a very real disadvantage in the fact that the cannula is very apt to become displaced, especially in a restless child, and come out of the chest, pulling the drainage tube with it. This difficulty is entirely obviated by using a self-retaining rubber catheter, which is either introduced direct through a very small incision into the chest, or through a cannula, which is withdrawn immediately the drainage tube has been inserted. I have had an oval trocar and cannula specially made to enable a larger catheter to be introduced between the ribs than would otherwise be possible, but I am not sure that this method presents any material advantage over the method of direct introduction through a small incision in the chest wall. Two other disadvantages have been cited against this form of treatment—namely, that it is difficult to ensure adequate drainage, and that after-treatment requires almost continuous supervision by specially trained nurses. With regard to efficiency of drainage, we have not found the difficulties so great as would be thought. Irrigation of the cavity by Dakin's solution, two or three times a day, seems to soften or disintegrate those large masses of fibrin which so often impede the free passage through the tube. If the latter appears to be blocked it is detached from the suction apparatus, and, by means of a glass syringe, Dakin's solution is alternately forced gently through the tube and sucked out again. By doing this a large amount of fibrin can often be removed, and when the suction apparatus is replaced drainage is found to proceed quite satisfactorily. The last objection to continuous suction, that it requires unremitting attention, is only partially true. Once it is satisfactorily started very little attention is required, unless the tube gets blocked and requires syringing out, as it occasionally does. Irrigation with Dakin's or some other antiseptic ought to be carried out at least two or three times a day, no matter what method of drainage is adopted, and it is much easier to detach the suction pump and irrigate through the catheter than it is to remove the messy dressings from a patient's chest and irrigate through an ordinary open tube. One way and another, I do not think that this method requires more attention than can easily be given in the ordinary routine way in a hospital ward or a nursing home.

During the last eighteen months I have treated all cases of empyema coming under my care, twelve in all, by this method. Of these twelve cases, one, a man of 35, who had a large chronic empyema of some five months' duration, died as the result of multiple cerebral abscesses three weeks after admission, and while the empyema was still draining. The other eleven cases have all done uniformly well.

After removal of the catheter I have, in all cases, put a fine tube into the sinus to drain the small cavity remaining. The sinus is usually healed completely after three or four days, but in four of my patients the wound, after closing up, has broken down again, and a small abscess has discharged, after which the sinus has again closed up and given no further trouble. This is perhaps due to the wall of the sinus itself being infected, and can probably be obviated by treating the latter with flavine or some similar preparation. In all cases except one the cure has, I believe, been complete, and, so far as one can tell, permanent. One patient, who originally had a very large staphylococcal empyema of ten weeks' duration, returned to his work as a miner some six weeks after discharge, and came back to hospital two months later with an abscess pointing over the old sinus; some six ounces of pus were evacuated from the cavity, which rapidly healed and has not, so far, recurred. Another patient had a double empyema, both sides being drained simultaneously, and closing on the seventeenth and eighteenth days respectively. This patient has remained fit ever since, and I am informed he has been for some months working about his farm as usual.

The average period during which drainage has been required has been nineteen days. One particularly satisfactory feature in all has been the rapid expansion of the lung, as shown by the amplitude of respiratory movements on the affected side, and the return of breath sounds at the base.

The ages of the eleven patients still living ranged from 4 to 50 years; the organism isolated was the pneumococcus

in eight cases, combined in one instance with the streptococcus and the tubercle bacillus; in two cases the staphylococcus; and in one case the *Bacillus coli*.

The advantages that I think one can justly claim for treatment by continuous suction drainage are:

1. Introduction of the catheter is rapid and easy, and entails virtually no shock.
2. Anaesthesia is correspondingly brief, and, if necessary, the operation could be done, except perhaps in infants, with a local injection of novocain.
3. The tube causes little or no pain.
4. Nursing of the patient is much easier and cleaner.
5. The risk of secondary infection of the empyema is very much diminished.
6. The wound closes quicker than by open drainage.
7. Re-expansion of the lung is more rapid and complete.

