XXXIV.—*On the Variations of the Fertility and Fecundity of Women according to Age.* By J. MATTHEWS DUNCAN, M.D.

(Read 2d May 1864.)

In 1855, when the systematic registration of births in Scotland was established, the schedule used exacted from the public a variety of interesting details in connection with each return,—a circumstance which gives to the registers for that year an extraordinary value. For, in consequence, I believe, of numerous complaints regarding the irksome labour of filling up the document, it was discontinued, and a much less comprehensive schedule has been in use ever since. It is from the registers of births for 1855 that I have extracted almost all the data which have yielded the results I am now about to communicate. Similar data cannot be found in the subsequent registers. The great value of these registers has been distinctly pointed out by Dr STARK, the able assistant to the Registrar-General. I must here acknowledge, with grateful thanks, the assistance and encouragement I have received from Mr SETON and other officials of the Register-House.

The exigencies of time, labour, and expense, constrained me to restrict the number of births to be operated on within moderate limits; and I selected Edinburgh and Glasgow, with their 16,593 children legitimately born in 1855, as the field of operations. It is needless to enter fully upon the reasons of my selecting the conditions of legitimate birth in Edinburgh and Glasgow; my only object was to secure as much as possible of accuracy and completeness in the filling up of the schedules. It must be noted, that legitimate births, as registered, include only births of living children at the full term of pregnancy or near it.

The well-known difficulty of handling statistics without infringement of the rules of logic has made me be very cautious in my progress in this investigation, and I am all the more bound to be careful, because it will be necessary, in connection with my present topic, to point out great errors made by authors who have entered upon it. But although I trust no fault will be found with my mode of reasoning, I have to admit the existence of some comparatively few and unimportant errors in the details given in the registers. The chief of these will be stated in connection with the tables to be brought forward. So far as I know the errors are all in the original registers; in the elaboration of the details thence derived, I have spared nothing that could insure accuracy; and must here men-

tion my obligations to the various intelligent and assiduous gentlemen who have assisted me in the work.

The part of my investigations which is the subject of this communication is confined to the determination of the comparative fertility or productiveness and fecundity of women at different ages. It is necessary, in order to avoid confusion, here to establish a distinction, which I shall maintain as I go on, between fertility or productiveness and fecundity. By fertility or productiveness I mean the amount of births as distinguished from the capability to bear. This quality of fertility or productiveness is interesting chiefly to the statistician or the political economist. It does not involve the capability of every individual considered to bear, nor even the conditions necessary for conception. By fecundity I mean the capability to bear children; it is measured by the number born, and it implies the conditions necessary for conception in the women of whom its variations are predicated. This quality of fecundity is interesting chiefly to the physiologist and physician.

In discussing the subject of comparative fertility and fecundity at different ages, I may incidentally afford means for estimating the degree of fertility or fecundity of different ages; but I wish it to be distinctly understood, that I have not proposed to myself, in this paper, the consideration of the actual degree or amount of fertility or fecundity at any age, but only the variations of fertility or fecundity at different ages as compared with one another.

CHAPTER I.—*The Actual Fertility of our Female Population as a whole at Different Ages.*

The first law which I propose to establish, has reference to the ages of the mothers of legitimate children. In Edinburgh and Glasgow legitimate births form at least 90 per cent. of the whole born. The law, therefore, regards the ages of the women from whose fertility 90 per cent. of the population are recruited.

It must be observed, that this law or general statement shows nothing regarding the fecundity of women of different ages, although it has been held as doing so; it merely enunciates a truth in the doctrine of population. I place it first because it is pretty well known, because in my own investigations it was first made out, and chiefly because it is essential, before proceeding farther, to show the facts on which it is founded in their true light, avoiding the great errors of which they have been made the basis.*

The facts or data illustrating this law, with which I am best acquainted, have been derived from reports of lying-in dispensaries, as by Dr GRANVILLE, or from similar accounts of lying-in hospitals, as by Dr COLLINS, Drs HARDY and M'CLIN-

* See GRANVILLE, Transactions of Obstetrical Society of London, vol. ii.

