VISIT OF CANADIAN DOCTORS ASSOCIATED WITH TUBERCULOSIS.

On 23rd October 1928, the President—Sir Robert Philip—extended on behalf of the Society a hearty welcome to our Colonial colleagues.

The following Demonstrations and Papers were given and discussed:

EXHIBITION OF LARGE PARAFFIN SECTIONS OF LUNG.

Dr Agnes R. Macgregor said:—The demonstration on the table will perhaps be of interest to some of you because it illustrates a method of investigation which is coming to be more and more used now, but even yet is not employed as much as it probably will be in the future: that is to say, the use of really large sections cut in paraffin. The advantages of this method are very obvious, especially in any investigation which requires a study of the distribution of pathological change; and we have here a number of these large sections laid out illustrating various stages, types, and modes of spread of tuberculosis in the lungs of young children. The cases from which these sections were obtained were children in the Sick Children's Hospital here. The sections were cut in the Laboratory of the Royal College of Physicians. They are cut in paraffin and are of a thickness which is very little more than that of ordinary small paraffin sections. For this reason they are extremely helpful in an investigation of the morbid anatomy of pulmonary diseases in children, such as Dr M'Neil, Dr Alexander and myself have been carrying out; because not only are they very useful as naked-eye specimens, but also they are of such a quality that they can be examined in a detailed fashion under high powers of the microscope. There are seven cases, and sections extending in each case to a full lung are laid out on the table. Each case is accompanied by a card which gives a very short account of the clinical history of the case and a brief note of the principal pathological features of the section.
Standardisation of Tuberculin

THE STANDARDISATION OF TUBERCULIN.

Introductory Remarks by Lieut.-Col. A. G. M'Kendrick.—The desirability that tuberculins prepared at different laboratories should only be issued when they attain in strength to a suitable standard, has long been recognised; and recently, with the passing of the Therapeutic Substances Act, such a standardisation has become obligatory. The methods of standardisation are various—depending in the case of Koch's original method upon the lethal effect of tuberculin upon tuberculous guinea-pigs, and in the case of cutaneous methods upon the degree of reaction set up in tuberculous subjects. As one of the many and various undertakings of the Laboratory of the Royal College of Physicians is the preparation of tuberculin, its Curator, Sir Robert Philip, determined to examine the whole question of standardisation, and in particular to determine whether the operation could not be conveniently and accurately carried out on the human subject, who, after all, is the final recipient of the preparation. By using patients known to be sensitive, the time and organisation necessary for preliminary sensitisation is eliminated—a matter of great importance to the staff of a laboratory which has many commitments.

Professor T. J. Mackie, as adviser to the Board of Health in relation to the operation of the Therapeutic Substances Act, has co-operated in this investigation, and under his supervision Dr R. S. Begbie has carried out a parallel series of observations on guinea-pigs, whilst under the direction of Sir Robert Philip, Dr Donald Stewart has undertaken assays on human beings. Carrying out the test on human beings, it was found that as many as 24 observations could be made on one patient. In practice, a series of dilutions—usually six in number—of one tuberculin are applied to the skin of the forearm according to a method which will be described in detail by Dr Stewart. A similar series of dilutions of a standard tuberculin are applied to the other forearm. The diameters of the areas of reaction are measured—and so from measurements made in exactly the same way and on the same patient, quantitative comparisons of the two tuberculins are obtained. The individual observations give varying results, but by taking a sufficiently large number of these the mean result may be readily obtained and the error of the mean may be calculated. By making 30 observations
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with each tuberculin, 6 on each of five patients, the error proved in practice to be roughly about 10 per cent. The method has given consistent results. For example, in comparing a tuberculin A with the standard on a group of five individuals, the strength of the unknown was found to be 1.09 times the normal, with an error of about 5 per cent. In a second batch of five patients tested at a subsequent period, the reading was 1.05 with an error of about 3 per cent. Each of these strengths was deduced from 60 independent quantitative observations. From the fact that the area of the skin of the human subject is large, a comparatively small number of patients is required to obtain this degree of accuracy—and the reading of the results is a matter of comparative ease because of the fairness of the human epidermis.

STANDARDISATION OF TUBERCULIN BY MEANS OF THE CUTANEOUS TEST.

A Preliminary Communication from the Research Department of Southfield Sanatorium Colony, by Dr Donald Stewart.—The cutaneous reaction as described by Von Pirquet was used as the basis of all the following work. Before commencing any actual series of observations, several points had to be determined. It was necessary, first of all, to ascertain what types of reaction would be given in human beings when various strengths of the same tuberculin were applied to the arm. A tuberculin was therefore applied in the following strengths, diluted with sterile carbol-saline solution, 1/1, 1/2, 1/4, 1/8, 1/16, and 1/32, M’Neil’s modification* of the Von Pirquet method being used for the scarifications. It was found over a considerable number of patients that the degree of reaction was directly proportional to the concentration of the tuberculin, the more concentrated the tuberculin the greater being the degree. It was further found that the same tuberculin gave similar results in both arms of the same patient. And finally, after extensive trial, it was found that both the glycerine medium in which the pure tuberculin is made up, and the carbol-saline with which it was diluted, gave no reaction on the skin surface when applied per se.

* M’Neil, C., British Medical Journal, 1923, i., 673.
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In the first series of observations an unknown tuberculin was tested against a tuberculin of ascertained strength. Each tuberculin was applied to the flexor surface of the forearm of the selected patient—a known tuberculin reactor—in the above dilutions by M'Neil's method. Within six to ten hours definite reactions could be recognised, more or less circular in outline, concentric round the scarified area. The next problem that arose was the best way of recording each reaction. It was considered that the most accurate way to arrive at the degree of intensity of reaction was to measure its diameter. Accordingly the reactions were measured in millimetres both medio-laterally and proximo-distally at intervals of 12, 18, 24, 36, 48, 60, and 72 hours after application of the tuberculin. It was found in every one of the cases examined that the maximum reaction—that is the reaction when most clearly outlined against the white background of the patient's skin—was attained after the lapse of 48 hours, and that thereafter it tended to decrease in intensity. Accordingly, in the subsequent recording of results, the measurements were made 48 hours after the application of tuberculin.

