It does not, of course, follow from this that drug-resistant strains are always of high virulence. Indeed, in *in vitro* experiments the reverse is usually the case. But in hospitals drug-resistant staphylococci have emerged as the result of the transfer of strains from patient to patient in the presence of antibiotics, and this form of animal passage has inevitably favoured the selection of highly virulent organisms. With the associated elimination of drug-sensitive strains the drug-resistant staphylococci have been left a relatively clear field.

If this is the case, attempts to reverse the process are of considerable importance; but, clearly, a controlled antibiotic policy gives us no respite from fighting cross-infection. Nevertheless, in view of the ubiquity of the staphylococcus and the consequent impossibility of eliminating all potentially pathogenic strains from the hospital environment, it seems reasonable to concentrate on those strains most likely to be dangerous. At present, in most hospitals these appear to be multiple-resistant organisms, usually of phage group III or type 80. It is possible that if we concentrate our attack on these strains we shall favour the selection, in hospitals, of less virulent staphylococci.

Summary

The incidence and drug-resistance of all staphylococcal infections in the surgical wards of a large general hospital have been studied over the period October 1, 1957, to June 30, 1959. In the six months prior to the investigation a number of anti-cross-infection measures were introduced into the hospital, and in April, 1958, a controlled antibiotic policy was put into operation.

During the investigation 5,239 patients were admitted to the wards studied and 452 had a staphylococcal infection. The total incidence per patient of all types of staphylococcal infection fell from 10% to 7% between January and July, 1958, and thereafter remained stationary.

At the beginning of the investigation 70% of the infections were resistant to penicillin and tetracycline and only 12% were sensitive to penicillin. At the end of the investigation 36% of the infections were resistant to penicillin and tetracycline and 48% were sensitive to penicillin. Analysis of the strains of *Staph. pyogenes* (on the basis of phage type) showed a similar trend towards penicillin sensitivity.

Most of the infections were localized and many were very slight, but 49 patients developed generalized infection and 24 of these died; 44 of the generalized infections and 23 of the fatal infections were due to multiple-resistant strains; 12 of these patients had been transferred from other hospitals for treatment of renal failure and were already infected on admission.

It is a pleasure to thank the entire medical, nursing, and administrative staff of the hospital, and especially the sisters of the surgical and penicillin wards, whose magnificent co-operation made this investigation possible. We would particularly like to thank Dr. W. Hayes, who not only played a major part in planning the experiment but was the catalyst who started the reaction.

The antibiotic policy was planned by a joint committee of representatives of the Medical Research Council Antibiotics Clinical Trials Committee and of the staff of Hammersmith Hospital, which consisted of the following people: Professor L. P. Garrod (in the chair), Drs. Mary

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OPEN LUNG BIOPSY FOR DIFFUSE PULMONARY LESIONS

BY

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Diffuse pulmonary lesions have always presented a diagnostic challenge. In spite of intensive investigation, many cases remain obscure until further developments or even necropsy reveal their nature. Various methods have been devised to obtain a portion of lung tissue for histological, bacteriological, or chemical examination. Biopsy by means of a needle, drill, or thoracoscope appears to be inadequate. The only method of obtaining an adequate specimen which is both visibly and palpably diseased is open biopsy. This method was first described by Klassen *et al.* (1949), and further articles have appeared from other centres in the United States. So far no report on this subject has appeared in the British literature. We should therefore like to record the experience of this procedure at the London Chest Hospital during the past five years.

Method

General anaesthesia is employed in all cases. The site of the incision is planned according to the maximal radiological distribution of the disease. In earlier cases a routine thoracotomy incision was used with or without removing the rib. In later cases it was found that a smaller antero-lateral incision, usually about 6–8 in. (15–20 cm.) long, could be employed, with the possibility

of extending it if desirable. The chest is opened through the rib bed without removing the rib. The lung is inspected and palpated, together with hilar and mediastinal nodes. A suitable gland is removed for histological section. A portion of lung approximately 2 by 3 by 5 cm., showing most disease, is excised between two clamps. The lung is sutured in two layers by means of deep mattress and superficial continuous chromic catgut sutures. After insertion of antibiotics the chest incision is closed, leaving an intercostal drain for 24 to 48 hours.

