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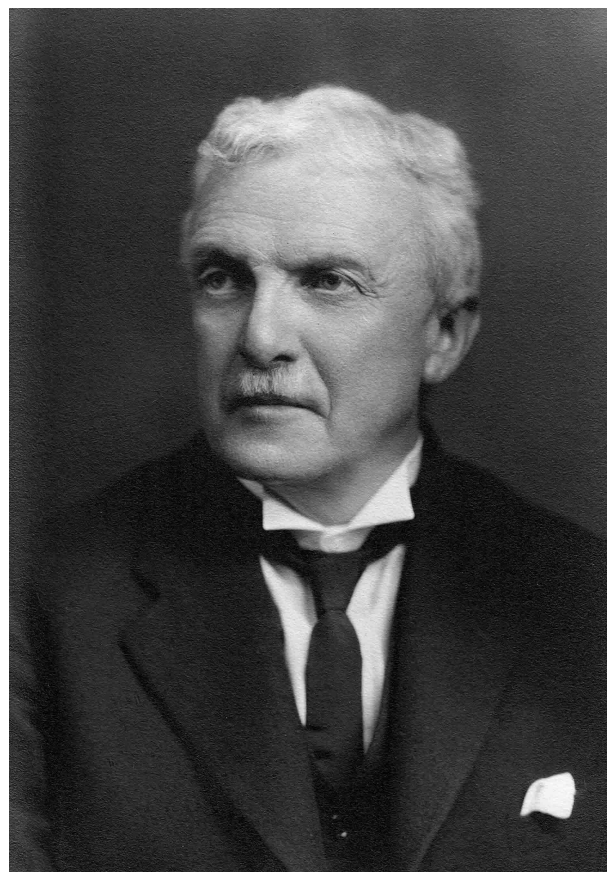
THE USE AND MISUSE OF TUBERCULIN IN THE TREATMENT OF PULMONARY TUBERCULOSIS

In 1890 Professor Koch, who had discovered the tubercle bacillus in 1882, announced that he had discovered a remedy for tuberculosis in tuberculin, made by growing virulent tubercle bacilli in a 5 per cent, glycerol broth medium for six to eight weeks at 38°C., the mature culture being sterilised in a water bath at 100°C., evaporated to one-tenth of its original volume, and filtered. The filtrate, which contains about 40 per cent, of glycerol, is known as tuberculin. It is labelled as T. (human) or P.T. (bovine), according as the bacilli used in its manufacture are of the human or bovine variety.

At first I got my tuberculin from the German firm who made tuberculin for Koch. But after war broke out in 1914 this was no longer obtainable, and I got it from Burroughs, Wellcome & Co., and could detect no difference between theirs and that made in Germany.

Not many of those present can remember, as I do, the excitement that was caused by Koch's announcement in 1890. At first the supply of tuberculin was limited, and anyone who wanted tuberculin treatment had to go to Germany for it. In 1891 wealthy patients from all over the British Isles, Belfast included, paid their doctors to accompany them to Germany. Some of these patients were so far through that they died on the outward journey, some in Germany, and some on the homeward journey. Koch had experimented on guinea-pigs, and found that these animals, when injected with a lethal dose of tubercle bacilli, lived much longer than otherwise if they got injections of tuberculin. But there had not been sufficient experience showing the proper dosage and intervals, and that tuberculin should not be given to febrile patients. Altogether, the doctors who went with patients to Germany in 1891 came back so disappointed with the results of tuberculin treatment, that no one seems to have thought of using it in this country till 1910, when it was introduced by W. Camac Wilkinson.

Camac Wilkinson was a native of Sydney,



Australia. After graduating with honours in Arts in Sydney University, he came to London to study medicine, and graduated M.B.Lond. in 1882, with first-class honours in medicine, gaining a scholarship and a gold medal. He proceeded M.D. two years later, and did postgraduate work at Strasbourg and Vienna. While on the Continent he became an ardent admirer of Koch. He was elected F.R.C.P.Eng. in 1902. He then returned to Sydney, and held hospital appointments and a lectureship in medicine and pathology, and gained experience in using tuberculin. In 1909 the Royal College of Physicians, London, awarded him the Weber-Parkes prize for the best essay on a subject connected with tuberculosis. The title of his essay was "Tuberculin in the Diagnosis and Treatment of Tuberculosis." This essay was published, with additions, in book form in 1912. Camac Wilkinson died in London last February, aged 88.