In all the patients, careful watch was kept for forty-eight hours after the application of the tuberculin for the incidence of any focal and general reactions. In no case did any anxiety arise, and from that fact it was concluded that no reasonable objection could be raised to using human beings as the medium for further observations.

The early results were encouraging. In practically every instance the tuberculins gave reactions whose diameter was proportional to their concentrations as in the original cases. In the majority of the patients dilutions 1/16 and 1/32 gave very little or no reaction. It was possible therefore to compare one tuberculin with another, both being applied under the same conditions.

At this stage objections were raised on the ground that the scarified areas were not uniform in size and shape, and that therefore there must be some considerable degree of experimental error in the results. It was felt also that if the method was to be elaborated further, that is if more than twelve scarifications were to be made on the same patient, some method involving less time and less discomfort to the patient, and at the same time ensuring a more uniform degree of scarification, should be sought for.
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After extended experiment the following technique was evolved. A burr, somewhat after the fashion of that employed by a dentist, having a serrated circular end, three millimetres in diameter, was used for the scarifications (Fig. 1). After some little practice it was found that this produced a uniform circular scarified area (Fig. 2). By using the modified burr, each scarification could be made in a fraction of a second, and twenty-four such areas, which the later series entailed, along with the application of the tuberculin dilutions, could be completed within one or two minutes. After the scarifications had been made, one drop of the tuberculin was applied and allowed to dry on the skin. As before, readings were taken of the diameters after forty-eight hours had elapsed.

A definite technique having now been arrived at, it was felt that further series of observations should be made. A number of tuberculins, accordingly, all of unknown strength, were diluted as before, and compared with a known standard. It was found that three tuberculins and the standard could with ease and safety be compared in all the dilutions on the same patient. As before, the results were satisfactory, and readings were made without difficulty forty-eight hours after the original application.

As a result of these extended observations, it was found that there was a direct relationship between the area of reaction and the concentration of tuberculin applied. In estimating the strength of various samples, therefore, this relationship has been advantageously used.

Dr G. C. Anglin said—This communication has been of great interest to me. For some years at the Connaught Laboratory, which is associated with the University of Toronto, a considerable amount of tuberculin has been prepared, and for perhaps ten years Dr A. H. W. Caulfield, who is in charge, has been using a method of standardisation similar to what has been described by Dr Donald Stewart, but lacking certain advantages of the Edinburgh method. The method we have used has been an injection intradermally of \( \frac{1}{30} \) of a c.c. of a dilution of 1 in 400 of standard tuberculin (i.e. \( \frac{1}{20} \) mg.) and a similar amount of the tuberculin to be tested. After comparing reactions, the new tuberculin is diluted accordingly. We have found that method of considerable practical advantage, but I think the system of using varying dilutions might well be incorporated in ours. On the other
Standardisation of Tuberculin

Fig. 1.—The modified scarifier in use.

Fig. 2.—The result of scarification, showing the circular area as it appears on the arm before the application of tuberculin.
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hand, it seems to me that the intracutaneous injection has the advantage of accuracy of dosage which is necessary if results are to be compared.

Remarks by the President.—Sir Robert Philip said that the standardisation of tuberculin was a matter of scientific interest and practical importance. Various methods had already been proposed for the purpose. A recent Act passed in this country made a scheme of standardisation imperative. Certain conditions were laid down regarding the potency of tuberculins to be recognised for therapeutic purposes. The conditions were based on the results of inoculation in animals. It had occurred to him that, by means of the cutaneous reaction in man, a simpler and sounder method of standardisation might be reached. The test observations were harmless to the individual on whom the test was made, and the results of the observations were all the more significant and practically serviceable because of the subsequent therapeutic application of the substances to man. The reference in the Act was to observations based on inoculation of an animal. There could be little doubt that, for the purposes of the present harmless observations, man should be regarded as the best animal for the purpose. That was why the above investigation had been undertaken.

THE TRAVELLING DIAGNOSTIC CLINIC FOR DISEASES OF THE LUNGS.

By Dr G. C. BRINK, Toronto, Ontario.

The travelling clinic is a development of recent years. I believe that about twelve years ago what might be termed extension clinics were operated by one of the Welsh sanatoria. In 1923 the Department of Health of the Province of Ontario established a travelling diagnostic clinic.

The objects of such a clinic are:

I. To be of assistance to the general practitioner not in close proximity to a sanatorium or consultant in disease of the lungs, in the diagnosis of tuberculosis.

II. To educate the public indirectly through their physicians and in other ways, the importance of an understanding of tuberculous disease; that this disease may be prevented.
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and, if discovered early and given the proper treatment, cured.

III. To gather statistical and other information regarding the prevalence of the disease in the several districts of the province.

Organisation of Clinic Centres.—Varying factors in different districts make necessary different methods in the establishing of clinic centres.

Arrangements for organising and conducting the clinics are made with the co-operation of the practising physicians and the local boards of health in the various centres.

One of the staff from headquarters of the Provincial Department interviews the local medical officer of health and the president and secretary of the local or county medical association, and outlines to them the objects of the clinic and the methods under which it is conducted. If possible, the subject is discussed at the local or county medical association meeting. If this is not possible, a circular letter giving all the information about the clinic is sent to the medical association of the district. The acceptance of the clinic is left entirely with the physicians of the district, and a clinic is not established unless the physicians are in full accord.

The local board of health of any municipality accepting the clinic is expected to furnish accommodation—one to four rooms—one or two rooms for examination purposes, one for the dark room, and one for the X-ray apparatus. A corridor is usually used for the waiting-room; this is satisfactory, because never more than two patients are awaiting examination at one time.

The clinic is preferably held in a hospital. We try to encourage this, because it tends to make the hospital a clinic centre. If a hospital is not available, a hotel or some public building is utilised.

About one month prior to the visit of the clinic to a centre, a circular letter is sent out from the head office through the local medical officer of health, to every physician within the area. This letter contains information as to the location and time of the clinic, and gives the names of the physicians who will be present. The secretary of the medical society or the medical officer of health is given the task of allotting the appointments to the physicians. If for any reason this is not to be desired, our clinic nurse proceeds to the clinic centre
and secures from each physician his list of cases and allots to him the hours of appointments.

