On the Determining Causes of Parturition

Thesis

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Introduction.

There are few subjects in the science of obstetrics that have been admitted to possess greater interest than that of the determining causes of parturition. Dr. Matthews Dunsac speaks of their discovery as a "grand result" to achieve. For Dr. Tyler Smith "it is one of the most interesting problems of obstetrics." Schroder considers it "one of the most interesting subjects of Midwifery." and Playfair remarks that "it has been from the earliest times a questio in Venaria amongst Physiologists". These quotations might be multiplied ad infinitum, it therefore seems astonishing that such an interesting question, and one the solution of which has been sought for so long a time, should still be surrounded by a cloud of uncertainty. The fact is that as long as obstetrical science was not advanced enough to allow of a satisfactory explanation being given, almost every writer spent his utmost vigourity in advancing some theory which being based upon false premises was necessarily erroneous. Since, however, the great advance has been made of looking upon the uterus as furnishing the efficient causes of parturition, a new departure seems to have been taken by obstetric writers. Satisfied as they certainly had a right to be that the grand discovery of the role played by the uterus, was the basis of almost all the useful improvements that could take place in Midwifery, the majority of obstetricians seems to have considered it superfluous to obtain a clear insight of the causation of the uterine action. It was left to a small minority of those theoretically inclined minds to make it the subject of their enquiries.
even growing more insignificant, and for more than thirty years there has been no new theory proposed, although everyone is dissatisfied with those now existing. The unsatisfactory character of these theories is clearly due, in great part at least, to the imperfect of knowledge that prevailed at the time they were put forward. But, now, Orctetrical Science appears to have attained a sufficient degree of Development to allow of a solution being given to that hitherto unanswered problem, and an attempt at the explanation of this interesting question will be made in the following pages.

It was my intention to preface the following remarks by a careful historical review of the subject and to enter into a full discussion of the different theories which still command a greater or lesser amount of support. Thanks to the great kindness of Dr. Fancourt Barnes who gave me free access to his fine collection of old Historical works; thanks also to the riches of the British Museum Library, I could have offered a very interesting historical sketch, if the subject had lent itself to it; but although numberless authors have touched the question, there is, at least in former times, a remarkable absence of interesting variety, therefore thought it preferable not to burden these pages more than I could possibly help, with uninteresting matter. On the other hand, the discussion of the various theories which have survived would have added considerably to the value of this study, but unless I had limited myself to a repetition of the various criticisms that have already been offered, and which, to my mind, are far from being the totality of those that can be brought forward, the subject would have carried me far beyond the limits permissible in this kind of work, limits that I am already afraid of having passed.

It may, however, briefly be said that these theories explain more or less satisfactorily, although
never completely, the Determining Causes of Normal Parturition at term, and do not fail, it is true, to notice any other instance of Parturition, the circumstances of which seem to favour the view they advance, but none of these is made to account for all cases in which the expulsion of the ovum occurs as a result of the action of the efficient causes whenever that action is brought into play.

My aim has been to supply that omission I painfully feel how imperfectly I have succeeded. I feel convinced, however, that the imperfections do not apply so much to the value of the theory as to the manner in which it has been expounded: the deficiency there cannot be more evident to any one than it is to myself, but, at least, I have endeavoured to submit the theory to a more crucial test than any of those previously advanced, and were it not for the want of space, it could, I believe, be easily proved that it bears that test better than any other.
Determining Causes of

Parturition

Chapter I

Nature of the Subject

I Definition

The first step in this study is evidently to arrive at a clear understanding of the meaning of the expression: Determining Causes of Parturition. For that purpose, some of the definitions given by various authors will be first enumerated, and by borrowing from them, an attempt will be made to present a definition as complete and comprehensive as possible.

10 Caprara says: "This name is given to everything that can determine the action of the efficient cause and consists of unnatural and natural causes. The latter only claim our attention here."

10 Depardieus gives the following definition. The determining cause is that which, acting spontaneously, results in the setting in of the uterine contractions at the regular term of gestation."

10 Schroeder, although he does not give a definition properly so called, expresses himself in the following manner: "It is certainly one of the most interesting subjects of Midwifery to study how the uterine contractions are excited at a certain time, and how they are continued, gradually increasing in power, until the foetus is expelled."

Gleaning its components from these various statements, I propose using the following definition as a basis for this study:
The determining Causes of Parturition consist of every natural cause acting spontaneously, that results in the setting in of the action of the efficient causes and in their continuation until the expulsion of the Foetus.

There are two factors in this definition which require complete elucidation: the nature of the efficient causes, and the determination of the limits within which they act, that is to say, the limits of Parturition.

II. Efficient Causes of Parturition.

Nature — Everyone is now agreed upon this question, the efficient causes are entirely material and broadly speaking may be said to be found in the maternal muscular system. The muscular elements concerned belong both to the unstripped and striped muscles. The uterine and vaginal muscles furnish the unstripped those of the abdominal parietes and the Diaphragm furnish the striped elements. Together these muscles may conveniently called the Muscles of Parturition, or the parturient powers.

Their relative importance in the act of Parturition is far from being the same, and they may be divided into 2 sets, the primary and the secondary.

The primary are made up of the uterine muscles, their characteristic is to be indispensable to, and to act during the whole period of Parturition. The secondary, that is the abdominal and vaginal muscles, are only auxiliary to, and acting during a limited part of Parturition.

Mode of Action — The only way in which muscular tissue can act is by contracting, and no contraction can take place unless there is a stimulus to excite the muscular tissue to action.
Keeping in mind the nature and the mode of action of the efficient causes and reverting to the definition of the Determining causes of Parturition, it will be seen that some of the abstract terms it contains may now be replaced by their material equivalents. Thus "the efficient causes" find an equivalent in "the muscles of Parturition"; their "active" can be replaced by the "Contraction" of these muscles; and the "Cause" which gives rise to that action is adequately represented by the word "Stimulus"; so that the final definition may be as follows:

The determining causes of Parturition consist of every natural Stimulus acting spontaneously, that results in the setting in of the Contractions of the Muscles of Parturition, and in their continuation until the expulsion of the Foetus.

III. Extent of Parturition.

It is evident that the utmost importance for the elucidation of the nature of the Determining causes of Parturition, is clearly, define its limits, for a complete explanation of any phenomenon must naturally account for all the features it presents, from its very origin to its termination.

Where, however, information is sought on that subject, it soon becomes evident that the limits of parturition are still undetermined, as far as any rate, as a scientific delimitation is concerned. This curious anomaly seems to result from the looseness with which etiological terms are used. For all writers, parturition appears to be synonymous with labour, pregnancy interchangeable with gestation. But what does etymology say on that point.

Parturition is derived from partus (I procreate); Labour from labor (work, exertion, suffering). Pregnancy is derived from proo (before), and gene or gigno (I procreate). It is therefore synonymous with proo parturition if such a word existed. Gestation...
owes it original to Goeto (I carry),

Etymologically, therefore, the meaning of
these words is very distinct; a woman may be
parturient and get not in labour; again, she
may be parturient or in labour and still carry
geination only ending with the birth of the foetus;
but, evidently, she cannot be pregnant and par-
turient at the same time; pregnancy must neces-
sarily cease where parturition begins.

I am well aware that giving an etymological
demonstration of differences existing between scien-
tific expressions is hardly considered satisfactory by
a scientific mind, and very justly too. Scientific terms
whatever may their derivations be, really mean whatever
idea they convey to the mind of the reader; and if two
terms convey the same idea, however faulty it
may be etymologically, their indiscriminate use
is certainly justifiable. But the matter assumes a
very different aspect if the terms do not apply to one
and the same idea, and the words Parturition and
labour, for instance, evidently belong to the latter ca-
tegory. Labour is simply a collective equivalent
of the clinical symptoms of Parturition, symptoms
which vary in intensity and duration, which may even
be altogether absent; whilst Parturition is a
physiological function which has to be performed,
and goes through certain definite phases whether
accompanied or not by the symptoms of labour.
Labour therefore can only be the equivalent of Partu-
rition in the mind of the pregnant woman, but
not in that of her medical attendant.

Hence the utter confusion resulting from their
indiscriminate use in scientific language and the
absolute impossibility of determining the limits of
Parturition, by endeavouring as has been done so far,
to determine those of Labour.

On the contrary, these limits may be readily
ascertained by the consideration of Parturition as
a physiological function and the first step toward
the elucidation of the question is to find a satisfactory
definition. It is proposed to pass first to review some
of the definitions given by various authors:
"Parturition is the exit of the child and its accessories from the bosom of its mother." (Baudeloque)

"Parturition is the function which results in the expulsion of the product of conception from the organism of generation." (Dupaix)

"Parturition is the functional act by which the product of conception is separated from the maternal organism." (Yarner and Contrepois)

"Parturition is the act by the help of which the foetus and its accessories are expelled from the maternal organism." (Charpentier)

These definitions are unsatisfactory because they only give an insight into the result, and not into the manner or extent of parturition. The following take that important factor more or less into consideration.

"Parturition is a function consisting in the spontaneous or artificial expulsion of a viable foetus and of the accessories through the natural parts of generation." (Lapeyre)

"Parturition is a function which consists in the expulsion of the foetus and its accessories, out of the womb, whereas they have developed during the ordinary period of gestation." (Deborneaux)

"Normal parturition is the expulsion of the foetus at term from the uterus, through the maternal passages by natural forces." (Schroefer)

The last definition seems the most complete by far. At the same time as it only applies to normal parturition, it is too limited for the present study which requires a definition that applies to all the cases in which the products of conception are expelled from the pregnant maternal organism by the spontaneous action of the efficient causes of parturition. This expulsion may take place before, at, or after term, as long as it is effected by the contractions of the muscles of parturition, the determining causes of these contractions are to be found. It is therefore a definition of natural or spontaneous parturition which is needed, and which can be best obtained by ascertaining when it does happen, how it is accomplished, and in what it does result.
When does it happen? There is no special limit of time, it may be said to happen at the termination of pregnancy.

How is it accomplished? This requires a knowledge of the factors concerned in its performance. They are four in number:
1. An object to expel—the ovum.
2. A cavity from which it is expelled—the receptacle of pregnancy.
3. A passage through which it is expelled—the passages of Parturition.
4. An expelling power—the muscles of Parturition.

In what does it result? Generally in the expulsion of the ovum, and although in extrauterine gestation and missed labour the expulsion may not take place, these rare exceptions will, for simplicity's sake, be overlooked, and the definition framed as follows:

**Natural parturition is the termination of Pregnancy. It consists in the expulsion of the ovum, by the spontaneous action of the muscles of Parturition, from the receptacle of Pregnancy through the passages of Parturition.** It results in the expulsion of the ovum.

This definition once obtained, what help can it be in the determination of the limits of Parturition?

The end of that function is easily defined for it corresponds to the complete expulsion of the ovum.

The beginning is much more difficult to specify and, at any rate, has not yet been exactly determined either for Parturition or for Labour. Leishman, for instance, says: "Some little difficulty is experienced in determining the exact moment from which Labour is to be dated." and Sarnier states that "it is not as easy as is generally believed, to recognise whether a woman is in labour, or whether, on the contrary,
labour has not yet begun."

The elements that may be of help in the determination of the beginning of Parturition are derived from the features of the Parturient powers, and from the differentiation of the receptacle of Pregnancy from the passages of Parturition.

The Parturient powers, that is, the contractions of the muscles of Parturition, would evidently give the required information if they were only present during the performance of that function, or if they assumed special and well determined characters at that time. But, as will be noticed more fully later on (page ), these contractions exist during Pregnancy, and their passage from the pregnant to the parturient state is not marked by any definite modifications in their features. This factor does not, therefore, give any reliable landmark.

But if it is possible to differentiate the organs concerned in Pregnancy from those through which the ovum passes during Parturition, the exact beginning of the latter act will be readily determined; for evidently, as soon as the ovum begins to influence upon the passages, Parturition begins. This is universally admitted and it is well brought forward, for instance, in the definitions of Demeineaux and Schroeder (page 8), but the delimitation between the Receptacle of Pregnancy and the Passages of Parturition has never been properly made.

When it was generally received that the cervix from the middle of Pregnancy, gradually took part in the formation of the receptacle of the ovum by a progressive caviation of the canal from above downwards, it was but natural to suppose that the os externum formed the line of demarcation in question; but in the present state of knowledge this seems hardly satisfactory. Parturition or Labour, however, are still considered to begin with the beginning dilatation of the os externum, as is readily shown by the following quotations:
The first effeetue contractioes having prabably resulted in an opening of the cervic to a trifling extent -... we are enabled to trace the process of dilatation." (Leichman)

"At last, the time of gestation has arrived and labour commence. The primiparae, this is announceed by the opening of the cervix, which had till then remained closed, in multiparae, by the complete obliteration of the thick edge formed until that time by the os tineas." (Cageaux)

"The woman is in labour... if the cervix be obliterated and it orifice progressively dilating." (Tournier et Chaumouoit.)

"labour actually commences... the os uteri will be found partially dilated." (Payfais)

"When labour actually commences, the cervix is only represented by a line hardly recognizable in primiparae, a little more marked in multiparae." (Charpentier.)

These quotations might be multiplied, but the proceeding are sufficient to show that labour or parturition, is generally considered to begin with the dilatation of the os externum.

That this view is not universally admitted is seen by the following statement of Schroeder: "The period of opening of the cervix, or dilatation, begins at the end of gestation and ends by the complete dilatation of the orifice... It is generally found that the cervix has kept its entire length, and the dilatation of the os internum is effected first." Still he seems half afraid of his statement being too absolute, for he adds: "It is only in exceptional cases that, in the last part of gestation, the pains become so strong (insusceptible labour) that the cervix is already found obliterated."

Logically, however, no exception should be admitted for it is evident that the cervix is either part of the receptacle destined to receive the ovum during pregnancy or part of the passages through which it has to pass during parturition, and it is plainly most illogical to consider it part of the canal when the contractioes which cause its obliteration are painful, but part of the cavity when they are palse, and that is, in fact, what Knewedorl remarks.
For the following reasons, I believe that in all cases the cervix forms part of the passages of parturition:

10. In the unipregnated state, the mucous membrane of the cervix is different from that of the uterus anatomically, and also physiologically; for menstruation does not affect it more than it affects the vaginal mucous membrane.