It was through one of his pupils that I became interested in tuberculin. This was Dr. Hilda Clarke, who opened a tuberculin dispensary in 1911, under

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the auspices of Portsmouth Borough Council. Dr. Hilda Clarke had become interested through her sister having recovered from pulmonary tuberculosis under tuberculin treatment given by Camac Wilkinson. In 1915 Dr. Hilda Clarke published a book entitled "Dispensary Treatment of Pulmonary Tuberculosis."

About thirteen years ago I was in Cardiff attending a medical meeting, and called on Professor Tytler, and tried to interest him in tuberculin treatment, but without success. He gave as his reason that he did not understand how tuberculin acted, whereas he could see the reason for collapse treatment. I told him I was getting as good results from tuberculin treatment as were got by collapse methods. But he was not interested. This reminds me of a story told of Rev. W. P. Nicholson when he was conducting a mission in Belfast about twenty years ago. To a man who said, "I can't believe anything I don't understand," Nicholson replied, "Do you understand how a red cow eats green grass and turns it into white milk?" And a Greater than Nicholson has said, "By their fruits ye shall know them." There are many things that we use every day that we do not fully understand. Men used light long before the wave theory was thought of by any of them.

There is, however, a very good working hypothesis of how tuberculin acts, the Wolff-Eisner theory. To lead up to this let us first consider certain phenomena which are easily verified. In the case of some persons who are suffering from tuberculosis, the subcutaneous injection of a minute quantity of tuberculin, say .0000001 c.c., or less even, is followed, after an incubation period varying from a few hours to two or three days, by some or all of the following reactions :-

1. *Local reaction* – Indicated by redness, swelling and pain round about the site of inoculation.
2. *General reaction* – Indicated by impairment of the patient's sense of well being, loss of appetite and of weight, and increase of pulse-rate.
3. *Temperature reaction* – Indicated, when slight, by a diminution in the daily range of the patient's temperature, commonly called "flattening of the temperature chart," or by a rise of temperature not exceeding 99°F. Any greater temperature reaction I call "febrile reaction."
4. *Focal reaction* – i.e., hyperaemia at the site of disease, with increase of discharge, if any. Hyperaemia is readily observed in cases where the lesion is in the skin. In pulmonary cases focal reactions, when sufficiently great, can be recognised by increase in the quantity of sputum.

If the reactions have not been too great, the indications of local and temperature reactions disappear in a day or two, and those of general and focal reactions may become reversed, the patient feeling better than before he got the injection, the appetite being improved, the weight increased, and the pulse-rate diminished.

In the case of other persons who are suffering from tuberculosis, however, the injection of so small a quantity of tuberculin may be followed by none of these reactions, in order to produce which, the dose may have to be multiplied hundreds or thousands or myriads of times; but the reactions can be produced by giving a sufficiently large dose.

Further, it is found that the condition of this latter class of persons in regard to tuberculin can be brought about artificially, in the case of the former class, by the administration of gradually increasing doses given at suitable intervals, the amount of tuberculin that can be tolerated being thus gradually increased. This gradually increasing tolerance of tuberculin can be produced by doses slightly less than would produce local or febrile reactions, as well as, or even better than, by doses producing the same.

TOXIN THEORY.

All the above phenomena, as to which observers are agreed, point to the action of a toxin; a toxin being a poisonous substance requiring an incubation period before it manifests itself, and bringing about, when introduced into the body of an animal in non-lethal doses, the production of a body that is an antidote to itself, called its anti-toxin. Whatever degree of tolerance of tuberculin is possessed by a person who has suffered from tuberculosis, may be attributed to the presence of anti-toxin in his tissues, produced as the result of previous inoculations of tuberculin, either administered artificially or admitted to the circulatory system from the patient's own lesion.

MODIFICATION OF TOXIN THEORY REQUIRED.

But now another curious fact has to be considered, viz., that in the case of persons who have never suffered from tuberculosis, large quantities of tuberculin, say, .01 c.c., or more, can be injected subcutaneously without producing any apparent reaction. Now it is contrary to experience to find the presence of antitoxin in the body, unless the anti-toxin has been either artificially bestowed or produced in response to the stimulus of the corresponding toxin.

WOLFF-EISNER THEORY.

It is therefore reasonable to conclude that tuberculin does not itself contain the toxin which

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produces the local, general, febrile, and focal reactions that may follow its administration; but that there is, in the tissues of persons who have suffered from tuberculosis, some substance which, by reacting with something in the tuberculin, produces the toxin. Such substance, called by Wolff and Eisner tuberculo-lysin, we shall for convenience call lysin.