Staff and Equipment.—The staff of the clinic is composed of one or two physicians and a nurse. The equipment consists of a portable X-ray unit, including X-ray machine, upright cassette holder, portable dark room, clinical history forms, sputum specimen bottles, nightingales, and the necessaries for throat examinations and tuberculin tests.

We travel and transport all our equipment by railway.

The duration of a clinic varies from two to ten days. With one physician working, the examination of eight to ten adults or twelve to fourteen children is considered a full day’s work. Without a trained nurse this number of examinations would not be possible. She records the temperature, pulse, and weight, and when trained is competent to secure the greater part of the history, and take charge of the routine X-ray work, thus permitting the clinician more time for the examination of the patient and, if necessary, discussion of the case with the physician.

A good clinic nurse is invaluable in meeting women patients and preparing them for examination. She can also keep the work running smoothly.

Rules of Clinic.—No case is admitted to the clinic unless brought in or referred by a licensed physician. The physician is always welcomed and encouraged to be present at the examination. No information is given the patient when at the clinic. A detailed report is forwarded to the patient’s physician after the return of the clinic to headquarters, where the X-ray films are developed and all data correlated. X-ray films are taken on all cases. Tuberculin tests are carried out on all patients under 17 years of age and in many adult cases.

It was at first thought that examinations should be limited to early, moderately advanced, and contact cases. However, it was soon apparent that physicians should not be discouraged from bringing in advanced cases, because of the following reasons:

1. Pneumo-thorax treatment is indicated in many advanced cases, many of whom may be admitted to a sanatorium for the treatment.

2. The admission of an advanced case to a sanatorium removes the source of infection from the home and community.
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(3) The presence of an advanced case at the clinic affords an opportunity to get in touch with the contacts.

Literature published by the Canadian Tuberculosis Association is given only to cases in which the diagnosis is definite at the clinic or to present contacts. The information contained in this printed matter is of extreme value.

The question arises as to who should or should not be admitted to a travelling clinic. The location of the clinic centre will have much to do with the ruling made. It is apparent to all that if a clinic is being held in moderately close proximity to a city in which men have for years been spending time and money in training themselves in the diagnosis and treatment of tuberculosis, that it is most unfair to these physicians if people who are well able to pay a physician's and radiologist's fee should be given a free examination at the clinic. We have to leave the choosing of the patients entirely with the physicians. Where special advice is not within reasonable distance the above question does not exist. The large amount of the tuberculosis work in the past has been done by the physicians classed as chest consultants, and to whom every consideration should be given.

In reporting our cases, we follow this procedure.

The physician who examines the patient dictates the report, and if he is doubtful of the diagnosis, the case is held over for consultation. All reports are checked by the examining physician and one of his colleagues. If there is not an agreement as to diagnosis, or recommendation, a third physician is called in. The consultants and radiologists of Toronto have very kindly given us their opinions in our difficult cases. In this way we endeavour to give the referring physician the best opinion we are capable of giving.

We have twenty centres in the province we visit annually. Apart from these we endeavour to hold clinics in new centres. To date we have held over one hundred clinics and have visited sixty centres. Along with this, the clinic staff in co-operation with the Division of Industrial Hygiene has examined upward of two thousand miners in Northern Ontario, one hundred and fifty quarry workers, sixty cement workers, and seventy men engaged in our grain elevators for silicosis and tuberculosis.

I have records of only 3603 cases referred to our tuberculosis clinics. In all about 4500 have been examined. Of the 3603 cases 412 showed evidence of minimal tuberculosis, 254 of
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moderately advanced disease, and 150 were advanced cases. In the 816 tuberculous cases 522 were classified as having active disease and 294 as being quiescent, arrested, or apparently cured.

I think I am conservative when I say that the majority of the tuberculous cases were undiagnosed, before the examinations at the clinic. At least 80 per cent. of the minimal cases were undiscovered.

Unfortunately, I have not available the number of non-tuberculosis lung conditions found on those classified as undiagnosed.

The Results of the Clinic Service.—1. In centres over 5000 we have received cases from over 75 per cent. of the practising physicians—in towns under 5000 and in villages practically all the physicians refer cases.

2. We are noting that in repeat visits to any centre greater interest is being shown by the physicians in their tuberculous cases. More contacts and fewer unnecessary cases are being referred. We are frequently asked to give papers on the diagnosis of the disease. In fact we always carry a stock paper on clinical signs, and also one on the interpretation of X-ray films. I really believe some progress has been made as the result of these talks.

3. The public is apparently becoming more interested and alive to the methods of combating tuberculosis. Frequently physicians tell us when they bring in contacts that they are of the opinion that the contacts are in good health, but that the tuberculous parent has insisted on all the children being examined.

4. The work has shown the need of greater facilities—beds—for the tuberculous, and I hope will help in the obtaining of more sanatoria.

After four years' observation I can honestly say that I think the travelling clinic is a necessity in Canada in the control of tuberculosis. It is a definite link between the people, general practitioner, and the sanatorium.

Sir Robert Philip in his remarks of yesterday intimated that the general practitioner must be the greatest factor in any tuberculosis programme. We believe this to be true, and have and will continue to work entirely through the family physician.

I must not omit to mention that several of our sanatoria have or are conducting what is termed extension clinics; these
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Clinics are held in towns close by these institutions and are taken by a member of the staff. Their results have been exceedingly encouraging.

The X-ray equipment is transported in specially made boxes:

Box No. 1 contains—Control and reostat.

2 Transformer.

3 Accessories, such as tube arm, etc.

4 X-ray tube. Usually carried by one of the staff.

5 Cassettes.

6 Portable take down dark room.

7 Films.

8 Miscellaneous—gowns, nightingales, tuberculin syringe, towels, gauge, tongue depressors, etc.

9 Wire, etc.

Minimal equipment necessary:—(1) X-ray machine and tube; (2) cardboard holders and films; (3) box containing accessories—tuberculin, gowns, etc.

