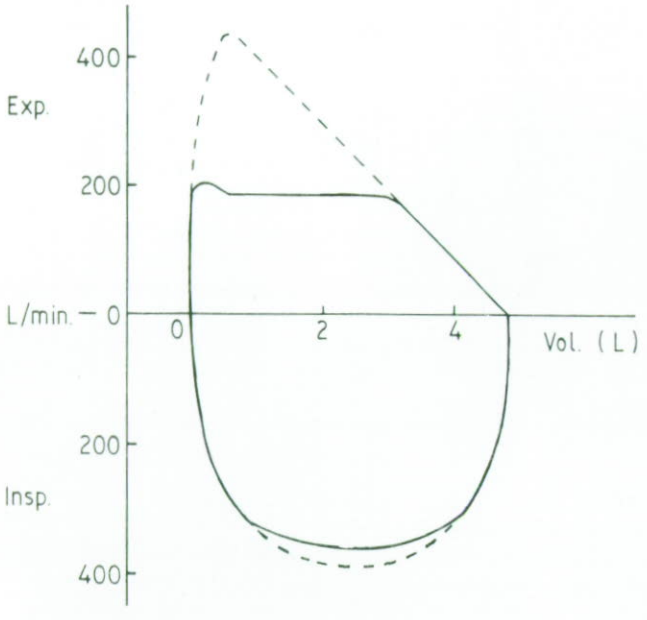

Fig 6. *Flow-volume curve in a patient with variable intrathoracic large airway obstruction.*

The key to making a correct diagnosis lies in recognizing the patterns seen in the different types of obstruction. The whole curve must be inspected, and one should not rely on deriving information from numerical data only; pattern recognition is more important in this context. The peak inspiratory and peak expiratory flow rates should, however, be carefully noted. If either is less than 200 litres/min, significant obstruction is present; if below 100 litres/min, the obstruction is severe.

In cases of severe obstruction, blood gases may be abnormal and respiratory failure can supervene[4].

Plain chest radiographs may reveal little, but tomography of the upper airways may indicate the site and extent of narrowing in a way that respiratory function tests cannot.

Mirror examination of the larynx may reveal the cause of an obstruction, but in most cases bronchoscopy is eventually required. This shoult not be done with the fiberoptic bronchoscope because complete occlusion of the airway may occur; this is one occasion when the rigid bronchoscope is preferable.

CONCLUSION

Large airway obstruction may be an unsuspected lesion that gives rise to the gradual onset of breathlessness, and it is occasionally misdiagnosed as progressive asthma or chronic obstructive bronchitis. Close inspection of single pulmonary function tests may indicate the site of the obstruction, but flow-volume curves are necessary to confirm the typical physiological impairment and the degree of narrowing present. Bronchoscopy using the rigid bronchoscope is usually necessary to complete the investigations.

Acknowledgement

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CORRECTION.

DIAGNOSIS OF UPPER AIRWAYS OBSTRUCTION. Duncan Empey.

BREATH Issue No. 15 February 1982.

The editors regret the errors in the printing of the captions to this article and enclose a corrected version.

Ventolin Inhaler

(Salbutamol BP)

Uses
Routine control of bronchospasm in bronchial asthma, bronchitis and emphysema, or as required to relieve attacks of acute bronchospasm. Doses may also be taken before exertion to prevent exercise-induced asthma or before exposure to a known unavoidable challenge.
Dosage and administration
As single doses for the relief of acute bronchospasm, for managing intermittent episodes of asthma and to prevent exercise-induced bronchospasm.
Using Ventolin Inhaler—*Adults:* one or two inhalations.
Children: one inhalation increasing to two if necessary.
Using Ventolin Rotahaler—*Adults:* one Ventolin Rotacap 200mcg or 400mcg.
Children: one Ventolin Rotacap 200mcg.

For chronic maintenance or prophylactic therapy.

Using Ventolin Inhaler—*Adults:* two inhalations three or four times a day.
Children: one inhalation three or four times a day increasing to two inhalations if necessary.
Using Ventolin Rotahaler—*Adults:* one Ventolin Rotacap 400mcg three or four times a day.
Children: one Ventolin Rotacap 200mcg three or four times a day.
For optimum results in most patients inhaled Ventolin should be administered regularly.
Contra-indications
Ventolin preparations should not be used for the prevention of threatened abortion during the first or second trimester of pregnancy.
Precautions
If a previously effective dose of inhaled Ventolin fails to give relief lasting at least three hours, the patient should be advised to seek medical advice. Ventolin should be administered cautiously to patients suffering from thyrotoxicosis.
Unnecessary administration of drugs during the first trimester of pregnancy is undesirable.
Side effects
No important side effects have been reported following treatment with inhaled Ventolin.
Presentation and Basic NHS cost
Ventolin Inhaler is a metered-dose aerosol delivering 100mcg Salbutamol BP per actuation. Each canister contains 200 inhalations. Basic NHS cost £3·00.
Ventolin Rotacaps 200mcg and 400mcg, each contain a mixture of the stated amount of microfine Salbutamol BP (as sulphate), and larger particle lactose in light blue/colourless or dark blue/colourless hard gelatine cartridges, respectively. Containers of 100. Basic NHS cost £5·29 and £7·15, respectively.
Ventolin Rotahaler for use in conjunction with Ventolin Rotacaps. Basic NHS cost 78p.
Product Licence numbers

Ventolin Inhaler	0045/5022
Ventolin Rotacaps 200mcg	0045/0116
Ventolin Rotacaps 400mcg	0045/0117

Becotide Inhaler

(Beclomethasone Dipropionate BP)

Uses
Bronchial asthma especially in patients whose asthma is not adequately controlled by bronchodilators and patients with severe asthma who would otherwise be dependent on systemic corticosteroids or adrenocorticotrophic hormone (ACTH) or its synthetic equivalent.
Dosage and administration
Using Becotide Inhaler—*Adults:* two inhalations three or four times a day is the usual maintenance dose. In severe cases dosage may be started at twelve to sixteen inhalations per day and subsequently reduced when the patient begins to respond.
Children: one or two inhalations, two, three or four times a day according to the response.
Using Becotide Rotahaler—*Adults:* one 200mcg Becotide Rotacap three or four times a day is the usual maintenance dose.
Children: one 100mcg Becotide Rotacap two, three or four times a day according to the response.
For optimum results inhaled Becotide should be administered regularly.
Contra-indications
No specific contra-indications to inhaled Becotide are known but special care is necessary in patients with active or quiescent pulmonary tuberculosis.
Precautions
The maximum daily intake of Beclomethasone Dipropionate BP should not exceed 1mg. Inadequate response after the first week of inhaled Becotide therapy suggests that excessive mucus is preventing penetration of inhaled drug to the target area.
A short course of systemic steroid in relatively high dosage should be given and therapy with inhaled Becotide continued.
Unnecessary administration of drugs during the first trimester of pregnancy is undesirable. When transferring patients to Becotide from systemic steroid therapy the possibility of adrenocortical suppression should be considered and patients given a supply of oral steroids for use during periods of stress. Please refer to the detailed procedure described in the data sheets for Becotide Inhaler and Becotide Rotacaps.
Side effects
Occasional candidiasis of the mouth and throat (thrush) occurs in some patients, particularly those with high blood levels of *Candida precipitins*. Topical therapy with antifungal agents usually clears the condition without withdrawal of Becotide.
Presentation and Basis NHS cost
Becotide Inhaler is a metered-dose aerosol delivering 50mcg Beclomethasone Dipropionate BP per actuation. Each canister contains 200 inhalations. Basic NHS cost £4·77.
Becotide Rotacaps 100mcg and 200mcg, each contain a mixture of the stated amount of microfine Beclomethasone Dipropionate BP and larger particle lactose in buff or chocolate-brown/colourless hard gelatine cartridges, respectively. Containers of 100. Basic NHS cost £7·26 and £9·67 respectively.
Becotide Rotahaler, for use in conjunction with Becotide Rotacaps. Basic NHS cost 78p.
Product Licence numbers