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THE PROGNOSIS AND TREATMENT OF ECLAMPSIA AND ALBUMINURIA:

WITH SPECIAL REFERENCE TO THE RISK OF RECURRENCE IN SUBSEQUENT PREGNANCIES.*

BY

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It is in some ways remarkable that, despite the close study which the clinical features of the toxæmias of late pregnancy have received, we should now be discovering, not only that there are still a few fields left for us to explore, but that some of our teaching on the basic clinical facts has proved to be incomplete and in certain respects actually unsound. Take, for example, eclampsia. It has been almost a commonplace in our teaching that a woman who has suffered from this condition is little likely to suffer in any similar way in her next pregnancies. A study of such cases proves this to be incorrect. At the British Congress of Obstetrics and Gynaecology in 1927 I³ showed that in 47 consecutive cases of eclampsia in parous women admitted to the Edinburgh Royal Maternity Hospital eclampsia occurred six times in a previous pregnancy and "albuminuria" nine times. This gave a total recurrence figure of 31.9 per cent. Adding to this six cases, in which there had been abortion, accidental haemorrhage, premature or stillbirth without toxæmia in the previous gestations, we got a total recurrence of abnormality of 44.7 per cent.

Dr. Jessie C. B. Sym has since carried out a similar investigation of the subsequent obstetric history of the surviving cases of eclampsia treated in the hospital from 1919 to 1926, and in a total of 67 cases which were traced she found that 42 had become pregnant again, with a total of 60 completed gestations. Of these, 3 had developed eclampsia for the second time, with a fatal result in one case, whilst in 15 of the other pregnancies "albuminuria" occurred, giving a total of 18 out of 60 subsequent pregnancies which were toxæmic, or 30 per cent. Adding to this 6 more, in which abortion, etc., took place, we get 24 abnormal pregnancies out of a total of 60, or 40 per cent., a figure which emphasizes the risk which is run by an eclamptic patient should she become pregnant again.

A similarly sinister record is revealed when the "albuminuria" cases are studied. In the paper to which I have already referred I recorded a recurrence of toxæmia, and of abortion, etc., without toxæmia, in 42 out of a total of 118 studied—that is, in 35.6 per cent. These figures referred to the previous pregnancies in parous women admitted to the hospital with "albuminuria." By following the surviving cases into their subsequent obstetric life we have found that 51 out of 81 cases subsequently became pregnant again, and had between them 84 completed pregnancies. Of these, 44 had "albuminuria" (this diagnosis was based on clinical evidence supplied by the patient in 5)—that is, 52 per cent. In 14 of the other pregnancies there occurred abortion, accidental haemorrhage, etc.,

* A paper read before the Section of Obstetrics of the Royal Society of Medicine, November 16th, 1928.

without toxæmia, making a total abnormality recurrence of 58 in 84, or 69 per cent. The considerable increase in the percentage of recurrence in the pregnancies occurring after the first toxic gestation treated in hospital as compared with those in the pregnancies prior to this is to be accounted for by the fact that in many instances the follow-up proved the attack of toxæmia treated in the hospital to be the beginning of the recurring sequence.

We thus see that 82 out of a total of 144 subsequent pregnancies in cases of toxæmia (eclampsia and "albuminuria") were vitiated by toxæmia or intrauterine disaster to the foetus without toxæmia—that is, a percentage of 57. Furthermore, 3 of the 93 women who became pregnant subsequent to their leaving hospital died from toxæmia in a subsequent pregnancy—that is, more than 3 per cent. It is probable that this death rate would have been actually higher could all the cases have been followed up, for it is known that "deaths" are notoriously difficult to trace.

Findings similar to those here recorded have been reported by other observers—by Greenhill¹ and Gibberd,² for example. Greenhill studied the subsequent completed pregnancies of 16 women who had had eclampsia, and found that in 9 these were normal, whilst in 7 they were toxæmic—that is, in 43 per cent. Gibberd found that in 28 cases of albuminuria there was a recurrence of the toxæmia in 19—that is, 68 per cent.

This large incidence of recurrence in all classes of toxæmia carries with it implications of far-reaching importance. In my opinion this fact of recurrence, applying as it does to all types of the disease—eclampsia, pre-eclampsia, etc.—constitutes the most significant addition to our knowledge of the subject made within recent years, and it must be regarded as an important new clue in our efforts to trace the underlying causes.

The first lesson it teaches is the inadequacy of our present classification, for this has been based on the view that eclampsia and "pre-eclampsia" are essentially non-recurrent. The type in which recurrence is the characteristic feature we have thrown into a category by itself. We have classed it as "recurrent," or, in view of the observable kidney lesion sometimes accompanying it, as "nephritic." The new discoveries obviously render this classification unsound, for it is clear that in respect of the criterion of recurrence there is nothing to distinguish one kind of late pregnancy toxæmia from another. Furthermore, it is apparent that the view which attributes recurrence to a defect in renal function must, if well founded, apply equally over the whole range of these toxæmias.

