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The Instrumental Dilatation of the Cervix and Orifice of the Womb during Pregnancy and Labour.*

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(Translated from the French by Prof. R. Mobbs, of Geneva.)

It may sometimes be an advantage both to mother and child to bring labour to a speedy termination when dilatation is not yet complete or even to interrupt labour by sure and rapid means when the mother runs any risk that can only be averted by recourse to so extreme a measure. In all ages medical practitioners have sought for fit processes and methods for the accomplishment of this purpose. The means employed up to the present may be grouped under two important categories—(1) those the aim of which is to provoke labour, such as the Krause bougie, the Kiwisch shower-bath, the bags of Barnes, Fehling, Garriel and Champetier de Ribes, Tarnier's dilator, Braune's colpeurynter, etc., etc.—these are slow methods; (2) those which are used for the purpose of rendering the uterine cavity accessible, in the shortest time possible, to the operations necessary for the immediate extraction of the fœtus. These are rapid, and amongst them must be classed the processes of instrumental or manual dilatation, deep incisions in the cervix uteri and the “cesaricum vaginale.”

At the International Medical Congress, held in Berlin in 1890, Professor Bossi, of Genoa, described an original method by which forced labour could be brought about within a fixed time. In cases

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of necessity it was possible, by this method, to obtain complete dilatation even in ten minutes; the surgeon was absolute master of the situation, and could always extract the fœtus in the lapse of time necessary in a given case. This end was obtained by means of a special instrument tested with success in a certain number of cases, and which has been modified and perfected in such a way as to render it less dangerous. The construction of the instrument is, of course, generally known.

Practitioners everywhere admit the immense importance of this new method, but though it has already produced such excellent results and deserves the most serious consideration, it is still evident that the instrument itself is not yet perfect, and already a number of more or less happy modifications have been suggested. The efforts of inventors have been directed towards three principal improvements:—

1. It was necessary, first of all, to give to the instrument a true pelvic curvature.
2. It was necessary to simplify the instrument, to make it lighter and more easily susceptible of disinfection.
3. It was necessary to enlarge the surface of the blades or increase the number of acting points in order to prevent the risk of rents, always possible.

Of all the models proposed I shall only mention those of Raineri, Nowakowski, Kaiser and Frommer, but there are many others. All of them convey to us the idea of man's marvellous faculty of invention, but not one has as yet solved the problem in a satisfactory way, and all are in every respect inferior to Bossi's invention itself. Indeed, this is no matter for surprise when we consider that it was only after fifteen years of assiduous study and ever-renewed experiment that Bossi succeeded in producing the model in question. The most important improvements called for are the first and last—(a) As a matter of fact Bossi's dilator does not possess a properly called pelvic curvature; (b) the acting surface of the blades is certainly too small, thus incurring the danger of more or less considerable cervical rents. Let us examine these two points:—

Firstly, what are we to understand by a pelvic curvature in an instrument such as that we have under study? The direction of the cervix of a pregnant uterus on the point of delivery being perpendicular or about on the plane of the inlet of the true pelvis, it is not enough to give the instrument a more or less pronounced antero-concave curvature to make of it a pelvic curvature in the obstetrical sense of the word. This will only be really obtained when

the plane, in which the extremities of the blades of the instrument move, is found to be absolutely parallel with the plane of the inlet of the true pelvis, and consequently parallel with the plane of dilatation of the uterine orifice. Then only will it be possible to effect the opening desired without any dislocation and at the very point where the physiological dilatation takes place. But neither does Bossi's instrument nor any of its numerous modified forms fulfil this condition. Indeed, a glance is enough to see that even when the handle is greatly lowered, which in certain cases, such as primiparæ, can only be done with great difficulty, it is absolutely impossible to bring the circle of the opening into a plane even approximately parallel with that of the inlet of the true pelvis. In spite of the willingness of the operator, these two planes always form a greater or lesser angle at the posterior opening, and it is not difficult to see that this defect is inherent in the mechanism of the instrument itself. All the improved models of Bossi's dilator are constructed on the original plan, without the constructors having been able to deviate from it in any way whatever, and it is to this lack of a pelvic curvature that must certainly be attributed the greatest number of rents made during the use of the instrument. The blades occupy a position altogether out of keeping with the plane of the opening of the uterine orifice, and the result is that no dilatation is possible without producing dislocation and *excessive tension* highly prejudicial to the integrity of the orifice.