Becotide Inhaler	0045/0089
Becotide Rotacaps 100mcg	0045/0119
Becotide Rotacaps 200mcg	0045/0120

Beconase Nasal Spray

(Beclomethasone Dipropionate BP)

Uses
The prophylaxis and treatment of perennial and seasonal allergic rhinitis, including hay fever and vasomotor rhinitis.
Dosage and administration
The recommended dosage is two applications into each nostril twice daily. Alternatively, a single application may be given into each nostril three or four times a day.
Not for use in children under six years of age.
Contra-indications, warnings, etc.
There are no specific contra-indications but any infections of the nasal passages and paranasal sinuses should receive the appropriate treatment.
Care must be taken while transferring patients from systemic steroid treatment to Beconase if there is any reason to suppose that adrenal function is impaired.
Unnecessary administration of drugs during the first trimester of pregnancy is undesirable.
No major side effects attributable to Beconase have been reported, but occasionally sneezing attacks have followed immediately after use of the aerosol.
Presentation and Basic NHS cost
Beconase Nasal Spray is a metered-dose aerosol delivering 50mcg Beclomethasone Dipropionate BP per actuation into a special nasal applicator. Each canister provides 200 applications. Basic NHS cost £4·77.
Product Licence number
0045/0093

Further information on Beconase, Becotide, Rotacap, Rotahaler and Ventolin (trade marks) is available from:
Allen & Hanburys Limited, Greenford UB6 0HB

EDITORIAL

Ruminations

Man remains a mortal being and cancer in its various forms continues to frustrate our puny efforts to prove the contrary. It has been customary to divide the factors which cause cancer into 'hereditary' and 'environmental' (or 'nature' and 'nurture' if you prefer it) but any individuals developing cancer would, with few exceptions find it hard to pin-point the reasons why they have apparently been singled out, while others escape. People tend to be fatalistic about the hereditary factors, but we ought to be able to do something about the environmental ones — if we could only identify them.

A report of over 100 pages on the whole question of the environmental cancer risk in the United States has recently been produced[1] by Sir Richard Doll (who pioneered research into the relationship of smoking and of asbestos to lung cancer) in conjunction with Dr Richard Peto. Those who do not have the time or opportunity to read it in the original, can find a useful review in a recent British Medical Journal[2]. The authors come to the conclusion that cancer is largely an avoidable disease and that environmental risk factors are paramount. These factors have been divided into 12 categories such as smoking, occupation and diet and the authors have tried to ascertain what proportion of the total cancer case-load falls into each category; it is no surprise to find that smoking comes out top of the table, accounting for no less than 30% of the cases, the majority of which are of course, in the lung. (A downward trend in lung cancer seems to be related to the reduction in tar content which we discussed a year ago in this Journal[3]). Of the remaining cases, a large proportion arises from 'dietary' factors, including such possibilities as contamination with carcinogens or their actual production during the process of cooking — back to raw carrot! The figure is very roughly 35% but the authors admit that this might be anything from 10% to 70%!

The question of 'occupational' lung cancer has aroused a great deal of controversy. Figures of 30% and even 40% for the proportion of total cancer cases attributable to occupation alone have been bandied about, but these estimates now appear to be over-enthusiastic and Doll and Peto come to the conclusion that the figure is more likely to be around 4% with a margin of error of 2% to 8%. This would still leave us with several thousand deaths every year from this cause alone. It is often forgotten that a high proportion of workers in hazardous industries are also cigarette smokers and that the carcinogenic effect of the two factors together may be much more than simply additive.

Until recently, Trade Unions have not been prepared to take much action on the smoking question, but in December the TUC General Council agreed to a number of measures designed to reduce smoking; there will be no smoking at TUC Committee meetings and pressure will

be brought to bear on Government to ban tobacco advertizing and sports sponsorship by tobacco companies. Let us hope there will be no interference with the TUC decision-making processes without the traditional 'smoke-filled room'. (Aside — could the difficulties encountered in resolving the railway dispute have been related to nicotine deprivation?) So far, the only action worthy of note that has been taken on the Government side is the transfer of Sir George Young, one of the leading campaigners against smoking, from the DHSS.

Whatever the eventual fate of tobacco advertizing, there can be nothing like some positive health education to counteract its effects and it is a pleasure to report that the BBC is now showing a series of six 10-minute programmes on Sunday afternoon — 'So You Want to Stop Smoking'. The series is presented by Dr Miriam Stoppard in a cheerful manner pleasantly contrasting with the sombre tones so often heard and without too heavy an emphasis on statistics. She has assembled a team of four smokers, all of whom have expressed a determination to give up. Each has decided on some strategy; one, for instance, intends to avoid smoking after a meal and another to give up smoking in bed and to take a walk instead.

A follow-up in a year's time would be of some interest; if the subjects were randomly chosen, one could reasonably predict that only two of the four would have been able to give up and that only one of those would still be a non-smoker when the year was up. In fact, we understand that the participants have been carefully screened by the producers so as to include people with a good chance of giving up. The key question is perhaps whether the average smoker-viewer is going to switch on (and thus miss part of Rugby Special) and can then generate enough interest in the participants to wish to emulate them.

Talking of smoking and its chronic effects, the International Year of Disabled People has just come to an end. A recent Gallup Poll[4] has shown that there is a strong feeling among the general public that the lot of the disabled should be improved even in this era of public spending cuts; indeed 75% of the sample believed that there should be a single unified benefit for all physically or mentally handicapped people. No actual sums were mentioned and our resident cynic wonders if an identical result would have been obtained if those being questioned had actually been asked to put their hand in their pocket.

The effects of such campaigns and associated research programmes naturally take a long time to filter through to the people for whom the benefits are intended. Patients with chronic respiratory problems in particular, could be forgiven for wondering when all this is going to affect them. They have in fact now formed their own action group, the 'Union of the Physically Impaired against Segregation' and have rather neatly turned the whole argument on its head by challenging the established view and pointing out that their difficulties in earning a living, their immobility and social rejection arise, not from *their* physical disability, but from the failure of society itself to cope with their needs. There's no answer to that!

Finally, in this highly selective review of recent events, a notable 'first' was notched up the other day in a certain chest department which shall remain nameless. A young woman attended for lung function tests and brought her two-year-old baby with her. The mother entered the body plethysmograph and the door was closed; at this point, the child hitherto quite docile, fell into a paroxysm of acute mother deprivation which no efforts on the part of the staff could assuage. Nor could the mother do the test under these circumstances. The only solution was to put the baby into the body box with its mother; all was quiet and the test was completed without further ado. Now could Association members kindly tell us what calculations are needed to obtain the right answer for a) Airways Resistance, b) Total Lung Capacity? Answers to the Editor, please — urgent!

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BREATH

The Editors of Breath owe grateful thanks to the many people who have made possible the publication of our Journal: to our printers, Stevens Brothers and particularly Mr Boughton for most helpful co-operation and for doing an excellent job: to Claire Robertson for typing (and retyping) articles and reports, to Margaret Rusbridge for preparing a number of the diagrams, to our advertisers for their continued support and last but far from least, to our contributors without whom there would be no Journal.