I have elsewhere discussed the discrepancies in fact and in theory which seem to me to lie at the back of any such view, and I cannot enter into the matter fully on this occasion. At the outset I would direct your attention specially to the fact that the attitude we adopt towards this question has implications which are not merely academic in their nature. Bound up with them are important issues of an essentially practical nature. We may, in the first place, in accordance with the usual teaching, attribute the tendency to recurrence to a chronic renal defect, which leads to a breakdown of function in succeeding pregnancies. In support of this view we may cite the nephritis which punctuates these recurring toxæmic gestations, and, in addition, the evidence of nephritis which is sometimes found in the intervals between the pregnancies. On the other hand, we may regard the nephritis as caused by the toxæmia, which in such women tends to recur during their pregnancies, and the accumulated result of which in some instances may be to produce persisting and chronic nephritis. These two standpoints are distinct and mutually exclusive. According to one the recurring toxæmia springs from the kidney defect. According to the other the kidney defect springs from the recurring toxæmia.

For many years I have been unable to satisfy myself that in endowing the kidney with etiological properties of a primary character we were not theorizing beyond our facts. As I now see it I am satisfied that, whilst we are still far from a complete understanding of all the phenomena, the data, when fairly marshalled and analysed, drive us in a very compelling manner to regard the kidney as an organ

which in the sequence of events plays a part which is entirely secondary, and which in its liability to suffer damage by the specific toxins elaborated during the development of a vitiated pregnancy is in no way different from such other organs as the liver and the heart. The arguments in favour of this view may be summarized as follows.

1. A recurrent attack of eclampsia or albuminuria is in no essential fact different from the initial attack in the first pregnancy involved. Now there is no evidence that this initial attack is in any way, directly or indirectly, dependent upon a renal defect. There is, on the other hand, ample evidence that the kidney damage invariably occurring in such a case is directly caused by the toxins elaborated in a specific manner in some other region of the pregnant organism. Why in a recurrent attack should the relation of the kidney in the sequence be different?

2. Just as the initial eclampsia or albuminuria occurs typically in a woman whose kidneys were previously healthy, so typically in the intervals between the pregnancies, which are recurrently toxic, the kidneys reveal no evidence of any deficiency. Furthermore, subsequent to a series of toxæmic pregnancies, in each of which the kidneys have suffered, the patient may enjoy good health with no cardiovascular or renal disease so long as she does not again become pregnant.

3. The chronic renal lesion found occasionally in such women is easily explained as due to the effects of one bad attack or to the accumulated results of the damage sustained during a recurrent series of toxic pregnancies. Dr. Jessie Sym has carried out an examination of the cardio-vascular system, of the blood urea and the urea concentration test, in 66 post-eclamptic and 73 post-albuminuric cases treated in the Edinburgh Royal Maternity Hospital. This revealed evidence justifying a diagnosis of chronic renal change in 2 of the post-eclamptic cases (3 per cent.) and in 6 of the post-albuminuric cases (8 per cent.). The significant fact is that in 7 out of these 8 cases the patients had two or more toxic pregnancies. Of those cases—comprising approximately half of the total number—in which a single toxic pregnancy had occurred, in only one was chronic renal change found, and in this case the toxæmia lasted for eighteen weeks. These facts indicate that the degree of involvement of the kidney is directly related to the interval over which it is exposed to the toxins of an abnormal pregnancy.

4. Marching side by side with the tendency to recurrent toxæmia there is a well-recognized tendency to the succeeding pregnancies of such women being terminated prematurely by abortion, stillbirth, or accidental hæmorrhage. This tendency has usually been attributed to a chronic renal deficiency. In my previous papers I have called attention to the fact that these abortions, etc., may be unassociated with any toxic manifestations or any recognizable renal defect, although they occur in women known to have this tendency to recurrent toxæmia in their other pregnancies.

For lack of a better explanation in the past we have in similar contingencies had recourse to the "nephritic" conception. In this view these damaged pregnancies would be attributed to a deficiency in renal function which is so meagre that it fails to reveal itself in the ordinary ways. How, it may be asked, could such a minimal defect, which is insufficient to cause any clinical evidence of its presence, precipitate the intrauterine disasters which these crises necessarily imply?