The fact that test doses of tuberculin have never, so far as I know, proved lethal, helps to confirm this theory. On one occasion I gave a patient a first test dose, T. .0002 c.c., which caused a sharp febrile reaction, the temperature going up to 102°F. A fortnight later the first treatment dose, P.T..0000001 c.c., was given, and was followed by a reaction almost as great, the temperature rising to 101 °F. T. is five to ten times as strong as P.T., so that the test dose was at least 10,000 times as strong as the one that produced almost as great reaction. If the toxin were ready-made in the tuberculin, one would expect that in a patient so sensitive that the smaller dose produced so much reaction, a dose 10,000 times as great would have killed him. But the fact that he was not even seriously injured is simply explained by the Wolff-Eisner theory, according to which the amount of lysin present sets a limit to the amount of toxin that can be produced from any dose of tuberculin, however great.

Further confirmation of the Wolff-Eisner theory may be derived from another consideration. It is well known that toxins are, as a class, thermolabile, i.e., they are easily altered by heat so as to lose their toxicity, a temperature of 60°C. being usually sufficient for the purpose. Now, in the preparation of tuberculin it is subjected to the heating effect of steam at a 100°C. for an hour, and yet toxic effects result from its administration, which confirms the view that the toxin is not ready-made at the time of the heating.

FACTORS TO BE CONSIDERED IN THE ADMINISTRATION OF TUBERCULIN.

In administering tuberculin, then, we should take into account the following factors :-

1. The tuberculin, which can be measured. The essential ingredient, whatever it be, will be in proportion to the quantity of tuberculin used, so long as one variety of tuberculin is adhered to.
2. The lysin present in the patient's tissues.
3. The anti-toxin present in the patient's tissues.

The quantities of the last two can be estimated only indirectly, by comparison with the amount of tuberculin used, and observation of the effects produced.

The total toxin produced from a given dose of

tuberculin will be the equivalent of the tuberculin or of the lysin, whichever be the less. Obviously it cannot be greater than either.

The free toxin produced will be the equivalent of the total toxin minus the antitoxin, if this be a positive quantity. Otherwise there will be no free toxin.

TOO LARGE DOSES.

The maximum reactions will be obtained from the dose of tuberculin which is equivalent to the lysin present, the free toxin available for producing reactions being in this case the equivalent of lysin minus anti-toxin. If the dose of tuberculin be in excess of the lysin, no greater reactions will be produced, and the excess of tuberculin is apparently eliminated in a few days. But in this case the operator has no control over events, as the effects produced do not depend on the only item that he can regulate, viz., the dose of tuberculin.

HYPERSENSITIVENESS.

We are now in a position to give a simple explanation of a condition of affairs which has been a puzzle to many workers. A certain dose of tuberculin having been given, and a febrile reaction produced, the same dose is repeated, and a greater febrile reaction follows. It may be repeated again and again with increasing reactions. This state of affairs has been attributed to hypersensitiveness on the part of the patient. But the proper inference is, not that there is anything abnormal on the part of the patient, but that the dose of tuberculin is in excess of the lysin, and that the latter has increased, as the result of each injection, faster than the anti-toxin.

If one persists, as some workers have done, in repeating the same dose, it may happen that the lysin will increase till it is greater than the equivalent of the dose of tuberculin, after which the total toxin produced by each dose will no longer increase, and the anti-toxin increasing with each dose, the free toxin will now grow less with each dose, till it is no longer able to produce reactions. But it is not a wise procedure, as the severe reactions which may result from it may be harmful. It is better to follow this rule :- *If a certain dose be followed by a febrile reaction, and its repetition by a greater reaction, reduce the dose.*

TOO SMALL DOSES.

If the dose of tuberculin be less than the equivalent of the anti-toxin present, no free toxin will result, and, of course, no reactions, nor any stimulus toward healing of the lesion. But the patient will not be in statu quo ante. For a portion of his lysin and anti-toxin will have been used up, without the liberation of any free toxin to act as a stimulus toward producing more of these substances; thus rendering

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him liable to have reactions from smaller doses than before. This explains how it is that in Bardswell's words, "By the frequent repetition of a dose of moderate amount, intolerance, or hypersensitiveness, as the condition is usually termed, is actually encouraged."

USEFUL DOSES.

We thus see that at any particular time in a patient's history there are certain rather narrow limits within which the dose of tuberculin, to be of benefit, must lie. It should exceed the equivalent of the patient's anti-toxin, otherwise there will be no useful stimulus from it; and it should not exceed it by much, lest the effects be injurious or beyond control.