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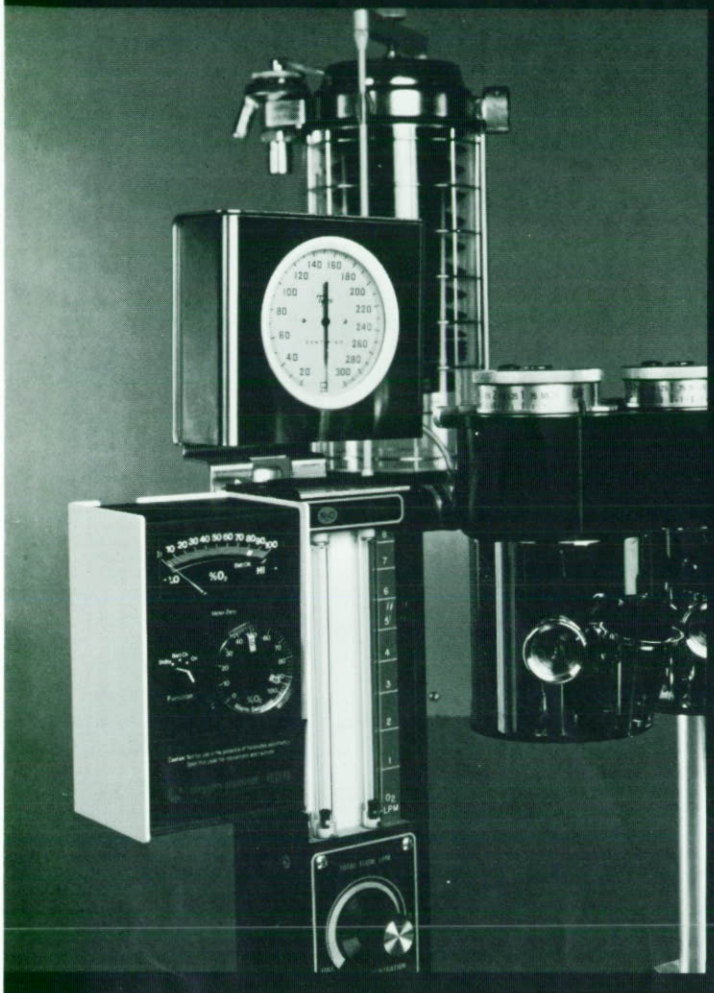

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DIAGNOSIS OF UPPER AIRWAY OBSTRUCTION

D. W. Empey
The London Hospital

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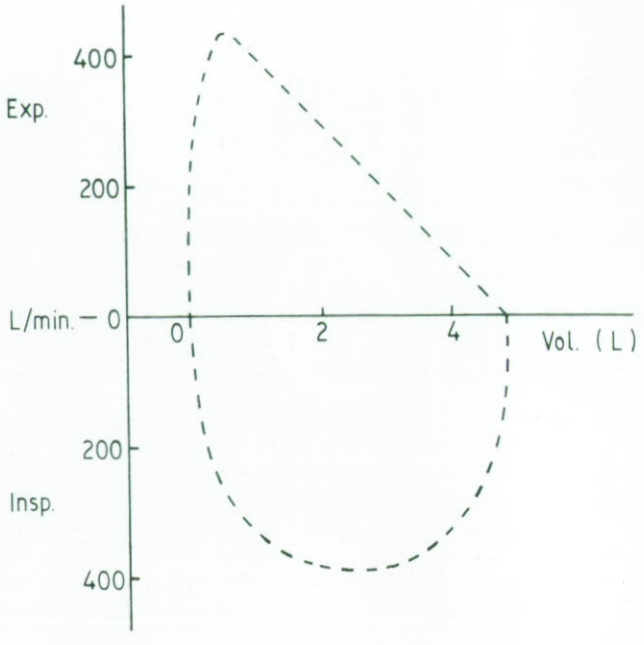

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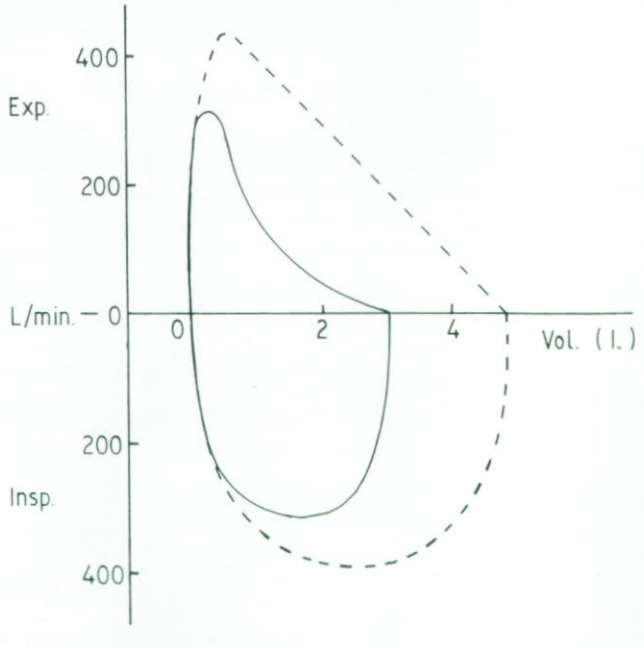

Fig 2. *Diagram of normal maximal flow-volume curve (shown with dotted line in Figures 3- 5).*

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From the physiological point of view, flow-volume curves are the most satisfactory method of diagnosing and assessing the severity of large airway obstruction[3]. Many pulmonary function laboratories now perform these tests routinely or at least have the facility available upon request.

The key feature in all cases of large airway obstruction is the appearance of a plateau of flow on the inspiratory and/or expiratory loops of the curve. This is in marked contrast to the normal individual or the patient with asthma, chronic obstructive bronchitis, or emphysema (Figs 2 and 3).

The curve shown in Fig 4 is the typical pattern seen in a case of large airway obstruction that is "fixed". This means that the severity of the narrowing is not influenced by the phase of respiration, and the reduction in flow rate is uniform throughout inspiration and expiration. An infiltrating tumour constricting the trachea or a heavily scarred stricture might produce this type of pattern.

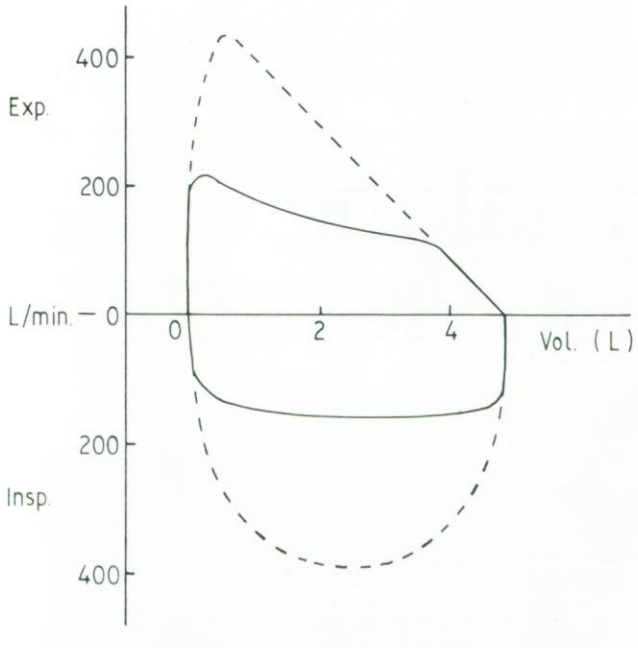

Fig 3. Flow-volume curve in a patient with chronic obstructive bronchitis.

The situation may be complicated by the effects of forced inspiratory or forced expiratory manœuvres on the degree of narrowing at the site of the obstruction. In some cases of bilateral vocal cord palsy or extrathoracic narrowing of the trachea, the airway is kept open during forced expiration but collapses inward during forced inspiration. This means that the lesion is variable in size and has the effect of producing an asymmetrical flow-volume curve that is quite characteristic in its shape (Fig 5).

