THE GULSTONIAN LECTURES,

OR

THE STERILITY OF WOMEN.

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By J. MATTHEWS DUNCAN, M.D., LL.D., ETC.,

Physician-Accoucheur and Lecturer on Midwifery at St. Bartholomew's Hospital.

LECTURE II: PART III.—ITS THEORY OR CAUSATION.

IN Galton's statement of the actual infertility of heiresses, there is observable a remarkable comparative paucity of male issue—a fact which goes, like many others, to confirm the ancient and still prevalent opinion that relative sterility or weakness of reproductive energy tends to the production of females rather than males. This department of the study of sterility I shall not enter on, the causes of the excess of females over males in all births being the subject of an extensive literature, and its relations being too numerous and complicated for advantageous discussion in this place. But I may state that I have long been impressed with a belief, in accordance with the chief pertinent facts, that the excess of female births is due to the prevalence of a degree of weakness of reproductive energy. Excess of female births is coincident with other evidences of sterility.

We have already given reasons for believing that, when a woman bears above ten of a family, she shows an unnatural or excessive amount of fertility; and this belief is corroborated by the demonstration we now propose to give, that excessive families occur chiefly in women who are married in the sterile age, or age of weak reproductive energy characterised by absolute sterility and by morbid production, whether abortive, premature, or mature. At present, we only consider the production of mature children, and we find the unnatural intensity of fertility in the young shown by absolutely large numbers, that is, above ten; while, in the elderly, it is shown by rapidity of births or intensity of fertility, so long as it lasts; and we may here remark that it has been elsewhere proved that, for such women as begin childbearing late in life, there is a prolongation of the period of fertility beyond the average age of ceasing to bear, not a prolongation, as estimated from beginning to end, of actual childbearing.

That the fertile younger are more fertile than the fertile older is shown by the following table of data derived from St. George's-in-

TABLE XVII.—Showing the Fertility of Mothers Married at Different Ages.

Years Elapsed since Birth of First Child.	Average Number of Children to each Marriage formed at Ages:			
	16-20.	21-25.	26-30.	31-35.
10	5.05	4.51	4.42	3.44
20	7.68	7.01	6.43	3.00
30	8.41	7.89	6.80	7.00
40	10.85	8.24	5.00	4.00

the-East. That the younger fertile have a longer perseverance in fertility than the fertile older is shown by Table XVIII, derived

TABLE XVIII.—Showing the Amount of Continuance in Fertility of Wives Married at Various Ages, as shown within Twelve Months.

Age of mother at marriage.....	15-19	20-24	25-29	30-34	35-39	Total.
The number child-bearing in the fifth year of married life is 1 in...	2.6	2.7	4.1	4.9	10.5	3.2
The number child-bearing in the tenth year of married life is 1 in...	3.2	4.0	5.9	8.7	—	4.4
The number child-bearing in the fifteenth year of married life is 1 in...	4.6	6.8	18.2	37.4	—	8.0
The number child-bearing in the twentieth year of married life is 1 in...	8.5	14.3	129.8	—	—	16.3
The number child-bearing in the twenty-fifth year of married life is 1 in...	68.0	480.5	—	—	—	171.0

from my work on *Fecundity*. That the unnatural intensity of fer-

tility in women bearing large families begins with the commencement of childbearing, is shown by Table XIX, from Ansell, which

TABLE XIX. (from Ansell).—Showing Intensity of Fertility in Mothers of Families of Different Numbers.

In Families consisting of the Under-mentioned Numbers of Children.	Interval between the Marriage of the Parents and Birth of the—		
	1st Child.	2nd Child.	3rd Child.
	Years.	Years.	Years.
1, 2, or 3	1.78	4.84	7.38
4, 5, or 6	1.37	3.33	5.49
7, 8, or 9	1.18	2.82	4.68
10, 11, or 12	1.05	2.54	4.15
13, 14, or 15	1.08	2.40	3.81
16 or more	0.96	2.15	3.47

demonstrates the rapidity, only up to the birth of the third child, in families of various numbers. Up to the third birth, the rapidity is twice as great in families of sixteen or more as in families not above three; and it is easily counted that, while the small families came slowly, and the excessive families quickly, the families from seven to twelve came nearly at the average rate of one every eighteen months. That the unnatural rapidity of childbearing in excessive families continues throughout childbearing life is shown clearly by Tables IV and V. In my table, the quickest childbearing is every ten months, the family being nineteen in number. In Ansell's table, the quickest is every fifteen months, the family being eighteen.