Results

Complications.—There was no operative mortality in this series. In the majority of patients there were no complications, the post-operative course being satisfactory. Only two patients developed minimal pyrexia, and one had a small pleural effusion which needed aspiration three days after removing the tube. In only two cases were the complications more serious. One patient, suffering from a honeycomb lung due to eosinophilic granuloma, developed a spontaneous pneumothorax on the contralateral side on the third post-operative day; although this should be technically regarded as a complication, it is only fair to mention that it may have been a pure coincidence, since spontaneous pneumothorax is quite common in this condition. The other patient developed a subacute intestinal obstruction on the 17th post-operative day which responded well to conservative treatment. Thus the method appears to be safe, complications and operative morbidity being minimal.

Histology.—It will be seen from the Table that in only two cases (Nos. 8 and 13) were the histological findings indefinite, although even in one of these (No. 13) they were sufficient to make the pre-operative diagnosis improbable. In the other 24 a histological diagnosis was made, but in about one-quarter of these the aetiology remained obscure. The number of discrepancies with pre-operative diagnoses and the many interesting features demonstrated will be apparent.

Discussion

Various methods have been suggested and used in an attempt to obtain pulmonary tissue for microscopical and bacteriological examination. It may also be desirable to perform chemical analysis of the tissue obtained.

The simplest method would appear to be needle biopsy. This was first used as long ago as 1883 by Leyden, who performed it in three cases of pneumonia to isolate the invading organisms. Ellis (1947) devised a special biopsy needle with a squared-off cutting edge which is driven into the tissue by means of a dental drilling machine or motor. He applied this technique to the diagnosis of various tumours at different sites with great success and few complications. However, only nine cases of lung biopsy are tabulated, and in these there were two deaths, one immediate and one delayed.

A very full article by Woolf (1954) reviews the literature on the subject and analyses 94 biopsies of his own. He used an ordinary long needle (18 gauge 9 cm. short bevel with stylet), but a Vim-Silverman or similar type of needle has been used by others. Analysis of his results indicates that the procedure is far from being safe, there having been one death and numerous complications (45.8% of cases), though many of these

were of a minor nature. Lüdén (1955) reports four cases of severe haemoptysis with one death in a matter of three minutes during this procedure. Dustin (1953), Dutra and Geraci (1954), and Ochsner *et al.* (1947) have reported tumour implantation along the needle track which precluded subsequent surgery in cases of operable

Table of Results

Case	Age	Pre-operative Clinical Diagnosis	Biopsy and Final Diagnosis	Remarks
1	19	Honeycomb lung with diabetes insipidus	Eosinophilic granuloma	Treated by corticosteroids. Process arrested
2	66	Multiple metastases. ? Bronchial primary	Undifferentiated carcinoma with multiple metastases. Primary unknown	Needle biopsy negative
3	26	Hilar adenopathy with collapsed middle lobe	Hodgkin's disease	Bronchoscopic biopsy: "Chronic inflammatory tissue." Treated with nitrogen mustard with improvement. Survived 1 year
4	58	Pulmonary fibrosis. ? Asbestosis	Cystic bronchiolitis with diffuse leiomyomatosis	Scalene node negative. Treated with steroids. Complete clearing
5	38	Pulmonary fibrosis. ? Lymphangitis carcinomatosa	Diffuse interstitial fibrosis. "Hamman-Rich" type	
6	54	? Sarcoidosis	Sarcoidosis	Scalene node negative. Gastrectomy for lymphosarcoma of stomach 2 years previously
7	53	? Lymphosarcoma	1. Undifferentiated carcinoma 2. Mild pneumoconiosis	
8	46	Pulmonary fibrosis: ? cause	No specific diagnosis	
9	58	? Bronchial carcinoma	Sarcoidosis	Before diagnosis patient had deep x-ray treatment. Treated
10	21	Pulmonary tuberculosis	Sarcoidosis	
11	33	Pulmonary fibrosis	Bronchiectasis and bronchiolitis	Antituberculous treatment
12	43	? Rheumatoid lung	Chronic miliary tuberculosis	
13	40	? Rheumatoid lung	Patchy collapse only. No evidence of collagen disease	
14	51	? Pulmonary tuberculosis	Pneumoconiosis	Metastasis from adenocarcinoma of thyroid, removed 3 years previously, also considered
15	54	Bronchial carcinoma with metastasis	Bronchial carcinoma plus pulmonary fibrosis and bronchiolitis	Biopsy planned, but lobectomy carried out
16	46	Spontaneous pneumothorax with honeycomb lung	Chronic miliary tuberculosis (healing)	Antituberculous treatment
17	51	? Lymphangitis carcinomatosa	Lymphangitis carcinomatosa	
18	49	Pulmonary fibrosis with bronchiectasis	Sarcoidosis	Treated
19	58	Carcinomatous right lung	Secondaries from adenocarcinoma. Primary not known	
20	36	Honeycomb lung and diabetes insipidus	Eosinophilic granuloma	
21	54	Bronchial carcinoma. ? Metastases	Disseminated squamous carcinoma with occasional sarcoid nodules. Mediastinal glands: carcinoma and sarcoid	Scalene node: sarcoidosis only
22	64	? Bronchial carcinoma with pneumoconiosis	Tuberculosis with asbestosis	Antituberculous treatment
23	52	Pulmonary tuberculosis with ? bronchial carcinoma	Pulmonary tuberculosis. No carcinoma	Antituberculous treatment. Lobectomy
24	57	Pulmonary fibrosis	Diffuse interstitial fibrosis. "Hamman-Rich" type	
25	12	Cystic honeycomb lung	Histiocytic reticuloendotheliosis	Treated with steroids, with marked improvement
26	62	? Sarcoidosis	Bronchiectasis. Bronchiolitis	No evidence of sarcoidosis

