XXIII.—*On some Laws of the Sterility of Women.* By J. MATTHEWS DUNCAN, M.D.

(Read 19th February 1866.)

Before commencing the discussion of the subject, it is necessary to make some definitions, with a view to avoiding the confusion which extensively prevails, from the neglect of the all-important definition of terms. I might be even more exact than I shall be, and excuse myself from adopting such a seeming improvement, on the ground that further refinement of definition would itself cause confusion in the present stage of advancement of our knowledge.

Absolute sterility, I shall hold to mean the condition of a woman who, under ordinary favourable circumstances for breeding, produces no living or dead child, nor any kind of abortion.

Sterility, I shall hold to mean the condition of a woman who, under ordinary favourable circumstances for breeding, adds not even one to the population, or produces no living and viable child.

Relative sterility, I shall hold to mean the condition of a woman who, while she may or may not be absolutely sterile, while she may or may not be sterile, is, under ordinary favourable circumstances for breeding, sterile in relation to the circumstance of time; or, in other words, in relation to her age, and the duration of her married life.

CHAPTER I.—*Sterility of Marriages in our Population.*

Under this head, the age at marriage, and the duration of it, are not regarded. We simply compare the number of people living in the married state, without and with living children. The only information I have on this point is derived from the writings of Dr STARK.* “It is a pity,” says he, “that when the census was taken up, a query had not been put to every married woman, whether she had borne children. We have at present no means of ascertaining what proportion of the marriages proves unfruitful; and it is no criterion to ascertain the number of married persons who had children living with them on the night of the census. Married persons who had a numerous family, may have none with them, because they are grown up, or are absent at schools or trades. We know, however, from other sources, that a considerable proportion of marriages proves unfruitful; and as it was shown that the married women of Scotland produce

* Census of Scotland, 1861. Population Tables and Report, vol. ii. p. xxxvi.

more children in proportion to their number, than the married women of England, it would have been extremely interesting to have ascertained whether that depended on more of the Scottish married women being fruitful."

On this point I may here interpolate the observation, that, in my opinion, it is highly improbable that there is any essential difference in the fecundity of women in England and in Scotland. The researches now published make it necessary, with a view to settling the question raised by Dr STARK, to look into the comparative ages at marriage of the women in England and Scotland; a difference in that respect alone may prove sufficient to afford the solution of the whole matter. And like remarks are applicable to the supposed great fertility of Irish women.

"As it may," continues Dr STARK, "however, give a distant approximation, it may be stated, that taking two of the largest registration districts of Glasgow, it was found, that of 14,523 married persons living together, 11,718 had children living with them; while 2805 had no children with them. This would yield the proportion of 80·686 per cent. with children, and 19·314 per cent. without children; or, without the decimals, that in every 100 married couples, 81 had children, while 19 had none. These numbers may be safely taken as the proportion in the town populations, seeing that for each district the proportions came out within a very small decimal fraction of one another; also from the circumstance, that in other tables which have been published in the Registrar-General's second detailed Annual Report, relative to the proportions of children born by mothers at different ages in Edinburgh and in Glasgow, the results of the one town almost exactly corresponded with those of the other."

CHAPTER II.—*Sterility of Wives.*

The wives who do not increase the population, may be called sterile. But a wife who has one or several abortions, or who bears one or several dead children, or to whom both of these events happen, adds not a unit to the population; yet such a wife cannot be said to be absolutely sterile. In order to discover the amount of sterility of married women, I proceed on the following plan. I take the registers of Edinburgh and Glasgow for 1855, and find what is the number of first children produced in that year. With this I compare the number of marriages in that year. It is evident that the first children only should be counted, for they indicate all the wives who are not sterile. If one living child is born to a marriage, that marriage is not sterile. Further, it is evident that, although the first births in 1855 will not all pertain to the women married in that year, it may be assumed that, if the marriages be nearly the same in number for a few contiguous years, the first births in one year will give the fertility very accurately

of any of the contiguous years. From this fertility, the sterility can be easily computed.