Dr W. T. Munro, Glenlomond, said—Doubtless everyone knows that it was from Scotland and under the inspiration of Sir Robert Philip, that the idea of the dispensary observation of tuberculosis arose. I question very much if Scotland has taken up the idea as it should. Other countries have found the system most serviceable, and we have just learned that the difficulty in Ontario is overcome by a travelling diagnostic clinic. My own county has no dispensary, and I turn down 25 per cent. of admissions every year as non-tuberculous. This fact alone shows the necessity of the dispensary. From it all information should proceed and to it all cases, suspects and contacts, should go. It is interesting to learn, too, that this diagnostic travelling clinic carries such a complete diagnostic outfit, and that popular lectures can be given. The Royal Victoria Trust and the National Association for the Prevention of Tuberculosis both see to the dissemination of knowledge of the disease, so that we have nothing to learn in that respect. But one does feel that the Board of Health might have pushed the idea of the dispensary more in Scotland, and if this were done and proper equipment provided, it would surely be possible to score off the active registers many cases wrongly accepted as tuberculous. Dr Brink has shown us how they have overcome the difficulty, and he is fortunate in being able to follow up his cases. There, again, those counties without a dispensary
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are at a disadvantage. Certain lecturers, such as Dr Williams, have been round the Highlands and got the people interested in the prevention of tuberculosis, so that aspect of the work is just as well done here as it is in the Colonies.

Dr Brink seemed able to follow up each case in a way that possibly we cannot or are not allowed to, because we seem to get always into water-tight compartments. One is appointed to the sanatorium and one's job is to deal with patients inside the sanatorium, and when they leave one has nothing further to do with them. The local authorities take charge of these patients and we have got to go through a little circuitous route to find out what the subsequent progress of the patient is.

I think it would not be out of place here to suggest that the Board of Health might look a little closer into the question of dispensaries in Scotland, and where these do not exist, insist on them, and insist on getting everything necessary to make a correct diagnosis. If this were done I have little doubt that a great number of cases would be scored off the active registers.

Sir Leslie Mackenzie said—I am very glad to have the opportunity of meeting our friends from Canada. I have been in their country and seen and realise the kind of problem that they are up against as contrasted with our own. Obviously the enormous distances that have to be traversed in Canada constitute an entirely different problem from ours. After twenty-two years I am glad to be able to say to you, Sir Robert Philip, and to say to this audience that it is a profound personal satisfaction to find that you are still maintaining the method of dealing with the huge problem of tuberculosis that you began about a life-time ago. I remember well in March 1888 an examiner with a brown beard and a charming manner and long brown hair who sat on one side of a bed while I stood at the other. It was a clinical examination. He was gracious enough to me, but I was able in the year 1906, the date of our Tuberculosis Circular and for two years before it, to answer the questions put to me in a way that was more satisfactory to Sir Robert Philip.

The Scottish Board of Health and the Local Government Board for Scotland, after two years' discussion and talk in which Sir Robert Philip played an important part, finally embodied in an official circular the whole scheme that had elaborated itself in his mind. We did a very original thing. We asked our Chairman to make a memorandum of his ideas, and so far as I am aware, for the first time in Scotland, a consultant's memorandum was incorporated in a public document and developed and extended in the scheme we wished to see adopted. That was in 1906. The essence of that scheme, the cardinal point round which everything turned, was the facilities for diagnosis.
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Sir Robert Philip elaborated the idea of the dispensary, and the essence of it was provision for diagnosis. Everything goes through the dispensary, and everything radiates from it. Taking it all over, considering the thick difficulties of every sort that faced this problem, the results do indicate some progress in the last twenty-two years. Whereas before there was not one single bed in any public health hospital, there are now between four and five thousand devoted entirely to the treatment of tuberculosis. A great advance! In all the populated places, the dispensary plays its effective part.

I was glad to hear Dr Munro speak, and I think it is always a good sign when a man has so much work to do that he complains that he cannot get outside his institution. Those of us who have been at Glenlomond know the fine work that Dr Munro has been doing, and what you have heard to-day is only the complaint of an active man that he cannot do more. But medicine is not confined to tuberculosis. In the administration of the medical profession itself, in the public medical profession and in the institutions that the local authorities are responsible for, I see constantly one thing gliding into another, and if an occasional wrong diagnosis brings a man under good treatment, it is all to the benefit to the community. Take it from the man's point of view: he goes into an efficient institution and can be treated there—it does not matter whether for tuberculosis or not—doctors may be the means of saving a human life, and that is just as important. When I was Medical Officer at Leith I always said to the resident medical men:—Make your diagnosis if you can, but you are not dealing here with disease; you are dealing with sick persons, and your problem is how to return that sick child to its father and mother so as to be fit for civil life. For diagnosis, post-mortem examination is just as good as bed-side examination. Put diagnosis out of your head and treat the sick person. We are responsible for disease.

We have not the same difficulties as are met with in Canada, but we have problems of our own, and I think it may be said that although the travelling clinic would certainly be a help say, in parts of the Highlands and Islands, on the whole we find that the dispensaries in existence are very useful and are doing very good work.
Pneumothorax Treatment

FIFTEEN YEARS OF PNEUMOTHORAX TREATMENT.

Dr W. B. Kendall, Gravenhurst, Ontario, gave an outline of his work in connection with this form of treatment of tuberculosis. His remarks were illustrated by statistical tables showing the results obtained. These tables are appended.

| TABLE I. |
|----------|
| Treated . . . . : 479 (of 100) | Per cent. | Complete compression : 37.0 | Partial satisfactory : 15.0 | Unsatisfactory : 25.5 |
| No compression . . . : 579 | |

| TABLE II. |
|-----------|
| Treatment. | No Compression. |
|------------|----------------|
| Apparent cure | Per cent. 5.5 | Per cent. 0.0 |
| Arrest | 11.0 | 2.5 |
| Apparent arrest | 10.5 | 2.0 |
| Quiescent | 10.0 | 1.0 |
| Improved | 21.0 | 16.0 |
| Unimproved | 6.0 | 21.5 |
| Died | 35.5 | 50.0 |

| TABLE III. |
|-----------|
| Improved, etc. | 58.5 | 28.5 |
| Unimproved | 41.5 | 71.5 |

| TABLE IV. |
|-----------|
| Therapeutic Compression. | Unsatisfactory and no Compression. |
|--------------|----------------|
| Apparent cure | Per cent. 7.0 | Per cent. 0.0 |
| Arrest | 13.5 | 3.0 |
| Apparent arrest | 12.0 | 1.5 |
| Quiescent | 13.0 | 5.5 |
| Improved | 20.5 | 19.0 |
| Unimproved | 6.0 | 15.5 |
| Died | 28.0 | 55.5 |

| TABLE V. |
|----------|
| Improved, etc. | 66.0 | 29.0 |
| Unimproved, etc. | 34.0 | 71.0 |