rock, and others. I here present, as an example, the table of ages of mothers of legitimate and illegitimate offspring, whether born alive or dead, from the "Practical Treatise on Midwifery" of Dr COLLINS, master of the Dublin Lying-in Hospital. The data adduced by Dr GRANVILLE in the second volume of the "Transactions of the Obstetrical Society of London," are closely similar. Judging from these data, it would appear that most children are born of women at or near the age of 30 years or the middle of the child-bearing period of life; and that the offspring of mothers of ages advancing from the commencement of child-bearing to the age of 30 or the middle of the child-bearing period gradually increases; that the climax is reached at this age, and that thereafter the offspring of mothers advancing above 30 gradually diminishes. But while the age of 30 forms the climax, there is not an equal fertility on either side of it; a much larger part of the population being born of mothers under 30 than of mothers above 30. Dividing the number of mothers at 30 years, and adding together those on each side of the division, we have on the side of the younger 12,106, and on the side of the elder women 4279, giving a majority of 7827 in favour of the younger; or, otherwise stated, we have three-fourths of the births among the younger half, and only one-fourth among the elder. The mean age of the mothers in Dr COLLINS's table is 27 years.

TABLE I.—SHOWING THE AGE OF EACH OF 16,385 WOMEN, DELIVERED IN THE DUBLIN LYING-IN HOSPITAL.

Age,	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
No. of Women,	3	19	70	237	433	926	682	1142	1023	1089	1174	1295	983	1340	517	2346	242

Age,	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	50	53
No. of Women,	467	378	384	396	379	153	217	65	326	15	21	18	17	11	5	6	5	1

TABLE II.—SHOWING THE AGES OF 16,385 WOMEN DELIVERED IN THE DUBLIN LYING-IN HOSPITAL, ARRANGED IN PERIODS OF FIVE YEARS.

Age,	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50 and over.
No. of Women, . .	762	4862	5309	3817	1210	397	22	6
Percentage, . . .	4·65	29·67	32·40	23·29	7·38	2·42	·13	·03

The next table which I present shows an arranged collection of data, comprising the wives-mothers of living children born at or near the full time in Edinburgh and Glasgow in 1855. The former table has, regarding the use to be

made of it, the advantage over this table of including all mothers bearing children, whether legitimate or not, alive or dead, in the Dublin Hospital. But in every other respect, this second table presents what I judge to be more reliable data. The former table contains a class of cases selected according to complicated conditions which it is impossible to state, but which are the result of the correlated circumstances of the Hospital, and of the class from which in Dublin it draws its patients. In the second table the conditions of selection are fewer and less important, the chief being the legitimacy, life and maturity, or at least viability, of the offspring. Now the limits of the influence of these different conditions are pretty well known, and the proportional differences between the two tables are too great to be accounted for by these differences. The second table is thus shown to be the more trustworthy.

TABLE III.—SHOWING THE AGE OF EACH OF 16,301 WIVES WHOSE CHILDREN WERE REGISTERED IN EDINBURGH AND GLASGOW IN 1855.

Ages, .	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Mothers,	4	28	116	228	405	543	828	888	1024	1058	1063	925	1116	875	121	545	825	645	621

Ages, .	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	57	Total
Mothers,	691	594	409	426	287	404	142	148	80	66	50	27	6	9	4	—	2	4	1	16,301

TABLE IV.—SHOWING THE AGES OF 16,301 WIVES-MOTHERS IN EDINBURGH AND GLASGOW IN 1855, ARRANGED IN PERIODS OF FIVE YEARS.

Ages, . . .	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	Total
Mothers, . .	376	3688	5037	3850	2407	840	96	6	1	16,301
Percentage, .	2·30	22·62	30·89	23·61	14·76	5·15	·58	·03	—	

An inspection of this table shows again that the year of maternal life yielding most recruits to the general population is the thirtieth, and an easy calculation makes out that about three-fifths of the legitimately born population are derived from women of 30 years and under, while two-fifths are derived from women of 30 years and upwards. For, dividing mothers of 30 years of age, and adding together those on each side of the point of division, we have on the side of the younger 9708 mothers, and on the side of the elder 6593, giving a majority of 3115 in favour of the younger. The mean age of the wives-mothers in this table is above 29.

From these data I conclude,

1. That the actual, not the relative, fertility of our female population, as a whole, at different ages, increases from the commencement of the child-bearing period of life, until the age of 30 is reached, and then declines to its extinction with the child-bearing faculty.