Now, in 1855, there were, in Edinburgh and Glasgow, 4447 marriages, and 3722 first deliveries of living children, leaving 725 marriages sterile, or 1 in 6.1. But in these figures are included 75 marriages which did not take place till after the women had passed 44 years of age, and these will damage the physiological value of the statement, as these 75 women could not be expected to be prolific.

Of women between the ages of 15 and 44 inclusive, there were married 4372; among wives of the same ages, 3710 had first children, leaving 654 marriages sterile, or 1 in 6.6. In other words, 15 per cent. of all the marriages between 15 and 44 years of age, as they occur in our population, are sterile.

The statement of the amount of sterility just given appears to me, from the largeness of the figures used, to be far more valuable than any other I know of. But on account of their great interest, I shall quote the statements of two authors.* “In the Dictionnaire des Sciences Médicales (vol. vi. p. 245; see also *Neue Abhandlungen der Schwedischen Akademie der Wissenschaften*, vol. xi. p. 70), it is stated,” says Sir JAMES Y. SIMPSON,† “that HEDIN, a Swedish minister, had noticed that in his parish, composed of 800 souls, one barren woman is not met with for ten fertile. It is further stated, that FRANK asserted, but from what data is not mentioned, that it would be found on investigation, that in most communities containing 300 to 400 couples, at least 6 or 7 would be sterile, without anything in their physical condition to explain the fact. It seems to have been from this assertion of FRANK’S, that BURDACH, who is almost the only author who even alludes to the matter, has given the general statement, that one marriage only in 50 is unproductive (Dr ALLEN THOMSON’S excellent essay on Generation, in TODD’S *Cyclopædia*, vol. ii. p. 478, foot note).

“For the purpose of ascertaining the point by numerical data, I had a census taken of two villages of considerable size, viz., Grangemouth in Stirlingshire, and Bathgate in West Lothian,—the one consisting principally of a seafaring population, and the other of persons engaged in agriculture and manufacture.

“The following form the results in these two places:—Of 210 marriages in Grangemouth, 182 had offspring; 27 had none; or about one marriage in 10 was without issue. Of the 27 unproductive marriages, all the subjects had lived in wedlock upwards of five years, and in all, the female had been married that period before she reached the age of 45. Again, of 402 marriages in Bathgate, 365 had offspring; 37 had none; or about one marriage in 11 was unproductive. There were at the same time living in the village 122 relicts of marriages, and of

* LEVER’S statement I here quote, but I cannot ascribe much value to it, because no evidence is adduced, and because there is an evident numerical error in some part of the passage. He says, “It is found that $\frac{1}{30}$ th, or 5 per cent. of married women are wholly unprolific.”—*Organic Diseases of Uterus*, p. 5.

† *Obstetric Works*, vol. i. p. 323.

these 102 were mothers; 20 were not mothers; or about 1 in 6 had no family. In all, of 467 wives and widows, 410 had offspring; 57 had none; or about one marriage in 8 was unproductive. Of these last 57, six had not been 5 years married, and there were other six above the age of 45 when married. If we subtract these 12, we have, of 455 marriages, 410 productive; 45 unproductive; or 1 in 10 $\frac{1}{3}$ th without issue.

“Returns such as I have just now adduced are exceedingly difficult to obtain, in consequence of no registers being anywhere kept, so far as I know, that could be brought to bear upon the question. If it had been otherwise, I would here, if possible, have gladly appealed to a larger body of statistical facts, in order to arrive at a more certain and determinate average of the proportion of unproductive marriages in the general community. For the purpose, however, of extending this basis of data, I have analysed, with some care and trouble, the history of 503 marriages, detailed by SHARPE, in his work on the ‘British Peerage,’ for 1833. Among British peers, there were 401 marriages with issue; 102 without issue; or of 503 existing marriages among British peers in 1833, 74 were without issue, after a period of five years. Of those who had not yet lived in the married state for five years, 28 were still without family; and in BURKE’S ‘Peerage,’ for 1842, there still remained among these 28 marriages, 7 without issue, making 81 as the total number of unproductive marriages among the original 503; or the proportion of the unproductive to the productive marriages among this number is, as nearly as possible, 1 in 6 $\frac{1}{4}$. In the above calculation, I have excluded 8 unproductive marriages, in which the age of the husband at the date of marriage exceeded 56. These 8, however, ought to be deducted from the original sum of total marriages that were included; or, in other words, the 503 should be reduced to 495, and then the whole result would stand thus:—among 495 marriages in the British Peerage, 81 were unproductive, or 1 in 6 $\frac{1}{5}$ were without any family.” The proportion of unproductive marriages in Grangemouth, Bathgate, and the British Peerage, all taken together, was found by SIMPSON to be 1 in 8 $\frac{1}{4}$.