From this we infer that the optimum dose at any time is one that falls but little short of producing some perceptible reaction. It is obvious that in order to be sure that one is giving the right dose, one must occasionally give enough to produce reaction.

Fortunately, there are definite indications which usually give warning to a careful worker when he is in danger of overstepping the mark and causing febrile reaction. These have already been referred to, but it is well to emphasise them at this point. They are :—

- (a) Local reaction.
- (b) Elevation of temperature to a point not exceeding 99°F.
- (c) Flattening of the temperature chart.

On the appearance of any of these indications, the ratio of increase of doses should be slightly diminished.

By observance of this rule one can almost entirely avoid the production of febrile reactions, at any rate, of severe ones.

WRONG WAYS OF USING TUBERCULIN.

It is clear from what has been said above that there is no rule of thumb scale of doses that can be applied all round. Success in giving tuberculin depends on continually adapting the ratio of increase of dose according to the effects produced.

Here are some wrong ways that have been used :—
1. *Auto-inoculation.* — Marcus Paterson used graduated exercise in the treatment of pulmonary tuberculosis, and attributed favourable results to tuberculin received by auto-inoculation.

I agree with Marcus Paterson that when a patient's temperature does not exceed normal, and pulse-rate not much above normal, it is good for him to be put on graduated exercise, increased by regular steps, with at least two days' interval between the steps. But I consider this a most uncertain way of giving tuberculin, and not to be compared with giving regular measured doses.

2. Sir Almroth Wright suggested that tuberculin should be given in small doses, with so long an interval that the effect of one dose might be expected to have passed off completely before the next dose was given, and that so the dose need not be increased.

Wright's method, which is said to have given good results in many varieties of non-pulmonary tuberculosis, has proved disappointing when tried in pulmonary cases, probably because: (1) it fails to control the temperature, and (2) owing to the disturbing effect of auto-inoculation, the optimum dose does not remain constant, but varies in a way that cannot be calculated.

Dr. Tom Houston (now Sir Thomas) tried Sir Almroth Wright's suggested method about thirty-five years ago at Forster Green Hospital, where he was then an honorary visiting physician. After about a year's trial, he observed no noteworthy difference between the patients who had been given tuberculin and those who had not. He then abandoned the use of tuberculin in pulmonary tuberculosis; and word went round the doctors in Belfast, "Houston has tried tuberculin treatment in pulmonary cases, and found it to be of no use." And the effect of this appears to have persisted to the present day, so that young graduates of our University have the idea that there is no useful treatment for pulmonary tuberculosis but sanatorium treatment. This belief they convey to their patients, with the result that waiting-lists are swelled unnecessarily, and the waiting-time for beds is so great that the sanatoria do not get a fair chance.

3. Other physicians have tried to follow Koch's suggestion of giving injections at shorter intervals than Sir Almroth Wright suggested, and increasing the doses, but have failed to find the right way of increasing them. They very properly begin by making a series of dilutions: 1 in 10, 1 in 100, 1 in 1,000, 1 in 10,000, and 1 in 100,000.

Then beginning with the weakest preparation, some have given the following series of doses: 1/10th c.c., 2/10ths c.c., 3/10ths ex., up to 9/10ths ex., the next dose being 1 c.c., out of the same bottle, or 1/10th c.c. out of the next bottle. They then followed the same rule with the next bottle. These doses increase by 100 per cent., 50 per cent., 33 1/3 per cent., 25 per cent., 20 per cent., 16 2/3 per cent., 14 2/7 per cent., 12½ per cent., 11 1/9 per cent. Then, on moving up to the next bottle, the increase was suddenly made up to 100 per cent. Those who followed this method used to remark that violent reactions were apt to occur at the change from one bottle to the next higher; and, instead of realising that

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this was because they had suddenly changed the rate of increase from 11 1/9 per cent, to 100 per cent., they attributed these violent reactions to a supposed loss of strength in the more dilute preparation.

4. In 1932, being the jubilee of the discovery of the tubercle bacillus, it was arranged to have a discussion on "Tuberculin in Diagnosis and Treatment of Pulmonary Tuberculosis" in the Tuberculosis Section of the B.M.A. meeting in London that year. The discussion was in two parts, first on Diagnosis, and then on Treatment, the whole meeting lasting three hours.

The opener in each part was allowed twenty minutes, the next speaker ten minutes, and those who followed fewer and fewer minutes. There were seventeen speakers in all, of whom I was the last with three minutes.