2. That the actual fertility is much greater before the climax, thirty years, is reached, than after it is passed.

3. That at least three-fifths of the population are recruited from women not exceeding 30 years of age.

Before leaving these tables, it is expedient to direct attention to a striking lowness of figure at the ages of 29 and 31 respectively in Dr COLLINS's data. A similar fall on each side of the highest number occurs in Dr GRANVILLE's table, which has been referred to, and in every similar table which I know. This curiosity has given rise to very natural and ingenious speculation. Dr GRANVILLE suggests, that by the earlier decrement, nature means to rest awhile and gather strength for the enormous jump she is to make in the following year, and that by the second decrement she means to evince the exhaustion which invariably follows over-exertion. But I cannot acquiesce in this fanciful hypothesis, believing that really no such decrement, jump, and second decrement, occur. My explanation of this tabular phenomenon is suggested by the occurrence of similar falls on each side of the age of 40 years, in COLLINS's table, and in my own and in others. I am too well aware, from ample experience, of the impossibility of getting women's ages stated correctly, especially if they have passed twenty-five years, and have often observed, that when pushed, they say 30 or 40 as a round easy number; and the state of the tables appears to me merely to indicate that women of about 31 and of 41 years of age frequently say they are 30 and 40 years old respectively. In short, these decrements are evidence of the unfortunate element of error which creeps into the most carefully prepared vital statistics on a large scale.

CHAPTER II.—*The Comparative Fertility of the Female Population as a whole at Different Ages.*

Having shewn the actual fertility of women at different ages in our population, I now proceed to the question of the comparative productiveness of our whole female population at different ages. To settle this, it is only necessary to compare the number of children born of women of different ages with the number of women living at the different ages respectively. The result of the calculations involved in this comparison will be to show, not simply (as in Chapter I.,) the numbers of children born of women at different ages, but the number of mothers relatively to the number of women living at different ages—in other words, the comparative fertility or productiveness of our female population as a whole at different ages.

TABLE V.—SHOWING THE COMPARATIVE FERTILITY AT DIFFERENT AGES OF THE WHOLE FEMALE POPULATION OF EDINBURGH AND GLASGOW.

Ages,	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Women,	31,538	34,631	29,778	24,272	19,362	17,938	13,868
Children,	380	3731	5096	3895	2435	849	97
Proportion of latter to former is 1 in	82·9	9·2	5·8	6·2	7·9	21·1	142·9
Percentage,	1·20	10·77	17·11	16·04	12·57	4·73	·69

Table V. is constructed so as to bring out the desired results, and at the same time, be easily compared with Table VI. It must be observed that the fifth table does not exhibit results whose actual amounts are of much value, but results the value of which is very great with a view to determining the question of comparative amounts or productiveness. For, while the numbers of women at different ages include the whole women living at these ages in Edinburgh and Glasgow in 1861, the numbers of children born at different ages, as given in the table, include only children born under the conditions of legitimacy, live birth, and complete or nearly complete maturity in 1855.

In his work on Annuities* &c., Mr MILNE in 1815 published a valuable table, which he describes as “shewing the fecundity of women at the different periods of life in Sweden and Finland, from 1780 to 1795, both years inclusive.” It is taken from a paper by Mr NICANDER, to which he gives a reference, but unfortunately I have not been able to ascertain the exact conditions (if any) under which the table was prepared.

TABLE VI.—SHOWING THE COMPARATIVE FERTILITY AT DIFFERENT AGES OF THE FEMALE POPULATION OF SWEDEN AND FINLAND. [*From the Table of Mr NICANDER.*]

Ages,	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Females,	132,765	131,377	121,650	112,250	98,710	89,259	74,002
Deliveries,	3298	16,507	26,329	25,618	18,093	8518	1694
Proportion of latter to former, 1 in	40·256	7·959	4·620	4·382	5·456	10·479	43·686
Percentage,	2·48	12·56	21·64	22·82	18·32	9·54	2·28

* Vol. ii. p. 582.

In the last line of both tables (V. and VI.), it will be remarked that the first and last proportional numbers are very low, or that at the beginning of the scale, at the age of from 15 to 19 inclusive, fertility is comparatively very small; and that at the end of the scale, at the age of from 45 to 49 inclusive, fertility is again comparatively very small. This no doubt depends to a great degree on the circumstance, that among the women from 15 to 19 years of age, are included a large proportion of immature girls, and among the women from 45 to 49 years of age, a large proportion of women whose child-bearing powers have disappeared. Keeping in view this undoubted partial explanation of the lowness of the figure, or the lowness of fertility at these ages, the tables are seen to yield interesting results. They shew that the fertility of the populations of Edinburgh and Glasgow, and of Sweden and Finland, increases gradually, till the middle of the child-bearing period of life, or about the age of 30 years, and that then fertility gradually falls off towards its complete extinction.

