THE GULSTONIAN LECTURES, ON THE STERILITY OF WOMEN,

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LECTURE I: PART II.—NATURE AND AMOUNT.

THERE are several tests of relative sterility secondary to that implied in the frequent question, "How many did she bear?" These subsidiary tests are based on the ascertained course of natural fertility, and show deviations from this course of relative sterility. The inquiry that may be made by these tests implies a knowledge of how many children a woman will naturally bear, or is likely to bear, and the natural order of births. They are as follows: 1. When, after marriage, did she begin her career of child-bearing? 2. How rapidly did the children follow one another, or what was the interval between successive births? 3. When did child-bearing cease, or what was her age at the birth of the last child? 4. How long was the child-bearing period of life, and what was the interval between the beginning of the first pregnancy and the last? In studying population, these subsidiary matters are little regarded, for the statesman has a direct interest only in the mutually related questions, How many are born? How many might have been born? What is the health of those born? The answers to these inquiries give him the actual relative circumstances of the population, and in the case of a population this includes absolute sterility. He may only regard the increase or diminution of the sterility of the people as indicating the health of the progeny so far as it relates to fertility, and thus control that effect by raising or lowering the age of marriage. On the other hand, the physician, having the care of the health of individuals, and not of the people, has his chief interest in these subsidiary matters, which the statesman may not utterly neglect, but may leave to the care of the medical philosopher.

The importance of the question, How soon after marriage does a woman bear her first child? is evident, and it will be found to be more a test of sterility than it appears at first sight to be. Whitehead, in his observation of 541 married women of the average age of twenty-two years, makes the average interval to be eleven and a half months. Sadler says that married families do not become fruitful, on an average, during the first year, but a great number of cases which he says he has collected with a view of determining this point, give three-fourths as producing the first child in an average of one year after marriage. From the Edinburgh and Glasgow registers of 1855, I was able to make out this point in 3,722 cases (Table II).

TABLE II.
Showing the Interval between Marriage and the birth of a First Child.

Years married.	No. of births.
Less.	608
1	2,390
2	437
3	133
4	61
5	32
6	27
7	12
8	5
9	5
10	1
11	3
12	4
13	2
14	—
15	1
16	—
17	—
18	1
Total	3,722

TABLE III. (from
Ansell.)
Showing the Interval between Marriage and the Birth of First Children.

Year after marriage.	No. of first children.
1	3,159
2	2,163
3	421
4	137
5	69
6	26
7	21
8	11
9	7
10	7
11	5
12	4
13	3
14	2
Total	6,035

But in these extracts from the registers there are two sources of error, which prevent the exact comparing of the results with Ansell's table, for twins are excluded, being placed in the column of secundipare and, still more important, the large number of mothers whose children are still-born is excluded. Twins affect especially young, immature, quickly breeding mothers; their omission from the primary births, therefore, will delay the estimated time, and a similar delay will result from the omission of women having dead children; for such women, when they bear a first living child, will appear in the primiparous column with an overestimated and erroneous retardation of primiparity. The Edinburgh and Glasgow table gives the mean interval of seventeen months between marriage and the birth of a living child. It shows that fecundity is not demonstrated by a living child in the majority of cases until a year of married life is past. Nearly two-thirds of the whole begin with families in the course of the second year. It also shows that there is no ground of presumption of sterility until the fourth year of married life is entered upon; for, while of those three years married and less than four, 133 bore a first living child, there were only 154 who did so in all the subsequent years taken together. Of the whole 3,722 women, only about one twenty-fourth began bearing children after four years elapsed. Ansell's table includes first still-born children; he has corrected it for twins, and he gives the data in 6,000 cases. It is, therefore, better than the preceding and any others that I know with regard to this point. (Table III.) Ansell's table gives a mean interval of nearly sixteen months between marriage and the birth of a child. The majority of the women in Ansell's table bore first children before the first year of married life had passed, nearly seven-eighths before the expiry of two years. It also shows that there is no good presumption of sterility until the fourth year of married life has been entered upon. Of those three years married, and less than four, 421 bore a first child, and only 292 did so in all the subsequent years taken together. Of the whole 6,000 women, only about $\frac{1}{4}$ part began bearing children after three years, and only $\frac{1}{8}$ after the fourth year. It may, therefore, be held that married women delaying the commencement of fertility beyond six months are already exhibiting a degree of relative sterility; and this conclusion is quite in keeping with the rest of our knowledge upon the subject.