Dr WEST* states, that he found the general average of sterile marriages, among his patients at St Bartholomew’s Hospital, to be 1 sterile marriage in every 8.5.†

CHAPTER III.—*Absolute Sterility of Wives.*

In order to arrive at the absolute sterility of the wives in Edinburgh and Glasgow, it is necessary to add to the number of wives bearing first living children, the number of those who bear only dead children or abortions.

* Diseases of Women, 3d edition, p. 3.

† A statement of the sterility of Esquimaux women is given by ROBERTSON, Essays and Notes on the Physiology and Diseases of Women, p. 53.

The number of abortions has been variously estimated by GRAUNT, SHORT, WHITEHEAD, and others. The number of children born dead has been the subject of much investigation, among others by JACQUEMIER, BOUDIN, and LEGOYT. But were our information on these points very exact, it would not help us in this inquiry. For our purpose, the desideratum is not the number of abortions in a number of pregnancies, nor the number of children born dead in a number of births, but the proportional number of married women who produce nought else than abortions or dead children; who, while not absolutely sterile, yet add none to the population. Of this class of wives I know of no estimate.* I believe they are few, and I leave the statement of the sterile as a near approximation to a correct statement of the absolutely sterile.

CHAPTER IV.—*Sterility according to the Ages of Wives.*

To illustrate the variations of sterility according to age, I bring forward the accompanying Table (I.).

TABLE I.—SHOWING THE VARIATIONS OF STERILITY ACCORDING TO THE AGES OF THE WIVES.

Ages of Wives at Marriage, }	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50,&c.	Total.
Number of Wives, . . .	700	1835	1120	402	205	110	46	29	4447
First Children, . . .	649	1905	809	251	96	10	2	...	3722
Sterile Wives, . . .	51	...	311	151	109	100	44	29	725
Percentage Sterile, . .	7.3	0	27.7	37.5	53.2	90.9	95.6	100	16.3
Proportion Sterile, 1 in	13.72	0	3.60	2.66	1.88	1.10	1.05	1.00	6.13

With the numbers of marriages taking place in Edinburgh and Glasgow in 1855, at different ages of the wives, are compared the numbers of first children born in the same year to wives married at the same ages in that year or previously. The number of sterile wives is got by subtracting the latter figures from the former, and the percentage of sterile marriages is given in the penultimate horizontal line.

So far as the numbers are to be relied upon, we have from this Table the interesting results, that about 7 per cent. of all the marriages between 15 and 19 years of age inclusive, and as they occur in our population, are without offspring; that those married at ages from 20 to 24 inclusive, are almost all fertile; and

* The following extract from the work of Dr WEST, on Diseases of Women (3d edit., p. 367), may be of some value. It refers to the histories of a set of poor women labouring under uterine cancer. "There were but two out of the whole 150 women, whose pregnancy had issued merely in abortion."

that, after that age, sterility gradually increases according to the greater age at the time of marriage.

CHAPTER V.—*Expectation of Sterility.*

The main element in the expectation of sterility is the age of the woman at marriage. This has just been described. But, besides this, our statistics suggest to us other laws as to the expectation of sterility. Of these the first is :—

That the probability of a woman's being sterile is decided in 3 years of married life. For while a large number are fertile in each of the first three years of married life, only 7 per cent. of the fertile bear after 3 years of marriage, or about 1 in 13.