My knowledge of the conditions under which my own table was framed, as already stated, being exact, as compared with my knowledge of Mr NICANDER'S, I shall, in framing conclusions, adopt the results it affords. On like grounds, I shall excuse myself from proceeding to compare the easily remarked differences of the results of the two tables.

In regard, then, to the comparative fertility of our whole female population at different ages, I conclude—

1. That it increases gradually from the commencement of the child-bearing period of life until about the age of 30 years is reached, and that then it still more gradually declines.

2. That it is greater in the decade of years following the climax of about 30 years of age, than in the decade of years preceding the climax.

CHAPTER III.—*The Comparative Fecundity of the whole Wives in our Population at Different Ages.*

I now proceed to the question of the fecundity, not fertility or productiveness, of the mass of wives of different ages in Edinburgh and Glasgow. In the two preceding chapters the fecundity or comparative power of production at different ages has not been entered on; in them have been considered merely the actual production of children by women of different ages, and the comparative amounts of production by the female population at different ages. It is known that at all ages there is a great mass of spinsters whose productiveness is not tested, and it is of course necessary, in order to determine questions of fecundity, to eliminate all women not living in married life, or not having their fecundity tested in the ordinary way, from our observations and calculations. In this chapter, therefore, the comparison is not of mothers with women living as in chapter ii., but of wives-mothers with wives.

TABLE VII.*—SHOWING THE COMPARATIVE FECUNDITY AT DIFFERENT AGES OF THE WHOLE WIVES IN EDINBURGH AND GLASGOW IN 1855.

Ages,	15-19	20-24	25-29	30-34	35-39	40-44	45-49
Wives,	756	8874	14,622	14,579	11,871	10,506	7537
Wives-Mothers,	378	3709	5065	3872	2421	845	96
Proportion of latter to former is 1 in	2·0	2·4	2·9	3·7	4·9	12·4	78·5
Percentage,	50·00	41·79	34·64	26·56	20·39	8·04	1·27

The seventh table establishes a comparison between the numbers of married women of various ages, and the numbers of such women bearing living children. In Edinburgh and Glasgow, the number of wives within the ages of 15 and 49 inclusive, or who might have borne children in 1855, was 68,745, and the number of wives-mothers in the same population, in the same year, was 16,386,† or 1 in 4·2. In the table these are arranged in columns of different ages, so as to exhibit the comparative fecundity of the whole wives of different ages. It will be seen at a glance, that the table shews that the fecundity of the mass of wives is greatest in the first years of the child-bearing period of life, and I regret extremely that the data at my disposal do not permit me to condescend on the circumstances in this respect of each individual year. The table shows that, from the earliest years of child-bearing life onwards, the fecundity of the mass of married women gradually wanes to its extinction. It is also easily made out that while there were 24,252 wives under 30 years of age, and of these 9152 bore children, there were 44,493 wives of ages varying from 30 to 49 years inclusive, and of these only 7234 bore children; or, to speak in round numbers, the wives under 30 years of age were much more than twice as fecund as the wives above 30 years.

* In this table, the actual numbers are given as nearly as possible.

The numbers of wives have been arrived at in the following way. We have the population of Edinburgh and Glasgow in 1851 and 1861, and, by calculation, estimate the population in 1855. We have the actual numbers of wives of different ages in 1861, and by an easy calculation of proportions we reduce the numbers of wives of different ages to the numbers given for 1855.

The number of wives-mothers extracted from the registers of 1855, is 16,301, bearing 16,500 legitimate children. But the Registrar-General's Reports state the number of children as 16,593. Hence it appears that 93 births are omitted in the extracts. These omissions were made on account of manifest carelessness and inaccuracy in the registers. To these 93 births, corresponds the number of 92 mothers, one being deducted for a twin case. These 92 mothers have been added proportionally to the others, in order to make up the total of 16,393.

† The actual number of wives-mothers in Edinburgh and Glasgow in 1855 was 16,393. This figure is in the text reduced to 16,386, and seven wives-mothers omitted, because these seven were altogether exceptional, occurring as they did between the ages of 50 and 57, and could only damage the statement of results.