20. In the pregnant state—the muscular development of the cervix is inconsiderable; it compares with that of the uterus, but much more in proportion with that of the vaginal muscles. Its mucous membrane does not contribute to the formation of the decidua. Its softening takes place from below upwards, whilst that of the uterus is simultaneous over the whole extent of the organ. In multiparae the os externum is open during the greatest part of pregnancy, whilst the os internum is much more closely shut.

Lastly, the canal of the cervix is almost universally admitted to remain entire until a very advanced period of pregnancy. Holy, thought that it began to be taken up in the walls of the uterus about a fortnight before actual labour. List, and Professor Sayles of America, seem inclined to consider that it remains entire until within a few hours of the very beginning of labour. The researches of Ranle do not seem to invalidate the value of the fact that the canal of the cervix remains entire, for as Dr. and F. Barnes say in their latest work: "As to the neck itself diminishing in length as the cervico-uterine canal is formed, its muscular coat participates to the exclusion of the mucous coat in the formation of this canal." It is believed that Ranle's observations point to the following process taking place: the softening of the cervix taking place from outside inward as well as from below upwards, as soon as the external layer becomes sufficiently softened it is drawn up to form part of the cervico-uterine canal. This drawing up gradually increases with the softening. It is effected by a sliding of the muscular fibres over the mucous membrane.
Owing, however, to the connections of the mucous with the muscular coat, the sliding is not a free one, and as the cervical walls become sufficiently softened throughout and loose, therefore, part of their rigidity, an apparent shortening of the cervical canal may result. The cervical wall yields to the pressure exercised from above, the os externum becomes approximated to the os internum, the mucous membrane forming tuberculated folds to allow of this taking place; but the cervical canal, that is a cavity situated between two openings, the os internum and the os externum, remains untouched, for its two extremities, although they may become approximated always correspond to the same part of the lining mucous membrane, and no portion of the cervical mucous membrane helps to form the lining membrane of the receptacle of the ovum during pregnancy. The os internum is a fixed part and only becomes modified when parturition begins.

After Parturition - The muscular tissue of the uterus is firmly retracted, that of the cervix on the contrary hangs flaccid and relaxed.

The development of the cervix must, therefore, also point to the conclusion that, functionally, the cervix is a part of the canal of parturition, and not of the receptacle of pregnancy, for until the time of puberty, the body of the uterus remains in a rudimentary state, whilst the cervix, together with the vagina is much more fully developed; after puberty, on the contrary, the body of the uterus takes on special growth, but not so the cervix and vagina.

From these previous considerations, to which, from want of place, a passing allusion has only been made, it is believed that the cervix always forms part of the passages concerned in parturition, and that, consequently, parturition begins with the opening of the os externum. This delinitiation may not be the clinical, but it is functional and based on a constant factor, and it is such a definition as this that is wanted, when the limits of parturition are required, as in the present case, for a physiological purpose.
Chapter II

Characters of the Contractions of the Muscles of Parturition.

The limits of Parturition and the nature and mode of action of its efficient causes have now been determined, but as the latter consist in the contractions of certain muscles, it is necessary to pass on to review the features of these contractions, before proposing the stimulus that is believed to give them rise.

The muscles of Parturition forming part of the general muscular system, are evidently regulated by the general laws to which all muscular tissues are subject, but they also present special features which are of equal importance to consider.

I. General Laws.

These only are of interest that have to do with the functional activity of muscular tissue, for it is aimed to explain the causation of that functional activity in the Muscles of Parturition. These laws may be enumerated as follows:

1. There is no contraction without a stimulus.

2. The intensity of the contraction is proportional to the intensity of the stimulus.

3. Repeated contractions, or a contraction prolonged beyond a certain time result in muscular exhaustion: relative, when the muscle, is still capable of reacting to a stimulus of greater intensity; absolute, when the muscle is insensible to any stimulus of whatever intensity.

4. Rest in both cases restores muscular contractility.

II. Special Features.

The contractions which cause expulsion of the ovum during Parturition are 1o not limited to that time only, 2o involuntary, and 3o intermittent. These features require special notice as they are
of the utmost importance for the satisfactory elucidation of the determining causes of parturition.

10. The contractions are not limited to the time of parturition.

It is now universally admitted that the contractions of the uterine muscles are present, not only during parturition, but also during pregnancy. The researches of Braxton Hicks leave no doubt that besides the occassional contractions that are noticed during pregnancy, regular and intermittent, though weak, contractions are observed throughout the duration of the pregnant state.

In the study of the determining causes of parturition, it is clearly of the greatest moment to consider whether the contractions of pregnancy present the same characters as those of parturition, for if their features are the same, it is logical to deduce that their cause is also identical; if the same cause produces these both, any theory that only applies to one set of contractions must be erroneous. (Tarner, in Caeux and Tarner, Traité des Accouchements.)

Clearly points to the importance of the subject when he says: "We ask why the uterine contractions take place during the whole time of pregnancy, do not provoke the expulsion of the ovum until the term of gestation?" For him, evidently, the two sets of contractions are of the same kind, and have the same causation, and that such must be the case is readily proved by the following considerations.

10. The muscular elements concerned in the production of the contractions are the same during pregnancy and parturition. (The auxiliary muscles of parturition being naturally neglected since their action is not indispensable to the accomplishment of the function.)

20. Under certain circumstances the contractions of pregnancy assume the exact features of those of parturition, inasmuch as they give rise to the expulsion of the ovum, as in abortion or premature labour.
The same stimuli that are known to excite or increase the contractions of Parturition, excite or increase those of Pregnancy, the difference of their action being in degree, not in kind.

Walking for instance, is a ready method for exciting contractions during Parturition. Riding or dancing which evidently act in the same best exaggerated manner, are known to be able during Pregnancy to cause contractions violent enough to result in abortion.

The evacuations of the bladder and rectum are, during Parturition, a cause of increase in the intensity of the contractions, and I have noticed as will be more fully explained later on, I have also for result to exaggerate the Contractions of the pregnant state.

So the passage from the Contractions of Pregnancy to those of Parturition is gradual.

The objections offered to the statement that the contractions of Pregnancy are similar in kind to those of Parturition may be enumerated as follows:

1. The Contractions of Pregnancy are irregular, transient and painless, those of Parturition are regular, permanent and painful.

The irregularity and transient character supposed by some to be a special feature of the contractions of pregnancy do not, however, characterise them. The researches of Braxton Hicks, on the contrary, have established their regularity and permanence throughout the period of gestation. Charpentier, nevertheless, considers that "the true labour begins at last ushered by 2 phenomena that are never absent: the regularisation, the permanence of the uterine contractions, and the dilatation of the cervix."

Leishman also says: "The period soon arrives when the pain becomes more and more severe and returns at regular, periodical intervals;" both authors, therefore, implying that the previous contractions lacked these particular features.
That such a statement—should be made results from admitting pain as a necessary accompaniment of the contractions of Parturition, and furnishes another proof of the danger of loosely using as synonymous expressions so different in their meaning as pain and contractions. It is evident that if pain is used as a criterion, the contractions of Pregnancy are irregular and transient compared with those generally characterizing Parturition. But is it possible to take pain as a criterion? Playfair seems to think so for he says: "When labour actually commences... they [the contractions] are accompanied with pain." All authors, however, admit that the duration of labour is often shortened by the painful contractions only beginning when the cervix is widely open, that sometimes the child is born with only two or three pains when the head clears the vulva, that in a few cases the whole process is entirely unaccompanied with pain. On the other hand, it is also universally recognised that contractions may be painful not only during the so-called, preparatory stage, but for weeks before the beginning of actual labour. In such a case, it is evident that pain cannot be considered as the criterion of the contractions of Parturition, or painlessness that of the contractions of Pregnancy.

The contractions of Pregnancy present a very slow increase in intensity, if compared with the much more rapid increase that characterises those of Parturition.

This will be seen to be due to the stimulus that causes both kinds of contractions assuming a more rapid increase in intensity during Parturition than during Pregnancy.

Having passed in review the arguments in favour of and opposed to the question, it appears evident that the nature of the contractions in both conditions is similar, and that the stimulus that produces them must also be similar, the difference being of degree only.
The contractions are involuntary.

This, of course is the only kind of contraction to which the uterine and vaginal muscles can be subject; since they are composed of unstripped muscular fibres. There is not the same consensus of opinion as to the character of the contractions of the abdominal muscles. It is therefore necessary briefly to pass in review the different opinions to which this subject has given rise.

1. "The woman feels them (in the stage of expulsion) as instinctive want of cooperating in the labour. With each contraction she exerts herself to come to nature's help." (Holty.)

2. "The woman (in the stage of expulsion) helps the uterine contractions with all the strength of her will by exertions that she often can scarcely master." (Régis)

3. "The woman has now (in the second stage) conscious ness of a solid body which has to be expelled, and she, therefore, brings to bear upon it, half involuntarily, the action of all such voluntary muscles as she has at command." (Fleischmann)

4. "Until then, the uterus has acted alone to dilate the cervix, but from that time it seems to call to its help the contractions of the abdominal muscles." (Cazeneu.

5. "The abdominal contractions are to a certain extent, submitted to the control of the will; however the impulse that determines them is so energetic that oftentimes the woman could not, even of her own will, prevent them from taking place." (Tarnier et Chautemps)

6. "The respiratory act of this stage (the second) are truly reflex in their nature." (Tyler Smith)

7. "At the scene of the labour pains the muscular action of the abdominal walls is involuntarily exerted by reflex action." (Schroeder)

8. "As the head advances, and as the head passes into the vagina, and irritate the nerves that supply it; the abdominal muscles are often stimulated to contract through the influence of reflex action, independently of volition on the part of the mother." (Playfair)
From these quotations, it will be seen that Stolz and Depaul are decidedly in favour of the auxiliary muscles of Parturition acting under the influence of volition alone; that Leishman and Cazes are no very definite answer to the question; but that Varnier and Chautard, Tyler Smith, Schrader and Playfair distinctly admit that the action of these muscles is partly involuntary, all, except Varnier and Chautard, calling it a reflex action, where involuntarily performed.

There appears to be no doubt that these contractions are partly involuntary. It has often occurred that in answer to entreaties to pant, a woman to bear down during the stage of expulsion, the characteristic reply has been received that they could not help doing so. Besides, in the working classes at any rate, there are few women who can be prevented upon entirely to forego "bearing down" efforts during the first stage. If, then, the intensity of the abdominal contractions during that stage be compared with that of the contractions of the second stage, the most superficial examination will suffice to convince any one that the latter are much more violent. Some other stimulus must, therefore, have been added to that of volition, since volition, when acting in its utmost, gives rise to less intense contractions.

The importance, for the present study, of exactly determining the nature of the auxiliary contractions is evident; for if they were entirely voluntary, the stimulus that determines these would be known, but as they are believed to be partly involuntary, it will be necessary that the theory proposed should bring forward a stimulus capable of exciting these muscles to contraction without the interference of volition.

The Contractions are intermittent.

The fact is undisputable, but there is as yet no explanation of it universally adopted. The intermission has been compared to a reflex action, it has also been considered the natural consequence of the properties of the muscular tissue.
which cannot contract continually without requirig intervals of rest; lastly, it has been attributed to the intermittent action of the stimulus.

Before entering upon the discussion of these various opinions, it will be necessary to determine the features of the contractions and of the intervals that separate them.

The contractions may be said as a rule, to be, at first, weak, short and separated by long intervals; they gradually increase in strength and duration until the birth of the child, the intervals gradually becoming shorter.

The assent to that proposition is so general, that it would be superfluous to quote any authority to support it. But Holtz and Depaule hold different views. For Depaule, the duration of the contractions diminishes rather than it increases during the second stage. Holtz on the other hand states that during the stage of expulsion, the intervals during the contractions may be rather longer.

The weight of evidence, in a typical case, appears to be greatly on the side of the more generally adopted view; but whatever the true eal course of contractions may be, there is at any rate, one fact that is made clearly to stand out from the preceding remarks: The strength and duration of the contractions, and the lengths of the intervals that separate them, are anything but constant, even in a typical case; whilst their variations in an ordinary case of parturition are really endless.

The bearing of these characteristic features on the cause of the intermitence has now to be examined.

10. Are the uterine contractions rhythmical?

The favourite comparison used in favour of that view is with the action of the heart, and as the beat may be considered as a type of rhythmical action, it certainly gives the best possible ground for establishing a comparison; but is there any similarity between the action of the two?

10. In the heart, the rhythm is an inherent property
of that organ. It is impossible to imagine a living heart not beating.

In the uterus there exist, normally, no signs of contractions in the unimpregnated state, although it is admitted that the uterus passes from the unimpregnated to the pregnant state without acquiring any new property.

26. In the heart, coeteris paribus, as long as the muscular development remains the same, the rhythm conserves the same characters as the regularity and intensity of the beats and the duration of the intervals.

In the uterus, even during a typical case of parturition, the regularity and intensity of the contractions and the length of the intervals vary within very wide limits, and present so many different aspects that authors do not all agree in the description of their features. But of instead of a typical, an ordinary case is considered, the curious spectacle is offered of a rhythmic action, irregular, inconsistent, irregularly even for hours, without any adequate modification in the parts concerned; that is to say a rhythmic action with none of the characters of a rhythm.

30. The contractions of the abdominal muscles have never been said to be due to a rhythmic action during parturition; they, however, present the same characters of uniformity as the uterine contractions, if their action can be explained otherwise than by rhythm, why should the uterine uterine uterine be due to that specific mechanism?

30. Lastly, why should the action of the muscles of parturition be considered due to a complex nervous mechanism, no traces of which have been yet discovered, when it can be explained by a simpler mechanism, requiring, so to speak, a rudimentary apparatus, all the parts of which are at hand and readily demonstrated?

30 Is the intermitence due to Temporary Exhaustion? — This exhaustion although it certainly must often help in the production of the intermitence is inadmissible as a cause of all the intervals throughout parturitions, for it goes
altogether against the features of that intermittence. The intervals of rest are longest at the beginning of Parturition, whilst the contractions are the shortest and the weakest, and the uterine muscle the fhest. The following impossibility would therefore result: A fresh muscle after weak and short contractions would require a greater interval of rest to recover from a supposed state of fatigue, then it would need, when already tired by previous exertions, and after longer and more violent contractions. This explanation, therefore, although it is believed to apply during part of the function of Parturition, is not sufficient by itself, and requires the help of the following factor.