TABLE II.—SHOWING THE FERTILITY OF MOTHERS, OF DIFFERENT AGES AT MARRIAGE, COMMENCING AFTER THREE YEARS OF MARRIED LIFE.

Mother's Age at Marriage, .	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total.
Number of Fertile, . . .	649	1905	809	251	96	10	2	3722
Number commencing Fertility } after being 3 years married, }	63	119	62	27	15	1	...	287
Percentage commencing Fer- } tility after being 3 years } married, }	9·7	6·2	7·7	10·7	15·6	10·0	...	7·7
or 1 in	10·3	16·0	13·0	9·3	6·4	10·0	...	13·0

This same Table affords us a second law of expectation of sterility :—

That when the expectation of fertility is greatest, the probability of sterility is soonest decided, and vice versa. For our Tables show that of the wives married from 20 to 24 who are all fertile, only 6·2 per cent. begin to breed after three years of marriage; while at the other ages, with less fecundity, a greater percentage commences after the completion of the third year of marriage.

CHAPTER VI.—*Relative Sterility.*

Here I take into consideration only those who have borne children, only those who are not sterile. Of course all these wives, if they survive in wedlock, will sooner or later become relatively sterile. Now, in a paper lately read to this Society, I showed that the prolongation of fertility was greater according as the age at marriage was less. From this conclusion it is easy to derive one in regard to relative sterility, to the effect that :—

Relative sterility will sooner arrive according as the age at marriage is greater.

The demonstration of these proportions is arrived at by showing the proportional numbers bearing at different years of married life, according to age at marriage. This is an indirect way of proceeding, but it is the only one I can find available, while I have no documents giving the ages of mothers at marriage, and their ages at birth of last children, the mothers continuing to live in wedlock.

TABLE III.—SHOWING THE RELATIVE STERILITY OF A MASS OF WIVES MARRIED AT DIFFERENT AGES AT SUCCEEDING EPOCHS IN MARRIED LIFE.

Age of Mother at Marriage,	15-19	20-24	25-29	30-34	35-39	Total.
Proportion Sterile about the 5th Year of Married Life is about 1 in } or a percentage of	2·78 35·9	2·61 38·3	1·68 59·4	1·51 66·0	1·19 84·1	2·09 47·9
Proportion Sterile about the 10th Year of Married Life is about 1 in } or a percentage of	2·09 47·9	1·71 58·3	1·39 71·8	1·24 80·8		1·61 62·1
Proportion Sterile about the 15th Year of Married Life is about 1 in } or a percentage of	1·57 63·8	1·32 75·5	1·10 90·9	1·05 95·5		1·26 79·2
Proportion Sterile about the 20th Year of Married Life is about 1 in } or a percentage of	1·24 80·4	1·13 88·6	1·01 98·7			1·11 89·8
Proportion Sterile about the 25th Year of Married Life is about 1 in } or a percentage of	1·02 97·6	1·00 99·65				1·01 99·03

Table III. gives the calculated amounts of sterility at different periods of married life in women married at different ages. It is needless to enter on the method of construction of this Table. It is merely the complement of Table XV., given in my former paper, where full details are stated. I shall only state, that this Table is all calculated for 20 months, with a view to giving the nearest accurate estimate, 20 months being what I have called the time-unit of fertility, the shortest time within which all women may be expected to show fertility if they possess it.

CHAPTER VII.—*Expectation of Relative Sterility.*

As a sort of appendix to this paper, I produce five Tables, giving all the details of the expectation of continued fertility; and conversely, of relative sterility. These Tables not only give data for calculating the chances of relative sterility, but also for calculating the probable number of the family produced in women at different ages becoming relatively sterile. To enter further upon these

considerations would be merely to give in writing what is more succinctly stated in the Tables themselves.

TABLE IV.—FIFTH YEAR OF MARRIED LIFE.