Secondly, with the instrument as it is actually constructed, it is hardly possible during the progress of dilatation to make use of larger and larger protecting caps, because then, owing to the size of the dilator, its introduction becomes quite impossible. An attempt has been made to remedy this defect, firstly, by simply doubling the number of blades, as in the Kaiser and Frommer dilators and others of the same kind; or, secondly, by attaching to the extremities of the instrument—as in the Nowakowski model—a sort of table-napkin ring which expands progressively and continuously, so that during the whole dilatation period the uterine orifice is always and in every part in permanent contact with the instrument. But Kaiser and Frommer have quite overlooked the fact that an increase in the number of points of contact is by no means the same thing as an enlargement of the surface of application, and a recent article by Bardeleben¹ has clearly shown how dangerous is such a modification. As to the Nowakowski dilator, the idea is evidently

1. *Bardeleben*. Wesen und Erfolg der schnellen mechanisch-instrumentellen Muttermundserweiterung in der Geburtshülfe, *Arch. f. Gynaekologie*, Bd. 70, p. 1.

ingenious, but it may reasonably be asked whether in cases in which under the influence of labour pains the head is caught in the inside of the napkin ring, it would be an easy task to withdraw the instrument without inflicting rents.

The problem to be solved is all the more important, seeing that—even if with the use of the present instruments complete dilatation is possible without the infliction of rents in the orifice—it is no slight matter to have obtained it with blades, say, of half an inch or an inch in width. As a matter of fact when the indicator registers four inches the dilatation really obtained will not be equal to a circle of four inches in diameter. After the operation the orifice, contracting by itself, can only correspond to a circle tangent to the points of the uterine orifice, just in the middle between two blades, and it is easy to see that it will be all the larger according to the width of the blades. This is very important, for in a necessarily incomplete dilatation rents may easily be inflicted at the time of consecutive intervention.

Although for a long time I had been conversant with Bossi's works, it was the incontestable authority of my honoured master, Professor Leopold, that led me to study the question more thoroughly. And, first of all, I asked myself whether the failure of others was not due to the two defects already referred to, and whether by rectifying these the method employed by Bossi in special cases could not be more largely applied than is at present supposed. On perusing the works of Bossi and his pupils and the more recent contributions of Leopold, Keller, Lederer, Knapp and others it is impossible not to feel that, if from this time we are really in possession of a method by which the period of dilatation can be shortened, one of the most important steps has been taken in the progress of obstetrical science since the invention of forceps and the use of chloroform. But should the method be reserved only for cases of eclampsia, of gravido-cardiac accidents, of phthisis, pyelitis, etc? Might it not be more generally applied, on condition, of course, that its use is rendered less uncertain and more available to the practitioner?

Having realised the impossibility of attaining this end by simply modifying Bossi's instrument, I soon became convinced that the problem could only be solved by the construction of an altogether new dilator, the mechanism of which should be entirely different. I put myself in communication with Mr. C. F. Hausmann, the director of the well-known surgical instrument manufactory at St. Gall, and was fortunate enough to awaken his interest and to

convince him of the importance of constructing a new instrument responding as far as possible to all the theoretic exigencies that could be formulated. These, which I explained to him, are as follows:—

1. The dilatation produced by the instrument should be effected as near as possible in a direction parallel to the plane of the inlet of the true pelvis in order that there may be no appreciable dislocation of the cervix or of the uterine orifice.

2. The instrument should respond to all the exigencies of modern surgery. Its reparation and sterilisation should be easy and simple.

3. It should be possible to modify the width of the blades, at will, during the operation and according to the degree of dilatation.

Owing to the extreme kindness of Mr. Hausmann, who spared neither time nor money in order to arrive at a satisfactory result, I am to-day in a position to bring before the notice of my co-practitioners a *new dilator* which is in a very real sense superior to all others, and which, I trust, will contribute to the introduction into the daily practice of attendance upon labour the mechanical method of the dilatation of the cervix uteri.