30. Is the Intermittence due to the Intermittent Action of the Stimulus? All the variations in the intensity and duration of the Contractions, with the endless modifications they present according to cases, and all the modifications in the duration of the intervals, seem to point to the fact that each contraction is independent of the one from the other, and that, if it lasts long, it is due to the prolonged action of the Stimulus that causes it; if it violent, it comes from an increase in that said Stimulus; if it be absent, it results from the Cessation of the Stimulations. It therefore remains to find a Stimulus, which, not only will satisfactorily account for the contractions but will explain all the variations to which they are subject.

Bonds, as the contractions of Pregnancy are admitted to have the same origin as those of Parturition, it will be necessary to account for them by the action of that Stimulus, and a few words will also be required to show why pregnancy ceases and Parturition begins; why the contractions, which during Pregnancy had been very gradually increasing in intensity, suddenly take on a much more rapid increase at the time of Parturition, and why the uterine contractions cease after the expulsion of the foetus.
Chapter III

The Stimulus of the Contractions

During Pregnancy, Micturation and Defaecation are in certain cases, followed by painful uterine contractions. This symptom was first brought under my notice sometime ago, by one of my patients to whom it caused a great deal of suffering and anxiety during the last few weeks of pregnancy. In her case, I was enabled to observe personally and repeatedly that, after the two acts mentioned, but especially after micturation, the uterine assumed the characteristic hardness it presents during contraction. Sometimes after one painful contraction the following remained painless, although readily recognised by palpation; often, however, two or three, or even more painful contractions appeared to be the consequence of the evacuation of the bladder and rectum. I therefore felt justified in concluding that the feeling of pain complained of was not due, as I first supposed, to the excessive irritability of the bladder and rectum, which is always present during pregnancy as a result of pressure; but that it distinctly originated in a uterine contraction.

Researches in various obstetrical authorities having convinced me that the above described symptom had not attracted attention, I was led to enquire whether it was generally present, or only occurred in that particular case owing to some indeterminate constitutional Deferment. It was evidently useless to question any but these women in which the latter weeks of pregnancy are characterized by painful contractions, for although an exacerbation of the usual painless contractions might follow micturation and defaecation, it would naturally pass unnoticed unless it were accompanied with pain. My observations having chiefly
been made amongst the working classes, in which the sensibility, as a rule, seems less developed than in the higher strata of society, my opportunities were rather limited; but in the comparatively few cases I have collected, the answer to my question was most decisively in the affirmative: the women had noticed that defaecation but not especially micturition were followed by an increase in the sensation of pain.

This pain, it has already been shown, is due to muscular contraction of the uterus. The fact that it is not noticed during the act but afterwards makes it difficult to account for it by a sympathetic irritation of the uterus. Besides a much simpler and direct explanation is at hand.

The state of vacuity of the bladder means the disappearance of the soft elastic cushion which it forms when full, between the pubic bones and symphysis on the one hand and the uterus on the other. It further implies that the soft, compressible and irritable uterine wall is placed between the rigid pubic bone and the rigid presenting head; instead of being situated between a hard surface (the presenting head) and a soft one (the full bladder). The compression to which it is submitted is therefore increased, and as it is the only factor that undergoes any alteration, it must be the cause of the increase of the contractions; but, if increased compression cause increased contractions, it is permissible to suppose that normal contractions may be due to less intense compression.

In the same manner, the rectum, when distended by fecal matters, if they be accumulated as high up as the first third of that organ must remove the uterus from immediate contact with the rigid promontory of the sacrum, and, in primiparæ at least, also remove it from immediate contact with the upper part of the body of the sacrum; but as soon as the rectum is emptied
a closer opposition follows, the compression is therefore increased, and as a result the contractions become more painful because they are more violent.

It is worthy of notice that the increase in the intensity of the contractions is more marked after micturition than after defecation. My own observations made that point quite evident in the case in which I had full opportunities to watch the characters of the uterine contractions, and the greater amount of pain experienced by the patient herself after evacuation of the bladder also point in the same direction. Now as a consequence of the mechanism just described, the amount of compression caused by micturition must be more considerable than that due to defecation. In the latter case, in fact, it may be very unimportant or even absent, if, for instance, the forces are very low or if they do not accumulate high enough to reach the upper part of the rectum. This, in itself, shows the importance of compression, by indicating that the intensity of the contraction is proportionate to the amount of pressure exercised.

Examples of contractions due to compression might be multiplied, but they will find a more appropriate place in the systematic discussion of the determining causes of parturition. The preceding instance has been given a leading place, partly because it appeared to bring to notice a symptom so far unrecognized, partly because it was the first fact which drew my attention to the importance of compression as a stimulus of the contractions both of the pregnant and parturient uterus.

For I naturally deduced that the contractions of parturition having the same characters as those of pregnancy, compression might perhaps account for them also. It appeared to me that if a mechanism were discovered through which sufficient compression could be applied, the vexed question of the determining causes of parturition might receive a solution. I believe to have
succeeded in my enquiries and will now proceed to offer the result of my researches.

**Compressio the Determining Cause of the Contractious of Parturition.**

By inverting to the definition of the Determining Causes of Parturition, they are seen to consist of every natural stimulus acting spontaneously that can determine the contractious of the muscles of Parturition. (Page 6)

The stimulus that is believed to fulfill these conditions is, as already stated, the mechanical one of Compression.

This is known physiologically to be incapable of acting as a stimulus of muscular tissue, either by direct irritation of the muscular elements or indirectly by the stimulation of sensory nerves. The parturient powers being muscular, there is no theoretical reason why they should not be stimulated to action by Compression. The question left for solution is therefore how can their contractious be caused by Compression?

The first step will be to enquire into the nature of the parts concerned in the mechanism of compression, then to pass to the description of that mechanism and apply it to parturition as a typical, ideal act, ruled by invariable laws as it occurs in nature with its Physiological and Pathological variations. The results of Physiological experiments will then be added, and an allusion made to the bearing of Compression on Comparative Parturition.

**I. Parts concerned in the Mechanism of Compression.**

These parts are the structures with which the Parturient powers are in anatomical relations. It is worthy of notice that these anatomical relations have been entirely neglected by the various
authors who have proposed theories on the determining Causes of Parturition. They seem to have overlooked that they might have a bearing on the subject of their researches and to have considered the uterus as an independent organ, so that their theory would apply as well to the matrix, out of the body as to that organ situated as it is, in the pelvic and abdominal cavities. They however, appear to me to be of the greatest value, and they form the basis of the theory proposed in the following pages.

For the sake of brevity, these relations only will be considered that have a bearing upon the present subject. They may be divided into:

Relations of the Uterus at the beginning of Parturition.

Relations of the Parturient Canal during Parturition.

A. Relations of the Uterus at the Beginning of Parturition

External Relations

Anteriorly — The uterus is related from below upwards to the posterior surface and superior border of the pubis, and Symphysis, from which it is separated by the urethra and some loose areolar tissue more or less infiltrated with fat — the superior portion of the retropublic fat deposit of Dr Hart. At the beginning of Parturition, the bladder is generally drawn up above the pelvic brim so that it lies between the uterus and abdominal parietes, rather than between the uterus and pubis. Above the pubis, the uterus is in close apposition with the abdominal parietes, except for its relation with the bladder which has just been described.

Superiorly. The anterior part of the fundus is in relation with the abdominal parietes, laterally. The uterus is related to the sides of the pelvic brim, the iliac fossa and the upper part of the pelvic cavity.
Posteriorly. It is closely related to the promontory of the sacrum and the upper part of the sacrum, as well as to the vertebral column. So close indeed are these relations that as Dr R. and F. Barnes state: "at the end of gestation... the uterine walls are plastic enough to mould themselves on the sacrum and vertebral column, thus forming at the level of the promontory a marked retreating angle." A state of things which is also described by Cazeaux.

II. Internal Relations

The presenting part, especially when it is the head entirely fills up the lower segment of the uterus, which is, so to speak, moulded to its shape.

B. Relations of the Parturient Canal during Parturition

They are taken as the canal gradually becomes dilated by the descending presenting part.
- Externally - It is related to the sides of the pelvic cavity and to the pelvic floor.
- Internally - It is related to the presenting part.

It is desirable to consider more in detail the different parts to which allusion has been made. They may be conveniently divided into: "Parts concerned in the production of compression, and Compressed parts."

10. Compressing Agents

These consist of the pelvic brim and walls of the pelvic cavity, the pelvic floor, the abdominal parietes and the foetus.

Pelvic Cavity and Pelvic Brim.

The surface of the bones and ligaments forming these parts is partly bare, partly covered by soft structures.

The most noticeable soft structures are the Pyramidalis and Obturator Internus muscles on each side, and the Bladder and Rectum. The other structures - vesicles and nerves - are of no
importance in this instance because they do not sensibly diminish the rigidity of the surfaces entering in the formation of the walls of the pelvic cavity. The Pyramidalis and Obturator internus muscles, themselves owing to their thickness more but a very imperfect pad, as Jamieson says, and as is also observed by Dr. F. Barnes, hardly modify the form and dimensions of the cavity because their thickness is unconsiderable.

As to the bladder and rectum, the state of their contents is of the greatest importance, owing to the modifications it causes in the nature of the pelvic cavity and brim. Allusions have already been made to that point, but the full consideration of the subject will be reserved until the various modifications observed in the contraction of the Pudendal muscles are taken up. Now, however, only such relations will be noticed as would exist in typical parturition, that is, with both the bladder and rectum empty. The bladder is drawn up above the brim; by this arrangement the pubic bones are left more uncovered, and the slight amount of softness that would result from the interposition of the two walls between the uterus and the bone, is removed. The rectum only comes in relation with the body of the sacrum at the level of the third vertebra, thus leaving the upper part of the body entirely uncovered.

Besides these parts that are more or less effectually covered, there are surfaces that are practically bare. This description applies to:

10. The Promontory of the sacrum, and the upper part of the body of the sacrum, down to the third vertebra. These parts, with the exception of some connective and areolar tissue, together with the ganglionic chain of the sympathetic are entirely uncovered.

20. Parts of the pubic bones and sympathetic. In the anterior wall of the pelvic cavity, there is a large triangular surface, which, when the bladder is above the brim, is uncovered, or nearly covered by the urethra and some areolar tissue.
more or less infiltrated with fat — the retro-pubic fat depot of Hart, deposit which, however, must owing to the displacement of the bladder, be greatly stretched and thinned. This triangular surface presents three sides for description.

The base extends from the external end of the iliac pectineal eminence of one side to the corresponding part on the other. It passes successively on each side along the ileopectineal eminence, the pubic angle and crest of the pubis; the upper border of the symphysis pubis forming its central part. The sides, similar to each other, form a curved line the boundaries of which are made up by the tendons corresponding parts of the borders of the borders of the levator ani and obturator internus muscles.

The base requires a few words of special notice. The only structures that are attached to the landmarks enumerated are ligamentous or rather membranous, they, therefore, leave the rigidity of the structures to which they are attached practically unmodified. Moreover, when the time of parturition is at hand, the uterus assumes such a position that its longitudinal axis forms with the horizon an angle of 30°. It follows that these membranous structures, which enter into the formation of the abdominal parietes, also assume the same angle instead of the much more open one that characterises them during the uninpregnated state. This removes them from a superior to any anterior relationship to the base of the triangle under study, so that the bony ridge formed by that base, is also practically uncovered at the time of parturition.

3° The internal border of the ascending rami of the pubis constitute another base portion of the walls of the pelvic cavity. Pelvic floor.

This, as D. R. and E. Barnes say is constituted by "a combination of tissues" and according to Hart and Barbour, it forms "a thick
fleshy, elastic layer," closing in the outlet of the bony pelvis. Two muscles on each side, the levatores ani and the coccygeus may be said to form — so to speak — the framework round which all the other structures are arranged. This floor is extensible, to a greater or lesser extent, but owing to its elasticity and muscularity together with the enormous distension to which it is subjected, it offers considerable resistance to dilatation, so that any structure situated between itself and the dilating agent must be submitted to a corresponding amount of compression.

This brief study of the pelvic cavity and pelvic floor cannot be concluded without allusion being made to the subcutaneous and adipose tissue found in relation with them. In the words of Dr. Barnes it "consists of the loose connective tissue padding the interstices of the muscles, lying round the cervix uteri and spreading out beneath the peritoneum.... In certain places it is gathered into manes or pads, in others it is distributed in laminae or sheets." This loose connective tissue, in the majority of women is more or less unimportant because the quantity of fat deposited in its meshes being unconsiderable, the padding that it furnishes is a "quantité négligeable." But when the adipose tissue is abnormally developed, these pads assume an evident importance, for they cannot but diminish compression by intervening between the bony pelvis and the walls of the soft parturient canal.

Anterior Abdominal Varieses

The relations of the uterus to these parieties vary according to position.

In the supine position, they are chiefly relations of contact — the weight of the gravid uterus resting more or less directly on the vertebral column and the posterior surface of the abdominal cavity.

But in the erect position, these posterior relations are not merely of opposition, they are also of support, for, as pajot says: "The uterus rests on the anterior
abdominal wall which forms an elastic floor to it. That such is the case is readily demonstrated by recalling what happens when the abdominal parietes are abnormally weak: antversion, and prodditi on of the gravid uterus being evidently nothing but an exaggeration of the normal obliquity of the uterus, due to an abnormal laxity of the floor on which it rests. Moreover the angle formed with the horizone by the longitudinal axis of the uterus is one of 30°, and the only unyielding point on which the uterus rests is the anterior and inferior border of the brim. Now, it is evident that the segment of the gravid uterus at term situated behind a perpendicular line drawn through the pubis is much shorter and lighter than that situated in front of that line. If the gravid uterus be considered to form a level, the fulcrum of which is furnished by the pubic crest, we have a long arm with a heavy weight, opposed to a short arm with a light weight: the uterus, therefore, owing to the position it occupies in the body—that is with the long arm of the lever to which is attached the heavier weight higher than that of the short arm with the light weight—must be in a state of unstable equilibrium. If, besides, for simplicity's sake, the presenting part be admitted to be above the brim, it is evident that the anterior abdominal wall constitutes the only obstacle that prevent the uterus from assuming a position of stable equilibrium; it must, therefore, support all the extra weight attached to the anterior and long arm of the lever, so that, both theoretically and practically, it is easy to demonstrate that the relations of the part to the uterus is one of support as well as of contact.