The second question proposed is, how rapidly do the children in a family follow one another? or, what is the interval between the births of successive children? Authors on population used to hold that breeding women never exceeded in rate of prolificness a child every two years; but this, like many other of the observations on which theories have been founded, has been proved to be false. With our present knowledge, we can assert that women who breed, do so at an average rate of a child every eighteen months.

Table IV is compiled from the Edinburgh and Glasgow registers.

TABLE IV.—*Showing the Average Duration of Marriage at Birth of each Successive Child, and the Average Interval between the Births of the Successive Children.*

Number of children.	Number of mothers.	Duration of marriage in months.	Average interval between successive births.
1	3,722	17	—
2	2,893	38	19.0
3	2,534	64	21.3
4	1,982	90	22.5
5	1,543	115	23.0
6	1,221	137	22.8
7	848	162	23.1
8	641	181	22.6
9	425	203	22.5
10	222	225	22.5
11	152	235	21.4
12	61	246	20.5
13	34	263	20.2
14	11	281	20.1
15	6	280	18.7
16	2	336	21.0
17	2	252	14.8
18	1	252	14.0
19	1	204	10.7
Average	...	...	19.9

This table makes the average interval twenty months, but this requires several corrections. This table, like the next made up from Ansell, is not correctly described as giving the average interval between the births, but the average interval between marriage and the birth of a child. Ansell's table does not require correction for twins or dead children, and its value may be judged by the statement, indefinite though it be, that it is based on more than 25,000

observations in the upper classes. The average interval, as calculated from these, is eighteen months between births of the successive children. Ansell's table may be studied further, with a view to a statement of the average interval of those who have not excessive families, but the natural, or normal number; for those mothers who have shown excessive fertility, either by a high number of births, or by excessively rapid births, so long as child-bearing continued, are mixed up in each successive row of figures with those that are normal, or nearly so. Looking at the rows of figures of families from four to ten, showing intervals of from twenty to twenty-one months, we are safe in stating the average interval as above twenty months, and, probably, under two years. It may, therefore, be held that the married woman who, during child-bearing life, does not have a child every twenty months, is exhibiting relative sterility.

The third question is, when did child-bearing cease, or what was the age at the birth of the last child? Now, it is a rule to confuse the child-bearing period of life with the period during which women menstruate. This is a great mistake. It is only a part of this that is, in married life, occupied by child-bearing, except in rare cases, not one of which has ever come under my observation. When a woman begins child-bearing, she generally, under favourable circumstances, continues a career of fertility steadily till the last child is born. The registers tell us when women actually begin to have children, and I have already made use of such information; but we have no data nearly sufficient to decide what is the average age of commencing fertility. We have the average commencement connected with marriages, not the average age of commencing fertility as considered apart from marriage; we may, however, be sure from what we do know, that it is not the age of puberty, that it is not the age of commencing menstruation, that it is not the age of commencing nubility, at which procreation is commenced with the greatest advantage to mother or progeny. It is evidence of good conduct in the race, that we cannot get sufficient data, there being very few unions permitted in early life. Most of our women are, fortunately, married within the limits of nubility. Nevertheless, it is desirable that we should find out what is the mean age of commencing child-bearing, that is, supposing that all were subjected to the conditions from the earliest period: of this, however, we have no information. Regarding the time of cessation of child-bearing, we have exact information. It shows well the distinction that must be made between the cessation of menstruation and the cessation of procreation. Menstruation ceases at from 45 to 50 years of age; child-bearing ceases at an average age of 38. This cessation arises from no imperfection or decay of organs, but it may be due to that, nevertheless. It is highly probable that its main cause is the cessation of functional vigour and activity, for it is delayed in women who have begun their fertility late in life. On the subject of the cessation of child-bearing, our best information is again derived from Ansell, whose calculations are based on 4,800 observations, restricted to those in which both the father and mother survived the child-bearing age alike—a point which was determined in accordance with the scale I have already given. The chief governing rule is not to suppose a woman under 44 years of age to have borne her last child until she has been ten years barren—making it quite safe. The quinquennial from 39 to 43 was that in which the largest number ceased to bear; 38 is the mean age of mothers, married at a mean age of 25, at the date of the birth of the last child. The productive period begins earlier, and it is protracted to a later age in cases where the children are numerous than where they are few. This protraction is shown by the following table.