The opener on Treatment was Dr. R. A. Young, a very eminent physician on the staff of Brompton Hospital, but with no proper appreciation of how tuberculin should be given. He said that he gave the following series of doses to patients, which he supposed was as good as any:— 1/500,000; 1/400,000; 1/300,000; 1/200,000; 1/100,000. He then said, "We can now increase more rapidly, and give 1/75,000; 1/50,000, etc." He concluded by saying that he considered tuberculin treatment worthy of further trial.

The speakers who followed, including Camac Wilkinson, read what they had prepared for reading in the time allotted to them. They had no time to refer to what had been said by those who had already spoken. When it came to my turn, instead of reading what I had prepared, I asked for a piece of chalk. The meeting was in a lecture room, the seats of the audience rising from front to rear. The wall facing the audience was mostly covered by blackboard. I wrote down Dr. Young's series of doses, and the percentage increase in going from each to the next, as follows:— 25 per cent., 33 1/3 per cent., 50 per cent., 100 per cent. I then mentioned that Dr. Young said, "Now we can increase more rapidly," and increased by 33 1/3 per cent. The people in the gallery laughed at this, but the people sitting with their backs to the blackboard, including Sir Robert Phillip, who presided, Dr. R. A. Young, and other distinguished persons, probably did not see what was written, or know what the others were laughing at.

I simply remarked that, having used tuberculin in that way, I was surprised that Dr. Young even thought it worthy of further trial.

My time was then up, Sir Robert Phillip rang his little bell, and declared the meeting at an end.

Some months later Dr. Young's paper was published unaltered in the *British Medical Journal*, and I wrote making the same criticism as I had made at the meeting. Dr. Young took this badly, and replied, saying that if he were going to be criticized in that way he wouldn't use tuberculin any more. It was, of course, better that he should not go on using, or misusing, it as he had been doing. But a better alternative would have been to try to discover the right way to use it.

This I shall now try to state clearly.

It has been shown above that the useful dose is not far above, nor far below, what would produce perceptible reaction. In cases where there is no doubt about the diagnosis I begin with P.T. .0000001 c.c. This rarely produces any febrile reaction. But in the rare cases in which it does, I go down a decimal point. I have never had to go lower than this.

Having given a dose which produces no reaction, I double the dose each time until some reaction occurs. This doubling of the dose avoids our remaining long at too small doses. When a dose has been reached that causes reaction, it is repeated till it causes no reaction, unless the repetition causes a greater reaction, in which case the dose is reduced. After this the dose is no longer to be doubled, but one has to find out by trial the highest rate of increase that can be maintained without producing reaction. The percentage increase of dose that suits best varies between wide limits, say from 10 per cent, to 70 per cent.

It not only differs for different patients, but even for the same patient at different parts of his course of treatment. Success in giving tuberculin treatment depends on continually adapting the rate of increase to the patient.

In order to maintain a ratio of increase that has been found beneficial in a certain case, the graduations on the barrel of the syringe are too coarse. I therefore have special pipettes, with rubber teats, made for me by R. B. Turner & Co., London. They are made of a special glass, so that they can be heated in the flame of a spirit lamp without breaking. Each pipette has a bulb blown on it, and is of such dimensions that the 1 c.c. mark is above the bulb, and the .1 c.c. mark a little below it. The stem below the latter is graduated into tenths and hundredths, so that small quantities can be measured with great accuracy. This pipette serves for making dilutions as well as for measuring doses.

INTERVALS BETWEEN DOSES.

I find the following scale of intervals satisfactory:—

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Dose [and] Interval

P.T..0000001 c.c. to P.T..00001 c.c.

Three or four days (i.e., injections are given twice a week).

P.T..00001 c.c. to P.T..001 c.c.

One week.

P.T..001 c.c. or T..0001 c.c. to T..001 c.c.

Two weeks.

T..001 c.c. to T..01 c.c.

Three weeks.

T..01 c.c. to T..1 c.c.

Four weeks.

T..1 c.c. to T..2 c.c.

Six weeks.

Above T..2 c.c.

Eight weeks.

That the effect has not gone off at the end of these intervals is shown by the fact that the dose can still be increased at the end of them without producing reactions.

ADVANTAGES OF TUBERCULIN THERAPY.