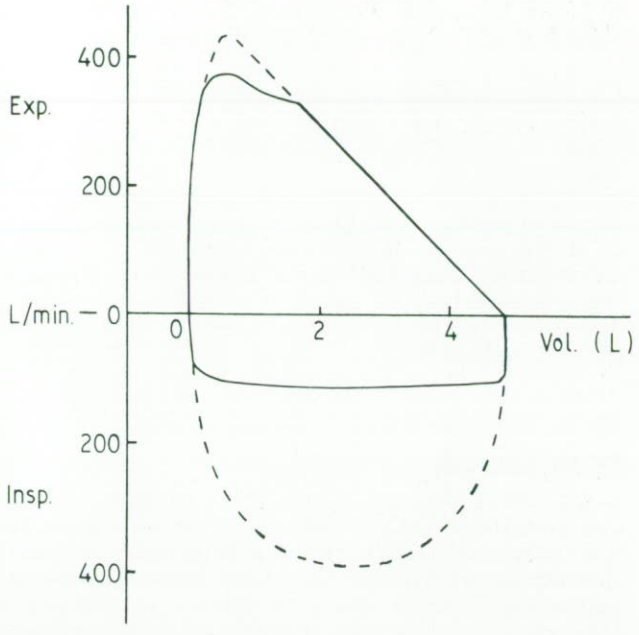

Fig 4. Flow-volume curve in a patient with fixed large airway obstruction.

The opposite situation may occur when the lesion is intrathoracic so that expiratory flow rates are reduced by compression of the narrowed area and inspiratory flow rates may be improved by the negative intrathoracic pressure, tending to pull the airway open. Again, this produces a characteristic asymmetrical curve

The key to making a correct diagnosis lies in recognizing the patterns seen in the different types of obstruction. The whole curve must be inspected, and one should not rely on deriving information from numerical data only; pattern recognition is more important in this context. The peak inspiratory and peak expiratory flow rates should, however, be carefully noted. If either is less than 200 litres/min, significant obstruction is present; if below 100 litres/min, the obstruction is severe.

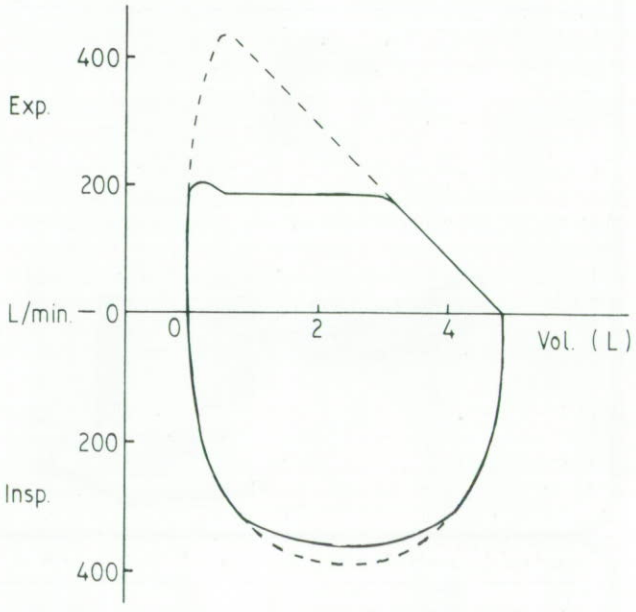

Fig 5. Flow-volume curve in a patient with variable extrathoracic large airway obstruction.

In cases of severe obstruction, blood gases may be abnormal and respiratory failure can supervene[4].

Plain chest radiographs may reveal little, but tomography of the upper airways may indicate the site and extent of narrowing in a way that respiratory function tests cannot.

Mirror examination of the larynx may reveal the cause of an obstruction, but in most cases bronchoscopy is eventually required. This shoult not be done with the fiberoptic bronchoscope because complete occlusion of the airway may occur; this is one occasion when the rigid bronchoscope is preferable.

CONCLUSION

Large airway obstruction may be an unsuspected lesion that gives rise to the gradual onset of breathlessness, and it is occasionally misdiagnosed as progressive asthma or chronic obstructive bronchitis. Close inspection of single pulmonary function tests may indicate the site of the obstruction, but flow-volume curves are necessary to confirm the typical physiological impairment and the degree of narrowing present. Bronchoscopy using the rigid bronchoscope is usually necessary to complete the investigations.

Acknowledgement
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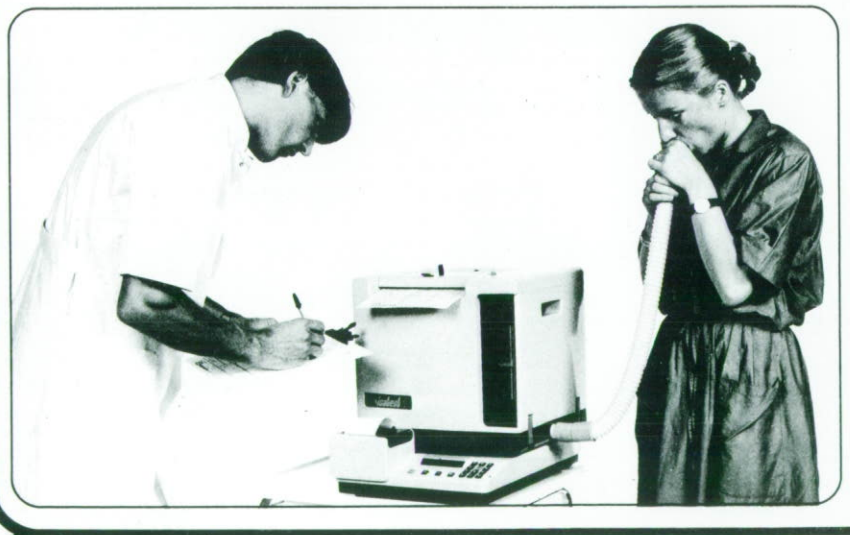

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THE RELATIONSHIP BETWEEN GASTRO-OESOPHAGEAL REFLUX AND BRONCHIAL ASTHMA

David N. Cooper
Department of Thoracic Medicine, Hope Hospital, Salford

INTRODUCTION

Many patients with gastro-oesophageal reflux (GOR) have respiratory symptoms and it has been suggested that there is a definite relationship between reflux and asthma[1,2,3]. Some patients present with respiratory symptoms and are subsequently found to have GOR, while others have obvious gastro-intestinal symptoms from the outset. There may also be an increased prevalence of hiatus hernia and GOR in patients with bronchial asthma[4], although this is controversial. Recent studies[1,5] indicate that many patients have improvement in their respiratory symptoms following surgical correction or effective medical treatment of co-existing GOR.

In order to investigate the possibility of such a relationship we asked all our asthmatic patients attending for routine follow-up whether they had symptoms of heartburn or regurgitation. We were surprised at how quickly we were able to find twenty with significant symptoms. These patients were entered into our first study[6] in which we attempted to treat GOR medically and looked for both subjective and objective improvement in respiratory function.

STUDY 1

All the patients had objective evidence of GOR as demonstrated by barium studies, endoscopy, oesophageal manometry and prolonged pH monitoring. Cimetidine, a histamine H_2-receptor antagonist which inhibits gastric secretion of acid and pepsin, was given in a double blind crossover trial. All patients received both active and placebo tablets during two 6-week treatment periods. Various measurements of respiratory function were recorded: —

1. A diary card in which was scored both day-time and nocturnal asthmatic symptoms.

2. Peak flow rates using a Wright Mini peak flow meter four times during the day. The best of three peak flow recordings were entered on the diary card.

3. A variety of other respiratory parameters including flow-volume loops, were recorded initially and at the end of each trial period.

Reflux symptoms were also recorded before the study and at the end of each 6-week period. The results of this study showed subjective improvement in asthmatic symptoms. There was little in the way of objective improvement in respiratory function apart from a trend for the peak flow readings to improve during the cimetidine treatment period; the difference between the two periods was statistically significant only for the last peak flow reading of the day. At completion of the trial, patients were asked which treatment period they preferred with respect to their chest symptoms. In 14 this was the cimetidine period, in 3 the placebo period and 1 had no preference. Although in this study we had hoped to show both subjective and objective improvement in pulmonary function, we felt that the subjective improvement should not be ignored, as significant statistical improvement in respiratory function is difficult to measure in this type of study.