But a more interesting and valuable comparison may be made by taking the same number of 15 years before and after the middle of child-bearing life, a total period of 30 years, which includes the immense majority of child-bearing women. Doing so, we find that of 24,252 wives under 30 years of age, 9152 bore living children, and that of 36,956 wives of ages from 30 to 44 inclusive, 7138 bore living children. Had the elder women been as prolific as the younger, they would have produced 13,946 children, instead of 7138; that is, the fecundity of the younger women was almost double that of the older.*

The table given in this chapter has been prepared (see footnote) so as to give the actual amounts. I found it possible to do this with a near approach to exactness, and it is evident that in this way the results derived are not only comparative statements, with only relative value, but also statements of actual values.

From the data now given I conclude—

1. That the fecundity of the mass of wives in our population is greatest at the commencement of the child-bearing period of life, and after that epoch gradually diminishes.

2. That the fecundity of the whole wives in our population included within the child-bearing period of life, is, before 30 years of age is reached, more than twice as great as it is after that period.

3. That the fecundity of the wives in our population declines with great rapidity after the age of 40 is reached.

Some of these conclusions may be stated, with the actual numerical results, as follows:—While of all the wives living in Edinburgh and Glasgow between the ages of 15 and 45, one in 3·8 or 26·3 per cent. bore a living child; of those

* The data at my disposal enable me to give the figures for each year of age up to 20. But the numbers are so small, that little value can be placed on the results drawn from them. They seem to me to indicate that the fecundity of the mass of married women is probably highest shortly after the age of 20 is reached. For although the low fecundity of one in 2·57 at twenty years of age, is absorbed in Table VII. in the period from 20 to 24, yet this latter period shows, on the whole, the higher fecundity of 2·4.

TABLE VIII.—SHOWING THE COMPARATIVE FECUNDITY OF WIVES AT AGES OF 16, 17, 18, 19, AND 20, IN EDINBURGH AND GLASGOW, IN 1855.

Ages,	16	17	18	19	20
Wives,	13	55	232	455	1043
Wives-Mothers,	4	28	116	228	405
Proportion of latter to former is 1 in	3·25	1·96	2·00	1·99	2·57
Percentage,	30·77	50·91	50·00	50·11	38·83

between the ages of 15 and 29 inclusive, one in 2·6, or 38·4 per cent., bore a living child ; and of those between the ages of 30 and 44 inclusive, one in 5·1, or 19·6 per cent., bore a living child.

CHAPTER IV.—*The Initial Fecundity of Women at Different Ages.*

In commencing the statistical inquiry whose results I am now giving, my object was to discover the fecundity of women at different ages, and I now proceed to address myself to this point.

It is not my object to illustrate the subject of the arrival of young girls at the age of maturity, the change of the girl into the fertile woman. In the case of some peoples, facts might be collected regarding wives so young as to be in a large proportion sterile from immaturity ; and their fecundity gradually appearing as age advanced, might produce a column of mothers from 10 to 20 years of age, shewing a gradually increasing fecundity of the population at these ages. Even in our tables derived from the data of wives in Edinburgh and Glasgow, some interesting results are to be found, and allowance must be made for a certain amount of immaturity in the wives of from 15 to 20 years of age. But this question of the arrival of girls at maturity is foreign to the present topic. In it all the women are supposed to be mature, and subjected to the conditions essential for procreation.

The fecundity of individual women is known to vary extremely. Some are very frequently pregnant, and repeatedly, or even constantly, have plural births, and thrive with it all. Under like conditions, other women are absolutely sterile, or a miscarriage or a dead mature child forms the climax of their fecundity, and this little may be effected at the expense of permanent constitutional exhaustion. Between these extremes of great fecundity and absolute sterility, there is an unlimited series of varying degrees of fertility. On this interesting aspect of the subject of fecundity, the present research throws little light. It is founded on the result of an aggregate of cases, and can show almost nothing as to individuals. It illustrates the fecundity at different ages of women generally, not the individual fecundity of any.

The table given in last chapter (Table VII.), affords data which cannot be applied to settle the question of the fecundity of women of different ages. For it is evident that among the mass of wives of each succeeding year, or series of years, are included the wives who were once of the former series or part of them—that is, a class of wives whose fecundity has been at least liable to be increased, diminished, or exhausted by procreation, before they have come to form part of the wives in any of the columns after the first. In order to arrive at the fecundity of women or wives of different ages, it is necessary to secure that the condi-

tions of the compared women of these different ages be as nearly the same as possible. This is not attempted in the seventh table.

TABLE IX.*—SHOWING THE INITIAL FECUNDITY OF WOMEN OF DIFFERENT AGES IN THE FIRST YEAR OF MARRIAGE.