There are two distinct advantages that may be gained by a series of properly regulated doses of tuberculin:-

1. *Control of the Patient's Temperature.* – It is well known that patients with pulmonary tuberculosis are liable to have their temperature raised by taking unaccustomed exercise. This is due to auto-inoculation, so that the rise of temperature is really a febrile tuberculin reaction. By a suitable series of tuberculin doses the amount of anti-toxin in the patient's system may be increased to such an extent that the amounts of tuberculin received by auto-inoculation become negligible. The patient may thus be freed from these, to him, capricious rises of temperature, often called "colds," associated with anorexia, wasting, night-sweats, and loss of strength.

Even in cases where the amount of lung impaired is very great and undergoes no diminution as a result of the treatment, or even gradually increases, it is worth while thus to keep the temperature under control when this can be done, as it sometimes can. It adds greatly to the comfort of the patient, enables him to enjoy his food, to take exercise without interruption, and so to train himself up till, in many cases, he is able to return to work.

I have some such patients who have been coming for their injections for many years, one of them for thirty-one years. They are now getting doses of over T..2 c.c. One of them, whom I saw recently, got a dose of T..1.1 c.c. They only come once in eight weeks, which does not interfere much with their work.

In some books 1 c.c. of undiluted tuberculin is

termed the maximal or maximum dose. Such maximum is evidently fixed by the size of the syringe used, not by anything in the patient's constitution.

2. *Healing of the Lesion.* – It has been noted above that after a mild tuberculin reaction there may be improvement in the patient's sense of well-being, appetite, weight, and pulse-rate. These desirable results can be produced as well, or better, by a dose a little less than would produce "reactions."

When the amount of impairment of lung is not great, one usually finds, after a series of suitable doses at suitable intervals for three months, that the "physical signs" are diminished, and the sputum is less in quantity and contains less yellow matter, and fewer tubercle bacilli when these have been present.

By continuing the course of treatment, one succeeds in some cases in abolishing all signs and symptoms of disease. After that, the treatment should be continued for at least three months to avoid danger of relapse.

SELECTION OF CASES FOR TUBERCULIN TREATMENT.

Assuming that the diagnosis of pulmonary tuberculosis has been made, the clinical thermometer may be relied on to indicate the advisability, or otherwise, of tuberculin treatment.

The patient, or a friend who lives with him, is shown how to take and record the temperature. If the patient be not at work, he is instructed to record his temperature at 8 a.m., noon, 4 p.m., and 8 p.m.; if at work, to record it before breakfast, before dinner, and at 8 p.m. He is provided with a ruled card on which to keep this record; and at each visit to the dispensary the records on it are marked on the temperature chart which is kept at the dispensary. The charting of the temperature records is important, as it reveals alterations in the temperature curves which might not strike one on merely glancing at the card.

If it be found after a few days' observation, that none of the recorded temperatures exceeds normal, tuberculin treatment may be begun at once, no matter what the condition of the lungs may be, provided the patient is not in extremis. As has been mentioned above, even in cases where there has been extensive destruction of lung, and one has little or no hope of cure, the course of tuberculin may be of considerable benefit to the patient; and, if properly regulated, can do no harm.

If the temperature be found to exceed 98.4°F. at any time in the day, the patient is ordered to go to bed and stay there, resting as completely as possible, till the temperature has settled. When the temperature has settled, the patient is allowed to get up by successive steps. The longer the period of rest

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required to cause the temperature to settle, the slower must be the gradations by which the patient is brought back to activity. After the temperature has settled, tuberculin treatment may be begun as soon as convenient. If the patient be in a sanatorium, or on domiciliary treatment, it may be begun at once. But if he is to receive the injections at a dispensary, he must first reach the stage at which he can travel to the dispensary and back without putting up the temperature.

At whatever stage tuberculin therapy be begun, the graduated exercises are to be proceeded with all the same.

RESULTS OF TREATMENT.

Some good results have been obtained by me in the treatment with tuberculin of tubercular adenitis, peritonitis, nephritis, cystitis, and other non-pulmonary affections. But I am unable to make a comparison between them and others of a like nature treated without tuberculin. But in County Down there has been an opportunity to make such a comparison in regard to pulmonary cases. Every year, usually in the month of March, with the aid of my colleagues, I try to trace all the survivors among those whose names have been entered in our books as suffering from pulmonary tuberculosis; and we make a note as to whether each one is fit to work or not. We succeed in tracing almost all of them.