As this first study had shown that medical treatment of GOR in asthmatic patients led to improvement in respiratory symptoms, we then had to decide in what possible way asthma and reflux could be related.

Firstly, perhaps, patients with severe reflux actually aspirate gastric juice into the tracheo-bronchial tree thus causing local stimulation and bronchoconstriction. This possibility was considered by Ghaed and Stein[7], who studied ten asthmatics with reflux and instilled radioactive sulphur colloid by a naso-gastric tube into the stomach at 10 pm. The following morning they scanned the chest using a gamma camera, but found no evidence of radio-activity in the lungs. We similarly investigated two patients but instead of scanning them on one occasion only we observed them continuously overnight. Though these patients could be seen to reflux as high as the pharynx, there was no evidence of overspill into the lungs.

Secondly, could acid entering the lower oesophagus stimulate nerve endings in the mucosa, leading by way of the vagus nerve to reflex bronchoconstriction? This mechanism was proposed by Mansfield and Stein[8], who found that infusion of dilute acid into the oesophagus of patients with asthma and reflux, induced bronchoconstriction which was reversed with antacids.

Thirdly, could the abnormal pressure changes in the thorax and abdomen during asthmatic attacks lead to reflux? Although it seems possible that reflux can cause asthma we do not know whether recurrent attacks of asthma can lead to permanent changes at the level of the oesophageal sphincter leading to chronic reflux.

STUDY 2

We felt that the most attractive theory was that proposed by Mansfield and Stein[8] who suggested that a vagal reflex might be responsible for the association between GOR and asthma. In our second study we attempted to confirm their findings by observing the effect on simple spirometric pulmonary function tests of intra-oesophageal acid infusion into asthmatics with reflux and comparing it with a group of non-asthmatics with reflux. In those patients who developed increased airways resistance during infusion of acid, we repeated the infusion after attempting to block the afferent pathway of the reflex with topical anæsthesia of the oesophagus using 4% lignocaine. In an overnight study we also monitored oesophageal pH levels and observed associated respiratory symptoms in the asthmatic group.

Eleven patients were entered in each group, the presence of reflux being confirmed by various tests including lower oesophageal manometry, overnight pH monitoring, Bernstein tests (infusion of dilute HCl into the lower oesophagus), oesophagoscopy and barium studies. Various measurements of lung function were recorded initially using the pre-calibrated PK Morgan TLC Test Spirometer used in our first study. With this system we recorded FEV_1, FVC, Peak Flow Rate, and maximum mid-expiratory flow rates at 50% VC. Later we changed to a Vitalograph with an automated function analyser which measured roughly equivalent values, namely forced expiratory flow of 0.2 to 1.2 volume segment and forced expiratory flow at 25 and 75% VC. Pulmonary function was recorded before and after insertion of the pH probe which was placed about 5 cms above the lower oesophageal sphincter. Dilute hydrochloric acid was infused until symptoms developed (usually after less than ten minutes) and then for a further five minutes if the patient could tolerate it. Pulmonary function was then re-tested.

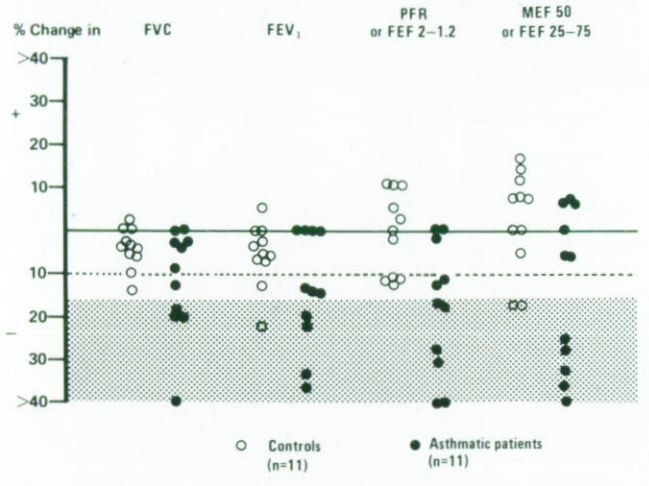

Fig 1. *Spirometric changes after naso-oesophageal intubation in 11 asthmatic patients and 11 controls. (Shaded area: fall greater than 15%)*

Fig 1 shows the response to naso-oesophageal intubation alone in both the controls and the asthmatic patients. Reductions in lung function indices of greater than 20% were mainly seen in the asthmatic group. Following infusion of acid into the oesophagus (Fig 2), there was again a reduction in a number of parameters, with the asthmatic group on the whole showing greater changes. In the five patients in whom acid infusion had produced the most marked reduction in pulmonary function, infusion was repeated after topical anaesthesia of the lower oesophagus.

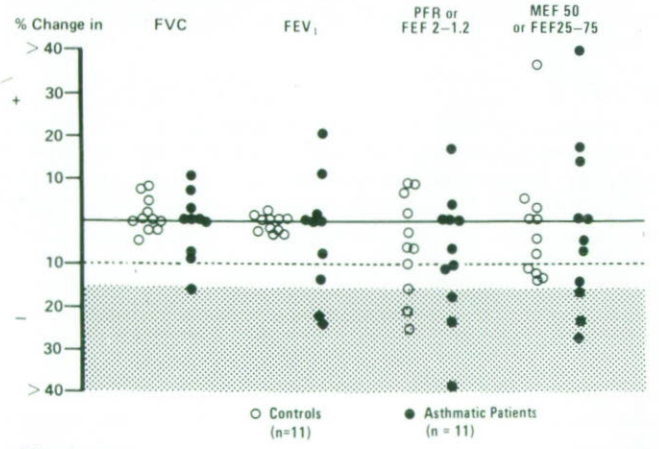

Fig 2. *Spirometric changes during infusion of 0.1 N HCl into the lower oesophagus.*

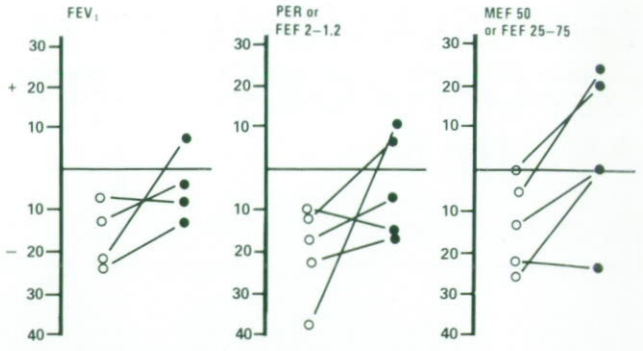

Fig 3. *Spirometric changes during infusion of 0.1 N HCl into the lower oesophagus before (open circles) and after local anaesthesia (closed circles).*

Fig 3 shows the changes in pulmonary function during acid infusion before and after local anaesthesia. In some patients the bronchoconstricting effect of acid infusion was considerably reduced. To illustrate this last point, the record (Fig 4) of a 37-year-old male patient shows evidence of marked fall in pulmonary function during the initial acid infusion but not after a repeat acid infusion following local anaesthesia.