**Foetuses.**

Two features are here of special interest: 10 in a typical case the head fills the lower segment of the body of the uterus which is exactly moulded over it. The same may be said of the relations of the head with the parturient canal which, as it becomes dilated by the presenting dep.
Ceming part, must necessarily adapt to its shape. When another part than the head presents, the same phenomena are observed, but as none of these presenting parts is as rigid as the head, it is evident that they, in their turn, must accommodate themselves to the parts through which they pass to a greater extent than the much more unyielding head.

2. The foetus growing during the whole time of gestation, both the size of the presenting part and the total weight of the foetus increase until parturition begins.

2. Compressed Parts.

Under this heading, the body of the uterus, the cervix, the vagina, and the vulva are considered.

Body of the Uterus.

This organ, as pregnancy advances, presents the following features. Its tissue gradually softens, its muscular and nervous elements gradually increase. As a consequence, it becomes more and more compressible, its contractions more and more powerful, and its irritability greater and greater. At the time of parturition, all these features attain their maximum development.

The weight of the uterus increases also considerably, for instead of weighing from 40 to 55 grammes, as in the unmarried state, it reaches at the end of gestation the weight of 200 or 250, or even 350 grammes (Tarnier). Properly speaking, however, this feature should not be considered here, for it belongs to the agents of compression, as it is evident that such a general increase of weight means increased pressure upon that special part of its parietes that rests against the rigid brim of the pelvis.

Cervix

I have previously given my reasons for holding that the cervix in its entire length forms part of the canal of parturition. (Pages 12 and 18.)
It will therefore be sufficient again to notice that it gradually softens from below upwards and from without inwards, and that the time when it reaches the os uterine is believed to be the time when pregnancy should be considered to end and partu- rition to begin, because it is then that the contrac-
tions become inefficient, begin to affect the prolapse of the ovum.

Vagina and Vulva.

They present no special character of interest except their greater muscular and nervous development and their more abundant blood supply the result of these conditions being an increase in their normal irritability.

II. Mechanism of Compression.

From the preceding considerations, it is evident that, at the time of parturition, it is justifiable to summarize as follows the anatomical relations of the uterus and canal of parturition — the compressed parts — to the pelvic brim and cavity, the pelvic floor, the abdominal parietes and the foetus — the compressing agents.

10. Relations of the body of the uterus to the pelvic brim and cavity due to the foetus.

These are from behind forward.

1. The promontory and the upper portions of the body of the sacrum — a rigid surface.
2. The uterine parietes — a compressible structure.
3. The foetal head — 2 rigid surfaces, one posteriorly, one anteriorly.
4. The uterine parietes — a compressible structure.
5. The pelvic brim and the upper part of the pos-
terior surface of the pubis — a rigid surface.

This, therefore, gives 2 soft compressible struc-
tures, each of which is situated between and in close apposition to, two hard unyielding surfaces.

20. Relations of the uterus to the abdominal parietes.

The position of the uterus in such
that if it were not for the resistance offered by the
pelves, the anterior segment would move
downwards and the posterior segment upwards, the
pubic rim acting as fulcrum.

30. Relations of the Canal of Parturition to
the Pelvic cavity, Pelvic floor and to the Foetus.
During Parturition the soft structures forming the
Canal are closely applied to the presenting part,
and are besides, in contact with the sides of the pelvic
cavity and with the pelvic floor — this contact being
especially intimate in two points at least, which
are those points corresponding to the longest diameter
of the presenting part.

In consequence of these relations the mechanism
of compression may be subdivided into five compo-
nent parts.

I. The weight of that section of the foetus and
uterus which is placed immediately above the
symphysis pubis and upper border of the pubis,
will evidently be a source of compression to that
part of the uterine parietes which lies between
the foetus and the pubic rim. To this may be
added the weight of the abdominal organs that
rest upon the fundus and posterior surface of
the uterus.

II. If the abdominal parietes, from whatever
cause it may be, become unable to support the
whole weight of the uterus and its contents, the
anterior segment of the uterus will tilt for-
ward, and the excess of weight will be commu-
nicated to the pubis. This increase of the
burden supported by the pubis will naturally
be followed by an increased compression of
that part of the uterine parietes situated bet-
ween the pubis and the presenting part.

III. When the tilting previously described for
the anterior segment takes place, it is evident
that a correspondent rise will be observed in
the posterior segment. If the presenting part
is sufficiently engaged at the pelvic rim, that
part of it which is in relation with the prominent and upper portion of the body of the uterus will become more closely approximated to those bony surfaces. In consequence, as much of the uterine parieties as is situated between the two rigid surfaces will be subjected to compression.

IV. When the presenting part is tightly fixed at the pelvic brim or in the pelvic cavity, it is evident and universally recognised, that the soft cervical and vaginal walls also are compressed between it and the hard bony pelvic cavity and brim.

V. When the contractions of the abdominal walls are brought into play, they act as agents of compression in the two following ways. They directly compress the parieties of the uterus situated between themselves and the fetus. They indirectly compress the lower segment of the uterus by forcing it against the brim of the pelvis.

Of these five factors some may act singly, others only in combination. The first, for instance, may be the only compressing agent, but the second cannot act without the first, and the third is never brought into play without the cooperation of the two former. The fourth, again, is self sufficient, whilst the fifth is the result of the action of the fourth. These combinations have the advantage to help in the explanation of the varied intensity of the contractions.

Compression, therefore, acts in so many different ways that there is no difficulty in accounting for the contractions of the uterus and other muscles of parturition, but what explanation is to be given of the intermittence of the contractions?

It has previously been stated why that intermittence was believed to be due, partly to the muscular action, and partly to the intermittence in the action of the stimulus, partly to the temporary exhaustion of the uterus and other muscular fibres (pages 20, 21, 22).

When the three first-factors of compression are
the Cause of Contraction, the intermitence of the latter is due to the intermittent action of the former: in the state of rest, the uterus is soft, it is therefore compressible, that is to say, in such a state as will enable it to react to the stimulus of compression. But as soon as contraction takes place, the muscular fibres become rigid, consequently their compressibility disappears, the compressing agent becomes therefore unable to perform their function, the stimulus ceases to act, and a natural result—the contraction comes to an end. This being accompanied by the relaxation of the muscular tissue, brings the various parts back to the state where compressio becomes again effective.

When, however, the presenting part is fixed at the brim or in the pelvic cavity, when, therefore, the fourth and fifth factors are the cause of the contraction, the intermitence of the latter is chiefly due to temporary exhaustion. At that time, the contractions are not merely uterine, they are also abdominal and vaginal. As far as the uterine muscle is concerned, the intermitence is entirely due to muscular fatigue: the organ has already been at work for a more or less considerable period of time, and the contractions are stronger and of greater duration; it is therefore natural to suppose that its irritability becomes diminished and its fibres partially exhausted; so that after a time, it will cease to react to the stimulus unless rest is first obtained. When, however, the uterine contraction ceases, the presenting part slightly recedes, stimulation is thereby diminished in two ways: the presenting part comes again in contact with a portion of the parturient canal which has been more completely dilated, and which has already been compressed for some time; so that the surface now stimulated by compression has already had its irritability partially exhausted. In this way the cessation of the abdominal and vaginal contractions can be explained by saying that although they could react to a stimulus of a given intensity, they are unaffected by one of lesser
intensity. When, besides, the abdominal and va-
quinal contractions have been established for some
time, the factor of partial exhaustion also enters
into action to explain their intermittence.

Before closing the subject of the Mechanism of
Compersion, an additional argument in favour of
its importance might be found in the fact that
the proportions between the foetus and the para-
rectum canal are such that compresion must
occur during Parturition. But compresion cannot
be present without resistance and pain being caused.
Now if compresion were not an indispensable fac-
tor for the accomplishment of the act, why should
the human frame be so built as to put unnecessary
suffering and delay in the way of the Completion of
Parturition? Whether the human body be constructed
according to invariable laws, or whether it be subject
to those gradual transformations more generally
admitted, now-a-days by scientific men; it seems
incredible that the mistake should have been made
of putting any obstacle in the way of the most im-
portant act of life, if there were not an absolute
necessity for that arrangement. The necessity of
compresion once admitted, it is difficult to un-
derstand how it could be useful except as a Determining
Cause of Parturition.

III. Compression as the Stimulus
of the Contractions
of Typical Parturition.

Having shown the various manners in which
compresion is capable of giving rise to the contrac-
tions of the muscles of Parturition, it is necessary to ascer-
tain whether, in that act, sufficient opportunities are
offered for the working of the mechanism in ques-
tion, and, further, whether compresion can account
for the variations in duration, intensity and
frequency that characterise the contractions of
the different stages of Parturition. It is intended to
take, as a standard, a case of what may be called typical Parturition, that is Parturition accomplished as if it were ruled by invariable laws, the succession of events being always the same, and always in keeping with the most advantageous termination of the act.

First Stage

1 Description

Extent.—It extends from the beginning of the dilatation of the os internum, to the complete dilatation of the os externum.

State of parts.—The uterus is soft and compressible, it has attained its maximum development in muscularity, irritability and weight. The cervix at the beginning of the first stage is entirely closed, its walls are softened throughout; the complete softening of the os internum determining the end of pregnancy and the beginning of the first stage. The abdominal parietes begin to give way under the combined weight of the uterus and of its contents, for it is now that during the last days of gestation the fundus not only descends in the abdominal cavity, but occupies a more anterior position, which it evidences.

The black dotted line is the perpendicular alluded to page 82.

The red dotted line and the red arrows refer to the mechanism of tillage described page 85 (It appears that both at the 36th and the 40th week the fundus should be placed more anteriorly, thus rendering the tillage action more evident.)
These various relations are well brought out by the accompanying diagram borrowed by Lute from Schulze, (and slightly modified here).

Position — Erect. This is rigorous as the typical position, because the contractions of the first stage are admitted universally to be favoured by the erect posture, it is therefore the best in keeping with the most advantageous termination of parturition.

2. Characters of the Contractions

General — The contractions, compared with those of the following stage, are weak, separated by long but not absolute intervals. They are confined to the uterine muscles.

Compared with each other, they gradually increase in strength and duration and are separated by gradually shorter intervals.

Special — In the first part of this stage, the contractions are more powerful in primipara than in multipara.

3. Mechanism of Compression

In this stage, the three chief factors of compression are the only active agents in originating the contractions. They consist of:

1. The weight of the uterus and contents immediately above the pubis. (Page 35)

2. The tilting downwards of the anterior segment of the uterus (Page 35)

3. The tilting upwards of the posterior uterine segment. (Page 35)

Besides these three primary factors, the fourth, that is the compression caused by the fixed presenting part, will be soon to act secondarily.

4. Application of the mechanism to the characters of the contractions.

The contractions, compared with those of the following stage, are weak, short, separated by long but not absolute intervals. The shortness is due to the fact that as soon
as the contraction begins, the stimulus of compression ceases to act. The weakness comes partly from the same cause, partly from the slightness of the stimulus.

The length of the interval is due to the fact that compression being comparatively slight, some time must elapse before, by accumulation of stimuli, it becomes powerful enough to cause contraction. The rest is not so absolute, because the stimulus unable to cause a definite contraction is sufficient to keep up a certain amount of irritation.

The contractions are only uterine because the compression only affects those parts of the body which reflexly or otherwise produce the contractions of the uterine muscles.

Compared with each other, they gradually increase in strength and duration and are separated by gradually shorter intervals.

The increase in the intensity of the contractions is due to an increase in the amount of compression brought about in the following manner:

10. The abdominal walls give way more and more under the weight of the uterus and contents, the weight thus communicated to the pubis proportionally increases, and the compression becomes therefore more considerable.

20. As the obliteration of the cervix progresses, the head descends in the pelvic cavity, the age of the plane of the foetal head situated in the plane of the bicorn gradually increases. The compression caused by the tilting upward of the head against the promontory is thereby increased.

30. As the cervix gradually becomes obliterated, the action of the fourth factor of compression is added to that of the three first. For as soon as the three first cause a uterine contraction, the presenting part presses the sides of the obliterated cervix against the sides of the cavity, a new source of stimulation is thus added to the
proceeding, and as it is only brought into play after the other factors have already begun their work, it evidently must increase the length and duration of the stimulation and simultaneously the duration and strength of the resulting contractions.

The intervals between the contractions decrease because the compression gradually increases; less time is required for the stimulus to become powerful enough to cause a contraction.

Special characters — The contractions of the first part of this stage (the so-called precursory stage) are generally stronger in pregnancy than in multiparae, because in the first the presenting part is already engaged at the brim, so that the third factor of compression due to the tilting against the promontory acts from the first; whilst in multiparae the head being generally freely movable above the brim, that factor either acts very slightly or does not act at all.

Second Stage

1° Description

Extent. It begins with the full dilatation of the os externum and terminates with the birth of the foetus.

State of Parts. — Uterus. — The same as in the first stage, but its muscular fibres are not so fresh owing to the previous contractions it has already gone through. The cervix is entirely dilated, its sides are close against the pelvic cavity, and it forms with the vagina a practically continuous canal, as the latter becomes dilated by the descending presenting part. The head is fixed at the brim.

Position — Horizontal.

2° Characters of the Contractions

General. — Compared with those of the first stage, they are more violent, longer, separated by shorter but more complete intervals of rest. Besides
Being uterine, they are also abdominal and vaginal.

Compared with each other, they gradually increase in intensity and duration, the intervals between them becoming shorter. This holds good until the head is born, after the contractions are much weaker.

Special — There are two contractions presenting special features 1. The contraction by which the head is made to clear the cervix. 2. The contraction that causes the birth of the head. The intervals following these contractions require also special notice.

3. Mechanism of Compression

The fourth and fifth factors chiefly act in this stage. They are:

1. The compression of the uterine, cervical, and vaginal parietes against the walls of the pelvic cavity or the pelvic floor, and the fixed head (page 36)

2. The compression (direct and indirect) of the uterine parietes caused by the contractions of the abdominal muscles (page 36)

4. Analysis of the Mechanism of Compression to the Character of the Contractions

Compared with those of the first stage, the contractions are more violent, longer and separated by shorter but more complete intervals of rest.

The head being now fixed at the brim, the compression must be greater than when it was only applied against it. The increased violence of the contractions is therefore explained by the increased compression.

The longer durations are due to the fact that the stimulus being permanent (since the head is fixed) the contraction lasts until the muscular fibres cannot any longer react to the stimulus.