It was considerations of this order that led me some years ago to approach these problems from a new angle. A critical analysis of the available data early proved that whilst the fact of toxæmia was the dominating clinical phenomenon, and as such had naturally obtruded itself into the forefront of the problem, it was by no means invariable and essential. It was rather of the nature of an accident or incident, which might occur in some circumstances but not in others. Thus, for example, it might be present in one pregnancy ending in accidental hæmorrhage, whilst in the same woman it might be absent in the next pregnancy which ended similarly. Whilst toxæmia was thus purely incidental, there was, on the other hand, one factor, and one factor alone, which seemed to run

throughout the process as an invariable accompaniment of the abnormal pregnancies, toxic and non-toxic alike. This was disease of the placenta. In all the affected pregnancies, whether they ended by abortion, accidental haemorrhage, or stillbirth, and whether they ended in toxæmia or not, one could always find placental damage. The existence of such a pronounced lesion, which, according to this reading, must be considered as arising independently of the toxic process, naturally pointed to a possible source of the toxic elements, which all agree to be responsible for the toxæmia of pregnancy. As I have shown, it is possible to account for all the known facts by predicating in such women the existence of some factor which during pregnancy may precipitate a toxæmia by involving the life of the placenta. This factor, whatever it be, is liable to persist in the intervals between the pregnancies, during which it may cause no apparent trouble, but it is apt to reassert itself in the same way during the next pregnancy. Whether, after the placental damage has occurred, toxæmia will follow will depend on two variables: (1) the amount of placental tissue involved, and (2) the time during which the damaged placenta is retained in the uterus.

OBSERVATIONS ON TREATMENT AND PREVENTION.

From this study of the subsequent fate of toxæmic cases we may draw lessons regarding (a) the management of, and the indications for terminating, an existing pregnancy, and (b) the question of future pregnancies.

Management of Existing Pregnancy.

In every toxæmic case the immediate outlook is uncertain, and, even in the mildest case, it is impossible completely to exclude the risk that at any moment the clinical picture may change rapidly for the worse. For these reasons, were we to consult the interests of the mother alone, we would be justified in terminating the pregnancy in almost every instance so soon as the first toxic manifestations appear. In addition to these immediate dangers there is the more remote risk of the patient suffering lasting damage to her cardio-vascular system and kidneys. In this series of hospital cases, which, of course, comprise those suffering most severely, this risk assumes the proportion of 8 per cent. of the total. As I have previously shown it is minimal in the woman with her first attack, the major danger being reserved for those with repeated toxic pregnancies.

Against these sombre admissions there must be urged the experience of all that many toxæmic pregnancies respond with rapidity to ante-natal care and hygiene, with special reference to the diet, the bowels, and rest. It is in this class of work that modern ante-natal treatment has claimed some of its greatest triumphs. At the same time there is, it seems to me, a risk that we may overestimate our powers in this connexion, for we must acknowledge that in this disease, which affects 3.5 per cent. of all pregnant women (Eden and Holland), the majority of the cases are destined from the beginning to pursue a simple course, just as we know that the greater proportion of the severe cases resist all our efforts to cure them.

The only sanction we have for an expectant line of treatment is that we may thereby carry the pregnancy over into a period that will ensure the viability of the child. In this very matter, however, our decisions are still further complicated by the fact that the disease, which so heavily prejudices the life and health of the mother, is even more unkind to the foetus. Of all the maternal diseases toxæmia is the one which is most lethal to the child. Thus Holland, in a series of 301 foetal deaths, showed that 77 were caused by albuminuria, eclampsia, or accidental haemorrhage—that is, 26 per cent. In the present record of albuminuric cases 49 out of 168 children died *in utero*—that is, 29 per cent. It is known that many of those born alive survive only a short time.

These considerations show that whenever we elect to treat a toxæmic patient expectantly we may be gambling with the life or health of the mother in the interests of a child whose survival is problematical. I am convinced that in the past we have often been over-zealous in our

regard for the child and too little attentive to the interest of the mother.

Where and whilst the manifestations are slight and the patient is under adequate supervision one may often safely temporize. In such a case, however, the termination of pregnancy as soon as the eighth month is well entered upon may be in the best interests of the infant.

Where there is marked oedema of the limbs and face, a blood pressure raised 30 or 40 mm. or more, a heavy deposit of albumin in the urine, a marked drop in the urinary secretion, and more especially if there are headache and visual symptoms, delay is dangerous. In less severe cases a delay sufficiently long to test the response to treatment may be considered justifiable, but any change for the worse, such as a rising blood pressure, a sudden drop in the quantity of urine, severe headache, etc., or a refusal of the symptoms to abate under rest in bed, watery diet, and active eliminative treatment, indicates the need for intervention.