bronchial carcinoma. One of us (L. J. G.) has performed a number of these biopsies in the past, but has given them up owing to the poor diagnostic yield and the considerable discomfort to the patient, though the number was too small to be of any significance. Since the chance of obtaining an adequate specimen by a random method from a tissue of such loose texture seems remote and the risks are not inconsiderable, it now appears to us to be an unjustifiable procedure.

Heine (1957) describes a method of biopsy through a thoracoscope fitted with a specially designed forceps. One or more portions of the lung "the size of a lentil" are excised, bleeding being controlled by diathermy. A definite diagnosis was reached in 12 of 13 cases, and no serious complication or death occurred. This method would appear to be elegant and simple, but obviously it is impracticable in cases where it is not possible to induce an artificial pneumothorax; in our own cases 9 out of 26 had adhesions in the pleural space. Furthermore, the method seems ill suited for conditions in which the lesions are not absolutely superficial. Mediastinal lesions can be visualized, but the use of a biopsy forceps would appear to be hazardous owing to the danger of damage to vessels at the hilum. Heine himself is far from regarding this as a routine method, and will report further on his experience.

The obvious method of choice is open biopsy. The first series was reported by Klassen *et al.* (1949), and eight years' experience has been gained (Andrews and Klassen, 1957). The original method consisted of a submammary incision 8 to 10 cm. long, using local analgesia with positive-pressure breathing; no suture of intercostal muscles was done and no drainage tube inserted. Presumably local analgesia was found to be unsatisfactory, as general anaesthesia is now used. Following Klassen's article, various large and small series of lung biopsies have appeared in the American literature utilizing or modifying his method (Theodos *et al.*, 1955; Effler *et al.*, 1955; Close, 1955; Bell, 1957). O'Donnell (1955) has recognized that the incision ought to be adequate for removing not only a portion of lung but also the mediastinal nodes if they are involved. Other surgeons (Storey *et al.*, 1953; Harvey *et al.*, 1958) agree that a larger incision, approaching that for a routine exploratory thoracotomy, is desirable. On the other hand, Breckler *et al.* (1957) recommend an incision of 3 to 5 cm.

As mentioned above, the method used at the London Chest Hospital ensures adequate inspection and palpation of the whole lung and removal of the most suitable specimen, together with a mediastinal node.

No procedure can equal open lung biopsy in establishing a definite diagnosis in diffuse pulmonary lesions. The essential problem is when to have recourse to this procedure. All available diagnostic methods should have been fully utilized, depending upon the clinical assessment of the case. Usually at this stage the problem has become limited to a few conditions. It may be argued that scalene-node biopsy should always be preferred to pulmonary biopsy in the first instance. Various authors (Shefts *et al.*, 1953; Longstreth *et al.*, 1957) have reported the results obtained by this procedure as described by Daniels (1949). In only one-third of cases is a positive diagnosis reached even with a very long incision and a dissection carried from the neck into the mediastinum ("cervico-mediastinal" exploration of Harken *et al.*, 1954). Nohl (1958), in a series of

58 cases, obtained 36 positive results out of 41 where the nodes were palpable, and 5 out of 17 where the nodes were impalpable, which is usual in the sort of case we are dealing with here. He points out that the success of the operation depends on the extent of the exposure and the amount of tissue removed, so that it is of necessity a fairly formidable procedure, requiring great skill and care.