Ages of Wives newly Married, . . . }	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	Total.
No. of Wives newly Married, . . . }	700	1835	1120	402	205	110	46	20	6	2	1	4447
No. of Wives Mothers within first year of Marriage, . . . }	96	339	139	46	19	4	...	...	...	...	...	643
Proportion of latter to former is 1 in }	7·3	5·4	8·0	8·7	10·7	27·5	...	...	...	...	...	6·9
Percentage,	13·71	18·48	12·41	11·44	9·27	3·63	...	...	...	...	...	14·46

Table ninth is constructed to show the relative initial fecundity of newly-married women of different ages. By the returns of the Registrar-General we calculate how many women at each succeeding year of age contracted marriage in 1855, in Edinburgh and Glasgow. My extracts from the register for 1855, shew how many of these women bore living children before they had been a year married. When the two figures are compared for each age, we have the fecundity at the outset of child-bearing at each age. The table reads as follows:—Of 700 women married between 15 and 19 years of age inclusive, 96 bore a living child before they had been wives for twelve months, or one in every 7·3; and so on.

Table tenth is in every respect the same as the former, only it shows the fecundity within 24 months of married life; or the number of women bearing living children before they were two years married is compared with the number of newly married. The observation that the fecundity within 24 months is much more than twice as much as the fecundity within 12 months of marriage, appears to me to give this table more substantial value than the former, as an indication of the actual fecundity of the outset of child-bearing at different ages.

Both these tables show the highest rate of initial fecundity to be between the

* The number of wives married at different ages in Edinburgh and Glasgow in 1855, is arrived at in the following manner. The marriages in Scotland in 1855 were 19,680. The marriages in Edinburgh and Glasgow in 1855 were 4447. The distribution of the 19,680, according to age at marriage, is given at p. 22 of the Registrar-General's Annual Report for 1861. This distribution requires a correction for the number whose ages at marriage were not known. Calculating on the ages of the whole 19,680, the proportional distribution of the 4447 married in Edinburgh and Glasgow is found to be as in the table above.

ages of 20 and 24 inclusive, and a gradual declension from that time on either side as age diminishes or increases.

TABLE X.—SHOWING THE INITIAL FECUNDITY OF WOMEN OF DIFFERENT AGES WITHIN THE FIRST TWO YEARS OF MARRIAGE.

Ages of Wives newly Married, . . . }	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	Total.
No. of Wives newly Married, . . . }	700	1835	1120	402	205	110	46	20	6	2	1	4447
No. of Wives Mothers within two years of Marriage, . . . }	306	1661	849	253	84	17	2	...	...	...	...	3172
Proportion of latter to former is 1 in }	2·3	1·1	1·3	1·5	2·4	6·4	23·0	...	...	...	...	1·4
Percentage,	43·71	90·51	75·80	62·93	40·97	15·45	4·35	...	...	...	...	71·33

The two following tables (XI. and XII.) show that on the side of the women younger than 20 years, initial fecundity steadily decreases with age. In regard, however, to these young wives, it may be objected that there is a source of error from immaturity which is certainly very trifling after the age of 20 is reached. And the objection is, theoretically at least, quite just, for it is absurd to attempt to measure the fecundity of women who have not become sexually mature, and the admixture of immature with mature is a source of error, important, directly according to its amount. It is unsatisfactory merely to allege in answer, that immature girls are not likely to be found among young wives in such numbers as to form a source of great error. I have therefore taken the following means to ensure that this source of error be completely excluded.

TABLE XI.—SHOWING THE INITIAL FECUNDITY OF WOMEN UNDER 20 YEARS OF AGE IN THE FIRST YEAR OF MARRIAGE.

Ages of Wives newly Married,	16	17	18	19
No. of Wives newly Married,	43	108	225	314
No. of Wives Mothers within first year of Marriage,	2	7	31	56
Proportion of latter to former is 1 in	21·5	15·4	7·2	5·6
Proportion after correction for Immaturity, is 1 in	15·5	12·8	7·0	5·4
Percentage,	6·45	7·77	14·70	18·30

TABLE XII.—SHOWING THE INITIAL FECUNDITY OF WOMEN UNDER 20 YEARS OF AGE WITHIN THE FIRST TWO YEARS OF MARRIAGE.