In all toxæmic cases, except those that are mild, which are seen before the seventh month, experience has taught me that delay is rarely if ever justified, for this necessarily implies a dangerously long interval of waiting before viability of the child is reached. I would like to see it laid down as an axiom that, except in mild cases, no toxic patient should ever be kept under treatment for more than two weeks, and then only if the progress is good. A disregard of this precept may damage a woman's health irreparably; these risks, as we have seen, are especially to be guarded against in women who have suffered damage in their previous pregnancies.

For ordinary routine purposes, where the urgency is not immediate, the best means for the induction of premature labour is the gum-elastic bougie or some similar method. Pituitary extract is of little avail for this purpose until the last days of pregnancy, although the hypodermic administration of 5-minim doses of this drug is of value in reinforcing the action of the bougies once uterine efforts commence. I then use 5 minims every half-hour till a total of 2 c.cm. has been administered. Where the blood pressure is high, pitocin, which contains the ecboic principle of the posterior lobe without the pressor agent, may be employed.

For cases of grave urgency the bougie method for inducing labour is too slow and too uncertain, and for such cases I employ Caesarean section under spinal anaesthesia. With this operation we obtain immediate evacuation of the uterus in a case where every hour's delay may jeopardize the prospects. By means of spinal anaesthesia we reduce the shock and we eliminate the risk of further damage to the organs associated with a general anaesthetic. Among these risks one of the greatest is irritation of the bronchioles, passing on to bronchitis and bronchopneumonia, from which toxæmic cases are specially liable to suffer.

For these reasons I have come to regard spinal anaesthesia as the ideal method in such cases. The immediate fall in blood pressure attending its use may in some ways be regarded as an added advantage in patients in whom an elevated pressure often constitutes a dangerous feature. At the same time I should like to take this opportunity of commending a wider employment of spinal anaesthesia as the routine procedure in Caesarean section. One of the most striking effects of the removal of the control of the spinal centres resulting from its use is a spontaneous and immediate contraction of the muscle of the uterine wound, producing a sort of natural haemostasis, which in many cases is so marked that the operation can be carried out literally without the loss of more than a few drachms of blood. In many instances—for example, in collapse from the exhaustion of a protracted labour or from loss of blood, as in placenta praevia—this fact may lead to a considerable reduction in the risk associated with the management of the case. A series of about 40 cases of Caesarean section so carried out by myself and my assistant with no mortality and in which are included a considerable number of grave cases of toxæmia, of placenta praevia, and of obstructed labour with potential sepsis, has led me to conclude that spinal anaesthesia has brought into the operation of Caesarean section a measure of safety which it

did not possess before. In cases where a drop in blood pressure is to be feared—as, for example, in the collapse from haemorrhage or in bad cardiac cases—I have, in addition, employed adrenaline, and, latterly, vasopressin.

At this point I would make it clear that once the toxæmia passes over into an eclamptic seizure any active intervention is to be rigidly avoided, and the patient must be treated along such lines of expectancy as those laid down by Stroganoff and others. On two occasions, it is true, I have carried out Caesarean section under spinal anaesthesia where the patients made a good immediate recovery under the Stroganoff treatment, but where, several days afterwards, there was a sudden and alarming recrudescence of the clinical features—rise in blood pressure, fall in urinary secretion, etc. The operative delivery was carried out with the idea that the risk of delay was greater than the risk of terminating the labour with the help of the spinal anaesthesia. A further indication in these cases was the continued intrauterine survival of the child, which I regard as a feature adding greatly to the gravity of the prognosis.

The Question of Future Pregnancies.

Among the lessons to be drawn from the data assembled in an earlier part of this paper there is one which is of profound importance. It is that the risk of toxæmia in subsequent pregnancies is so great that all such women should be warned of the importance of placing themselves under medical supervision from the early stages, should they again become pregnant. In the present state of our knowledge on ultimate causation we are not equipped with any certain method of protecting a woman with this taint against the risk of recurrence, but we can do much to safeguard life and health by emphasizing the imperative need of this ante-natal care if the major risks are to be avoided. The necessity for explaining these facts is all the greater because of the rapid recovery which usually follows on one attack and which often gives the patient a sense of security which is little justified. The woman who has already suffered from several toxæmic pregnancies should be the object of very special ante-natal supervision in the event of a future pregnancy.