Lastly we show, by a table framed from the Edinburgh and Glasgow data, that the wives beginning fertility at advanced periods of life have an unnatural intensity of fertility while it lasts, a greater intensity than that of women married and beginning to childbear at the best ages. (See Table XX.) This table reads

TABLE XX.—Showing the Intensity of Fertility in Wives Mothers of Different Ages.

Duration of Marriage.	Mother's Age.						
	15-19.	20-24.	25-29.	30-34.	35-39.	40-44.	45-49.
Under five years	1.128	1.610	1.825	1.844	1.827	1.698	1.200
Five years and under ten	2.500	3.190	3.750	4.048	4.085	3.792	4.000
Ten years and under fifteen	—	5.333	5.453	5.903	6.197	5.964	6.500
Fifteen years and under twenty	—	—	6.000	—	7.014	7.993	8.435
Twenty years and under twenty-five	—	—	—	7.000	9.396	9.718	10.528
Twenty-five years and under thirty	—	—	—	—	—	12.368	13.600
Thirty years	—	—	—	—	—	—	13.000

thus: To take the second row of figures—Fertile women five years married and under ten have, if they are now from fifteen to nineteen years of age, 2.5 children; if now from twenty to twenty-four years of age, 3.19 children; if now from twenty-five to twenty-nine years of age, 3.75 children, and so on.

Multiparity is a term already well recognised as implying that the subjects of it have had two or more pregnancies and births; but a woman may bring forth two or more children at once, and to this condition we apply the term pluriparity. The most common degree of pluriparity is the production of twins, these occurring about once in every eighty pregnancies. Triplets and higher numbers are very much rarer, and the rarity increases with the number.

Chiari, Braun, and Spaeth have given good evidence that abortions are comparatively more frequent in plural than in ordinary pregnancies. M'Clintock, founding on large experience, shows that hydramnios is also common. Acephalous monsters are found only in plural pregnancies. Monstrosities of all kinds are commoner in plural than in ordinary pregnancies. There are more dead-born children in plural pregnancies. The children born alive in plural pregnancies are more difficult to rear. "The proportion," says Ansell, "of infants that are stillborn or die soon after birth is, in the case of males nearly five times, and in the case of females nearly four times, greater in multiple than in single births."

Subsequently, we shall adduce evidence that pluriparity is specially associated with idiocy and imbecility of the children, and that it specially affects the sterile ages, or ages of weakness of reproduction. Excessive family, that is, above ten in number, specially affects the same ages, and is dangerous to the lives and injurious to the health

of both mothers and children. Both have therefore an alliance with sterility.

In a case of quintuplets the mother's age was forty and the pregnancy the tenth. In 7 cases of quadruplets the age of the mother was given in 6, and the mean is twenty-seven; the number of pregnancy was given in 6, and the mean is nearly three. The ages were nineteen and twenty with first pregnancies; twenty-five with third pregnancy; thirty with number of pregnancy not stated; thirty-two with a fifth pregnancy; and thirty-five with a fourth pregnancy. In one case of second pregnancy the age of the mother was not given. From a great variety of sources I have collected 43 cases of triplets (and of these I give in the subjoined tables some account). (See Table XXI.) In 40 cases the age of the mother is given, and the

TABLE XXI.—Showing the Ages of Mothers in Forty Cases of Triplets.

Age of mother...	19	20	23	24	25	27	28	29	30	31	32	33	34	35	36	37	38	44
Number of cases	1	3	1	2	4	2	2	1	6	1	1	1	1	6	2	2	3	1

mean is thirty. In 41 cases the number of the pregnancy is given, and the mean is four. (See Table XXII.) It is naturally expected

TABLE XXII.—Showing the Number of Pregnancy in Forty-one Cases of Triplets.

Number of pregnancy...	1	...	2	...	3	...	4	...	5	...	6	...	7	...	8	...	10	...	11	...	12
Number of triplets	8	...	8	...	12	...	2	...	2	...	2	...	3	...	1	...	1	...	1	...	1

that our best evidence should be derived from twins; but while this is really so, we have, even in these cases, to deplore the inadequacy of the data in point of number. I have not at present sufficient time at my disposal to enter into the details of the production of twins, and for these I refer you to my work on *Fecundity*. It is there shown that the frequency of twins increases with the age of the mother and with the number of the pregnancy, the very early ages of the mothers and the first pregnancy forming exceptions to the rule.