Scalene-node biopsy seems to be most useful in cases of neoplastic, infective, or granulomatous pulmonary disease, with maximal correlation in cases of sarcoidosis. However, even the latter diagnosis may be dubious, since a variety of conditions, such as tuberculosis, brucellosis, histoplasmosis, Hodgkin's disease, carcinoma, and berylliosis, may give rise to sarcoid-like lesions in scalene nodes (Jefferson *et al.*, 1954). On the other hand, considering the results of various major reported series of lung biopsy, a specific histological diagnosis appears to have been established in two-thirds of the cases; in the rest no specific lesion is discovered, but the histological end-results—for example, pulmonary fibrosis—can be appreciated in the majority, leaving about 10% where no opinion can be given. It would thus seem that when the scalene nodes are not palpable it is justifiable to go straight on to lung biopsy. It may be contended that this procedure is not without risk, which cannot be denied. In the largest series, that of Andrews and Klassen (1957), out of 119 biopsies there were four deaths, and these occurred in desperately ill patients who were regarded as moribund. In their last 50 there was no death at all. In our own admittedly small series there was no mortality, and morbidity was small. It would seem, therefore, that with proper selection of cases the risk should be minimal.

The establishment of a diagnosis by lung biopsy has more than an academic significance. In other series, as well as in ours, a large number of patients have been proved to be suffering from conditions in which treatment was possible. In this connexion we may quote the following cases.

Illustrative Cases

Case 5. (This case is being more fully reported by Dr. J. Macnamara elsewhere.) The patient was a married woman aged 38 with one year's progressive dyspnoea and three months' complete incapacitation. On examination, markedly cyanosed and dyspnoeic at rest, severe clubbing of fingers, generalized sibilant rhonchi, and crepitations at both bases. X-ray film: diffuse infiltration both lungs, more pronounced on the right. Other systems n.a.d. Scalene-node biopsy negative. Differential diagnosis was between a rapidly progressive pulmonary fibrosis and lymphangitis carcinomatosa. Lung biopsy (May 17, 1955) revealed changes of diffuse interstitial fibrosis of "Hamman-Rich" type. Treatment with corticotrophin and subsequently with cortisone was dramatically successful, and the patient is alive and well 3½ years later, having been taken off steroids, with complete clearing of lung fields.

A similar case has recently been reported by Van Slyck (1957). Another case of basal fibrosis of unknown aetiology may be quoted, and illustrates the value of examining a mediastinal node:

Case 18.—This patient, a spinster aged 49, had suffered from swelling and pain in fingers, wrists, and ankles 18 months previously. For one year she had a cough with increasing dyspnoea and recurrent pyrexial episodes. There were persistent fine crepitations at both bases. X-ray films: high diaphragms, with fibrosis and patchy atelectasis at both bases; mediastinal glands not enlarged; tomograms showed

fine cystic changes. Bronchogram showed basal bronchiectasis with considerable deformity of the bronchial tree in both lower lobes. Mantoux test negative in all dilutions. Kveim test negative. L.E. cells not found. Cystic bronchiectasis of unknown aetiology; rheumatoid lung and sarcoidosis were considered in differential diagnosis. Lung biopsy (February 11, 1957): A portion of right lower lobe, together with a mediastinal node, was obtained. The lung showed marked fibrosis and bronchiectasis with very scanty scattered sarcoid follicles. The mediastinal node, on the other hand, showed a remarkably active sarcoid process. Treatment with prednisone and antituberculous drugs was started, and has been continued for 18 months. The process appears to have been arrested, and the patient is clinically very much improved.

A further case in which the diagnosis of hilar adenopathy with pulmonary infiltration and a misleading bronchoscopy finding was rapidly solved by a lung biopsy may be quoted:

Case 3.—A young woman aged 26 had erythema nodosum one year before admission. On x-ray examination, the left hilar glands were found to be enlarged. While under observation she developed bilateral pain in the chest with wheezing. No other lymph-gland enlargement was noted. X-ray films showed gross bilateral hilar adenopathy and a collapsed middle lobe. Mantoux test positive 1:1,000. Sputum repeatedly negative for tubercle bacilli. At bronchoscopy granulomatous areas were seen in the right main bronchus, which on biopsy showed changes of chronic inflammation. A three-months course of streptomycin, P.A.S., and isoniazid was given without any benefit, and the patient continued to lose weight. Thoracotomy (October 12, 1954) revealed hard masses in upper and lower lobes and a collapsed middle lobe, which was resected and biopsy of involved areas of lung and mediastinal gland made. The histology was unequivocally that of Hodgkin's disease. She was given a course of nitrogen mustard, which was repeated on several occasions with much symptomatic relief. She died one year after starting treatment.