Both the greater intensity and duration are also due to the compression arising from the abdominal contractions. This stimulus beginning to act after the other factor of compression has already begun its work, naturally adds to the intensity and the duration of the contractions.

The length of the interval diminishes because the stimulus being permanent the muscle will react to it as soon as it will be at hand to irritate the
muscle as soon as this is sufficiently rested, and the interval of rest—necessary will be in considerable
owing to the violence of the stimuli.

The rest during the intervals is more complete because the muscular tissue being exhausted, completely ceases for the time to react to the stimuli.

Besides the uterine muscle, the abdominal and vaginal muscles take part in the contractions.

The vaginal would naturally do so from the direct compression they are subjected to. As to the abdominal it may be imagined, either that there is a connection with parturition, a special nervous mechanism so arranged that compression of the vaginal sensory nerve endings will, by reflex action, cause the abdominal muscles and the diaphragm to contract, or, more simply and also more probably that the mode of action of these muscles during parturition being identical with their action during defecation, their contractions are due to the compression of the rectum between the descending head and the sacrum, coccyx and pelvic floor, the mechanism of defecation being thus stimulated; the stimulation being, however, too violent to allow of any voluntary inhibitory action controlling the appearance of the contractions.

Compared with each other, the contractions gradually increase in intensity and duration, the intervals gradually becoming shorter.

The gradual increase in intensity and duration is due to the gradually greater superincumbency of the parturient canal exposed to compression as the presenting part descends further and further in that canal. It is also due to the fact that when the head comes in contact with the pelvic floor, this, owing to the principle that there is no contractile without a reaction, is compressed as well as the parietes of the parturient canal. Whilst in the pelvic cavity the compression caused by reaction against the bony surfaces cannot give rise to an appreciable increase of stimulation because of the inferior irritability of osseous tissue, but matter become very different when
the very sensitive and irritable pelvic floor is compressed. This compression is a new source of reflex irritation, which may readily be admitted to result in the increased intensity and duration of the contractions.

This, as well as the fact that when the head shows at the vulva it compresses the periosteum of the parturient canal against the hard bony uncovered border of the pubic arches, early accounts, by the amount of compression, for the extraordinary violence of the few contractions that precede the birth of the head.

The shorter and shorter intervals are explained by the increasing intensity of the stimulus, this increase, typically, more than compensating for the augmented exhaustion of the uterine and other muscles.

After the birth of the head the contractions become weaker.

This would naturally follow the diminished compression that must result from the rigid head being replaced as an agent of compression by the relatively yielding trunk. But unless compression is considered as the determining cause of the contractions, it seems very difficult to explain the diminution in the intensity of the contractions.

Special Contractions and Intervals.

1. At the time when the head clears the cervical opening. The contraction that immediately precedes the passage is of special intensity, whilst the interval of rest that follows it is characterized by its comparatively sudden onset and prolonged duration. The intensity of the contraction is easily explained, since the broadest part of the head first then passing through the orifice, the compression is at its maximum. The sudden character of the rest is due to the sudden diminution of the compression, for the cervix, instead of surrounding the broadest part of the rigid head, now encircles the relatively small and soft neck. The length of the interval results also from the diminished compression, which means a stimulus of lesser intensity, so that the uterus, which was able to react to a stimulus of a given intensity, requires a certain amount of rest.
before it can begin again to react to a stimulus of lesser intensity.

2° At the time when the head clears the vulva, the characters both of the contraction and of the uterine ones are the same as in the precedent, but in an exaggerated form. The compression is more violent because the surfaces compressed are more irritable; the rest is longer and more complete because the quota of compression which was exercised by the head against the vagina in the former case, is absent in this instance, the head being borne. Besides which the muscles of parturition are more exhausted and require longer rest before they can react to a stimulus of lower intensity.

Third Stage

A few words will suffice to cover all the facts of interest of this stage.

It extends from the birth of the fetus until the expulsion of the secundines is completed.

The uterus is partially exhausted, the cervix, vagina and vulva have, owing to continued compression, their irritability diminished. The placenta and membranes are soft, compressible structures.

Characters of the Contraction — Along internal uterine iglu before a new contraction takes place after the birth of the fetus. When the contractions begin, they are weak and of uncertain characters so that the spontaneous expulsion of the secundines may be deferred for a long period.

The Cause of the Contractions may be either the slight compression produced by the placenta and membranes upon the vaginal walls which are well rested when the contractions begin, or simply the fact that the secundines act as a foreign body and is that very irritating the parts to contraction, but the action of a foreign body as a stimulus might be due to its contact with the stimulated part, and it is an open question whether contact cannot be considered as a very slight form of compression, becoming sufficient in this instance, because of the nature of the compressing
agent.
Whatever may be the cause, the deductions to be drawn from the characters of that stage are of the utmost importance, for it plainly shows that as soon as the intensity of the compression diminishes or practically speaking disappears, the contractions accordingly become weaker, or even cease entirely.

IV. Compression as the Stimulus of the Contractions of Normal Parturition.

The study of the different phases of typical parturition having been completed, it is necessary now to investigate how compression accounts for the features presented by parturition, no longer as a typical act, ruled by invariable laws, but as it is really performed by nature, that is with very wide variation. It is believed this examination has not been attempted, except very partially, for any of the previously existing theories. It is, however, a necessary one, for, unless each case is admitted to have its special determining cause, it is evident that if a stimulus is able to cause one contraction, it should be able to determine all other contractions which present the same essential features.

At the same time, it must not be forgotten that a contraction implies two factors: a stimulus and a contracting element. The latter must be considered as a constant factor in the following study, otherwise a hopeless confusion would result. It is evident, for instance, that a stimulus of a given intensity, that gives rise to a certain amount of contraction in a normal muscle, might, in fact entirely to produce stimulation of the muscle become abnormally irritable, or, on the other hand, might cause a much more violent contraction of the muscle, for some reason or other, became hypersensitive; so that the same stimulus may give rise to
Contraction of varying intensity. For those differences clearly, the stimulus cannot be made accountable. In all cases, therefore, in which the modified caracters of the contractions are evidently due to variations in the stimulated muscles, no explanation will be attempted, unless they are inextricably welded to the variations arising from the stimulus.

These preliminary remarks being now necessary to define the field of the present enquiry, it is proposed to divide the subjects in two parts: Physiological and Pathological Parturition.

A. Physiological Parturition

By this is meant Parturition at term when the relations between the different parts concerned vary only within such limits as are compatible with the act being accomplished without necessarily endangering the safety of the mother or of the foetus.

The modifications to which the contractions of Physiological Parturition may be subjected, can be all classified under the headings: Diminution, Increase and Cessation.

Cessation of contractions, however, can hardly be recognised as a physiological variation, and its study will be reserved until the considerations of Pathological Parturition are begun. It is there more frequent and better defined, so that its elucidation will be come more evident.

It will therefore be sufficient, for the present, to enumerate the diverse conditions giving rise to the two variations of Diminution and Increase, and to endeavour to explain them by modifications in the stimulus of compression.

The sources of compression being two-fold: maternal and foetal, the parts played by each in the modifications of the contractions will be best considered separately.
a) Modifications of the Contractions referable to Modifications of the Maternal Urne of Compression, that is the pelvic brim, the sides of the pelvic cavity, the pelvic floor, and the abdominal muscles.

I. Diminutions — The diminution in the intensity of the contractions, which does not originate in a decrease of the irritability or contrac-tibility of the muscles of Parturition, may be said to occur in:

1. In cases of decreased resistance.
2. In distortion of bladder and rectum.
3. In certain positions.
4. In cases of obesity.

5. Diminished resistance — Nagel and Broussais say: "Observations teach that parturi-ent may be slow with a large pelvis." It is evident that in such a case, the Compression exercised upon the soft parturient canal between the presenting part and the sides of the pelvic cavity, will be diminished. Compression accounts therefore for that particular variation in the contractions.

2. Distension of bladder and rectum.

Bladder — It forms, when full, a cushion between the pubis and the uterus. This cushion diminishes the rigidity of the pubis and consequent-ly diminishes the amount of compression due to gravitation. Again, by finding the space neces-sary for its distension between the abdomi-nal muscles and the uterus, the bladder must straighten the axis of the uterus, the tilting forward of that organ is therefore diminished and the compresion produced by that tilting is proportionally decreased.

Rectum — If sufficiently distended with feces, it must, in the first stage, prevent the head from engaging at the brim, and in consequence prevent or diminish the Compression against the
promontory. When the presenting part is fixed in the pelvic cavity, it substitutes to the hard, bony surface of the sacrum a soft and compressible substance, the amount of compression is therefore proportionately diminished.

The diminution in the intensity of the contractions is therefore explained in both cases by a diminution of the compression.

The state of the contents of both the rectum and bladder, readily account besides for the irregularities in the contractions of the so-called precursory stage, irregularities which are observed in those women in whom the contractions of that stage are part of the time accompanied by pain.

In their case, the contractions may be painful, regular and violent and then gradually diminish and cease, to recur again after a term of apparent rest. Now, I have already given as the result of my observations, that, even during pregnancy, the evacuation of the bladder and rectum are followed by painful contractions. The same happens in the precursory stage, but in an increased force as would naturally result from the increased irritability of the uterus. As soon as the bladder and rectum are emptied, the contractions, acting at its best, the contractions become more violent and accompanied with pain, but as these organs gradually refill, the compression proportionately diminishes until it becomes insufficient to cause painful contractions; these however, are not absent, but only in abeyance as far as pain is concerned. If the fact is kept in mind that, in the last period of pregnancy, both the bladder and rectum are abnormally irritated by the unusual pressure exercised against them, and that, as a result of this condition, frequent micturition and defecation become the rule, it will be evident that all the necessary factors for the recurrence of the painful contractions at frequent intervals are present.
Position — The recumbent position is well known to diminish the intensity of the contractions. It is, for instance, recommended in cases of precipitate labour. By that position, the compression exercised by the sharp pubic rami is removed, the diminished intensity of the contractions is therefore easily explained.

Adiposity — The contractions of parturition are sometimes weak in fat women. Cajeaux attributes it to the deficient action of the abdominal muscles, which therefore do not take their share in the expulsion of the foetus. There can exist no doubt of that explanation as far as it goes, but it does not account for everything. Cajeaux, himself, in stating that the uterine contractions in such cases do not quite cease, implies that they diminish, and his explanation does not account for that part of the process. But obesity, by preventing the contractions of the abdominal muscles from attaining their full strength, diminishes the action of the fifth factor of compression, that is the compression caused by the contracting abdominal muscles, both directly and indirectly, as has already been explained. Again, in stout women, the loose connective tissue of the pelvis, which may be overlooked in other cases, acquires a certain importance; it becomes loaded with fat—lessens the hardness of the bony canal, and acting as a cushion, weakens compression. The diminution of contractions in such cases can therefore be accounted for by diminished compression.

II. Increase — The increase in the intensity of the contractions may be due to:

1. Increased resistance
2. Position
3. Special character of the pubic rami

Increased resistance — Neugebauer and Graeber also state that: “The evidence of narrowness of
the pelvis does not exclude premature labour. This increased resistance, however, only remains physiological when within certain limits, and as it happens more markedly in Pathological Parturition, its study will be reserved until the latter subject is reached.

20 Position – It is a well known fact that the contractions become more intense when the erect position is substituted to the supine, and further, that walking increases their strength still more than mere standing. Now the erect position evidently brings into play the compression of the uterus against the pubic, compression which is increased or, at any rate, decreased by the supine position. Walking further increases the intensity of the contractions because of the sudden jerks it communicates to the uterus, resulting in increased compression against the pubic rami. The effect of position has been known since a very remote time. Hippocrates says: "In difficult labour . . . . the (the woman), must also be shaken in this manner: let her be fastened to the bed by a broad band crossing her breast and her legs bent at the lower part of the bed; the upper end of the bed must be raised by two assistants, who gently shake her at intervals until the child is expelled by her pains." The advantages of that rather complicated manoeuvre are now readily obtained by the erect position and walking. In both instances, the variations in compression explained the modifications in the contractions. No simpler, and yet no more decisive argument could be brought forward to prove the importance of Compression as a determining cause of Parturition.

20 Special Characters of the pubic rami – It has been noticed that if the bony prominences of the pubic crest are more marked and sharper than usual, the contractions are more violent and painful. This would naturally
follow the increased irritation due to that
modified and more active form of compression.

6) Modifications of the Contractions
referable to Modifications of the
Fetal Source of Compression, that is
the Presenting Part.

Both diminution and increase of contractions
that can be referred to that source are due to dif-
ferences in presentations. It will therefore be
preferable to pass in review these different presen-
tations and to endeavour to explain the modi-
fications, in the increase and in the diminution,
presented by the Contractions, by the modifi-
cations of the stimulus of Compression.

10 Vertex Presentation.

It may be said that, from the immense
majority of cases in which that presentation
occurs, and from the fact that it is the safest
for mother and child, that the Contractions in
vertex presentations, offer the typical character
of the Contractions of Parturition. In the following
considerations they will therefore be taken as the
standard.

However, even in vertex presentations, there
are varieties in the intensity of the contractions.
A comparatively large head, for instance, will
cause greater violence of these contractions, evi-
dently by increasing the compression. The same
kind of variations will be found in every differ-
ent presentation, according to the projections
of the presenting part and the passage. It is,
however, evident that it would simply result
in confusion to take account of these differences.
It will be necessary to take in each instance an
average contraction, and compare it with the
standard contraction already alluded to, merely
keeping in mind that in each presentation
variations occur which can all be explained on
the following principle gathered from an observation of Koegeleb and Geusen, quoted as follows by Charpentin: "Koegeleb and Geusen do not admit the relative exaggeration of the contractions for they say observation teaches that parturition may be slow with a large pelvis and a badly developed foetus, whilst, on the other hand, the evident narrowness of the pelvis does not exclude precipitate labour." It is clear that in the first case the slowness of parturition can only be due to weakness of the contractions, and in the second, the rapidity result from their violence, now it is self evident that compression is diminished in the first, and increased in the second instance, and all the variations in the intensity of the contractions occurring in any of the different presentations, and not due to special conditions of the uterine muscle, can very naturally be accounted for, by this cause of the variations in the compression.