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## Pneumothorax Treatment

### TABLE VI.

| Condition          | Complete. | Partial. | Unsatisfactory. | No Compression. |
|--------------------|-----------|----------|-----------------|-----------------|
| Apparent cure      | 10.0%     | 5.0%     | 0.0%            | 0.0%            |
| Arrest             | 19.5%     | 10.0%    | 3.0%            | 2.5%            |
| Apparent arrest    | 19.5%     | 8.0%     | 3.0%            | 1.0%            |
| Quiescent          | 15.0%     | 11.5%    | 2.0%            | 9.0%            |
| Improved           | 10.0%     | 23.0%    | 6.0%            | 16.0%           |
| Unimproved         | 3.0%      | 8.0%     | 6.0%            | 21.5%           |
| Died               | 17.0%     | 34.5%    | 64.5%           | 50.0%           |

### TABLE VII.

| Condition          | Improved, etc. | Unimproved, etc. |
|--------------------|----------------|------------------|
|                     | 80.0%          | 57.5%            |
|                     | 20.0%          | 42.5%            |
|                     | 29.5%          | 70.5%            |
|                     | 28.5%          | 71.5%            |

### TABLE VIII.

| Condition          | Minimal. | Moderate. | Advanced. | All. |
|--------------------|----------|-----------|-----------|------|
|                    | Treated. | No Com-   | Treated.  | No Com-   | Treated.  | No Com-   | Treated.  | No Com-   |
|                    | Per cent.|  | per cent. |  | per cent. |  | per cent. |  | per cent. |  |
| Apparent cure      | 5.0%     | 0.0%      | 13.0%     | 4.0%     | 7.0%     | 2.0%     | 43.0%     | 2.0%     | 28.5%     |
| Arrest             | 14.0%    | 0.0%      | 12.0%     | 9.0%     | 14.0%    | 12.0%    | 53.0%     | 18.0%    | 50.0%     |
| Apparent arrest    | 19.0%    | 0.0%      | 11.0%     | 2.0%     | 8.0%     | 0.0%     | 20.0%     | 0.0%     | 9.0%      |
| Quiescent          | 14.0%    | 20.0%     | 12.0%     | 9.0%     | 7.0%     | 8.0%     | 16.0%     | 0.0%     | 16.0%     |
| Improved           | 24.0%    | 20.0%     | 7.0%      | 25.0%    | 4.0%     | 18.0%    | 21.5%     | 0.0%     | 21.5%     |
| Unimproved         | 5.0%     | 0.0%      | 27.0%     | 40.0%    | 53.0%    | 60.0%    | 50.0%     | 0.0%     | 50.0%     |
| Died               | 19.0%    | 60.0%     | 34.0%     | 65.0%    | 43.0%    | 22.0%    | 28.5%     | 0.0%     | 28.5%     |

### TABLE IX.

| Condition          | Improved, etc. | Unimproved |
|--------------------|----------------|------------|
|                     | 76.0%          | 56.0%      |
|                     | 40.0%          | 34.0%      |
|                     | 66.0%          | 65.0%      |
|                     | 35.0%          | 57.0%      |
|                     | 43.0%          | 22.0%      |
|                     | 28.5%          | 71.5%      |

### TABLE X.

| Condition          | Light. | Moderate. | Severe. | All. |
|--------------------|--------|-----------|---------|------|
|                    | Treated. | No Com-   | Treated. | No Com-   | Treated.  | No Com-   | Treated.  | No Com-   |
|                    | Per cent.|  | per cent. |  | per cent. |  | per cent. |  | per cent. |  |
| Apparent cure      | 6.0%    | 0.0%      | 3.5%    | 0.0%    | 10.0%    | 0.0%     | 42.0%    | 0.0%     | 28.5%     |
| Arrest             | 16.0%   | 4.0%      | 10.5%   | 2.5%    | 6.0%     | 0.0%     | 12.0%    | 0.0%     | 12.0%     |
| Apparent arrest    | 14.0%   | 8.0%      | 10.0%   | 1.5%    | 4.0%     | 0.0%     | 20.0%    | 0.0%     | 20.0%     |
| Quiescent          | 10.5%   | 8.0%      | 12.0%   | 10.0%   | 4.0%     | 0.0%     | 6.0%     | 0.0%     | 6.0%      |
| Improved           | 20.0%   | 32.0%     | 22.5%   | 13.0%   | 18.0%    | 6.0%     | 16.0%    | 0.0%     | 16.0%     |
| Unimproved         | 6.0%    | 20.0%     | 5.0%    | 23.0%   | 6.0%     | 17.5%    | 21.5%    | 0.0%     | 21.5%     |
| Died               | 27.5%   | 35.5%     | 35.5%   | 50.0%   | 52.0%    | 70.5%    | 50.0%    | 0.0%     | 50.0%     |

### TABLE XI.

| Condition          | Improved, etc. | Unimproved |
|--------------------|----------------|------------|
|                     | 66.5%          | 58.5%      |
|                     | 44.0%          | 73.0%      |
|                     | 58.0%          | 88.0%      |
|                     | 27.0%          | 58.0%      |
|                     | 12.0%          | 71.5%      |
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### TABLE XII.