As will be seen by the accompanying illustrations, my dilator is composed of an elongated handle containing a screw on which two sliding nuts turn inversely, and of four movable blades the extremities of which are turned up. The handle can be easily taken to pieces so as to be perfectly cleaned, and all the blades move in a plane parallel to the longitudinal axis of the instrument, which is so constructed that larger or smaller blades can be adapted to the handle in case of need. The posterior blade and the two lateral blades are furnished with a small spur in order to prevent them from slipping when inside the uterus. The extremities of the dilating blades all spread out equally from the same central point, and form during the operation a circle, the plane of which is parallel to the longitudinal axis of the instrument. The most important advantages of my new dilator are:—

1. It is possible to adapt to the same handle, according to the progress of dilatation, a succession of blades of wider and wider surface in such a way as to reduce to a minimum the risk of rents.

2. Owing to the fact that the dilatation is effected in a plane parallel to the axis of the instrument, it follows that my dilator presents in reality a pelvic curvature in the proper obstetrical sense of the word, it being possible to bring the dilating part of the instrument without the slightest difficulty into the plane of the inlet of the true pelvis, the uterine orifice undergoing no dislocation thereby.

3. The instrument is constructed in such a way that each of the blades can be introduced separately like the branches of a forceps and can be fixed to the handle when they are in perfect position. This permits the utilisation of much larger blades than those which are employed in the Bossi dilator and other instruments of the same kind. [I have a series of blades for my own use, varying from 0·6cm., 1·2cm., 2·4cm. to 3·6cm. in width.]

4. As soon as dilatation has been set up the blades can be withdrawn one after the other, thus preventing the danger arising from not being able easily to withdraw the instrument on account of the descent of the head during the operation.

The dilator constructed, the next thing was to test it by experiments. Dr. Aeppli, director of the Lying-in Hospital at St. Gall, at once, and with a kindness for which I cannot be too grateful, put the Hospital at my disposal, and during a short stay at St. Gall I was able to make my first experiments on four gravid women and three parturients. In none of these seven cases did I operatively terminate labour. The method was new; I hesitated a little, and as a matter of fact all I had in view just then was to assure myself that I was on the right track, that my instrument was capable of sufficiently dilating the cervix uteri without difficulty and without causing rents, in order that in cases of necessity labour might be terminated at once by any intervention (forceps, version or cephalotripsy). These seven cases have just been dealt with at length in a contribution to the *Archiv für Gynäkologie*.¹ I shall here give only a brief account of them:—

CASE 1. III-para, 33 years. Pregnancy at term. Cervix 1cm long. No pains. Head movable. Dilatation to a degree of 8cm. in half an hour, without narcosis and without pain. No hæmorrhage. Natural labour seven hours later. No fever.

CASE 2. Multipara. Pregnancy at term. Cervix $\frac{1}{2}$ cm. No pains. Dilatation in half an hour, without narcosis, without pain and without the least hæmorrhage. Natural labour three days after.

CASE 3. I-para. Parturient. Obliterated cervix. Orifice a little larger than a 2-franc piece. Dilatation to 8 $\frac{3}{4}$ cm., without narcosis, in 20 minutes. Dilatation interrupted on account of a slight loss of blood. Natural labour six hours later. The speculum examination after the expulsion of placenta revealed a small rent which did not bleed and which there was no necessity to stitch. No fever.

CASE 4. I-para. Parturient. Cervix 1cm. long. Orifice allowed of

1. *de Seigneux*. Beitrag zur mechanischen Erweiterung des Cervicalcanals und des Muttermundes während der Schwangerschaft und der Geburt. *Arch. f. Gyn.*, Bd. 70, p. 614.

introduction of a finger. Dilatation to $6\frac{1}{2}$ cm. in half an hour and without narcosis. Prolapse of umbilical cord and of a hand was then observed. Braxton-Hicks' combined version after several fruitless attempts at reduction. Extraction four hours later. Child asphyctic, could not be saved.

CASE 5. II-para. Pregnancy at term; $2\frac{1}{2}$ per cent. of albumen. Cervix 3cm. long. Dilatation to 9cm., without pains and without narcosis, in an hour. Labour set in from commencement of dilatation. Natural delivery $5\frac{1}{2}$ hours later.

CASE 6. I-para. Pregnancy at term. Cervix 3cm. in length. Dilatation to 10cm. in an hour and a quarter. Natural delivery following day.