Ages of Wives newly Married,	16	17	18	19
No. of Wives newly Married,	43	108	225	314
No. of Wives Mothers within two years of Marriage,	4	27	98	177
Proportion of latter to former is 1 in	10·7	4·0	2·3	1·8
Proportion after correction for Immaturity is 1 in .	7·7	3·3	2·1	1·7
Percentage,	12·90	30·00	46·44	57·84

The commencement of menstruation is generally considered by physicians an indication of the arrival of sexual maturity. It may be true that some are still immature in whom this phenomenon has shown itself, and it certainly is true that some are mature before its appearance. Yet it forms a generally accredited indication of maturity. The following table (XIII.), framed by Dr WHITEHEAD, is a large collection of data, showing the age of the appearance of menstruation in 4000 individuals in this country. It is easy to calculate what fraction of the whole 4000 had begun to menstruate at 16, 17, 18, and 19 years of age respectively, or, in other words, what fraction was capable of exhibiting fecundity at these ages. This I have done, and have corrected the numbers of wives in tables eleventh and twelfth accordingly, reducing them to similar fractional parts. After making this correction for immaturity, I have calculated the proportions of wives-mothers to wives, and placed the results in the last line. They remain the same so far as to show a steady diminution of fecundity as age diminishes.

TABLE XIII.—“SHOWING THE AGE AT WHICH PUBERTY WAS ACCOMPLISHED IN FOUR THOUSAND INDIVIDUALS.” (WHITEHEAD, *on Sterility and Abortion*, p. 46.)

At Age of 10 years 9 first Menstruated.				At Age of 19 years 148 first Menstruated.			
”	11	”	26	”	20	”	71
”	12	”	136	”	21	”	9
”	13	”	332	”	22	”	6
”	14	”	638	”	23	”	2
”	15	”	761	”	24	”	1
”	16	”	967	”	25	”	1
”	17	”	499	”	26	”	1
”	18	”	393	”		”	

From these data I conclude—

1. That the initial fecundity of women gradually waxes to a climax, and then gradually wanes.

2. That initial fecundity is very high from 20 to 34 years of age.
3. That the climax of initial fecundity is probably about the age of 25 years.

At this point my present inquiry is closed. I know of no other way of advancing our knowledge of this subject, than by the collection and analysis of statistics. The only very good quarry for such materials that I know of is the Scottish registers for 1855. The tables adduced might be improved by going over a larger field, and increasing the numbers analysed. But I do not see how the matter in the registers could be turned to more account, without encroaching on another topic which is at the same time closely connected with that under discussion,—viz., the fertility of marriage. Or, as marriage is scarcely admissible as a term in physiology, I should give this subject the title of ‘sustained fecundity,’ the degrees of fertility which women of different ages, beginning to live with men, continue to exhibit during the child-bearing period of life. In the meantime I shall summarily state, that, so far as I have advanced in this new topic, the evidence gained shows that, speaking generally, young women after the outset of child-bearing continue to exhibit a fecundity greater than is sustained by those married when comparatively elderly. The fourteenth table exhibits some of these results. It reads as follows:—Wives of from 20 to 24 years of age exhibit in the fifth year of marriage a comparative fecundity of 1 in 3·0; wives of from 25 to 29 years of age exhibit in the fifth year of marriage a comparative fecundity of 1 in 14·5; and so on. The table shows that at the fifth, the tenth, and the fifteenth years of marriage, the mass of women youngest married continue to show the greatest fecundity. The mass of younger women not only are more fecund at the outset of child-bearing, but after that time is past, they continue more fecund than older women who have been married the same number of years.

TABLE XIV.*—SHOWING THE FECUNDITY OF WIVES IN EDINBURGH AND GLASGOW, AFTER THREE DIFFERENT PERIODS OF CONTINUANCE IN THE MARRIED STATE.

Age of Wives,	20–24	25–29	30–34	35–39	40–44
Fertility in Fifth Year of Marriage,	3·0	14·5	59·9	202·4	698·2
Fertility in Tenth Year of Marriage,	...	4·0	23·2	95·5	404·9
Fertility in Fifteenth Year of Marriage,	...	...	6·5	44·3	340·0

I have made various other inquiries with a view to throw light on the topic of this paper. They refer to variations in sex, size, and weight of newly-born children

* This Table is not prepared so as to show anything more than is described in the text. Especially the figures in one horizontal line should not be compared with those in another horizontal line. To permit this, the table requires large corrections for deaths.

according to the age of the mother, also to the frequency of twins and triplets according to the mother's age. But the results of these investigations have been so imperfect or unsatisfactory that I do not now describe them.