Number of Child,	1st	2d	3rd	4th	5th	6th	7th	8th	9th	Total.
Wives Mothers, of Ages 20-24, .	13	39	160	31	4	...	...	...	...	247
Proportion of above to 644 Wives } Married at from 15-19 is 1 in }	49·5	16·5	4·0	20·8	161·0	...	..	...	...	2·6
Wives Mothers, of Ages 25-29, .	10	82	398	106	13	2	...	...	...	611
Proportion of above to 1686 Wives } Married at from 20-24 is 1 in }	168·6	20·5	4·2	15·9	13·0	843·0	...	...	...	2·7
Wives Mothers, of Ages 30-34, .	3	31	147	52	8	2	1	...	...	244
Proportion of above to 1008 Wives } Married at from 25-29 is 1 in }	336·0	32·5	6·8	19·4	126·0	504·0	1008	...	...	4·1
Wives Mothers, of Ages 35-39, .	3	12	37	14	1	1	2	1	1	72
Proportion of above to 358 Wives } Married at from 30-34 is 1 in }	119·3	29·8	9·7	25·6	358·	358·	·179·	358·	358·	4·9
Wives Mothers, of Ages 40-44, .	3	2	11	1	...	...	...	...	...	17
Proportion of above to 179 Wives } Married at from 35-39 is 1 in }	59·6	89·5	16·3	179·	...	...	...	...	...	10·5
Total Wives Mothers, of Ages 20-44,	32	166	753	204	26	5	3	1	1	1191
Proportion of above to 3875 Wives } Married at from 15-39 is 1 in }	121·1	23·3	5·1	19·0	149·	775·	1291·6	3875·	3875·	3·2

Lastly, I state a law of relative sterility for which I do not here adduce the numerical proofs, these having already been given in my paper lately read to the Society. This law is, that :—

A wife who having had children, has ceased for three years to exhibit fertility, has probably become relatively sterile ; that is, will probably bear no more children ; and the probability increases as time elapses. For the probability of sterility only commences after three years of sterile marriage. Further, the data given in Table II. of the paper just referred to, show that fertile women bear a child, on an average, about every two years, so long as they remain fecund. The data given in Table VI. show that successive children in a family succeed one another with an average interval of about 20 months. To these propositions I have to add the general consent, shown in the same paper, that fertile wives breed generally every two years ; consequently, that no class breeds, though individuals do, at shorter intervals ; and no class breeds at longer intervals, though individuals do so. Considering these different statements, it is apparent to the student, that there is no room left for any but a very inconsiderable number of women to breed at longer intervals than two years. For were there any con-

siderable number of wives breeding at longer intervals, the averages just given would be far overpassed. And some of these averages are, as already shown, considerably less than were believed to be the true averages by writers who were not thinking of the law now demonstrated, but of the ordinary rate of time-fertility of married women.

Besides, being of evident intrinsic value, the conclusions arrived at in this paper will afford to medical men, means of estimating the utility of the many vaunted methods of curing sterility which are now much in vogue, and which, considering the nature of the condition to be cured, justly excite anxiety for the honour of the profession in the minds of its best friends.

TABLE V.—TENTH YEAR OF MARRIED LIFE.

Number of Child, .	1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	Total.
Wives Mothers, of } Ages 25-29, .	...	1	14	30	78	51	8	4	...	...	...	186
Proportion of above to } 594 Wives Married at from 15-19 is 1 in }	...	594·	42·4	19·8	7·6	11·6	74·2	148·5	...	...	...	3·2
Wives Mothers, of } Ages 30-34, .	1	4	17	55	148	105	34	11	3	1	2	381
Proportion of above to } 1528 Wives Married at from 20-24 is 1 in }	1528·	382·	89·9	27·8	10·3	14·5	44·9	138·9	509·3	1528·	764·	4·0
Wives Mothers, of } Ages 35-39, .	...	2	4	19	60	48	13	5	2	...	...	153
Proportion of above to } 902 Wives Married at from 25-29 is 1 in }	...	451·	225·5	47·5	15·	18·8	69·4	180·4	451·	...	...	5·9
Wives Mothers, of } Ages 40-44, .	...	...	5	11	10	6	2	1	...	1	...	36
Proportion of above to } 313 Wives Married at from 30-34 is 1 in }	...	...	62·6	28·5	31·3	52·2	156·5	313·	...	313·	...	8·7
Total Wives Mothers, } of Ages 25-44, .	1	7	40	115	296	210	57	21	5	2	2	756
Proportion of above to } 3337 Wives Married at from 15-34 is 1 in }	3337·	476·7	83·4	29·0	11·3	15·9	58·5	158·9	667·4	1668·5	1668·5	4·4

TABLE VI.—FIFTEENTH YEAR OF MARRIED LIFE.