The diagnosis of pneumoconiosis is generally a clinical and radiological one, and may be very difficult to substantiate. A number of American authorities lay great stress on the value of biopsy in the establishment of the industrial aetiology of pulmonary changes. They not only examine the histology of the lesion, but may also carry out a microchemical analysis of the inorganic constituents (Effler *et al.*, 1955). This may have a great bearing on the question of compensation, and it may well be that the procedure could be more widely applied in this respect in the problem of pneumoconiosis. Our experience of this type of case is limited to one where the question of asbestosis arose and was disproved.

Case 4.—A woman aged 58 had been working with asbestos fibre for over four years. She had progressive cough and dyspnoea for 3½ years, and radiologically showed a diffuse bilateral pulmonary fibrosis. Sputum was repeatedly negative for tubercle bacilli, fungi, and asbestos bodies. Nevertheless, in view of the long exposure, a diagnosis of asbestosis was considered. Histologically the lung biopsy specimen showed numerous microscopic cysts lined by epithelium of respiratory type. Between these was fibro-muscular tissue and chronic inflammatory cells. A diffuse leiomyomatosis was regarded as the pathological process, in view of the fact that the walls of the alveoli were lined by smooth muscle. No evidence of asbestosis was found.

The condition of "eosinophilic granuloma" of the lung is being increasingly recognized, mainly through lung biopsy (Auld, 1957; Arnett and Schulz, 1957). One of us (Grant and Ginsburg, 1955) reported the first case diagnosed in this country by this method. Since then

another case has been similarly diagnosed at the London Chest Hospital. In both these cases there were pulmonary opacities and reticulation, associated with diabetes insipidus. A further case of rapidly progressive honeycombing of the lung had a biopsy very recently, which revealed an interesting example of this group.

Case 25.—A girl aged 12 was seen in 1953 at St. Andrew's Hospital, Bow, because she was not putting on weight. X-ray report: "Markings prominent. Nil in lung parenchyma." She remained thin but otherwise well. There was no history of respiratory disorder. Three days before admission she collapsed, became suddenly breathless, and developed productive cough. She failed to improve, was admitted to London Chest Hospital on May 30, 1958, and was found to have a right-sided tension pneumothorax and an enlarged (2 fingerbreadths), firm, and tender spleen. Both lungs showed radiological appearances of gross honeycombing. An intercostal tube was introduced. The lung partially re-expanded, but on the fifth day she developed a left pneumothorax. An intercostal suction tube was inserted on this side as well. The previous radiograph was not available at that time, and it was felt that she was a case of either congenital cystic lung or mucoviscidosis. The latter diagnosis was abandoned on finding trypsin in the stool and a negative sweat test. In view of the failure of the right lung to expand, a parietal pleurectomy was performed through a small submammary incision. The lung appeared grossly cystic, and in view of her serious condition biopsy was not performed. When her condition improved on satisfactory adherence of the right lung, it was decided to do a left lung biopsy combined with a left pleurectomy. At thoracotomy a small portion of lung was taken from the lingula. The section showed histiocytic reticulo-endotheliosis.

Occasionally a lung biopsy is of value in establishing the diagnosis of tuberculosis in cases where the diagnosis may not have been suspected or where it may enter into the differential diagnosis without any confirmatory evidence. Sometimes clinical and radiological findings may be atypical, or a failure to respond to specific antituberculous treatment may lead to the suspicion that tuberculosis is only incidental to some other condition. The following case illustrates this point.