CASE 7. III-para. Parturient. Obliterated cervix. Orifice size of a shilling. Dilatation to 10cm. in 50 minutes. Natural labour two hours later.

The slight rent referred to in the third case was evidently due to the fact that I was not then in possession of blades as large as those I now employ. As to the fourth case, I wish to state that this was not operated on by me, but by the hospital assistant. It is clear that dilatation should not have been stopped at $6\frac{1}{2}$ cm., nor should Braxton-Hicks' version have been applied, but, seeing the impossibility of reducing the umbilical cord, it was precisely a case for continuing the dilatation till it was possible to introduce the whole hand and perform internal version, followed by the immediate extraction of the foetus had that been necessary. Then the child would probably have been saved.

These tentative and encouraging experiments led me to modify my instrument in certain details and to continue to test its efficiency. A short time after, during a second visit to St. Gall, I had the opportunity of testing it in three new cases in which dilatation was followed by an easy application of the forceps. They were as follows:—

CASE 8. (Unpublished.) III-para; 32 years. Labour pains set in at 6 p.m. on July 24th. Head in the inlet of the true pelvis, slightly movable. At 10-30 obliterated cervix, orifice size of a 2-franc piece. Chloroform—narcosis. Introduction of the dilator which was at once opened to 5cm. The edges of the uterine orifice stiffened at this time. Every quarter of a minute I gave the screw a quarter of a turn, proceeding slowly and with the utmost prudence; from 7cm. I dropped to a quarter of a turn each half minute, and from 9cm. reduced even this to a quarter of a turn every 45 seconds, thus obtaining in about half an hour a dilatation of 11cm. without having produced the least hæmorrhage. Wishing to bring labour to a speedy termination, I applied the forceps

and slowly extracted a child of 2500gr. and 47cm. in length, that presented the following dimensions:—

Circ. FO = 34 cm.

B.P = 30 cm.

Diam. FO = 11 cm.

SOBr = $8\frac{1}{2}$ cm.

BP = 9 cm.

BF = 8 cm.

MO = 13 cm.

At the time of the two preceding births there had been pretty violent post-partum hæmorrhage resulting from adherence of the placenta. After half an hour I tried to expel the placenta by the Credé process. This was followed by a considerable loss of blood which could only be stopped by manual delivery. The placenta was very adherent, and hæmorrhage ceased from the moment of its extraction. Convalescence was normal, with the exception of a slight elevation of temperature the second and third days which necessitated an intra-uterine injection of lysol. Then all went well, and mother and child left the hospital in excellent condition on the 12th day.

CASE 9. (Unpublished.) III-para; 27 years. Entered the hospital on August 2nd, 1903, at 10-30 p.m. Labour had set in. Obliterated cervix; orifice size of a 2-franc piece. Water-bag still intact. Sagittal suture in the transverse diameter. Small fontanelle to left; large fontanelle to right. The pains being very slight and only occasional, I introduced the dilator without narcosis, and proceeded with the dilatation exactly in the same way as in the preceding case. The operation produced neither pain nor hæmorrhage. When the dilatation had attained 11cm. I still left the instrument in position for three full minutes and then withdrew it. At this juncture I observed that the orifice had fallen in upon itself, but that it was easy with the finger to push back the sides of it to the walls of the pelvis. The sagittal suture still remaining in the transverse diameter, the two fontanelles at the same height, I decided to break the water-bag, and asked the patient to push with all her might. The head then descended a little, and the sagittal suture fell into the left oblique diameter. Application of forceps was easy, and with chloroform a child of 52cm. and 3130gr. was extracted. After half an hour expression of placenta by Credé's method. A slight atonic hæmorrhage was easily stopped by massage of the uterus and an injection of ergotin. Suture of a small rent in the perineum with two stitches. Convalescence normal. Mother and child left the clinic in excellent health on the 12th day.

CASE 10. (Unpublished.) II-para; 28 years. Entered the hospital on July 28th, 1903, at 8 p.m. Spontaneous rupture of water-bag, and during the whole night slight pains. On the 29th, at 11 p.m., a second position was observed. The head was movable above the inlet of the true pelvis. The cervix was not yet obliterated and measured about 1cm. in length. The uterine orifice was very far back, and its edges were very thick.

Fig. 1.—Closed Dilator.

Fig. 2.—Open Dilator.