20. Face Presentations.

The characters of the contractions are very much the same as in vertex presentation, although they are spread over a longer period. The chief similarity in the individual contractions naturally follows from the practically similar rigidity of the face and of the vertex, the amount of compression caused being therefore identical. That the completion of the act requires more time is simply due to the fact that the presentation puts mechanical difficulties in the way of the progress of parturition.

30. Pelvic Presentations.

The contractions of the first stage are weak, irregular and separated by long intervals. The contractions of the second stage are very similar in intensity to those of the second stage of vertex presentation. If there is any difference, they are weaker.
The characters of the contractions of the first stage are due to the following circumstances. 10. The presenting part being relatively soft and compressible, the compression it exercises upon the uterine parietes against the hard pelvis is less than in vertex presentations. 20. Its size being more bulky and its shape not fitting so well in the lower segment of the uterus, the presenting part is higher up, that is removed from the brain. This again diminishes the intensity of the compression.

But as soon as the breech is fixed in the pelvic cavity, its larger size compresses, to a certain extent, for its greater softness, so that the compression it exercises is not sensibly lessened if compared with that present in vertex presentation. If, however, the knee or the feet present, the size of the presenting part is naturally diminished, the compression proportionately decreased, and the usually weaker contractions present in those varieties, accounted for. Another reason that explains the character of the Contractions of the second stage of an ordinary case of breech presentation, is that the breech adapting itself more readily to the parturient canal, progresses quicker through it, after each contraction, therefore, a greater surface of fresh and consequently more irritable tissue is compressed than in vertex presentation, so that the stimulus for the next Contraction is intensified, this mechanism again compensating for the greater softness of the breech.

40. Transverse Presentations.

This variety, should not, properly speaking, be considered under the heading of Physiological Parturition, its dangers both to mother and child being so considerable as to make it a truly Pathological condition. For the sake of brevity, however, it will be preferable to allude to it here, since all the other presentations are under consideration.

The first stage is characterised by weak, distant,
irregular contractions; the stage of expulsion (in spontaneous evolution) by very violent contractions. The high position of the presenting part and its relative softness account well for the weak, irregular contractions, by the same mechanism that explains those of breech presentation during the first stage.

The violence of the contractions when the shoulder is engaged and the gradual increase in their intensity until the birth of the foetuses are also satisfactorily explained by the increasing compression that must follow the considerably and gradually increasing size of the presenting part. The larger size of the presenting part more than compensates for its greater softness, and that such is not only a practical, theoretical but a practical compensation is proved by the occasional sequelae of transverse presentations: sloughing of, and consequent fistulae in the maternal organs plainly testify to the violence of the compression that has given rise to these conditions.

These remarks, summary and incomplete though they be, seem sufficient to prove how easily in Physiological Parturition, modifications in the compression account for modifications in the contractions.

Before passing to the considerations of Pathological Parturition, the special features of Parturition following Multiple Pregnancy will be examined.

Parturition following Multiple Pregnancy.

Two varieties are to be considered here: The uterus is emptied of its contents on one occasion, or parturition, after having effected the expulsion of one foetus, is suspended for a considerable length of time, the expulsion of the second foetus taking place at a later period.
These & variations are generally admitted to be due to viupregnation taking place at the same or at different times, and they will be considered here in that manner.


These remarks will be limited to the consideration of twin pregnancy; the phenomena of parturition in cases of triplet, quadruplet, etc., being too imperfectly recorded to allow of any satisfactory explanation.

The two children may be viable, or one foetus may be dead and the other alive, the death of one of them having taken place at some period as other of pregnancy, without, however, producing abortion.

1. When the two foetuses reach full term, the special character of the contractions are the following: The first child is born according to the general manner, then an interval of rest occurs, and the second child is expelled by a few, comparatively weak, contractions.

The mechanism of compression that causes the expulsion of the first child is the same as that which has been described in the case of single pregnancy; there is therefore no need to repeat it: the subject will be taken as it presents itself as soon as the birth of the first foetus is completed.

There is an interval of rest between the last contraction of the first expulsion, and the first of the second labour. Its duration may vary, but as a rule, it is always present. The change in the intensity of the compression readily accounts for it by the following mechanism:

Succeeding to the violent contractions compression exercised by the first foetus against the most irritable parts of the parturient canal, compression caused by the second against the uterine wall, is inconsiderable, first, because the presenting part is not yet joined at the brim; secondly, because the irritability of the uterus is inferior to that of the vagina; thirdly, because that irritability has already been blunted by the compression previously exercised; fourthly, because the muscular fibres, being partially
exhausted; react with more difficulty to the stim-
ulus, whatever its intensity may be. For these
various reasons, the compression caused by the
second foetus is very much less effective than that
to which the uterus was reacting shortly before, and it
requires a more or less prolonged rest before the stim-
ulus is sufficient again to produce a contraction.
The interval is therefore easily explained, its variations
in duration depend upon the amount of exhaustion
of the uterine muscle, the more or less close apposition
of the presenting part to the pelvic brim and the sides
of the pelvic cavity, and the size and variety of this
presenting part.

The comparative weakness of the contractions
that expel the second foetus are admitted to be due to
the diminished resistance offered by the already
dilated canal; but this lessened resistance would
only imply quicker expulsion, if the stimulus caus-
ing the contraction were not connected with the
amount of resistance. It is evident, for instance,
that if oviparous excitement were the determining
cause of the contractions, the fact that the passagies
are already dilated would not modify the effect of that
stimulus; but, if it be kept in mind, that a

diminished resistance means a lesser amount of
compression, the weakness of the contractions be-
comes easily explained by the weakness of the
stimulus. The fact that the dilated parts have
already lost some of their irritability by former
compression is another factor which also accounts
for the character of the contractions.

16 When one of the foetuses dies during pregnancy
without interrupting the course of gestation, the
fact that abortion or premature labour are not
induced, may be explained by holding that even
with the changes that such a death causes in the
maternal and foetal structures, the compression
exerted is not powerful enough a stimulus to
induce sufficiently puer violent contractions to cause
expulsion.
The expulsion of the dead ovum at term is due
either to its connection with the living, or to the fact that it acts as a foreign body against which the uterus, being then highly irritable, acts until it is expelled.

2. Parturition after Superposition

The state of matters in this case is such that with two fetuses in utero some time elapses between the birth of the first and that of the second, and both children, when born, are mature. It is therefore evident that at the time of the birth of the first fetus, the second is still undeveloped and therefore underweight. In such a case the mechanism of compression acts in the following manner.

The first child is mature, its weight combined to that of the other is insufficient to produce the necessary amount of compression to induce parturition; but, parturition means partial exhaustion both of the muscular tissue and of the irritability of the compressed parts. It may therefore happen that, if the uterus be sufficiently exhausted and the fetuses light enough, the amount of compression produced will not suffice to cause the expulsion of the uterine contents. Even after the uterus, the amount of compression caused by the weight of the second fetus may remain insufficient to induce the necessary contractions. The uterus will therefore remain in utero until, by further development, both its weight and its size will furnish the requisite amount of compression, when the contractions of parturition will again take place.

But it also happens that the two fetuses are born together, one being imperfectly developed, the other presenting the appearance of a full-term fetus. The simultaneous birth of the two may be due to one of the following mechanisms. After the birth of the first, fully developed child, the weight of the second may become sufficient, owing either to its being very near the average, or to the
B. Pathological Parturition.

By this is meant Parturition in cases in which the relations existing between the different parts concerned vary within limits that are incompatible with the act being accomplished without endangering the safety of the mother or of the child or of both.

It will be best divided into Parturition at term, parturition at other times, and attempts at parturition.

I. Parturition at term.

The modifications to which the contractility of Pathological Parturition at term may be subjected can be classified under the headings: Diminution, Increase, Cassation.

The sources of compression being two-fold, the part played by each will be best studied separately.

a) Modifications explained by modifications in the Maternal Sources of Stimulation.

Pelvic brim and cavity — The modifications presented by these are observed in cases of Contracted pelvis — 1st stage — The contractions are weaker, more irregular and prolonged over a longer period than in typical Parturition.

It is evident that, in this stage, Compression...
must act at great disadvantage. The presenting part is of normal size, the pelvis contracted, the necessary result will be to remove the head from the brim; that is to say, from the hard portion of it, as a rule, compresses the uterine parietes, and to make it rest against the softer structures which fill the iliac fossae. The compression is therefore lessened and the weakness of the contractions accounted for. But further, that weakness, together with the disproportion of the head to the pelvic cavity, will prevent the head from engaging at the brim. This will result in the absence of comprension against the promontory of the sacrum; another source of stimulation being thus withdrawn, the character of the contractions are but a natural consequence.

According to Schroeder, primary feebleness of the contractions is rarer in flat than in juxton minor pelvis, but he does not account for this difference in the contractions as far, at least, as the first stage is concerned, for he merely says: "The partial pressure to which in the flat pelvis, the lower uterine segment is subjected on the part of the promontory and the symphysis, seems to arouse the greater energy of the uterine action, whilst the pressure exerted on all sides in the uniformly contracted pelvis has not apparently the same effect." It is true that he adds: "It is probable that here (in juxton minor pelvis) the uterine muscles are less developed — an arrest of development of all the organs of generation." But the fact that he puts forward and foremost another explanation proves that even to his mind the latter is very doubtful and, at any rate, of secondary importance. That his first explanation does not apply to the contractions of the first stage is evident, since for any pressure to be exerted by the promontory and the symphysis, or by the walls of the uniformly
Contracted pelvic cavity the presenting part must be engaged, and it only becomes to after contractions have been going on for some considerable time. The difference in the intensity of the contractions is, however, easily explained by variations in the stimulus of compression. In flat pelvis the head has no more difficulty in reaching the pelvic brim than in a normal pelvis; it will certainly have more difficulty in engaging, and, as a result, the contractions will be weaker in flat than in normal pelvis; but they will be stronger than in just minor pelvis, because, in the latter, the head before reaching the brim, must rest upon the two iliac fossae (the transverse diameter of the pelvis being also contracted). These both from the fact that they are surfaces instead of a border, and that they are cushioned instead of bare, will only give rise to a smaller amount of compression and consequently to weaker contractions.

Second Stage — The contractions are more violent, longer and more frequent than in the second stage of typical Parturition.

It is put down as a law by almost every authority, that the greater the resistance, the more violent will be the contraction. But increased resistance could have no effect on the contractions unless it gave rise to increased compression. It may therefore be said as well: the greater the compression, the more violent the contraction; and it is believed that no more evident relation of cause and effect could be found in favour of the theory advocated in these pages.

Further, the fact that the contractions are more violent in flat than in just minor pelvis, and the very explanations given by Schraeder, not only clearly point to the importance of pressure but to the special role played in it by the
promontory and symphysis. It is impossible to hold that partial pressure would be more efficient than general pressure, unless the quality of the one was different from that of the other. However, even in a normal case the promontory and the symphysis (with the adjoining pubic bones) are the barest and therefore the hardest parts of the pelvic cavity. It is natural, therefore, that their quality as compressing agents, should be superior to that of any other part of the walls of the pelvic cavity; but when their normal hardness becomes exaggerated by position as it does in flat pelvis, both their compressing power and their importance as a determining cause of contractions become further accentuated.

8) Modifications of the Contractions explained by Modifications in the foetal Source of Compression.

Under this heading, the character of the contractions in cases of hydrocephalus and placenta praevia will be considered.

Hydrocephalus where the vertex presents.

I have been unable to arrive at a clear notion of the character presented by the contractions during the first stage, as compared with those of typical parturition. According to the present theory they should be weak and irregular until the head is fixed, and the fact that the first stage may, and generally does, extend over an abnormally long period, seems to point to contractions of that character. But my information is not precise enough to allow of a satisfactory discussion of the question.

When the head is engaged and fixed at the brim, however, the contractions become violent and their intensity gradually increases until expulsion. The great compression that must follow the passage of the enormous, although very compressible, head, readily accounts for the intensity of the contractions,
the slow progress of labour showing that, although
the head is compressible, its size more than com-
pensates for that characteristic feature and gives
rise to enormous resistance and therefore consi-
derable compression.

Placenta praevia—Contractions in such
cases are, as far as I have been able to ascertain,
very much the same as in normal parturition. Now,
the placenta evidently forms a cushion be-
 tween the presenting part and the uterus, and if that
cushion extends as high up as the promontory
and the pubic rim, it must necessarily prevent
the full amount of compression of the uterine
parietes by the presenting part, and the contra-
tactions should diminish in intensity. It is true
that the modifications that such a state must cause
in the properties of the uterine, might compensate
for any discrepancy between the amount of the
compression and the intensity of the contractings
of such discrepancy exist. But my study of
that particular point has not been intimate
enough, to justify my forming an opinion on
that subject.

Cessation of the Contractions
I have, so far, endeavoured to account for
the increase and diminution of the contractings
in pathological cases of parturition but have
left cessation of these contractings entirely
unalluded to; because, although it may happen
in any of the various cases reviewed, it always
does so according to the same rules, and it was
therefore thought preferable to reserve it, study
till it could be made complete at once.

Cessation of the contractings evidently pro-
ceed from the exhaustion of the muscular
muscles. This exhaustion may be partial or
it may be complete—It is relative or partial
when the muscular fibres, although incapable of
reacting to a stimulus of a given intensity, are able to contract in answer to a more intense stimulation. It is absolute, or complete, when no stimulus, of whatever intensity it may be, produces any contraction.

Clinically, cessation of the contractile waves either when the presenting part makes no progress or when it progresses along the passages.

If the presenting part makes no progress, it is evident that the amount of compression remains the same. Gradually the contracting muscles grow tired, and the stimulus becomes insufficient to excite them to contraction in their state of partial exhaustion.

If, however, the presenting part progresses down the canal, it is evident that the stimulus of compression increases. In such circumstances, it may either not increase rapidly enough to keep pace with the increasing exhaustion of the muscle or the contractions being thus due to partial exhaustion; or a time arrives, if partial exhaustion is too long prolonged, when whatever may be the intensity of the compression and its rate of increase the muscles will cease to react because the exhaustion has become absolute.

II Parturition not at term

This is naturally divided into Parturition before and Parturition after, term.

A/ Parturition before term.

This includes Abortion and Premature labour.

In these the only modification in the contractions that require notice is their exaggeration, not compared, this time, with the contractions of typical parturition, but with those of that time of gestation at which the abortion or the premature labour occurs.