TABLE VI (from Ansell).—Showing the Mean Age of Mothers at the Birth of their last Child in Families of different numbers.

Number in family.	Mean age of mothers.
1	31.08
2 or 3	31.21
4 or 5	37.04
6 or 7	39.21
8 or 9	40.61
10, 11, or 12	41.74
13, 14, or 15	42.83
16 or more	44.32

Women have, in their career, with a view to our present subject, many stages in life. There is the age of puberty, or of commencing menstruation; and this is to be distinguished from the age of commencing child-bearing, regarding which we have no data. But the age of commencing child-bearing, though it may be identical with that of commencing menstruation in individual cases, is certainly not nearly so in the mass of women, being fortunately considerably delayed. Then, after the age of commencing child-bearing, comes

the age of nubility, the age at which a woman can enter married life with the best chance of having a healthy and not excessive family. After the age of nubility comes the age of cessation of child-bearing, which is 38 for women married at 25. Women may bear children after this age, or after the cessation of menstruation altogether, but such cases are exceptional. The last stage in the career is generally the cessation of menstruation at the age of from 45 to 50. There is a mean age of puberty; a mean age of possible commencing procreation; a still further advanced mean age of commencing procreation; a still further advanced mean age of nubility, or fitness for procreation; a still further advanced mean age of cessation of procreation; and, lastly, there is a mean age of cessation of menstruation, and of possible procreation. Most of these stages of woman's life have their analogues in females among the lower animals, and some of them in the life of plants.

Writing regarding the age of cessation of child-bearing, Whitehead makes the following pertinent remarks: "The mean age of the individuals recorded in the preceding table, at the time of the last delivery, 1,586, gives an average of 41 years. The average age of the same individuals at the time of the last menstruation is 47 years, so that a period of nearly six years is indicated during which, although the menstrual function continued to be more or less efficiently discharged, aptitude for procreation did not exist. They were all placed under favourable circumstances for the continuance of child-bearing so far as regarded their matrimonial position. A like period of uterine quiescence is observed before child-bearing begins."

To the question, how long does child-bearing continue? it is easy to give some answer; for if the average age at the commencement of child-bearing is 26 years, and the mean age at termination is 38 years, the average duration of the child-bearing period is 12 years. The proof of fertility will be the number of pregnancies multiplied by 9 months, added to the intervals multiplied by 9 months.

It will vary from one-child sterility, with 9 months of the child-bearing period of life, to ten-child fertility, with a child-bearing period of life of 171 months, or about 14 years. In the case of twenty-child fertility, the period of child-bearing is very much less than 30 years; because women of this great and excessive prolificness hurry their children into the world, and get through the high number. From Ansell's statement of 4,899 married women whose ages at the birth of their last children were known, both parents surviving the child-bearing age of the mother, I have constructed Table VII to show, as near as the figures will give it, the

TABLE VII (from Ansell).—Showing the Average Age at Cessation of Child-bearing in Families of different numbers, and the Time occupied in Child-bearing, estimated at the rate of eighteen months for each child, in families of less than ten children: the mean age of mothers at commencement of child-bearing being twenty-six years, and the parents both surviving the child-bearing age of the mother according to the scale of Ansell (p. 50).