Fig. 3.—Assortment of the four series of Blades (natural size).

The cervical canal gave easy access to two fingers. Pains were slight, occurring about every ten minutes. The cervix not yet being obliterated, the head still above the inlet of the true pelvis, and an application of the forceps after dilatation seeming to be difficult, I gave up for the moment all idea of intervention. At 2 p.m. same condition; slight pains. At 5 p.m. pains more acute, every five minutes. Obliterated cervix Orifice size of a five-shilling piece. Head engaged in cervix. Introduced dilator, the blades of which could at once be opened to 7cm. The tension of the edges of the orifice being very great, I operated with the utmost prudence and gave the screw of my instrument only a quarter of a turn every minute. From time to time I waited for two full minutes before continuing the dilatation. I went on, thus attaining in 35 minutes 11cm. without the least hæmorrhage. At that moment I had chloroform given. Application of Tarnier forceps, and easy extraction of a living child. Expulsion of placenta by Credé's method three-quarters of an hour after delivery. No hæmorrhage. Mother and child left the hospital in good health on the 12th day.

May I be allowed to repeat here some very important recommendations included in my first article?

Firstly, my dilator ought not, without a clearly defined indication, to be used in the case of a woman not in labour, and I only regard as such an indication all those conditions which place the mother in a position in which she runs any risk and which imperatively call for interruption of pregnancy and the speedy evacuation of the uterus. In all these cases dilatation should be followed by the immediate extraction of the fœtus.

As to the regular employment of this method for the purpose of provoking premature labour, this is a question which still remains to be studied. It is quite possible, I may add even probable, that it will in time completely replace the habitual employment of the Krause bougies. It was in this way that at the Dresden Gynæcological Clinic my honoured master, Prof. Leopold, to whom I presented my instrument last autumn, utilised it in two cases, which will be dealt with in detail in a future publication. One of the two was that of an eclamptic who was brought to the clinic in a state of complete coma. The cervix uteri was intact, the woman having as yet no labour pains and the orifice being completely closed. It was possible to dilate it very rapidly without the least hæmorrhage and in a manner sufficient to permit of the perforation of the child, already dead, and its extraction afterwards. The operation did not last more than an hour at most. In the second case it was a question of narrow pelvis. Prof. Leopold decided to provoke premature labour by means of my dilator. The cervix was intact,

very long, the orifice completely closed. Within 30 to 40 minutes it was possible to dilate it to $5\frac{1}{2}$ cm. without any loss of blood, without the slightest pain and without narcosis. A bag was then easily introduced and labour set in a few hours later.

Secondly, except in these urgent cases the method should only be used when the cervix is quite obliterated and the dilatation of the external orifice has already begun. In this way the eventual danger of rents is avoided, rents all the more serious that the cervix is less obliterated, for it ought never to be forgotten that no metallic dilator has succeeded up to the present in producing the obliteration of the cervix and the orifice. All dilators produce only the lateral distension of the edges of the orifice and the obliteration of the cervix uteri can only be effected by the contraction of the uterus.

Thirdly, in cases in which the dilatation has only been brought about for the purpose of shortening the first stage, it is not at all necessary to bring labour to an end by an operation. This may be very well left to nature, as is evident from the following two cases which I recently had occasion to treat:—

CASE 11. (Unpublished.) IV-para; 25 years. The three preceding confinements normal. January 16th, 1904, at 1 p.m., spontaneous rupture of water-bag. Labour pains did not set in till 4 p.m. They occurred at first with regularity every five minutes, but diminished in frequency and in acuteness during the evening, to return in full force about 11 o'clock. The following day, at 4 a.m., the midwife called me in. The cervix uteri was obliterated, and the orifice was a little larger than half a crown. The child seemed small with head engaged. No water-bag. As at 6 o'clock pains had not yet returned, and it seemed that labour would last a long time, I decided to use my dilator. The dilatation being sufficient, I at once used blades of $2\frac{1}{2}$ cm. in width, which I introduced separately like the branches of a forceps, and which I fixed one after the other to the handle of the instrument, this succeeding admirably. I then turned the screw without stopping till tension of the edges of the orifice was produced. The indicator marked 5 cm. From that point I only gave a quarter of a turn per minute, constantly controlling the degree of tension of the orifice. During this time and probably under the direct influence of these manipulations, uterine activity little by little reappeared. The pains, at first slight and occasional, returned at shorter intervals and with increasing violence. By the time the dilatation had attained $8\frac{3}{4}$ cm. they became expulsive. In spite of that I distended my instrument to 10 cm. and observed the descent of the head between the blades, which I drew out one after the other at 7-15 p.m. This was followed by two strong expulsive pains sufficient to expel the child—a child 44 cm. long and 2100 gr. weight. Natural delivery took place

without any hæmorrhage, and speculum examination revealed no rent. No fever.