If it be possible, in this instance, to prove that increase of compression is the cause of the engage.
vation of the contractions, it must be admitted that, as a fortis, compression is sufficient to explain the contractions of parturition at term; for in parturition before term, compression acts at a disadvantage, owing to the following reasons, which affect it more or less according to the time at which the expulsion of the products of conception occurs.

10. An inferior parturient power, since the uterus is imperfectly developed and its irritability under the average.

20. An inferior stimulation, for the foetus being less developed, its weight and size are under the average, its influence on compression therefore lessened.

30. An increased resistance, resulting from the imperfect softening of the cervical walls.

Therefore under such unfavourable circumstances compression can be made to account for the contractions of premature parturition, it will evidently do so when the muscularity and irritability of the muscles of parturition are at their maximum, when the foetus is heavier, and the resistance offered by the cervix at its minimum.

The subject may be divided in spontaneous and accidental premature parturition.

The causes of the spontaneous variety may be due to modifications in the parturient powers, the ovum, the receptacle of the ovum during pregnancy or the passages concerned in parturition.

10. In the parturient powers — General, Pithros, overexcitability, and irritability, Syphilis, lead, and noxious gases poisoning, etc.

Local: Uterine hyperemia, hyperesthesia.

20. In the ovum — Diseases of the ovum and foetus, Death of the foetus.

30. In the receptacle — Displacements, adhesions, fixing the uterus, tumors.

40. In the passages — Narrowness of the cervical fibres.

The causes of the accidental variety may be
enumerated as follows: Falls, excessive fatigue, long railway journeys, excessive riding, dancing, excessive work at sewing machines, etc., etc.

But many of these causes, such as those, for instance, coming from modifications in the parturient powers are of no interest in this study. It has already been shown that variations in the action of the determining causes of parturition need only explain the modifications in the contractions, if the parturient powers remain the same. The same remark applies to the amount of resistance offered, for it is evident that, with diminished resistance, a given stimulus may give rise to efficient contractions, whereas, with a normal amount of resistance the contractions would remain useless as far as the expulsion of the foetus is concerned.

It is therefore sufficient to account for those causes of premature parturition that result from the modifications in the ovum or in the receptacle during gestation.

a) Parturition before term due to modifications of the ovum.

It seems almost impossible to arrive at a conclusion of the part played by compression in such cases. The arguments drawn from these modifications are more negative than positive; they do not go against compression being the determining cause of parturition, but they give very slight help in demonstrating its importance.

For instance, death of the foetus, molar degeneration of the membranes are not necessarily followed, or followed immediately, by the expulsion of the uterine contents. Compression at such times being comparatively insignificant, it should not be capable of producing abortion, but the fact is nothing more than a negative argument; when however, the delayed expulsion of the ovum at last takes place, it is permissible to suppose that such changes have been wrought...
in the uterus, that comparatively slight compression becomes sufficient to give rise to the contractions necessary for the expulsion of the ovum.

The role of compression is therefore very obscure in most of these cases, but in one instance it may be of some help in giving rise to the contractions of parturition. In hydratrophic degeneration, it is evident that the enormous distention of the uterus must increase the pressure caused against it by the surrounding organs; the weights of its contents also will give rise to a certain amount of compression against the pubis, so that compression may, at any rate, be considered as an auxiliary factor in the act of expulsion.

61 Parturition before term due to modifications in the receptacle of the ovum.

Displacements—

Prolabus, anteversion and retroversion are the chief displacements to consider.

Prolabus—This being very rarely, if ever, complete, the uterus as it grows is contained within the pelvic cavity. If it does not become replaced in time, either naturally or artificially, it becomes impacted. But impaction cannot be present without compression; the compression grows daily with the growth of the uterus, and a time comes when the muscular fibres react to the stimulus by contractions vigorous enough to cause premature expulsion.

Anteversion—Within certain limits, anteversion is evidently a cause of increased compression against the pubis and promontory, for the abdominal parietes which, normally, only begin to give way to the weight of the uterus and contents during the last week of gestation, become, in cases of anteversion, incapable of giving sufficient support to the uterus much before the appointed time. As a consequence the uterine
anterior uterine segment tilts downwards, and the posterior upwards, prematurely, so that the compression against the head pubis and the promontory is increased, and explains premature expulsion.

That anteverversion may be changed into procidentia without abortion occurring, results from the abdominal parietes giving way before the uterus has attained sufficient development to be excited by the increased compression to contract is powerful enough to cause abortion.

Retroversion — This furnishes one of the most telling and interesting arguments in favour of the present theory. Retroversion is universally admitted to be one of the most frequent causes of abortion; it is also admitted to give rise to abortion by the compression exercised against the pelvic cavity by the growing uterus: that is to say, that compression of the parietes of the uterus, while the organ is in a state of inferior development—both muscular and nervous—is considered sufficient to determine expulsive contractions. It is therefore remarkable that, although there are as has been shown, abundant sources of compression of the same uterine parietes at term, when they are fully developed, compression has never been yet proposed as the determining cause of the contractions of Parturition. It is true that compression of the cervix forms the basis of Powers' theory, but, in his eye, the chief cause of Parturition was the stimulation produced by compression of a special part of the uterus, the sphincter, as he calls it, in opposition with that produced by compression of the rest of the uterine parietes, whilst, on the contrary in the theory proposed in these pages, the very similarity of the compressed parts—the uterine parietes, is the chief argument used to explain the contractions of Parturition—whether at term or before term, and also as will be shown later on, the contractions of Pregnancy.

Adhesions — all such adhesions have for consequence to
prevent the free development of the uterus." (Cageaux) and to "render it a more or less fixed organ." (Playfair)

The necessary result is that, as the organ develops, it is unable to rise above the brim, the compression becomes therefore gradually increased, and, when sufficient, gives rise to muscular contractions powerful enough to effect the premature expulsion of the ovum.

Tumours

According to Cageaux and Playfair, tumours whether uterine or extra uterine, but contained in the pelvic cavity, act in the same way as adhesions do: by diminishing the cavity of the uterus, or narrowing the entrance that they prevent the full development of the uterus, and consequently increase compression.

Abdominal tumours, in their turn, increase compression: directly, by compressing the uterine parietes situated between their surface and the foetus; indirectly, by adding their weight to that of the uterus and contents pressing against the walls of the pelvic cavity, or by preventing the womb from rising above the brim.

Before passing to accidental premature parturition, abortion due to twin pregnancy may be alluded to here, although, properly speaking, it ought to have been placed with the cases of premature labour due to modifications in the ovum. It is evident that the increased weight resulting from the pressure of two foetuses instead of one, gives rise to an increase of the compression which would normally be present at the corresponding time of single pregnancy. The abnormal type of the uterine tumour also results in increased pressure by the surrounding organs; and, for both these reasons, compression may again be considered as taking its share in determining the contractions that end in the expulsion of the uterine contents.

Accidental premature parturition — It causes show very forcibly the importance of compression. To use the words of Cageaux: "The tetradactyly due to a long railway journey or to prolonged working at the sewing machine," and it might be added, to excessive riding, dancing, etc., "may produce abortion." It is evident, however, that the only way in which
those trepidations can irritate the uterine muscle in by repeatedly causing it to be compressed against the hard pubis against which it rests. This repeated compression is therefore the cause of abortion.

B. Parturition after Term.

The only variety of protracted gestation that seems due to other sources than special conditions of the parturient powers, is that which sometimes accompanies procidience of the uterus; and although this condition of the uterus does not necessarily imply delay in parturition, it is thought that no more logical place could be found for its consideration.

Procidience uteri:—The contractions are very frequent or painful in the latter part of pregnancy; in some cases, however, they are slight and painless. Sometimes, after a period of more or less painless contractions, the true labour pains begin; at other times the contractions of parturition only begin after the position has been rectified; in no case do they become effectual in expelling the ovum until the longitudinal axis of the uterus has been made to correspond better with that of the brim. In all cases, a certain amount of compression must result from the pressure against the pubis of that segment of the uterus and cervix that is in contact with it. This amount of compression is insufficient to excite contractions which may be painful or not; but which, owing to the position of the uterus, cannot become efficient. The compression, besides, remains the same in intensity excepting from the increase that must result from the growth of the fetus, so that, distressing as may be the contractions, they do not exhibit the considerable augmentation in intensity and painfulness which follows the rapid progress of the fetus through the parages. When, however, the position is rectified, compression begins at once to be more powerful, gives rise to stronger and now,
efficient contractions, the stimulus becomes gradually more powerful and parturition is completed.

III. Attempts at Parturition

Under this heading it is intended to examine the conditions present in cases of extra-uterine pregnancy, and of Mixed Parturition.

Extra uterine Pregnancy.

"throw considerable light upon the vexed problem: what is the cause of labour." (Diseases of Women, p. 55)

The question presents itself for study under two aspects. The first variety includes all the cases ending in the premature rupture of the sac, and has no connection whatever with the determining causes of parturition. The second, and in this case, the only interesting variety comprises all the cases in which pregnancy goes on for a shorter or longer period, and in which contractions similar to those of parturition take place at some time or other generally near the time of the full term — are attempts being thus made at the expulsion of the products of conception.

Taking the Classification of Playfair for guide, it may be said that all such cases are comprised under the heading of Abdominal Pregnancy, primary or secondary. Its characters are chiefly the following: The ovum, whether fertilized, as in primary cases, or after having acquired a certain amount of development in some other part, as in secondary abdominal pregnancy, falls, by gravitation, in the pouch of Douglas. It therefore develops, first of all, in the pelvic cavity. As it grows, it pushes the uterus forward and the cervix is brought comparatively high behind the symphysis pubis. By further growth, the tumour rises above the breech. The uterus, also, undergoes an increase in development, its volume and muscularity augment very notably; its tone becomes softer, the mucous membrane hypertrophies and more vascular. All these conditions are clearly shown in the two valuable illustrations of the subject found in Dr. Hart and Barbour's Gynecology.
efficient contraction, the stimulus becomes gradually more powerful and parturition is completed.

III. Attempts at Parturition

The considerations of the phenomena of parturition, under such circumstances, are of the utmost interest, and it may be said, with P. Bares, that the phenomena offer points of remarkable physiological and pathological interest. Thought to throw considerable light upon the vexed question: what is the cause of labour" (Diseases of Women, p. 352).

The question presents itself for study under two aspects. The first variety includes all the cases ending in the premature rupture of the sac, and has no connexion whatever with the determining causes of parturition. The second, and in this case, the only interesting variety comprises all the cases in which pregnancy goes on for a shorter or longer period, and in which contractions similar to those of parturition take place at some time or other generally near the time of the full term - an attempt being thus made at the expulsion of the products of conception.

Taking the classification of Playfair for guide, it may be said that all such cases are comprised under the heading of Abdominal Pregnancy, primary or secondary. Its characters are chiefly the following. The ovum, whether fertilized, or in primary cases, or after having acquired a certain amount of development in some other part, as in secondary abdominal pregnancy, falls by gravitation, in the pouch of Douglas. It therefore develops, first of all, in the pelvic cavity. As it grows, it pushes the uterus forward and the cervix is brought comparatively high behind the symphysis pubis. By further growth, the tumour rises above the brim. The uterus, also, undergoes an increase in development, its volume and muscularity augment very notably; its tone becomes softer; the mucous membrane hyperastrophies and more vascular. All these conditions are clearly shown in the two valuable illustrations of the subject found in Dr. Hart's and Barbour's Gynaecology.
The contractions in the cases of abdominal pregnancy present the following characters. Cazesaux says that "Shorty after conception abdominal pains more or less analogous to those of uterine pains occur," but as these seem, by other authorities, to be regarded as the result of inflammatory process, no reliable argument can be obtained from them in favour of against the causation of uterine contractions. But, according to all authors, at the usual term of pregnancy, and, according to Cazesaux, sometimes at the 7th month, true labour pains supervene. They last for a longer or shorter period, which may exceed four days, and then entirely disappear, to reappear again repeatedly and undetermined intervals as long as the fetus lives.

These pains are evidently due to muscular contractions, either uterine or proceeding from the cyst or from both sources.

The position of the parts, the character presented by the contractions, by their intermittence, and their cessation at the death of the fetus, all seem to point to compression as the stimulus that determines the contractions.

The cervix, it has been seen, is placed against the posterior surface of the symphysis; it occupies that position owing to the growth of the tumour in the pelvis cavity. The compression produced by that growing tumour is often sufficient to cause dysuria; why should it not be powerful enough to excite the cervix as to cause contractions of the uterus; or again, it is evident, that if there are muscular fibres contained in the cyst, the latter becoming compressed against the sides of the pelvis cavity, contractions will be caused in the muscular elements in answer to the stimulation arising from the compression. As by further development of the tumour and also of the muscular cavity and contractility of the contracting element, compression becomes more powerful and efficient, the contractions will increase in intensity. If they generally become well marked at term,
It is because the tumour being able to spread above the diaphragm, the amount of room it has is about the same as in normal pregnancy, and compression naturally becomes more efficient, when the abdominal tumour has attained the usual size of the gravid uterus at term. But contractions may occur before that time, that is, contractions presenting the so-called characters of those of Parturition; and this is the natural result of the variations that are likely to occur in the amount of compression, for as soon as this becomes powerful enough, the contractions caused will assume these so-called characters of the contractions of Parturition, that is, intensity, regularity, and painlessness. When once established, the contractions may last for days without ceasing. They last as long as the compression remains the same in intensity, but it is natural to suppose that their continued action causes, sooner or later, some modification in the position of the foetus which diminishes the amount of compression. The contractions then cease, until by further growth of the foetus, or by some new rearrangement of parts, the compression is again sufficiently increased to give rise to painful contractions simulating those of Parturition. A telling argument in favour of that interpretation of facts is that, as soon as the foetus dies, the contractions cease. The result of that death is the softening of the tissues of the foetus and the cessation of its growth. For both reasons the compression becomes diminished, and it is only fair to assume that the cessation of the contractions is due to that diminution.

Mixed Parturition

This subject, which includes the study of mixed abortion and mixed labour, would require for its elucidation a consideration of each recorded case, for the constitution of the woman, her state of health, the living or dead state of the foetus, its presentation, are most important factors to take into account. Such study would evidently lie out of place here, space only allowing a few short remarks.