The next point we have to consider is the advice to be given in regard to preventives. So great is the risk run by women with this taint that this matter of prevention may be considered as arising in practically all cases. Personally I believe it may be laid down as a rule that no woman should be exposed to further risk if she has had two or more toxic pregnancies, for the risk of future recurrence rises rapidly with the number of pregnancies already so vitiated. Where, on the other hand, the disease has involved the loss of the child on each occasion, there may be such a desire for a further attempt that the medical attendant may require to be satisfied with urging that this can only be sanctioned if the patient adequately recognizes the need for supervision throughout the pregnancy.

In anticipation of a future pregnancy everything should be done to build up the strength of the patient and to remove any factors that may, even indirectly, have a bearing on this tendency to recurring trouble. It has been suggested by some observers that focal sepsis may play a contributory part in the taint which these women carry over from pregnancy to pregnancy. In a previous paper I have referred to some considerations which are in keeping with this view, and have suggested that it is conceivable that some such factor is at the back of the tendency to placental disease, which, as I have pointed out, is the only essential lesion of the pregnancy in such cases. In a few instances I have found that, following the removal of gross sources of focal sepsis—for example, tonsils and teeth—a previously unbroken sequence of damaged pregnancies has been interrupted and has been succeeded by normal gestations. The data are still too meagre to allow of a definite pronouncement on this matter, and I merely throw out the suggestion tentatively. In eliminating this factor of potential sepsis, however, we are taking a step likely to help the general health and resistance even should the subsequent history fail to establish it as a factor of primary value.

CONCLUSIONS.

1. In a series of hospital cases treated for eclampsia and albuminuria there was found to be a recurrence of toxæmia or non-toxæmic interruption of pregnancy (abortion, accidental haemorrhage, etc.) in succeeding gestations in over 50 per cent.

2. There is no evidence that this tendency to recurrence is directly or indirectly dependent upon any persisting renal defect. Chronic nephritis is found in only a small proportion of cases, and there is evidence that this is the result of the toxæmia.

3. In view of the large risk of recurrence the need for ante-natal supervision from an early stage in the event of a subsequent pregnancy should be clearly explained to the patient.

4. Toxæmia in two or more pregnancies is an indication for the prevention of any further pregnancy.

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THE PRESENT POSITION OF ULTRA-VIOLET LIGHT THERAPY.*

BY

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It is now so generally realized that ultra-violet light radiations consist of a small block of waves in the electro-magnetic spectrum that it is unnecessary to enter at any length into the physical nature of this source of energy. It is also realized that this electro-magnetic spectrum stretches from beyond the gamma rays of radium through α rays on to ultra-violet light, then through the visible spectrum to infra-red, and on to the Hertzian waves, which are employed both in wireless and in diathermy.

Owing to the extreme differences in wave-lengths between one end of the spectrum and the other, it has been found impossible to use the same unit of wave-length measurement, and this has constituted one of the difficulties in understanding the nature of ultra-violet light. The Angström unit is nothing more or less than an agreed subdivision of the metre or millimetre which gives a number to the shorter waves of the spectrum that is neither absurdly large nor carried to an absurd number of decimals. For instance, it would be extremely inconvenient to think or talk of the distance between Edinburgh and London as being, say, six thousand million million Angström units; and it would be equally inconvenient to talk of a hair having a diameter of, say, point seven or eight noughts one of a kilometre.

The Angström unit has, therefore, an arbitrary length of one ten thousand millionth part of a metre—that is, one ten millionth part of a millimetre. This arbitrary length enables us to talk of gamma rays in terms of tenths and hundredths of this unit; of α rays in tenths and small units; of ultra-violet light in figures round about three thousand, and of light up to about seven thousand. It is only when we get to infra-red that the numbers begin to get so big that it is worth while changing over from these units to actual millimetres or decimals of a millimetre. Thereafter, by keeping to the ordinary metric measurements, we eventually reach the well-known wave-lengths of 2 LO and 5 GB, and it is these latter wave-lengths that are employed in diathermy.

The relationship between the length of a wave and the frequency, or number of complete waves that can pass a given point in one second, can be made clear by a simple analogy. Suppose one is standing on a bridge watching a train composed of sleeping cars and ordinary cars passing underneath. The complete train will be travelling at a uniform rate, just as ether waves travel at a uniform rate, but the more lengthy sleeping cars will take a longer

* A lecture given to the Border Counties Branch of the British Medical Association.