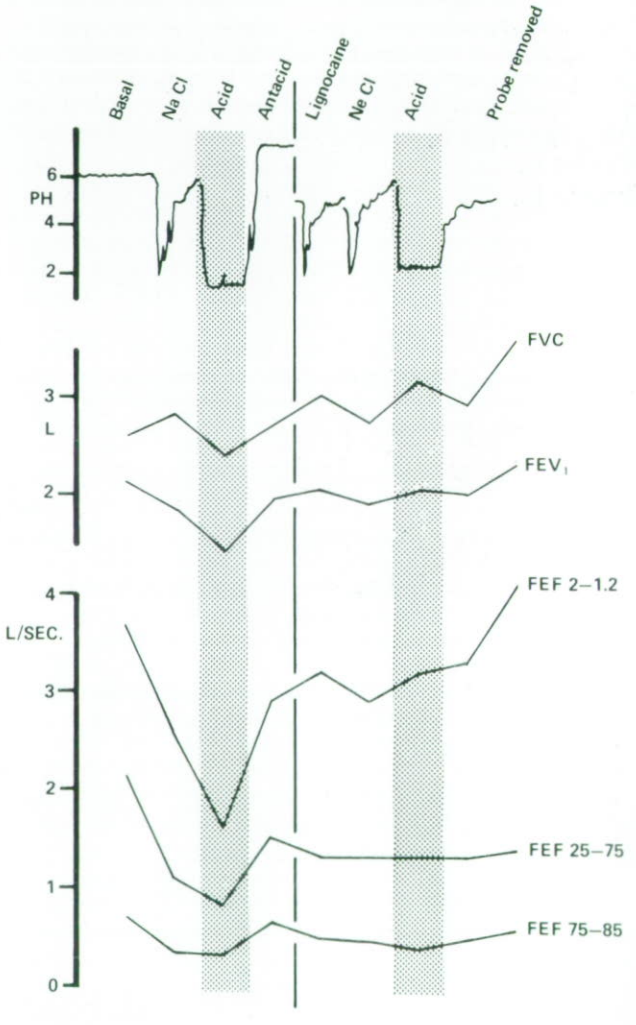

Fig 4. *Spirometric changes in a 37-year-old asthmatic patient. L-hand panel: acid infusion. R-hand panel: acid infusion after lignocaine anaesthesia.*

To complement this study on acid infusion we also studied the effect of spontaneous reflux, by continuous recording of overnight pH and observation of any related respiratory symptoms such as cough and wheeze. Fig 5 is an example of a patient observed to have cough and wheeze immediately following fall in oesophageal pH. During the period 12.30 to 3.00 am, the patient was observed to have seven related episodes.

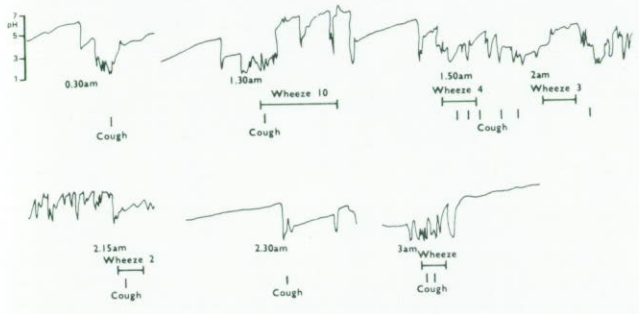

Fig 5. Oesophageal pH and nocturnal respiratory symptoms in an asthmatic patient. Respiratory symptoms follow pH reduction.

In the eight patients with asthma whom we investigated there seems to be a correlation between the degree of bronchoconstriction during acid infusion and the severity of nocturnal reflux as shown in Table 1. The peak flow falls seem to correlate well with the degree of reflux as measured by the total number of nocturnal reflux episodes and the number of related episodes of wheezing.

SUMMARY

In these studies, we have shown that:

1. There is a definite relationship between gastro-oesophageal reflux and bronchial asthma.
2. A vagally mediated reflex may be responsible for the association.
3. Treatment of reflux may improve chest symptoms.

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TABLE 1: RELATIONSHIP BETWEEN DEGREE OF ACID-INDUCED BRONCHOCONSTRICTION AND SEVERITY OF NOCTURNAL REFLUX

Patient	% change in PEFR after acid infusion	NOCTURNAL REFLUX		
		No of episodes	Longest single episode (mins)	No of reflux episodes leading to cough or wheeze
1	−38	67	21	50+
2	−23	25	7	19
3	−17	39	5	29
4	−11	20	3	2
5	− 7	1	1	0
6	− 7	12	8	12
7	+ 4	38	9	1
8	+ 7	8	5	0

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A TECHNICIAN TRAINING SCHEME IN PRACTICE

Peter Lockwood
Harefield Hospital

The introduction of the O TEC Course has stimulated much interest in supernumary technician training schemes in Medical Physics and Physiological Measurement. Such a scheme has actually been run by the Hillingdon Area Health Authority hospitals for the last ten years.

THE 'GUY'S SCHEME'

The idea was originally mooted by Dr. M. K. Towers, Consultant Cardiologist at Harefield Hospital, and the late Dr. Denis Deuchar, then Consultant Cardiologist at Guy's Hospital, in about 1970. At that time, it was hard to obtain suitably qualified cardiology technicians to fill the many vacant posts available nationally. The outcome of many months' discussion between the DHSS, Dr. Deuchar and the scientific staff of Guy's, the Brook, and Harefield and Mount Vernon Hospitals was that in September 1971 the procedure known as 'The Guy's Scheme' got underway. From the beginning, those appointed into the supernumerary posts on the training scheme were called 'trainees', to distinguish them from in-post student technicians, and their posts were financed directly from the DHSS via the relevant regional boards. The scheme was a two-year ONC course and for each year two trainees were appointed and financed by each of the three authorities, Guy's Hospital, the Brook Hospital in the SE Thames Region, and Harefield and Mount Vernon Hospitals in the NW Thames Region. Appointment was a rather complex procedure which changed each year, but, broadly speaking, the parent hospital short-listed its candidates who were interviewed collectively by the representatives of the three authorities.

Dr. Deuchar was firmly of the opinion that the first year should be primarily an opportunity for the trainees to gain a preliminary impression of the range of the work covered by the departments. Initially, therefore, the trainees rotated in pairs through the departments at Guy's Hospital, one month at a time, purely as observers. It was only after this 'Cook's Tour' that they settled down to a further two months' more concentrated experience in the departments. It was during this second period (lasting approximately to Christmas of the second year) that the departments in the peripheral hospitals (i.e. Brook, Harefield and Mount Vernon) took part in the training programme. Once this second rotation had been completed, the trainees settled into the departments of their choice to complete their two training years. From these departments they took their ONC examination and attempted to obtain permanent posts.

PROBLEMS WITH THE SCHEME

As this was an experimental scheme in many respects, the details varied a good deal from year to year as and our experience increased so the procedures were modified. In particular it was soon realised that the original 'Cook's Tour' notion was ill-judged. Because the trainees were not expected to participate actively in the work of the departments in their initial month's visit an attitude of remoteness and exclusivity was engendered. Some will go as far as to say that we trained the participants to be lazy! Certainly it was found that on the trainees' second visit to a department, there was considerable difficulty when attempts were made to involve them in active day-to-day work. Similarly, resentment was engendered in the minds of the in-post student technicians who were doing precisely the same ONC course at Paddington College. This routine was soon changed and the first 15 months of the course were spent with the trainees making single visits to each of the departments, of longer duration. It was soon realised that it was important for the trainees to feel that they had a base and that this would help to foster some feeling of commitment to their primary employing authorities.

REORGANISATION

By 1977 the nature and organisation of the course had changed and it was decided that the Harefield and Mount Vernon trainees (by this time known as the 'Hillingdon AHA' trainees) should gain their work experience exclusively (or as exclusively as possible) in the NW Thames region. This was made possible by the fact that within the Hillingdon AHA there were active and willing departments of Cardiology, Medical Physics, Audiology and Respiratory Physiology, to participate in the scheme. We were very lucky in that the department of Clinical Neurophysiology at the Whittington Hostpial, and in particular Dr. Etta Friedman and Mrs. C. O'Brien, were prepared to take part. Similarly, Mr. E. Gains, the principal technician in the Department of Surgery at the Royal Postgraduate Medical School, Hammersmith Hospital, accepted our trainees for experience that we could not give. Thus the trainees had some weeks of first-class EEG tuition, of experience of physiological measurement in a busy research department, open-heart surgery, renal dialysis and animal work.