Case 23.—A man aged 52 was admitted to the London Hospital with a diagnosis of granuloma inguinale. There were no chest symptoms or signs, but routine x-ray examination revealed a round mass in the right mid-zone which in the lateral view appeared to involve both middle and lower lobes, and to abut upon the hilum. There was also some enlargement of the left hilar nodes and diffuse infiltration in both lower lobes. Sputum was found to contain tubercle bacilli on direct smear. Treatment was therefore started with streptomycin, isoniazid, and P.A.S., and he was transferred to the London Chest Hospital. Treatment was continued for three months without any change in the radiological appearance, although sputum became negative. The possibility of some concomitant condition was considered and bronchoscopy was performed. This showed some pressure on the right lower lobe bronchus, which was deformed and scabbarded. The left lower lobe bronchus also showed considerable narrowing. Sputum was negative for neoplastic cells. It was therefore decided to proceed to lung biopsy. On thoracotomy (May 1, 1958) a large firm mass was found in the fissure, involving the middle lobe and adjacent portion of the right lower lobe. There was also scattered parenchymal disease in both these lobes. A portion was excised and sent for frozen section, which was reported as tuberculous without any evidence of other disease. It seemed likely, therefore, that this was a case of primary tuberculosis in a middle-aged person, and the possibility of a carcinoma or other lesion was excluded.

Another interesting case of tuberculosis with unusual features may be quoted.

Case 16.—A man aged 46 had had shadowing in the right upper lobe since 1947, with local extension in 1949. This was regarded as probably tuberculosis in spite of repeatedly negative sputum examinations. In 1952 a further reactivation in the right upper lobe occurred, and he also developed severe bronchitis followed by a left spontaneous pneumothorax. This proved difficult to re-expand. There were numerous scattered opacities throughout both lung fields, particularly in the upper zones. It was decided to do a lung biopsy and at the same time identify an air leak. On thoracotomy (January 1, 1957) a large leak and small emphysematous bullae were present in the left upper lobe and apex of the left lower lobe. Both lobes were fibrotic, with numerous hard calcified nodules scattered throughout. Microscopical examination of a biopsy specimen showed lesions strongly suggestive of calcifying chronic miliary tuberculosis. He was put on antituberculous drugs for the first time.

From these illustrative cases it is apparent that much can be expected in the way of providing a definitive diagnosis and a rational basis for therapy, and even where therapy is not possible a radical change in prognostic outlook may result.

As regards the academic value of such a procedure there can be no question that much hitherto inaccessible information may be derived from it, since it enables the pathological histology of various disease processes to be studied during their active phases. It is interesting to note that one observer (Close, 1955) did not hesitate to do two successive biopsies on the same patient in order to observe the effect of treatment. It appears to us that there is a field for a great increase in the use of this valuable procedure, from all points of view, and it is also possible that it should be considered earlier as a diagnostic measure, since it could be carried out in a fitter patient and might be even better tolerated, thus leading to the earlier institution of treatment.

Summary

A series of 26 cases of lung biopsies by thoracotomy is presented. Complications were minimal.

The importance of securing an adequate specimen, including an affected mediastinal lymph node, is emphasized.

The advantages of open lung biopsy over other biopsy procedures are stressed.

The method appeared to be of great value in establishing a histological diagnosis in diffuse pulmonary lesions and rational treatment for various conditions. The histological diagnosis was obtained in 24 out of 26 cases.

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ABO BLOOD GROUPS AND SECRETOR CHARACTER IN RHEUMATIC CARDITIS

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Glynn *et al.* (1956) emphasized that there must be important host factors in rheumatic fever because, though the disease usually follows a streptococcal throat infection, only a small proportion of cases of streptococcal tonsillitis do, in fact, develop the complication. They pointed out that one important variation in the environment of the streptococcus depends on the blood-group secretor status of the host, and this idea led them to investigate the secretor character in patients with rheumatic fever. In 460 schoolchildren, who were used as controls, they estimated an incidence of 22.6% non-secretors of ABH from the results of an anti-Le^a serum and saliva test (most individuals who are non-secretors of ABH secrete large amounts of Le^a), whereas among 450 children with rheumatic fever the estimated non-secretor figure was 28.7% and the difference was significant at the 5% level.

The same authors have recently published further data (Glynn *et al.*, 1959). Using the same salivary anti-Le^a technique, they found a Le^a-positive incidence of 21.2% in 1,129 healthy schoolchildren as compared with 27.5% in 611 cases of rheumatic fever (significant at the 1% level). Similar results were obtained with *Ulex* extract, which tests directly for secretor status by showing the presence or absence of H-substance, this being present in the saliva and other body fluids in secretors of any of the ABO blood-groups. By the *Ulex* method, Glynn *et al.* (1959) found that 22.9% of 669 healthy schoolchildren were non-secretors and the comparable figure in 553 rheumatic fever cases was 28.9% (significant at the 2% level).

Glynn *et al.* (1956) gave details of the ABO blood-group distribution among patients and controls, and,