|                  | Treated. | No Compression. |
|------------------|----------|-----------------|
|                  | Unilateral. | Per cent. | Bilateral. | Per cent. | Unilateral. | Per cent. | Bilateral. | Per cent. |
| Cured            | 5·0       | 6·0           |            |            |            |            |            | 0·0       |
| Arrested         | 15·0      | 7·5           |            |            | 4·0        | 1·5        |            | 0·0       |
| Apparent arrest  | 12·0      | 8·5           |            |            | 2·0        | 0·0        |            |           |
| Quiescent        | 12·5      | 8·0           |            |            | 8·5        | 9·5        |            |           |
| Improved         | 22·0      | 20·0          |            |            | 16·5       | 15·5       |            |           |
| Unimproved       | 6·0       | 5·0           |            |            | 25·0       | 19·0       |            |           |
| Died             | 27·5      | 44·0          |            |            | 44·0       | 54·5       |            |           |

### TABLE XIII.

|                |                |
|----------------|----------------|
| Improved, etc. | 66·5           |
| Unimproved     | 33·5           |

### TABLE XIV.

|                  | National Sanatorium. | Rivière's Summary. |
|------------------|----------------------|---------------------|
|                  | All Cases Treated. | Complete and Partial Satisfactory. | American. | European. |
|                  | Per cent. | Per cent. | Per cent. | Per cent. |
| Arrested         | 16·5      | 20·5       | 10·9      | 16·1 |
| Quiescent        | 21·0      | 25·0       | 10·8      | 9·8 |
| Improved         | 21·0      | 20·5       | 29·2      | 31·2 |
| Unimproved and died | 41·5  | 34·0       | 49·1      | 42·9 |

### TABLE XV.

|                |                |
|----------------|----------------|
| Improved, etc. | 58·5           |
| Unimproved and died | 41·5  |

Dr Cameron, East Fortune, said—The percentage of cases that are suitable for pneumothorax treatment is comparatively small, and it depends on the state of the patient when he comes to the sanatorium. We get cases in the sanatorium which appear to be on ordinary physical grounds suitable for pneumothorax treatment, and we find by examination that the disease is confined to one lung with the other lung functioning. What does Dr Kendall consider is the recognised period during which a patient should be treated before resorting to the induction of artificial pneumothorax? If a patient does not improve under the ordinary sanatorium treatment at the end of three months, and is a suitable case for pneumothorax treatment, then I think the
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treatment should be instituted. Some patients refuse the treatment, and at a later period begin to improve and finally reach a period of quiescence of the disease. When you have the experience of that happening in cases which are theoretically suitable, you ask yourself what percentage of cases which have had the treatment would finally reach that stage without the treatment having been induced.

2. What does Dr Kendall consider the ideal time during which pneumothorax treatment should be carried out? It is said to be two or three years, but some results have been very disappointing when the patient stopped treatment at the end of that period, and others have been very favourable when treatment has been stopped at an earlier period.

3. I should like to hear the results of Dr Kendall’s partial pneumothorax cases. It has been my experience that results are disappointing when a partial pneumothorax is induced, but one is surprised to find that a partial pneumothorax sometimes seems to exercise a degree of compression which culminates in an extremely gratifying result.

4. The question of complications in pneumothorax treatment. I have never had any sudden complications, and I think if one takes care that these do not happen very often nowadays; but a complication which may occur is the chance of pleural effusion taking place. In many of these cases the effusion becomes purulent. Tuberculous pus is formed, and I have three cases on hand just now when this pus has been aspirated for long periods and refills been given, but the pus is full of T.B. Has Dr Kendall had much experience of that complication, and what are the final results in these patients?

5. I should like to know what is the future life of patients who have undergone successful pneumothorax treatment. What is the average duration of life?

_Dr W. B. Kendall_ said, in reply—Dr Cameron asked how long patients should be kept in residence before compression should be attempted. My reply is that it is quite impossible to state, as each case must be individualised. In an acute case of, say, a pneumonic type, I would certainly attempt compression at once, as also in a complication such as a pulmonary haemorrhage.

How long should pneumothorax be carried on? No definite time can be stated, this again depending on the patient. I have a physician on my staff who has had refills for a period of nine years, and he states that he will take refills as long as I am willing to give them to him.

As to completeness or incompleteness, this is obvious. If complete, the result is much more satisfactory than if only partial.

As to the use of X-ray equipment, our first seventy-five cases were done before we had X-ray equipment. In my judgment, the X-ray is not imperative, but it is of course of very great value.
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As regards complications, when in London I listened to some Papers on this subject. One physician spoke of the procedure as being the mere prick of a needle: the time for refilling was but ten minutes, and the patient was then able to return to his work in the garden. In contrast to this, another physician spoke of having put gas in the pericardial space and again in the stomach, and stated that he had had several cases of pleural shock and two casualties. I wish to impress on my hearers at this Edinburgh meeting that the procedure should be given its due as a surgical measure—even if done by physicians. Some patients might refuse treatment; while I have had others who shed tears because they were not able to take it. Fluid in the pleural space can be treated with equanimity. My figures state how many cases we had with fluid and how many of these developed empyemas. We have had twenty thoracoplasties cases done by one surgeon, and fourteen of this number are again at their work. This surgeon has gone through a hundred cases and, so far as I know, he has not had one casualty.

A STUDY OF THE EPIDEMIOLOGY OF TUBERCULOSIS IN A PRIMITIVE PEOPLE.

By Dr R. G. FERGUSON, Fort Qu'Appelle, Saskatchewan.

This paper was an abstract of a report on the investigation being carried out by the National Research Council of Canada on Tuberculosis among the Indians of the great Canadian Plains. The summary and conclusions of the paper, which has been published in full, are as follows:

Summary.—1. Sporadic cases of tuberculosis among the Plains Indians were observed after 1858, but cases of tuberculosis were of rare occurrence until the early 'seventies.

2. About 1884 tuberculosis became so common among the Indians that it assumed the proportions of a serious epidemic which, around the Qu'Appelle Valley, reached its height between this date and 1890. In Alberta, among the Blackfeet, it did not reach its maximum until 1902. After the acute phase, which lasted less than two decades, the epidemic gradually subsided and the number of deaths has slowly decreased, but even now, after forty-four years, the tuberculosis death-rate among the Plains Indians as a whole is about 800 per 100,000, or nearly twenty times that of the surrounding white population.