OUR PRESENT SYSTEM

After further reorganisation, we have settled on a system in which two technicians are appointed each year alternately to Cardiology and Respiratory Physiology in the first year and Audiology and Medical Physics in the second. These are the base departments and from them the trainees are seconded on a nominal two-month basis to each of the other departments and to the Whittington and Hammersmith Hospitals. In fact, they spend about six weeks on secondment but having the time-table organised on a two-month module means that there is allowance for annual leave, sickness, or additional training in a particular topic. Thus there is a built-in flexibility. Between secondments the trainees return to their base departments and spend the majority of the second academic year there; thus on completion of the O TEC course the trainee has a total of about a year's experience in his chosen branch of physiological measurement. The reader will observe that the trainee is appointed to a base department and then spends the final period in his chosen department. This, happily, tends to be the same department but the system is such that a change-over according to the desires and aptitude of the trainee can be accomplished. For instance, the 1979-'81 trainees both ended up in the Cardiology Department. On the other hand, some change their allegiance and one of the 1978-'80 trainees started in Audiology and ended up in Medical Physics.

Some measure of the success of the scheme can be judged by the number of trainees still employed in the NHS. Of the 18 trainees who have completed the course since 1971, ten gained employment in NHS scientific departments. One of these, in fact, transferred into Biochemistry: this is the only pathology branch for which the ONC in Medical Physics and Physiological Measurement qualified one for technician grading. Four of the trainees are now in Audiology departments throughout the London area, three are in Cardiology departments and one is in Medical Physics. We have every hope and expectation that our present four trainees will likewise gain their qualifications and obtain suitable posts in hospital departments of their choice.

ANNUAL GENERAL MEETING OF THE ASSOCIATION

The Annual General Meeting took place on Saturday, 10th October 1981 at the Derbyshire Royal Infirmary.

We owe grateful thanks to Gillian Lowe for organising the meeting, to the speakers for their stimulating papers, to the caterer, Mrs Livesey, for producing an excellent lunch and to Dr Windebank who very kindly chaired the scientific session.

We are also most grateful to the following firms who generously sponsored the meeting and put on demonstrations of their products:

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The following scientific papers were given during the morning session:

1. Angler's Asthma — Susan Hill — General Hospital, Birmingham

Fishing in the country streams round Birmingham should hold much in the way of quiet contemplation — unless one is unfortunate enough to develop 'angler's asthma'. This was shown by a series of elegant immunological tests to be due to sensitivity to the 'gozzer', the local name for the species of super-maggot used by the craftier West Midlands sportsmen.

2. Pleural echocardiography — J Hadfield — Derbyshire Royal Infirmary

The identification of opacities in the pleural space by conventional X-rays is not always a simple matter and it may not be possible to tell exactly how much fluid is present and where it is, particularly if there is also a solid mass. Examination of the echoes produced by ultrasound was shown to improve the diagnosis rate over that obtained by X-rays alone and the two together produce a 98% success rate. In order to remove the fluid, just home in with your needle, right on target!

3. Pulmonary embolism — W J Windebank — Derbyshire Royal Infirmary

The incidence of pulmonary embolism has increased many-fold over the last ten or twenty years and Dr Windebank in an excellent review, outlined the serious consequences of the condition, such as pulmonary infarction and right heart failure; large emboli commonly arise post-operatively from thrombosis in leg veins and can have fatal results. Diagnostic problems arise and the condition may have to be distinguished from pneumonia and myocardial infarction. The diagnosis can usually be made by the technique of pulmonary angiography, in which contrast medium is injected directly into the pulmonary artery via a venous catheter; this technique will show blocked pulmonary vessels and often the precise localisation of the emboli. In good hands (eg in Derbyshire) this is a perfectly safe procedure and more sensitive than lung scans.

4. Estimation of mixed venous pCO_2 levels for calculation of cardiac output — J W Reed — University of Newcastle-upon-Tyne

The introduction of the rebreathing procedure for measuring mixed venous pCO_2 should have simplified the measurement of cardiac output. By the usual method, the subject rebreathes a high CO_2 mixture from a bag until a plateau value is reached. The problem is that the procedure itself leads to a period of hyperventilation; it is usually assumed that this has settled down within 30 secs but Dr Reed showed that the effect can last for as long as 3 minutes, with serious errors in the estimated value of cardiac output.

CHAIRMAN'S REPORT

Derek Cramer
Lung Function Unit, Brompton Hospital, London SW3

I would like to open this report by expressing my thanks to the organisers of the two excellent Association meetings we have had this year, to Gillian Lowe who was responsible for this meeting and to Margaret Marples who organised the Spring meeting held at the Hope Hospital, Salford. I am also grateful to the speakers, the caterers and the sponsoring firms, in fact all who helped to make the meetings possible.

I will outline some of the more important events of the last year:

GRADING

A new grading structure has been introduced for Medical Physics and Physiological Measurement Technicians, which became effective on the 1st April, 1981. There is now a Principal Medical Physics grade, but in order to be eligible, at least 15 technicians have to be working in your unit. On the Physiological Measurement front, a senior-chief technician grade has been introduced; this grade now offers a comparable salary with the Medical Physics Grade I but you need to have at least 6 technicians working for you. Several members feel that the new grades are too "number-orientated", especially the more senior grades. It would seem that there could be several chief technicians in respiratory function units who would not be eligible for a senior-chief post becaue of insufficient numbers, whereas a chief technician in a cardiac department could easily have 5 cardiographers in the unit and would thus be eligible. The dental technicians, on the other hand, apparently do not have any numbers written into their grading structure. It is hard to see why they should be such a privileged group! We clearly need much better representation when such documents are being prepared.

TECHNICIAN ASSESSMENT

A meeting on this subject recently took place in Harrogate attended by Gillian Lowe, Sally Gough, Jim Reed and the editor of *Breath*. The meeting was organised by the DHSS and the aim was to discuss the assessment of the practical ability of student physiological measurement technicians. (Jim Reed discussed this meeting in more detail when he spoke about education later in the afternoon.)

CERTIFICATE OF COMPETENCE

Another major change is that the Certificate of Competence from the Physician has been phased out and has been replaced by nationally accepted examinations such as the O TEC.

OPERATING DEPARTMENT ASSISTANTS

DHSS evaluation of Operating Department Assistants (ODAs): Several respiratory units have been visited and the purpose of the exercise was to see whether ODAs should be paid as 'ancillary staff' or as 'technical staff', i.e. physiological measurement technicians. Apparently the ODAs and the PMTs were assessed by some of the DHSS staff who evaluated their job content as compared with their job description.

THE FAMT

There is still no FAMT journal, not because the Central Council had not tried to produce one, but because the individual societies did not seem to want a journal because of all the financial implications. The other point of interest on the FAMT scene was that the Institute of Science Technology had a letter published in the 'Wireless World' saying that it would be a good idea to set up a diploma, especially for people that had not got sufficient academic qualifications. Apparently, nothing has so far materialised.

BREATH

I would like to thank the editor of *Breath* — Dr. Hutchison, the assistant editor — Jane Jones and all the other people who have written articles for *Breath*, helping to make it such a professional journal. All members now are receiving 3 copies per annum.

I must stress what good value being a member of the ARTP really is — the regular journal (*Breath*), a unique badge, 2 scientific meetings a year, 2 business meetings a year plus the glorious food! What is more, negotiations with the Inland Revenue have taken place and we hope that very shortly all members will get tax relief on their membership contributions.

Finally, I must thank all my fellow members on the Executive Committee who have put in a lot of extra work over the year, especially the secretary, Gillian Lowe, who has had the awesome task of dealing with most of the correspondence.

TREASURER'S REPORT

Mr. Chairman, Ladies and Gentlemen,

I should like to present the Treasurer's report for the period October 1980 — October 1981. The accounts have now been audited.