In a paper by Arthur Mitchell, published in the *Medical Times and Gazette* (Nov. 15th, 1862), he shows that twins are peculiarly liable to be imbeciles or idiots. The conclusions of Mitchell's paper are so pertinent to the present subject, that I quote them here at length. "1. Among imbeciles and idiots, a much larger proportion is actually found to be twin-born than among the general community. 2. Among the relatives of imbeciles and idiots, twinning is also found to be very frequent. 3. In families, when twinning is frequent, bodily deformities [of defect and of excess] likewise occur with frequency. 4. The whole history of twin births is exceptional, indicates imperfect development and feeble organisation in the product, and leads us to regard twinning in the human species as a departure from the physiological rule, and therefore injurious to all concerned. 5. When we pass from twins to triplets and quadruplets, everything we know regarding these latter gives support to the general conclusions in question."

Besides these accumulated dangers and disasters to the children produced in plural pregnancies, we know that plural pregnancy is dangerous and disastrous to the mothers. The trivial and the graver disorders of pregnancy are more common in pluriparous than in uniparous women, and the disasters and deaths in childbirth and in childbed are also more numerous in the pluriparous than in the uniparous. Nothing can be better demonstrated than that woman is naturally or normally uniparous, and that pluriparity is an unnatural or abnormal condition connected with sterility by being observed in the sterile ages, or ages of weakness or imperfection of reproductive power. It does not imply the desirable productiveness of health and vigour, but the reverse.

Pluriparity in a population, then, is not an indication that its social condition is as it should be. It shows, according to its amount, that marriages take place too early or too late in life; and it may be predicated of such a population, that it has a correspondingly large maternal and infantile mortality, and that the reared children are not of the finest. While woman is normally or physiologically uniparous, like the mare and cow, many of the other domestic animals are normally or physiologically pluriparous, as the dog, the rabbit, and the sow; and the fertility of most birds is a sort of pluriparity.

In the uniparous animals, pluriparity is rare in various degrees in the different kinds; but the extreme rarity in some, as in the mare, may to some extent depend on the circumstance that, in general, only the finest specimens at the most suitable ages are allowed to exhibit their fertility. Little, indeed, is known about them with the exactness desiderated with a view to comparison with woman; yet

we may safely assert that, among breeders of horses and cattle, the production of twins is, with a view to their interest in both mother and offspring, not looked upon with favour.

In the sheep, there is such a frequency of twins, and even of triplets, that there may be some hesitation in classing it with uniparous mammals.

In the pluriparous animals, on the other hand, uniparity is uncommon, and pauciparity is an indication of reproductive weakness or imperfection, while a just degree of pluriparity is natural or physiological. "It is remarked," says Spencer, "by Buffon, that when a sow of less than a year old has young, the number of the litter is small, and its members are feeble, and even imperfect."

The domestic hen, in its fertile career, admirably illustrates the rise and decline of pluriparity, and the variations are in accord with the great law of age, which holds good in women and in all living beings. Its first and its last productions are small in size, and are believed to be peculiarly liable to be addled or without yolk, or to be otherwise incapable of being hatched. In its first year, according to Geyelin, it produces only 15 or 20 eggs; in its second, 100 or more, up to 120; in its third year, from 120 to 135, and here the climax of fertility is reached; in its fourth year, it produces from 100 to 115; in its fifth, from 60 to 80; in its sixth, from 50 to 60; in its seventh, from 35 to 40; in its eighth, from 15 to 20; in its ninth, from 1 to 10. The fertility rises quickly to its summum in the third year of life, and more slowly fades to its disappearance in the tenth year of life.

In like manner, the bitch and pig begin their fertile course with a small number, which year by year rapidly increases; and, after a few years, whose number I cannot give, again decreases, till fecundity disappears, this last production being often a premature or a dead foetus. The pluriparous animal has its best young when its progeny is most numerous. The best young may be so described, as in pups, on account of their intelligence, docility, or special talents; or they may, as in a litter of pigs, be best because they are large and easily made to grow to great bulk or weight. In the case of the bitch, it is impossible to reduce to an exact statement the value of pluriparity, but it is no doubt very great; and while it is the case that, when most in number are produced there is also most in weight, the statement of weight of the pups gives no idea of their value. In a litter of pigs, the value of pluriparity is a simpler matter, being estimated almost entirely by weight and capability of rapid growth; and both may be very well stated in figures.

The uniparous mare has a foal, which may be valued partly for bulk, especially if it is to do rough, heavy work; but the bulk of a foal bred in the racing stud is a matter of comparatively little moment; and I daresay all will agree that the nobler the breed of horses, or the higher the qualities expected in them, so is bulk in the foal of less and less importance, and so also is pluriparity less and less desirable.