3. All varieties of disease existed during the epidemic—
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glandular, pulmonary, osseous, and meningeal. Adenitis was the most impressive type in the acute stage, when it affected all ages. In 1906 at the Qu'Appelle School, 19.5 per cent. were operated on for glands. During the first twenty-five years of the epidemic, physicians report one out of three to have been suffering from tuberculous adenitis. Pulmonary tuberculosis was by far the most common fatal form.

Among the children who are the third generation to be affected by the epidemic, glandular tuberculosis is becoming rare. Among 500 school and pre-school children examined, just over 3 per cent. had tuberculous glands.

4. During the first two decades of the epidemic the prevalent type of disease was very acute, frequently terminating in a few months or even weeks. Many cases, despite acute onset, developed into chronic type and recovered.

5. During the acute phase all ages were affected, but the highest mortality existed among children, and the age of maximum fatal susceptibility from 1886 to 1906 was under 5 years. During the next twenty years, the period of subsidence, the age of maximum fatal susceptibility had shifted to late childhood—between the ages of 10 and 15.

6. The first generation of the epidemic, or generation of adult infection, suffered severely, 26.86 per cent. falling victims to the disease. The second generation, or generation of childhood infection, sustained a greater loss from the disease, 32.7 per cent. having died from tuberculosis. The third generation, whose parents were tuberculised before fecundity, might be said to have been conceived in tuberculosis. 20.46 per cent. of these have died to date from tuberculosis. Considering the years of young adult life with high mortality through which they must yet pass, it is calculated, according to the mortality by age for the last two decades, that this percentage will be increased to 22.6 before the age of 40 is reached.

7. A study of 147 families on the Qu'Appelle and File Hills Reserves, traced through three generations, showed that only one family had succumbed to tuberculosis alone. Five families with the exception of aged grandparents have succumbed to tuberculosis alone. Only three families have passed through three generations without recorded deaths from tuberculosis. These three families have lost heavily from other illnesses, and the number of their members now living is 20, out of a total number living of 239, so that their contribution towards the
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Propagation of the tribe has been limited. Among the remaining families 69 have died out, tuberculosis being a factor, the average percentage dying of tuberculosis being 31.37.

Among the 60 who have survived, the average death-rate from tuberculosis has been 18.7 per cent. From this it would appear that those eliminated were non-resistant to disease generally, rather than lacking resistance to tuberculosis only.

8. Comparing the morbidity from tuberculosis among full-blood Indian school-children with the morbidity of those having a cross of white blood, no appreciable difference was observed in the number with demonstrable lesions; but when on the reservation the mortality from tuberculosis among the full bloods was compared with the mortality among the crosses, it was found that the infusion of white blood noticeably increased the resistance of the offspring against fatality, the percentage being 19.92 among the full bloods as compared with 12.5 per cent. among the crosses.

9. The morbidity among survivors is of interest:

|          | Active. |         | Inactive. |
|----------|---------|---------|-----------|
|          | Lungs.  | Glands. | Lungs.    | Glands.  |
| Grandparents |        | 2.8     | 22.72     | 12.00    |
| Parents    | ...     | ...     | 6.60      | 3.30     |
| School-children | 7.1     | 3.7     | 4.08      | 0.90     |
| Pre-school children | 0.9     |          |           |          |

10. On admission to the school at an average age of 7.6 years, just over 60 per cent. were sensitive to tuberculin. At 11 years of age over 96 per cent. were sensitive to tuberculin, and this percentage was maintained until 15 years of age, after which there was a slight reduction in percentage of those reacting positive to tuberculin. The average incidence of infection among 374 children at an average age of 12.4 as indicated by tuberculin sensitiveness was 92.24 per cent.

11. The type of disease developing among fifteen school...
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children under observation from 1st June 1926 to 1928 falls sharply into two varieties:—

First, type among the more resistant, found in eleven children who responded to disease by localising a minimal lesion.

Second, type among the less resistant group of four children, among whom disease proved fatal within a few months.

Those who fall into this second group probably would not respond to rest and hygienic conditions, and it would appear that they will require prophylactic immunisation if they are to survive.

Conclusions.—1. The Indians of the Plains are universally tuberculised. The epidemic is now on the wane. The mortality is still twenty times that of the surrounding white population.

2. There has been no loss of infectiveness, as seen from the fact that over 90 per cent. of the school-children react positive to tuberculin.

3. There has been no apparent loss of virulence, as shown by the fact that three out of four deaths among a group of 15 cases of recent infections occurred within five months from the time they had been examined and found to have had no active disease.

Until recently the Plains Indians have consumed little milk or milk products. Their cattle are more or less tuberculised. 7 per cent. reactors were found at File Hills, one of the reserves under investigation.

4. The type of germ, so far as indicated by typing of 15 specimens of glandular material, is human.

5. The type of disease among the survivors still falls into two distinct classes with widely varying resistance:

First, running rapidly fatal course.

Second, reacting well with localised pulmonary or glandular lesions, and in no way differing from white children. Among these Indians this appears to be an individual trait, rather than family or generation trait.

6. Among the bands studied, survival was assured to family trees, which were more prolific and more resistant to white man's diseases in general rather than to those naturally resistant to tuberculosis.

In the process of civilisation just over every second family tree has died out within three generations. Among the
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families eliminated, 31 per cent. died of tuberculosis compared with 19 per cent. among families which have survived.

Family resistance to tuberculosis was found to vary in degree, but practically all families suffered from the disease. The exceptions (those apparently naturally resistant), as also those susceptible to the extent of extermination by this disease alone were unimportant.

7. Resistance to tuberculosis appears to far outshadow any effect of predisposing factors, such as food, housing, and sanitation, in survival and in recession of the epidemic.

8. Among the predisposing factors the effect of acute epidemic diseases, such as pertussis, measles, and influenza, appear to be of first importance. Food would appear to be a modifying factor; housing less important.

Sanitation and personal cleanliness have not yet attained a position where they modify infectivity as shown by the tuberculin test.

That the combination of good food, housing, and sanitation does have a noticeable effect upon morbidity has been observed in the health of children in schools of varying hygienic status. Its effect on mortality from tuberculosis is evident. When comparing the File Hills Demonstration Colony with the adjacent Reserve, it was found that 14 per cent. of the third generation of the Colony have died from tuberculosis as compared with 21 per cent. of the same generation on the Reserve.