The views hitherto entertained regarding the influence of age on fecundity have been various. "In regard to age (says BURDACH*) fecundity is diminished in the first and last portions of the continuance of the aptitude for procreation. The elk, the bear, &c., have at first only a single young one, then they come to have most frequently two, and at last again only one. The young hamster produces only from 3 to 6 young ones, whilst that of a more advanced age produces from 8 to 16. The same is true of the pig. This rule appears to be general, since it applies also to the entomostraceæ; according to Jurine, the number of the young of the *Monoculus pulex* is at first from 4 to 5, afterwards rising gradually as high as 18. We scarcely ever encounter the births of 3 or 4 children, except in women who have passed the thirtieth year. Precocious marriages are not only less fertile, but the children also which are the result of them have an increased rate of mortality. According to Sadler, every marriage in the families of the peers of England yields 4.40 children when the woman was married below 16 years of age; 4.63 from this age to 20; 5.21 from 20 to 23; and 5.43 from 24 to 27." The notions here expressed by BURDACH are in the main correct; but it is evident that they are very indefinite. They are to be regarded, also, more in the light of happy guesses than of well-founded opinions. BURDACH evidently places chief reliance on the evidence afforded by the numbers at a birth. From many quarters I have received corroboration of BURDACH's statements regarding the increase and subsequent decrease of the number produced at a birth by pluriparous animals, and I have received similar information regarding bitches, guinea pigs, the fertility of hens, &c. When I first paid attention to this subject, the plural births of women appeared to me to form a simple key for the determination of the fecundity of women at different ages. But I soon became dissatisfied with the materials I quickly collected. Woman is not a pluriparous animal, neither does she produce so regularly, or according to season, as the animals with which she is compared. In her the occurrence of twins and triplets is an exception to the normal rule, and the number of children born by her cannot be so simple and sure a test of fecundity, as in the case of animals having multiple litters at stated periods. Indeed, it is apparent that the evidence derived from plural births alone in women may positively mislead, for a woman may be more fertile bearing one child at a time frequently than another bearing twins or triplets more seldom. In this place I shall only say, that the numerical study of twins, in reference to the age of the mother, yields interesting results, which do not confirm BURDACH's statement regarding them, yet are not hostile to the conclusions of this paper. BURDACH, in his work, describes an annual rise and fall in the fecundity of some pluriparous

* Physiologie, tom. ii. page 117.

animals. This annual variation forms a series of wavelets in the course of the great wave running from youth to old age, and culminating in middle life. This annual rise and fall of fecundity he attributes to the influence of cold.

In his "Treatise on Man," M. QUETELET has, with some care, collected the statistical materials available at the time for advancing the settlement of the question of the relation of age to fecundity. He does not allude to the opinions of BURDACH, probably because they have no sufficient foundation, but he refers to MILNE, MALTHUS, SADLER, GRANVILLE, FINLAYSON, and several foreign authors, who have more or less directly tried to throw light on the topic. QUETELET's whole chapter on the influence of age on the fecundity of marriages is very unsatisfactory. It is at least difficult to reconcile with one another the conclusions arrived at in various parts of this chapter, and I shall not attempt to do it. It is only fair to say, that he seems conscious of the numerical deficiency of data sufficient for a basis of any conclusion, and as an example of the state of matters, the table of SADLER, which he and BURDACH both quote, may be mentioned; in it the number of marriages analysed is under 500, and they are all selected according to extraordinary conditions. The final conclusion which M. QUETELET announces is, that it is before the age of 26 years that we observe the greatest fecundity in women.

The last writer on this topic whom I know of is Dr GRANVILLE, who, in an interesting paper in the London Obstetrical Transactions, returns to the description of his former labours in the same field. In this paper, production or fertility is confounded with productive power or fecundity, and the table to which I have alluded in Chapter I. he describes not as showing the fertility at different ages of the industrial classes of the metropolis, but erroneously, as showing the alternations in the productive power of women at different ages.

In this paper, then, I have, *inter alia*, shown that the great majority of the population is recruited from women under 30 years of age; but that the mass of women in the population, of from 30 to 40 years of age, contribute to the general fertility a larger proportional share than the mass of women of from 20 to 30 years of age:—

Further, that the wives in our population, taken collectively as a mass, show a gradually decreasing fecundity as age advances; but that the average individual wife shows a degree of fecundity which increases till probably about the age of 25, and then diminishes.

The fertility of the average individual woman may be described as forming a wave which, from sterility, rises gradually to its highest, and then, more gradually, falls again to sterility.