We have already used estimates of weight and length of single children as indications of fertility in woman; and, if weight and length of twins were a test of paramount import, then twinning would, correspondingly, connote fertility, as 12 lb. exceeds 6½ or 7 lb. But there are higher qualities than the combined weights and lengths, and it is these higher qualities that are deficient in twins. Weight and length are valued merely as indications of general health and full development of individuals, not of twins.

Pluriparity in uniparous animals is rare, and for its study great accumulation of instances is required; and knowledge regarding it in these animals is tardily gained. Pluriparity in some common domestic animals is an every-day matter; and, without any deliberate study, its variations strike even the obtuse—a class often specially sensible of the pecuniary advantages of the higher degrees of pluriparity. It is the striking characters and advantages of high degrees of pluriparity in pluriparous animals that have led to the general adoption of the erroneous opinion, that pluriparity, even in the uniparous animals, as in woman, is an unqualified sign of fertility.

In pluriparous animals, and specially in the common hen, the quick rise and more gradual decline of fecundity is plainly observed; the climax in the hen, as in other pluriparous animals, being marked by the highest number of annual production, or in a single brood or litter. In woman, there is the same kind of variation; but in her it is a decline from occasional pluriparity to the production, with due intervals, of the best kind of single births; and the rise is back again to occasional pluriparity, and hurry of births one after another.

In the common hen, the rise to the climax occupies three years of life, and the more gradual decline occupies six years, according to Geyelin's data, already given:—In woman, the decline to the lowest

if we count roughly, from fifteen to twenty-five years of age, occupies ten years, and the more gradual rise, from twenty-five to forty-five, occupies twenty years. In the hen, the rise is from 15 to 135, and the decline from 135 to 1. In woman, the decline is from about 1.02 to 1, and the rise again to about 1.02. There can be little doubt that a similar rise and fall, or fall and rise, are to be found in the history of the fertility of other living things. The curve of this climax and anti-climax is not a part of a circle. Dr. Routh, in a valuable paper on "Procreative Power," published in the *London Journal of Medicine* for 1850, describes this curve, representing what he calls the inclination of procreative power, and thinks the circle is perhaps the nearest that could be selected; but the circle cannot be made to represent the figures on which he relies. He makes the age of greatest fecundity in woman twenty-six, and the climax and anti-climax may be partially indicated by the following figures, which he gives: At fifteen years of age, the figure is 22; at twenty, it is 32; at twenty-six, it is 100; at thirty, it is 92; at thirty-five, it is 74; at forty, it is 54; at forty-five, it is 39.

In leaving the subject of twins, it is natural to refer to malformations and monstrosities as showing weakness or disorder of the reproductive powers, but on this point I have no good detailed evidence to adduce meantime. Yet it is well known that a great body of opinion is in favour of the view, and there are many facts pointing in the same direction. In the course of these lectures, I have frequently mentioned such opinions and facts, but the subject is well worthy of special study. Here I would only refer to the frequent combinations of idiocy and malformation, of idiocy and twins, of idiocy and premature or post-mature maternity, of malformation and twins, of interbreeding and malformation, of interbreeding and sterility, as combining to form an argument that may, if worked out, be found to be conclusive on this question.

Experiments in producing malformations and monstrosities in the common fowl have been very fruitful in results, and demand caution in judgment as to the potency of such influences as age of the mother. Especially interesting in this view is the recent discovery of Daresse that mere delay of incubation, in the case of the eggs of the common fowl, is a cause of malformation in the chick.

REMARKS

ON THE

LOCAL ORIGIN OF MALIGNANT GROWTHS.*

By JONATHAN HUTCHINSON, F.R.C.S., F.R.S.

Senior Surgeon to the London Hospital, Consulting Surgeon to the Royal London Ophthalmic Hospital

MR. PRESIDENT AND GENTLEMEN,—The subject before us is, as I understand it, the nature and scope of the local influences which induce malignant action. We accept, as being too obvious to need demonstration, the statement that cancer has both exciting and predisposing influences. The question, whether cancer be a local or a constitutional disease, seems to me, when put in such terms, to be almost childish; and I confess that I shall feel greatly disappointed if, in the discussion which is to follow my remarks, it should be in any way assumed that this is the matter in debate. Malignant processes of cell-growth are, I submit, not in any sense specific; they are modifications of the normal conditions of cell-life, and they depend not in the slightest degree upon the introduction of any new germs from without. They are the results of the sum of influences to which the organism has been exposed during its personal career; and it follows, as a matter of course, that these must have been some of them constitutional, and some of them local. It is with the latter that we have to deal to-day, and with these alone. It may, however, clear the matter somewhat if I first say a few words on the doctrine of cancer, and as to the general conditions which predispose to malignant action. In doing this, and indeed throughout my paper, I shall use the term cancer in its old sense, as denoting all forms and varieties of malignant disease.