A comparison of the results of treatment by different methods needs to be made in a large number of cases that are reasonably comparable. Some patients have so little resisting power that no known method is able to check the disease. To say that a remedy is of no use because it fails, or is inapplicable, in such cases, would be absurd. In the comparison to which I am about to direct attention, no cases are included in which death took place within six months from the time when the patients were first seen by a tuberculosis medical officer. I have excluded also all cases in which tubercle bacilli were not found in the sputum. The prognosis in T.B. minus cases is very much better than in T.B. plus cases; and to mix them together in an investigation of this kind would cause confusion.

With the above exceptions, all the patients whose names were entered in our books as suffering from pulmonary tuberculosis from 1913 to 1922 inclusive are included in charts I and II, except a very few whom I have been unable to trace. In charts III and IV patients enrolled from 1923 to 1932 are similarly included. At the first examination each case was marked T.G. (Turban-Gerhardt) 1, 2, or 3, according to the extent of the disease in the lungs as revealed by

physical examination. On this basis the cases have been divided into two groups, T.G. 1 and 2, and T.G. 3. This has been done because the prognosis is very much better in the former.

In County Down we have no county sanatorium. Those patients to whom sanatorium treatment was granted were sent in the first ten years to Forster Green Hospital or to the Royal National Hospital for Consumption, Newcastle, Co. Wicklow. Both of these stipulated that they were for early cases, or cases that had some prospect of recovering working power. Patients who did not show some sign of improvement were usually discharged before three months. In the comparison I have not classed as "Treated in Sanatorium" any patients who received less than three months' sanatorium treatment. Similarly, I have not classed as "Treated with Tuberculin" any who received less than three months' tuberculin treatment. Most of these were treated at dispensaries, but a few received tuberculin treatment at home from their own doctors, under the supervision of the tuberculosis medical officer.

In the second period of ten years very few patients were sent to Newcastle, Co. Wicklow, and the numbers sent to Forster Green Hospital increased. In this period both these sanatoria used sanocrysin and collapse therapy. Some patients were sent in this period to Rostrevor Sanatorium, but in charts III and IV these have not been included with the "Treated in Sanatorium," because Rostrevor Sanatorium was willing to keep patients whom we wished to isolate even when there was no hope of their recovery; and therefore they had, as a whole, a worse class of cases than those treated at the other sanatoria or at dispensaries.

The group described as "Treated Otherwise" includes all who did not receive tuberculin treatment for three months, and did not receive three months' treatment in Forster Green Hospital or at Newcastle, Co. Wicklow. It includes some who received less than three months' treatment in one of these institutions, some who received less than three months' tuberculin treatment, and some who were treated in Rostrevor Sanatorium irrespective of the duration of this treatment.

In 1932 I read a paper before this Society, and showed charts I and II. The concluding paragraph of that paper was as follows:—

"None of these patients had artificial pneumothorax or sanocrysin, which have been introduced subsequently. When sufficient time has elapsed for these newer methods to produce their full effect, the sanatorium-treated cases should make a

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better showing. But they have a lot of leeway to make up before they equal the tuberculin-treated cases."

Comparing charts I and III, we see that this prediction has been fulfilled. The tuberculin curve is not very different in the two charts, while the sanatorium curve is more than twice as high in chart III as in chart I, and that for those who received both tuberculin and sanatorium treatment, about 50 per cent, higher.

The treated-otherwise curve is about 30 per cent, higher in chart III than in chart I. This may be due to a diminution in virulence of the tubercle bacilli, or an increase in the resisting power of the population, or to a greater willingness on the part of the patients on domiciliary treatment to obey instructions.

Comparison of charts II and IV also shows improvement in all the curves on chart IV, most pronounced in the case of the sanatorium-treated patients.

It is also noteworthy that the difference between the percentages at work of the tuberculin-treated and the sanatorium-treated patients is greatest in the early years, and is very much less when it comes to ten years. This is probably because our tuberculin-treated patients are encouraged to go on graduated exercise as soon as their temperatures are normal, and some have received the Treatment and done well on it without giving up their work at all; whereas sanatorium-treated patients are often kept resting in bed for long periods, even when their temperatures are normal. This is a matter of great importance to the patient whose family is dependent on him.

It should also be noted that the highest curve of all is that for patients who received at least three months each of tuberculin and sanatorium treatment. These received the tuberculin treatment either before their admission to the sanatorium or after their discharge. I think it might be better still if they received the two simultaneously. I should like to have had the opportunity of putting this to the test.