CASE 12. (Unpublished.) III-para; 37 years. Labour pains began January 22nd, 1904, at 8 a.m. I was called in in the evening at 7 o'clock. On arriving I found the cervix obliterated, a dilatation as large as a florin and the water-bag ruptured. In an hour I succeeded in producing, without any lesion, complete dilatation, and the child, a small one, was expelled naturally by four or five expulsive pains.

And now what conclusions may be reasonably drawn from this first series of experiments? It is evident that I cannot, and indeed have no wish to pronounce, in spite of these very encouraging results, a definite judgment on the method itself. The only fact to be borne in mind is that in any case the use of my dilator permits of obtaining, without narcosis, without pain and without danger, a dilatation sufficient for the delivery of a living child. If the method be considered without *parti pris* such a result cannot be regarded otherwise than an indisputable progress in obstetrical practice. But undoubtedly it is to Bossi that the merit is due of having demonstrated for the first time the possibility of the rapid dilatation of the cervix uteri or the orifice at every period of pregnancy or labour. May I be allowed to hope that I have succeeded in preventing certain dangers and inconveniences of his dilator, and thus have contributed to the generalisation of a method which in certain special cases may save so many mothers.

Who at the present hour shall predict the services which, in the future, may be rendered in this domain by the Bossi method? Is it not our first duty thoroughly to examine a new method which has in view the well-being of those confided to our care? We cannot stop at theoretical considerations. It is experimenting alone which must decide whether the mechanical method of the dilatation of the cervix uteri is really without danger, whether it can be applied in all cases, and if not, in which cases; in a word, to determine all the pro and con indications and seeing the importance of the matter the attempt is eminently justifiable.

It is at least a worthy thing that all who are connected with university clinics should interest themselves in this matter in order to arrive at a definite judgment with regard to the method itself, calling to mind the admirable words with which Bumm,¹ in his recent work, concludes the first chapter devoted to a brief historical review of the development of obstetrics:—"Our science, like that of every other branch of medical practice, is still far from the perfection of

1. Bumm. Grundriss zum Studium der Geburtshülfe, 1903.

its development. After periods of repose and reflections during which we were content to enter into and more fully possess the heritage slowly acquired, we come into position of new methods which always enlarge our horizon. May our descendants, moved with regard to us by the same sentiment with which we are moved in considering the immense work accomplished by our predecessors, be able to say that we too were really worthy of them, that we, too, left some small trace on the path of progress."

As will be seen in the above article, I was led by force of circumstances to employ my dilator in absolutely normal cases, without any special indication. This is easily explained by the fact that eclamptic cases and others are not in reality so frequent as may be supposed even in hospitals, and I should have been obliged to wait too long before being able to test my dilator which could only be done by application in a sufficient number of cases.

From the experiments I have made with my dilator up to the present, and while awaiting still further tests of its efficiency, I may describe my results as follows:—

(a) My dilator renders the immediate termination of labour possible, with or without narcosis, when the orifice is not yet sufficiently dilated to admit of obstetrical intervention, and when the state of mother or child calls for immediate delivery.

(b) It also renders equally possible a rapid termination of labour in all cases in which the life of the mother is in any danger on account of pregnancy, and where this risk can only be avoided by the extraction of the child at a time when the cervix is still intact.

As to the systematic application of the method in cases of parturients in whom dilatation does not take place in spite of violent pains, or in other cases in which, as the result of complete inertia of the uterus, a woman may remain for several days without any apparent progress in the dilatation of the cervix, I desire to state that I consider this question as one as yet far from being settled, notwithstanding the very encouraging results I have obtained up to the present. At the same time I regard it as a question which certainly deserves the most serious consideration and impartial study on the part of specialists.