The general result of modern histological inquiry has been, I believe, to lead us to regard the malignant process as, in the main, a local reversion to foetal modes of growth. A certain group of cell-elements succeeds in freeing itself from the central control of the

organism, and develops for itself upon a plan which is really retrograde, and which produces structures, which are not only in themselves useless, but which possess the power of infecting their neighbours. These growths are beyond the influence, or almost so, of the various agents which have been found effective in controlling inflammation. I am not sure that this insusceptibility to the action of drugs is not the principal characteristic of cancer. The infection of the glands, of the viscera, and of the organism generally, is a power which cancer shares with inflammatory processes. The more we investigate, probably, the more clearly we shall see that all inflammations are really infective; and that, from every structure in a state of inflammatory disease, particulate elements are shed, which, being carried in the lymphatic and vascular channels, may reproduce processes more or less similar in distant parts. The attempt, therefore, to distinguish between inflammation and malignant new growth, by reference to the infective power of the latter, thus breaks down. It is only because the results of general infection are, in the case of cancer, conspicuous and incurable, that we have come to regard this phenomenon as almost pathognomonic.

As it will be part of my assertion to-day, that inflammatory processes may pass by almost insensible gradations into those of malignancy, it becomes of much importance to get rid of false impressions as to the features which distinguish them. If we could find some remedy, the internal administration of which should cause a malignant ulcer to heal, or a malignant growth to melt away, as we witness when mercury or iodide of potassium is given for syphilitic formations, we should soon cease to notice any clearly marked clinical distinctions between cancer and inflammation. Nor, in truth, is the cancerous growth wholly beyond the reach of the remedies for inflammation. It is possibly true that none of the internal remedies—such as mercury, antimony, arsenic, and the like—have any appreciable influence upon it; but the local application of cold, and the local use of such agents as lead and spirits of wine, which repress cell-growth, have, if vigorously employed, an unquestionable power in retarding its development.

No one has ever doubted that there are constitutional states which predispose to cancer. In the first place, it is obvious that the structure in which it begins must be alive; and, in the next, it is clear that all living tissues are not equally liable to it, nor the tissues of all living organisms. It occurs in the lower animals as well as in man, but not with equal frequency in all. Possibly it is very rare in wild animals, and happens almost solely in those in whom the average duration of life is prolonged through artificial protection. Amongst the lower animals, as with ourselves, it is an appanage of old age. Senility, either of the structure concerned or of the entire individual, appears to be almost necessary to its production. When exceptions to this occur, they are probably due to the influence of inheritance. Speaking generally, there is no clinical fact more decidedly marked than that the tissues of young persons, however much exposed to the influences which in more advanced years are prone to evoke the disease, are not liable to take on a cancerous mode of growth. Whatever its character, and however prolonged its influence, we do not expect to see local irritation produce cancer in any person under middle age. When exceptions occur, they are to be exceptionally explained.

Sometimes it is not so much senility of the entire organism as what we may term local senility, an old age of the tissues concerned, which is premature, and does not correspond with that of the body as a whole. Nor, indeed, is it correct to say that the degree of senility is the measure of the proneness to cancer, for it is not in conditions of advanced senile atrophy that cancer is most apt to occur, but rather in its commencement. Tissues and organs which are just passing out of use, which are just commencing to decline, are those which are most prone to develop it. Of this law, the female breast offers us the best and most instructive example. It is quite possible that it is under this head that we ought to place part, at least, of the influence which previously existing local disease appears to exert in evoking cancer. Moles, and other forms of congenital excess, as well as certain innocent forms of new growth not congenital, are, as is well known, liable to be attacked by cancer. It may be that these growths run through their life more rapidly than normal structures, and thus, on the score of senility, become liable to cancer more early than the rest. It may be also, and it not improbably is, that this, too, is the way in which long-continued local inflammation sometimes acts; exhausting, as it were, the vital vigour of the part affected, and reducing it to the level of those of much older individuals. In this way, local inflammation may play the part both of predisposing and of exciting cause.

A few words must be said as to the causes of variety in the can-

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