CHART I.—SHEWING PERCENTAGE OF PATIENTS AT WORK

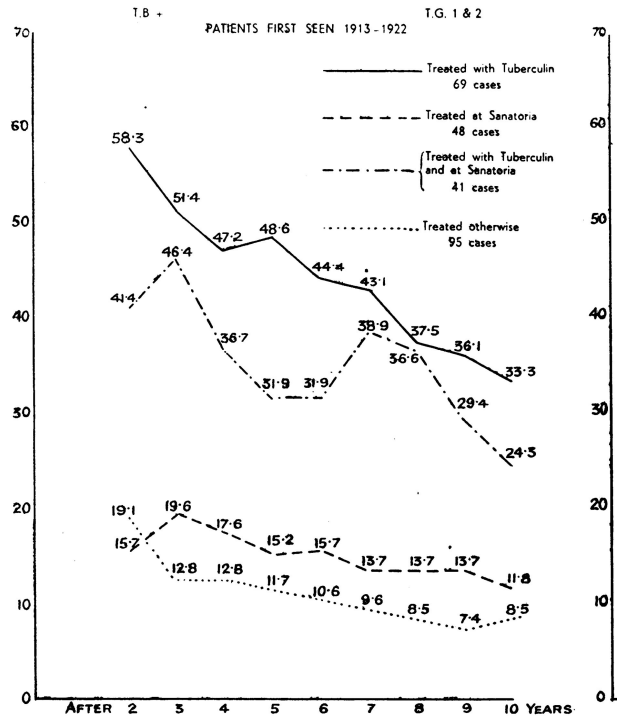
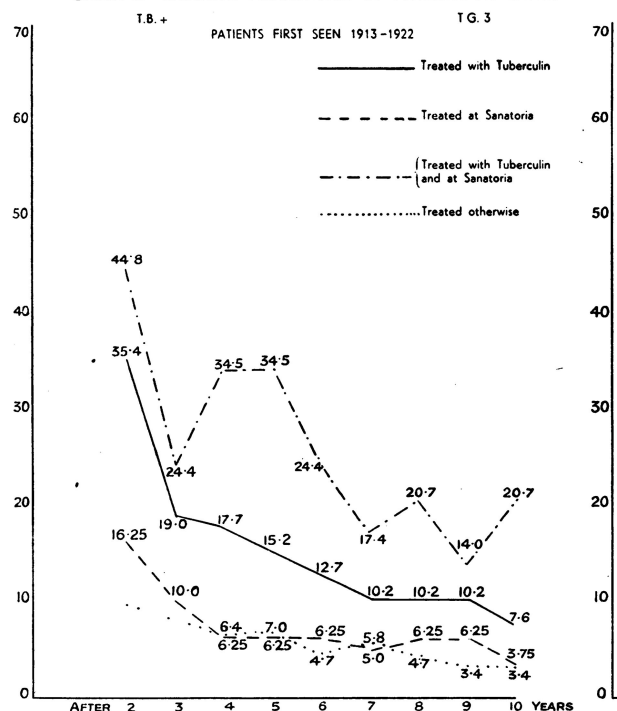


CHART II.—SHEWING PERCENTAGE OF PATIENTS AT WORK



John Richard Gillespie

CHART III.—SHEWING PERCENTAGE OF PATIENTS AT WORK

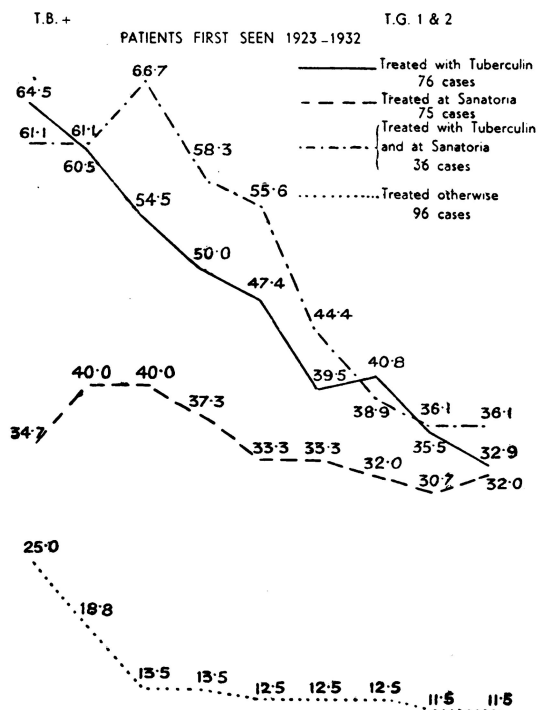


CHART IV.—SHEWING PERCENTAGE OF PATIENTS AT WORK