9. The effect of rest and general hygienic treatment on recovery and mortality of the resistant type has been demonstrated by results under sanatorium treatment. The resistant type of Indian children respond approximately as well as do the white children.

10. Infusion of white blood by crossing has been shown to have conferred increased resistance. It has not decreased morbidity, but it has reduced mortality.

11. The resistance produced through one generation of sensitisation by uncontrolled infection appears to be limited. The increase in resistance, as indicated by present and probable mortality among the third or more sensitised generation compared with the second generation or generation of childhood infection on virgin soil, forces this contention.
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12. The processes by which the resistance of the Plains Indians to tuberculosis has been increased are manifold.

(i) The elimination of the weak and non-resistant. Among the families surviving the epidemic, 18.7 per cent. have died of tuberculosis compared with 31.37 per cent. among those families which have succumbed.

(ii) Infusion of more resistant white blood by crossing. A mortality of 19.92 per cent. among full bloods compared with 12.5 per cent. among the crosses.

(iii) Sensitisation of soil evident in the third generation. A mortality of 28 per cent. in second generation compared with 22 per cent. in the third.

(iv) Improved living conditions in the widest sense. A mortality of 14 per cent. on the Demonstration Colony compared with 21 per cent. on the average reservation.

13. From a comparative study of the mortality from tuberculosis of the sexes by age-groups during the two decades 1906 to 1926, it was found that child-bearing had no appreciable effect on the resistance of the females to this disease.

14. After three generations of tuberculisation the surviving Indians are biologically strong. The birth-rate has been maintained, and the infants at birth are well nourished and strong.

Discussion.

Sir Robert Philip asked what determined this big epidemic. Was there a sudden access to relationship between the Red Indians and the civilised men at that period, or what were the influential causes in the matter?

Dr Ferguson replied — The Indians of Western Canada had occasional contact with traders from 1738 down to 1860. During this period these Indians resorted, at certain times in the year, to adjacent trading posts outside the plains for the purpose of trading; but since the Indians of the plains had few valuable furs, and because they were very hostile to the invasion of traders, permanent posts were not maintained in their midst. About 1840 missions were established on the watercourses surrounding the plains, but the missionaries, during the first two decades, had very little contact with the Plains Indians. About 1860 the missions invaded the plains and afforded additional contact. Following the massacre of whites in Minnesota by the
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Sioux Indians in the early 'sixties, many of these Indians already tuberculised escaped to Canada and invaded the territory of the Plains Indians who, up to that time, had suffered very little from tuberculosis. About the same time the half-breeds on Red River, who were at that time highly tuberculised, were given access to the plains. They spread out among the Indians, carried on as free traders, and constituted a serious source of infection.

In 1878 and 1879 the white settlers began to come in, and by 1882 the Indian Reserves were surrounded by white settlers. Then came the education of Indian children. In 1884 boarding schools were established for the education of these Indians, and large numbers of them were concentrated in these schools. Those who were not infected on admission to school were tuberculised very soon afterwards. In the records of the schools it was discovered that in one year 13 deaths from tuberculosis occurred among an attendance of 200 children.

A careful study of the early literature referable to the western plains, together with the knowledge of the general death-rate derived from treaty payment records convinces one that tuberculosis was not common as a cause of death among these Indians until about 1882. By 1886 there was a tremendously acute epidemic; after 1890 the epidemic began to subside and went down fairly rapidly until about 1908. Since 1908 it has subsided very slowly.

When asked if there was any relationship between this epidemic and the alteration in the flesh-feeding habits of the Indians, Dr Ferguson said—What we consider predisposing causes is a complicated question. Intercurrent epidemics as were shown on the screen had a very unfavourable effect on the mortality from tuberculosis. Food was found to be an important factor. At the time of the onset of this epidemic the food of the Indians was radically changed. They had lived almost entirely on the flesh of the buffalo. When the buffalo were exterminated in 1879 they went on to rations, first of all, which consisted of cured meat and flour and tea. Later that was supplemented by fresh beef, and from then there was a gradual improvement in the food. Now a few of them are milking cows, but the improvement has come slowly. The Indians used to have good teeth and there was no evidence of malnutrition; but the first generation that lived on this particular diet had hypoplasia of the teeth, and there was evidence of rickets about as common as among white children. The housing, too, was changed and became very bad; but before improvement began the general death-rate fell steadily, so that housing in itself was not an essential factor. So far as food is concerned, several tribes of Indians in Northern Saskatchewan had maintained their original food, and yet the epidemic went on about the same.
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There was an epidemic, and the importance of the epidemic far out-shadowed the importance of any one predisposing factor. When taking predisposing factors altogether, it was found that improvement of the general living conditions was an important factor in reducing mortality.

Colonel Greig said—The Society greatly appreciates the exceedingly valuable communication which Dr. Ferguson has made, and we express our thanks very sincerely to him for giving us this extremely interesting record of his observations. I think, as Sir Robert Philip said, that such observations offer a key to the solution of many problems in disease, for by studying the reaction of disease in different communities living under different conditions a great deal has been done in the elucidation of the problems of disease, apart from tuberculosis.

We have been told a very interesting observation by Dr. Ferguson, namely, that the Indians of Saskatchewan take very little milk, yet they suffer very markedly from glandular infection. That infection is generally associated with the bovine type of tuberculosis; but infection of glands is probably really largely of human type. In Dr. Ferguson’s investigation one can exclude very largely milk infection. In India and in China bovine tuberculosis is comparatively rare. In Saskatchewan, while the cattle are infected with tuberculosis the black population is not consuming the infected milk.

The question of resistance of the population to disease is very important in regard to the problem of immunity; it is a complex question involving many factors, as Dr. Ferguson showed. The comparison of disease incidence in white and black populations offers a method of investigation almost the same in value as a laboratory study in animals, and is, perhaps, better, because it is not always safe to translate literally the observations on animals to man. Here you are making comparative observations on groups of human beings, and so are able to compare on a large scale their reaction to disease, a method which affords valuable help in the elucidation of such problems.