Our chief expenditure is on travel expenses and postage, both of which have risen in price in the last year. This, regretfully, meant that the subscription charge had to be increased.

Although BREATH manages to make a small but consistent profit, the cost of printing it is also about to rise 10%. Advertising prices will have to rise to cover this. We had a nice boost in the form of a donation from Vitalograph of £100 which enabled them to reprint from the article by Houston, Parry and Smith entitled "Have you looked into your spirometer lately?" which was published in the February issue this year.

Our expenditure on catering is well covered by the generous donations that we receive from the firms exhibiting at the meetings.

Generally, as you can see from the copy of the balance sheet in front of you, our account is healthy. We may be liable for tax on the interest on our deposit account, but at the moment we are trying for charitable status and our affairs are being dealt with by the tax office.

And lastly. We depend for our survival on the subscriptions from members. Therefore, may I appeal to those who have not yet paid — to do so.

Thank you.

ASSOCIATION OF RESPIRATORY TECHNICIANS & PHYSIOLOGISTS

STATEMENT OF INCOME & EXPENDITURE

1st OCTOBER 1980 to 30th SEPTEMBER 1981

EXPENDITURE		INCOME	
Travelling Expenses	299.07	Subscriptions	688.00
Catering	310.16	Donations	510.00
Postage & Stationery	284.52	Advertisements and Miscellaneous	1,780.35
Breath	980.00	Deposit Account Interest	61.63
Printing	510.00		
Miscellaneous	32.00		
Badges	122.64		
Excess Income over Expenditure	501.59		
	£3,039.98		£3,039.98
Bank Balance 30.9.81	856.43	Balance Brought Down	501.59
Deposit Account 30.9.81	568.77	Bank Balance 1.4.81	416.47
		Deposit Account 1.4.81	507.14
	£1,425.20		£1,425.20

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ARTP NEWS

NENE COLLEGE, NORTHAMPTON

Dear Sir/Madam

You will be pleased to know that this college will be offering, from September 1982, a part-time BSc degree in Health Science Studies.

The degree is intended for those in the professions supplementary to medicine as well as nurses who are able to avail themselves of degree-level education. This will provide for those with the desire and aptitude for higher-level work than their basic professional training and opportunities to engage in a programme which will enhance their personal development both educationally and professionally, and yet will cause the minimum of disruption to the service.

The service situation itself will also benefit from the constant feed-back brought about by this type of course arrangement. The Northamptonshire Area Health Authority is most supportive to this course and all the major professions supplementary to medicine have been involved in the discussions regarding this degree to date. I should add that the degree will be from Leicester University as this is an Associate College of the University.

I would be most grateful if you could give this new course maximum publicity and I would be pleased both to welcome you to college and to answer any queries you may have.

David R George
Dean, School of Sciences

THE SOCIETY OF ANAESTHETIC LABORATORY TECHNICIANS

Dear Sir

The next Scientific Meeting of the Society of Anaesthetic Laboratory Technicians will be held on 2nd and 3rd April, 1982, at the Royal Postgraduate Medical School, Hammersmith Hospital, London. If any of the members of your association would like further details of this meeting, they may be obtained from Mr. M. K. Chakrabarti, Department of Anaesthetics, Royal Postgraduate Medical School, Hammersmith Hospital, Ducane Road, London W12.

Anne M. Rhodes
Society of Anaesthetic Laboratory Technicians

BRITISH SYMPOSIUM ON RENAL TECHNOLOGY

University of Warwick
26th-28th September 1982
Organised by the Association of Renal Technicians
This will be the seventh symposium to be organised by the Association of Renal Technicians. The symposium aims to adopt a multidisciplinary approach, and should therefore appeal to technicians, physicists, clinicians, nurses, home dialysis administrators and all others with an interest in the application of technology to the treatment of renal disease.

The scientific programme will comprise three sessions, Monday morning, Monday afternoon and Tuesday morning.

There will also be a commercial exhibition, the largest of its kind in the U.K., which will be opened on Sunday afternoon and will remain open throughout the symposium.

The annual symposium dinner will take place on Monday evening.

Residential accommodation offering a high standard of comfort will be provided in the nearby halls of residence.

Papers will be presented in English. Authors are requested to submit an abstract, not exceeding 300 words, typed with double spacing on A4 paper by the 26th. of February 1982. The authors of those papers which have been accepted will be notified in March 1982.

The address to which abstracts should be sent is: Mr. A. Deller, Dep't. of Medical Electronics, St. Bartholomew's Hospital, London EC1A 7BE.

For details of exhibition space and charges, please contact: Mr. J. Mollart, Renal Unit, North Staffs Royal Infirmary, Princes Road, Hartshill, Stoke-on-Trent, ST4 7LN.

BREATHING CLUB: FUTURE MEETINGS

March 1st: With Royal Society of Medicine: includes a session on Right Ventricular Function.
July 7th: Edinburgh: Disturbances of Breathing during Sleep.
Further details from Dr. Higgenbottam, Papworth Hospital.

PRESS RELEASE

MINIATURE SPIROMETER

A new miniature spirometer is now available in the U.K. from AIM MEDICAL LIMITED.

The *SP-1A* is manufactured by Schiller of Switzerland, and using a small air turbine generator and electronic timing it displays the volume of air expelled from the lungs in one second.

The value is displayed in digits and represents litres of air.

The importance of measuring the value of FEV_1 is well documented by Tiffeneau and other lung function specialists.

Weighing only 125 grams, the unit is truly pocket-sized and is provided with a small leather pouch for protection.

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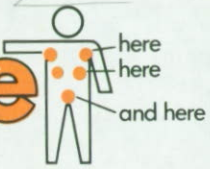

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Applicants for the student post must have at least 4 'O' Levels including physics, mathematics, biology and English language. They will be expected to pursue a course in Medical Physics and Physiological Measurement at a technical college.

Applicants for the post of technician must have ONC or O Tec in Medical Physics & Physiological Measurement and will be expected to pursue a higher recognised course. Day-release will be granted.

Salary Scale — Student Technician (at 18) £3155 — rising to £3765
Technician £4204 rising to £5381.
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Informal visits to the Laboratory can be arranged with Jane Jones, Chief Technician. Telephone 01-980 4433, ext. 320.

Application forms and job descriptions are available from Mrs. Bruford on Ext. 221.

SANDWELL AREA HEALTH AUTHORITY

PHYSIOLOGICAL MEASUREMENT TECHNICIAN — RESPIRATORY FUNCTION
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Applications are invited from suitably qualified technicians (male/female) for this newly established post situated in the Respiratory Function Department at Sandwell's new District General Hospital, near central West Bromwich.

The successful applicant, who will be experienced in lung function testing, will be responsible for the day-to-day running of the department which is well equipped with facilities for spirometry, transfer factor testing, body plethysmography and exercise testing.

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Sandwell is situated near Birmingham, affording all the facilities of Britain's second city; and the extensive Midland motorway network and fast inter-city railway links provide quick and easy access to many parts of the country.

For further information, application forms and job description, or to arrange an informal visit, please contact Mr J D Howell, Assistant Sector Administrator, Sandwell District General Hospital, Lyndon, West Bromwich, West Midlands. Telephone: 021 553 1831 ext 3136.

Breath is the journal of the Association of Respiratory Technicians and Physiologists. Original articles, reviews, correspondence or comment on subjects of scientific or general interest may be submitted to the Editor: D C S Hutchison, Chest Unit, King's College Hospital, London SE5 8RX. Material should preferably be typed on one side of the paper only, in treble spacing throughout. Photographs should be of good contrast, printed on glossy paper and unmounted. Tables and legends to figures should be typed on separate sheets.

Applications for advertisement space and for rates should be addressed to: Jane Jones, Respiratory Laboratory, London Chest Hospital, Bonner Road, London E2.

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