Number of Child, . .	1st	2d	3d	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	Total
Wives Mothers, of Ages 30-34, . . . }	1	3	2	6	11	18	24	28	18	2	1	1	1	116
Proportion of above to 532 Wives Married at from 15-19 is 1 in }	532	177.3	266	88.7	48.4	29.6	22.2	19.0	29.6	266	532	532	532	4.6
Wives Mothers, of Ages 35-39, . . . }	...	...	5	4	18	32	53	41	29	14	2	1	1	200
Proportion of above to 1360 Wives Married at from 20-24 is 1 in }	...	...	272	340	75.5	42.5	25.6	33.2	46.9	97.1	680	1360	1360	6.8
Wives Mothers, of Ages 40-44, . . . }	...	...	1	2	4	7	12	14	2	1	...	...	...	43
Proportion of above to 782 Wives Married at from 25-29 is 1 in }	...	...	782	391	195.5	111.7	65.2	55.9	391	782	...	...	...	18.2
Wives Mothers, of Ages 45-49, . . . }	...	...	...	1	1	1	...	1	2	...	1	...	...	7
Proportion of above to 262 Wives Married at from 30-34 is 1 in }	...	...	...	262	262	262	...	262	131	...	262	...	...	37.4
Total Wives Mothers, of Ages 30-49, . . }	1	3	8	13	34	58	89	84	51	17	4	2	2	366
Proportion of above to 2936 Wives Married at from 15-34 is 1 in }	2936	978.6	367	225.8	86.3	50.6	33.0	34.9	57.5	172.7	734	1468	1468	8.0

TABLE VII.—TWENTIETH YEAR OF MARRIED LIFE.

Number of Child, . .	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	Total
Wives Mothers, of Ages 35-39, . . . }	...	...	2	5	5	17	15	9	3	...	56
Proportion of above to 477 Wives Married at from 15-19 is 1 in }	...	...	238.5	95.4	95.4	28.0	31.8	53	159	...	8.5
Wives Mothers, of Ages 40-44, . . . }	1	1	2	9	14	28	8	13	2	2	80
Proportion of above to 1171 Wives Married at from 20-24 is 1 in }	1171	1171	585.5	130	83.6	41.8	146.4	90.1	585.5	585.5	14.6
Wives Mothers, of Ages 45-49, . . . }	...	...	...	...	...	3	...	1	1	...	5
Proportion of above to 649 Wives Married at from 25-29 is 1 in }	...	...	...	...	...	216.3	...	649	649	...	129.8
Total Wives Mothers, of Ages 35-49, . . }	1	1	4	14	19	48	23	23	6	2	141
Proportion of above to 2297 Wives Married at from 15-29 is 1 in }	2297	2297	574.2	164	121	47.8	99.9	99.9	388	1148	16.3

TABLE VIII.—TWENTY-FIFTH YEAR OF MARRIED LIFE.

No. of Child,	10th	11th	12th	13th	14th	15th	16th	17th	Total.
Wives Mothers, of Ages 40-44,	2	2	1	1	...	...	...	...	6
Proportion of above to 408 } Wives Married at from 15-19, }	204·	204·	408·	408·	...	...	...	...	68·
Wives Mothers, of Ages 45-49,	...	1	...	...	...	...	...	1	2
Proportion of above to 961 } Wives Married at from 20-24, }	...	961·	...	...	...	...	...	961·	480·5
Total Wives Mothers, of Ages } 40-49, }	2	3	1	1	...	...	...	1	8
Proportion of above to 1369 } Wives Married at from 15-24, }	684·	456·	1369·	1369·	...	...	...	1369·	171·