Dr. Matthews Duncan gives an interesting example
of what might be called mixed abortion. It is a case of long delay of labour after discharge of
the liquor amnii. The mother expected to be con-
fined in June; she quickened on February the 23rd.
On March the 10th, a copious flow of liquor amnii
occurred, and slight irregular pains were felt. The
liquor amnii continued to discharge freely but not
constantly, and irregular slight pains were fre-
quently felt. On the night of April the 28th, regular
pains came on. The child presented the breech; it had
the size and characters of a 6th month foetus, it
weighed 2 lb 13 oz, and showed signs of great compres-
sion.

In considering these various symptoms, it is noticed
that the rupture of the membranes does not seem
to have been due to abnormally violent contractions
of the uterine muscles. It was, however, followed
by irregular pains that returned at intervals, until
parturition occurred. Now, at the time of the rupture
the child was necessarily light in weight, and would
not therefore be likely to have given rise by
compression to contractions violent enough to
rupture the membranes. But as soon as these were
ruptured and the liquor amnii escaped in part,
the uterus would evidently become compressed a-
gainst the foetus with the result that stronger con-
tractions would be noticed. But, owing to the
light weight of the foetus, to the breech presenta-
tion, to the imperfect development of the uterus,
and to the comparative rigidity of the cervix,
these contractions would not become strong
enough (the compression remaining slight) to
cause expulsion. They would not occur at intervals
until the time of parturition, because the weight
of the foetus, grade and the irritability of the uterus
gradually increasing, the compression would become
greater and more effective, so that accidental
circumstances might readily cause the contraction
of pregnancy which are usually painless, to assume
a painful character; but they would only be capa-
ble of inducing expulsion, when the uterus is suffi-
ciently developed, the foetus heavier, and the cervix
more thoroughly softened.
Mixed labour is a phenomenon of very rare occurrence, and is even denied by some. Evidence in favour of its existence seems, however, too weighty to allow of its complete rejection. Playfair speaks of it as "probably most apt to occur in women of feeble and inert habit of body, possibly where there are some obstacles to dilatation of the cervix which the pains were unable to overcome."

Such conditions would necessarily prevent the adequate effect of compression, because although it might be present to a considerable extent, an inert and feeble uterus would only be feebly stimulated by it, because the obstacle preventing the dilatation of the cervix would also prevent the descent of the presenting part, the stimulus would thus remain constant for too long a time, the contractions would gradually diminish and finally disappear.

If these conditions be added the possibility of a contracted pelvis, keeping the presenting part removed from the brim, and, perhaps, an unfavourable presentation such as breech or shoulder, two more factors of diminished expulsion are added which may help in the elucidation of the causes of mixed labour.

V. The value of Compression tested by Physiological Experiments.

Schröder in his arguments in favour of the theory of Sir James Simpson of the Determining Causes of Parturition, makes use of the following words: "We find ourselves in the fortunate, but always rare, position of being able to call to our help the result of physiological experiment upon the living woman." This physiological experiment consists in the introduction of an elastic catheter between the membranes and the uterus, to cause abortion. It is not intended here to discuss the bearing of this experiment on the Determining
Causes of Parturition, it is however interesting to notice that, during Parturition at term, one of the methods employed to intensify the contractions (and which according to Charpentier "is sometimes very successful in reviving the uterine contractility") consists in a similar introduction of the elastic catheter. But in Parturition at term, the degeneration of the membranes and the separation from the uterine parietes is so complete as can be required by Sir Scipion's theory, the more so when labour has already been established for some time. Under such circumstances, the introduction of the catheter increases the intensity of the contractions, it cannot be by causing further separation of the membranes, and, therefore, nothing seems less demonstrated than the help it is supposed to give to the theory of Sir James Scipion by its pretended mode of action in inducing abortion.

But physiological experiments appear to give the present theory invaluable help; for artificial compression is one of the most evident causes of contractions both during pregnancy and parturition. Palpation, Rubbing of the abdominal walls, thrust through the abdominal parietes, give rise to contractions both during pregnancy and parturition; the spreading of the uterus after parturition, or the introduction of the hands in the uterus, and the compression of the parietes of this organ by the bimanual method, are also employed to cause uterine contraction. The motions of the foetus in utero are again another source of contractions. But all these are physiological experiments which bring out of the value of the compression of the uterine parietes as a cause of contraction, in so evident a manner, that it would be superfluous to do more than enumerate them.

The erect position and walking are other artificial means that, as has already been shown, increase the intensity of the contractions, by increasing the amount of compression. The same may be said of bending during Parturition, and of straining.
Faced too tight, during pregnancy.

The very introduction of an elastic catheter seems quite as likely to act by the compression that it must necessarily cause as in any other manner, and repeated vaginal examinations, which are a well-known cause of increased contractions must also act by the amount of compression to which they give rise, for it is difficult, if not impossible, to attribute the stimulation thus produced to anything but compression of very irritating parts. The same may be said of over-frequent coitus, only, in this case, a very small amount of compression is sufficient to induce comparatively so violent contractions, because of the hyperemia and hyperesthesia present during the act.

Examples might be multiplied, almost ad infinitum, but the most characteristic of all has been reserved for the last; it is furnished by the "Compressio foetoris," of Kristeller. Compression is evidently the aim of the method. One of the ways in which it is meant to act, and in which it certainly does act, is by exciting the contractions of the uterine muscles. Compression, therefore, becomes in this case the evident stimulus, the determining cause of the contractions. But it is merely an exaggeration of that compression which is an usual present during parturition. "The compression of the foetoris," says Kristeller, "must be directed downwards, whilst that of the lateral parietes must be concentrated towards the axis of the uterus." The former evidently increases the normal pressure against the bruix, the latter replaces or intensifies the normal action of the abdominal muscles as a source of compression. The compression, it is true, is more vitriolic than it normally is, but, as a compression, the uterus is evidently less irritable, so that it is only fair to assume that, with a more early stimulated muscle, an inferior but exactly similar cause of compression would be able to induce contractions. The consideration of the method of Kristeller appears, therefore, to furnish a most telling
Confirmation of the value of compression as a determining cause of Parturition.

VI. Comparative Parturition

As my researches have been almost entirely
limited to Parturition in the human species, I
am not prepared for a full discussion of the appli-
cability of my arguments to Comparative Partu-
rition; at the same time, I knew that if there were
an evident responsibility for compression to induce
the contractions of the parietal muscles of the
Mammalia, my theory stood, at best, on more
than doubtful ground. But this is very far from
being the case; for the vaginal contractions in
Mammalia can readily be explained by the same
mechanism of compression against the sides of
the Pelvic Cavity; and the uterine contractions
can also, prima facie, be explained in the same
manner as those of the human uterus: in the
prone position, still more than in the erect posture,
gravitation must cause tilting of the anterior
segment of the uterus downwards, and of the poste-
rior segment upwards; this further increases,
when the abdominal parietes become unequal
to the task of supporting the gravid uterus. The
compression of the uterine parietes between the
faetac and the pubis and promontory, is an
evident result of the relations of parts, and the
causation of the contractions can be explained
by a mechanism identical with that which
has been described in the human female.
Chapter IV

I have so far tested the value of the stimulus of compression as the determining cause of parturition, by endeavouring to explain by its variations all the variations of the contractions of parturition. It remains, before bringing this study to a close, to examine how far compression can be made to account for the contractions of pregnancy for the advent of parturition, for the modifications in the increase of intensity of the contractions of parturition compared with those of pregnancy, and for the practically complete cessation after the expulsion of the ovum is accomplished.

I Contractions of Pregnancy.

That compression is sufficient to account for these contractions during the latter months of pregnancy is evident on theoretical and clinical grounds. Theoretically, as soon as the uterus is sufficiently developed to rest over the brim of the pelvis, it rests against the symphysis pubis; the first factor of compression must therefore enter into action, for the weight of the uterus and contents causes pressure against the hard pubic bones. Clinically, it has already been seen that excessive riding, long railway journeys, too prolonged work at the tending machines, etc. can result in abortion. These, as has already been seen, act by exaggerating the action of the first factor of compression. If therefore exaggerated compression is able to cause premature expulsion of the ovum, by comparatively violent contractions, it is only natural to conclude that normal compression is sufficient to give rise to the weak contractions of pregnancy.

During the first three months of pregnancy,
when the uterus is within the pelvic cavity, compres-
son can again, but in another manner, account for the contrac-
tions. The uterus, even from the unimpregnated to the pregnant state,
becomes hyperemic and hyperaesthetic. It gradually
also increases in size, so that, indirectly,
at first, through the medium of the surrounding
structures, then directly, it comes in contact with
the parietes of the pelvic cavity. A certain amount
of compression is thus obtained which may well
account for the contractions of that period of
gestation. The fact that, when abnormally increased,
it is admitted to give rise to contractions power-
ful enough to cause abortion, as in retroversion or
prolapse of the gravid uterus, justifies the
theoretical conclusion just arrived at, and which
explains the contractions of the three first months
of pregnancy.

The gradual increase of the contractions
in pregnancy advances in this way: The uterus under-
going a gradual increase in its
mucularity and irritability would, even if the
stimulus remained the same, react more power-
fully from day to day; but the stimulus also
increases for—during the first 3 months—the
gradual increase of the uterus causes increasing
compression against the walls of the pelvic cavity;
—during the rest of the time— the weight
of the foetus becoming daily more considerable
evidently adds to the amount of compression
exercised upon the pubic rim.

## II. Advent of Parturition

The advent of Parturition, or the Duration of
Pregnancy vary within a period extending over
about eight weeks. These variations are very
clearly shown by the statistics of Meermann,
Murphy and Reid, tabulated as follows by Tannier
and Chautreuil.

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Days</th>
<th>Minimum</th>
<th>Murphy</th>
<th>Bird</th>
<th>Total for Dates</th>
<th>Percentage</th>
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<td>8</td>
<td>12</td>
<td>23</td>
<td>38</td>
<td>4.25</td>
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<tr>
<td>8th</td>
<td>260-266</td>
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<td>14</td>
<td>48</td>
<td>75</td>
<td>9.59</td>
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<td>81</td>
<td>122</td>
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<td>274-280</td>
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<td>168</td>
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</table>

It is clearly out of place, owing to want of space, to enter here upon the full discussion of that very complex subject, although it is believed that such a discussion would bring us strong prominence the value of compression as the determining cause of Parturition. It is merely desired to point out that the stimulus of compression as it is described in these pages, necessarily requires, to be acceptable, such variations in the duration of Pregnancy. Its mechanism implies a certain proportion between the state of the uterine walls, the weight and size of the foetus, the laxity of the abdominal parietes, the amount of cervical softening, which could not possibly expected to be always present at exactly the same period of pregnancy. Indeed, it would not be too much to say that the theory would be altogether upset if parturition regularly happened at a determined date. On the contrary the fact that it occurs within comparatively wide limits, is if not an argument in favour, at least no objection against—the role attributed to compression during Parturition.
III Increase in the Intensity of the Contractions at the time of Parturition.

It has been seen that the contractions of pregnancy gradually increased in intensity, and an endeavour has been made to explain the reasons of that increase (page 81). If now the contractions of the end of pregnancy are compared with those of parturition it is evident that the increase, during the performance of the latter function, is much more sudden than it previously was. This comparatively sudden increase is well explained by the increase of the stimulus of compression, no longer caused, as was the case during pregnancy by the growth of the foetus, but by the introduction of new factors of compression; for it is evident that, as soon as the os uterine becomes softened throughout, the contractions, by causing the obliteration of the cervix, push the presenting parts downwards, thus giving rise to the action of the compression against the sides of the pelvic cavity; or, again, the yielding of the abdominal parietes cause an increase in the intensity of the contractions by adding to the compression exercised by the pubic rami and by the promontory; in fact to many sources of stimulation by compression arise at the time of incipient parturition and during that act, that, if the contractions did not present a great increase in their intensity contraction could not, logically, be considered as the stimulus that determines them.

IV Cessation of the Contractions after Parturition.

The state of the uterus after parturition is not one of contraction but of retraction. Contractility and retractility are both brought into play.
during Parturition, and it is owing to the latter that the uterus follows the foetus as it becomes expelled from its cavity—the diminished volume of the uterine contents being accompanied by a diminution in the size of the uterine cavity; but after parturition, retraction alone causes the uterus to assume the rigid state in which it is found during the puerperium. The contractions completely cease. Since however the contractility of the uterus is still present, as shown by the occasional after pains, the cessation of the contractions must be due to the withdrawal of the stimulus that gave rise to them; but the foetus in practice, the only part that has been withdrawn, must therefore have contributed to the stimulation. Now, the foetus has been shown to be a necessary factor in the mechanism of Compresion, and as it is difficult to imagine any other way by which it could cause its own expulsion, we are, so to speak, driven to the conclusion that Compresion is the determining Cause of Parturition.
Conclusion.

I have now finished the exposition of a theory which I cannot but feel convinced would obtain general acceptence if it had found a more powerful advocate. It is very far from my mind to imply either that compression has not been before considered as an active agent in the determining causes of Parturition, or that it is the only factor concerned in the act. But I believe that, instead of merely deserving an auxiliary place, compression is the chief, the primary cause of the contractions of Parturition.

I am afraid my remarks fill a greater number of pages than is exactly desirable. I have however done my best to shorten this essay, and often, I have no doubt, I have lost in clearness what I gained in brevity.

Many of my statements, I am fully aware, are open to objections, a great number of which have presented themselves to my own mind in almost every subject considered in these pages. The theme, however, is so comprehensive, that I could only venture upon giving a sketch of it, reserving both answers to objections and additional arguments for the very unlikely but, to me, very desirable occurrence of their being required.

It was also my intentions, at starting, not to advance a single fact without quoting the authority upon which I did so, for it was, I thought, of the utmost importance, in proposing a theory, to base it on nothing but facts admitted by the leading Obstetricians of the day. I soon found, however, that such quotations would inordinately lengthen these pages. I am therefore obliged to remain satisfied in stating that, whatever fact I have alluded to, has been gathered from at least one and
most frequently from more than one of the authors a list of whom is appended in the next page. I have, it is needless to say consulted many other sources of information, but as the statements derived from them have never been made use of unless confirmed by more recent authorities their enumeration would rather partake of the characters of an empty show, than serve a useful purpose.

Before closing these pages it remains for me to claim indulgence for the numerous mistakes both in style and in orthography, that I have doubtless committed. My only apology is that they are not due to carelessness but to an, as yet, imperfect knowledge of the language in which I have endeavoured to give expression to my thoughts.
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Etc. Etc.