Number of family.	Number of cases.	Mean age of mothers.	Time occupied in child-bearing.
1	244	30 years and 6 months	1 year and 6 months
2	401	32 " 11 "	3 years " "
3	425	34 " 5 "	4 " " 6 "
4	485	35 " 10 "	6 " " "
5	565	36 " 11 "	7 " " 6 "
6	494	38 " "	9 " " "
7	490	39 " "	10 " " 6 "
8	467	39 " 8 "	12 " " "
9	387	40 " 6 "	13 " " 6 "
10	312	40 " 10 "	14 " " 10 "
11	239	41 " 1 "	15 " " 1 "
12	170	41 " 7 "	15 " " 7 "
13	115	42 " 5 "	16 " " 5 "
14	43	41 " 10 "	15 " " 10 "
15	34	42 " 8 "	16 " " 8 "
16	10	43 " 6 "	17 " " 6 "
17	10	43 " 5 "	17 " " 5 "
18	6	44 " 7 "	18 " " 7 "
19	1	45 " "	19 " " "
20	1	45 " "	19 " " "

whole length of child-bearing life. The commencement of child-bearing at 26 years of age, is in all cases assumed; because it really was the mean age in Ansell's collection. This table affords further valuable information as to the duration of child-bearing in families which reach the normal limit of about 10, and we see that it is about 15 years. A woman, then, may be regarded as relatively sterile who, married within the years of nubility, that is, from 20 to 25, ceases to have children within 15 years from the birth of her first child.

Now, let us try to answer the comprehensive question: How many children does a woman bear? On the answer to this depends the settlement of the amount of sterility. It cannot be satisfactorily answered directly, on account of the paucity of data; but such answer as I shall give, is corroborated by the various subsidiary answers which I have just furnished. I shall not enter on subjects (important politically) such as the number in actual families, the number of marriages, etc., because, these are foreign to our present inquiry. In the district of St. George's-in-the-East, the Statistical Society of London found among the poorer classes 80 mothers (this is the only table I know) who had been married at ages varying from 15 to 19, and who had lived in wedlock at least 31 years of the child-bearing period of life. These 80 fertile wives had borne on an average 9.12 children. Considering the undoubted existence of individual sources of error all tending to diminish the average amount, we may safely say that using the data of St. George's-in-the-East, that 10 is about the average fertility of marriages lasting during the whole child-bearing period of life. The average age of marriages in England is 25, and consequently the production should be less than 10 if a woman were living in fertile wedlock from 25 to the end of the child-bearing period of life—not all the child-bearing period of life. The actual fertility of these marriages in England if only nine in ten wives have living children, is, according to Farr, 5.2; but with a view of contrasting the data in St. George's-in-the-East with Ansell, these figures require correction, for the condition of living in wedlock till the end of the child-bearing period is omitted. If that condition were not omitted, there would, of course, be a large increase of fertility of wives in England. Ansell's collection includes 1,767 spinsters married to bachelors at the mean age of 25, and living in fruitful wedlock till the end of the child-bearing period, as calculated by a scale already given, and the production was 5.7, a figure which I regard as indicating less fertility than that of Englishwomen generally. The fertile wives of England, without the condition of persistency in married life to the end of the child-bearing period, bore 5.2 children. Ansell's mothers in the upper classes married at the mean age of 25, living in wedlock till the end of the child-bearing period, bore six children. The fertile wives of St. George's-in-the-East, living in wedlock to the end of the child-bearing period, bore above nine children. Each of these statements is some corroboration of the others; and keeping in view some further evidence, they seem to justify us in holding that a healthy woman living in wedlock during all the child-bearing period in life under the most favourable circumstances, should have a family of ten. Women under such circumstances bearing fewer than ten are relatively sterile. Further evidence to the same effect is got by referring to the data derived from the registers of Edinburgh and Glasgow. There I found among the fertile wives married at various ages a fertility of between seven and eight. Now, as many women are married some years after the best period for commencing child-bearing, we may, by making allowance for such delay, raise the number from between seven and eight to ten, the number indicated by the St. George's-in-the-East table.

There are many women who bear families above ten, and it is desirable to devote to them special consideration. Such families are, on the whole, abnormal or excessive. I have spoken of the occasional calamitous character of only-child fertility; but there is a mass of evidence tending to show that a family in the average female rising above ten begins to be excessive, and is increasingly so as the figure increases. It may seem paradoxical to bring the consideration of excessive families into a lecture on sterility; but in the next lecture the paradoxical character of this will disappear.

The bearing of a first child is well known to be dangerous and often fatal to the mother. After this, she comes into the period of child-bearing, which is the safest, and which continues while she has a natural or ordinary degree of fertility. The danger of primiparity is, for a fertile woman, inevitable; but the special danger of multiparity is only when the family is excessive, and this danger is good evidence of excessiveness. At the same time, the danger has been demonstrated to arise with the increasing elderness of the mother.

Our next table is Table VIII. This table does not give the actual mortality, but only such as may be compared with one another with a view to making out the peril attending confinements of different numbers.

In the sequel, I shall give further evidence as to the excessiveness of families above ten. This is based, not on danger to mothers only, but on the nature of the production; that is, the occurrence of twins, of weakly children, and of idiots.

TABLE VIII.—Showing a Comparative Percentage of Deaths in Successive Labours.

Number of pregnancy.	Number of mothers.	Number of deaths.	Percentage.	Or 1 in
1	3722	254	6.82	15
2	2893	60	2.07	48
3	2534	64	2.52	39
4	1982	39	1.97	51
5	1543	31	2.01	49
6	1221	28	2.29	43
7	848	16	1.88	53
8	641	15	2.34	42
9	425	13	3.06	32
10	222	9	4.05	24
11	152	5	3.28	30
12	61	1	1.64	61
13	34	4	11.77	8
14	11	—	—	—
15	6	1	16.66	6

LECTURES

ON

THE COMPARATIVE PHYSIOLOGY OF MENSTRUATION.

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GENTLEMEN,—The comparative method of study is, before all, the most trustworthy help towards the attainment of accurate knowledge, since, by its aid, a just appreciation of the relative value of facts may best be acquired. Accordingly, it merits employment whenever available, furnishing an efficient corrective of erroneous or disproportionate conceptions. It is valuable, also, inasmuch as it may afford clues to, or enlighten us respecting, important correlations; while its influence, in checking and balancing our views and conclusions, is uniformly beneficial. Acquaintance with the value of this method has led me to regard certain departments of medicine by its light, and among them the function of menstruation, in the elucidation of which it contributes important and suggestive information.

The illumination thrown by the comparative method upon certain biological problems ancillary to medicine is great; and the fervent, if not sanguine, hope is excited, that not only may similar enlightenment be vouchsafed in respect of recondit pathological problems, but that, through the pursuit of this instructive method, medicine, considered in its entirety one of the noblest studies, may, in process of time, be established upon foundations whence it may rise to a position not inferior to that accorded to other sciences.

The impression has long and widely prevailed, that the menstrual function is an attribute peculiar to the human female. Whether this be erroneous or not, will appear when inquiry is made into the manner in which the periodical activity of the reproductive organs is displayed or exercised in the females of the lower animals. Making due allowance for generic peculiarities, this function will be found to agree with others of the animal economy, in displaying harmonious subordination to the law of evolution. Inquired into on this basis, and in accordance with the comparative method, the evolution of oestro-menstruation is discovered to be orderly; and to correspond broadly with the evolution, anatomical and physiological, of the generative system of animals. In harmony with the universal result of biological research, the primitive indications of the function will be found to be but feebly marked. Gradually and progressively, however, the manifestations become more and more distinct, until, ultimately, the highest stage is attained in the human species. Thus traced step by step, it will be found that, from feeble and obscure beginnings in the lower creatures, the function emerges and develops until, in the highest mammals, it is unmistakably pronounced. It will also appear that, after its establishment at puberty—an epoch marking the assumption of the capacity for reproduction, and usually arriving only towards the time when the rate of growth is diminishing—its equilibrium is liable to fluctuation, and even dis-