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

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

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

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

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

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

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

LECTURES

ON

THE COMPARATIVE PHYSIOLOGY OF MENSTRUATION.

BY ALFRED WILTSHIRE, M.D., F.R.C.P. LOND.,

Joint-Lecturer on Obstetric Medicine, and Physician-Accoucheur for Out-Patients to St. Mary's Hospital; Consulting Obstetric Physician to the Hayes Cottage Hospital; Treasurer of the Medical Society of London; formerly Medical Inspector to Her Majesty's Privy Council, etc.

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

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

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

turbance, owing to the extreme sensitiveness of the reproductive system to vicissitudes of the environment, as Darwin and others have conclusively shown. It may be hoped that the laws governing this instability of equilibration will also be fully discovered, and, in process of time, admit of formulation, so as to render them amenable to remedial modification. Pursued and investigated on such a basis, there is a prospect that the physiology of the function may be brought within the domain of science, and cease to be a wonderment and mystery. It may also be hoped that the discovery of the physiological laws governing it will furnish, not only a foundation for the establishment of a sound and intelligent system of therapeutics, for correcting aberrations and remedying deviations, but also a more reliable basis than at present exists for pathological knowledge. Mr. Herbert Spencer well says (*Data of Ethics*, page 277): "Pathological science depends for its advances on previous advances made by physiological science. The very conception of disordered action implies a preconception of well-ordered action. Before it can be decided that the heart is beating faster or slower than it should, its healthy rate of beating must be learnt; before the pulse can be recognised as too weak or too strong, its proper strength must be known; and so on throughout. Even the rudest and most empirical ideas of diseases presuppose ideas of the healthy states, from which they are deviations; and obviously the diagnosis of diseases can become scientific only as fast as there arises scientific knowledge of organic actions that are undiseased." The gain accruing from accurate physiological knowledge may thus be great, and ever growing.

So conspicuous a manifestation of sexual aptitude as a menstrual flux, whether sanguineous or not, is hardly to be looked for in the females of classes below the mammalian, with which the study of the evolution of the catamenial function might appropriately commence, for "in the classes of birds, fishes, and oviparous reptiles, there is no uterus" (Laycock). But there are generative canals, out of which, in the process of evolution, the uterus arises, just as does the bladder out of the renal excretory canals; being developed by the aggregation of muscular fibres, and differentiation of epithelial elements at certain parts (like the stomach, with its powerful muscular and glandular apparatus, in the higher mammals, or the gizzard in the fowl); and it may be useful to trace their evolution, for, even in certain non-mammalian creatures, the excitement attending the active exercise of the reproductive function is occasionally displayed by increased vascularity and pigmentation of certain structures, particularly about the genital orifices, which exhibit a kind of efflorescence at the periods of sexual excitement. For instance, according to Pouchet, "Guersant says that, at the epoch of the oviposit (in fishes), the orifice of their sexual apparatus swells, and is clothed with a red tint. Savants who, like Spangenberg, are occupied in studying the genital organs of birds, have recognised that they experience also at the time of the oviposit a manifest excitement." I am informed that the genitals of the parrot and pigeon tribes show this excitement. In other creatures, *e.g.*, amphibia, the orifices of the generative canals opening into the cloaca are generally increased in size at the breeding season. Reptiles also show increase in cutaneous secretions, especially of the odorous variety, in association with sexual activity. Laycock observes: "Many tortoises smell of musk, which probably proceeds from follicles connected with the cloaca. Several lizards, among others the iguana, have a row of small follicles with round orifices at the inner side of the thigh, which secrete, especially at the coupling season, an odorous fatty liquid;" and Mr. Darwin (*Descent of Man*, p. 352) says: "During the breeding season, the anal scent-glands of snakes are in active function, and so it is with the same glands in lizards." As we ascend in the scale of creation, we shall find that the genital apertures of the higher creatures present analogous phenomena, culminating in the highest even in an issue of blood.

Attention may here be directed, *en passant*, to the general relations of pigmentation to reproduction, which are striking, and, as Mr. Darwin has shown, are in birds remarkable. He says (*Descent of Man*, p. 229): "Many birds acquire bright colours and other decorations in the breeding season alone;" and (p. 496) "certain ornamental appendages become enlarged, turgid, and brightly coloured during the act of courtship." Even in insects, sexual pigmentation is often highly conspicuous; and Mr. Darwin (*Ibid.*, p. 265) says: "The sedentary annelids become duller-coloured, according to M. Quatrefages, after the period of reproduction; and this, I presume, may be attributed to their less vigorous condition at that time." We may, therefore, derive instruction from the observation of the suggestive phenomena accompanying the active exercise of the reproductive functions, even in the lowest creatures.

Before the difference of sexes arises, both sexual elements (sperm and germ) exist, and are carried in the body of a single individual, though, curiously enough, the congress of two separate individuals is in some cases necessary for fertilisation, *e.g.*, in creatures which are not stationary.

Gegenbaur (*Elem. Comp. Anat.*, p. 54) says: "All those animals which unite in themselves both kinds of reproductive organs are known as Hermaphrodites. A separation of sexes is apparently foreshadowed in various forms, by the alternating activity of the organs, at one time the egg-forming, and at another time the sperm-forming, organ exercising its function. Hermaphroditism is the precursor of sexual differentiation.....A separation of the sexes affects the whole of the organism, for it produces a series of changes in each sex, which affect organs that had primitively little to do with the sexual function;" and Darwin remarks, "It has now been ascertained that, at a very early embryonic period, both sexes possess true male and female glands."

Before generative ducts arise, the generative products escape from the bodies of the lowest creatures by a coelomic orifice, and occasionally, even in this primitive stage, some excitement is displayed around the aperture; but, in the stage immediately above, when ducts begin to appear, imperfect though they be, we find that there is a remarkable constancy in the relation they bear to the renal excretory canals; that, in fact, the generative products, having no proper canals of their own, make use of those of the renal system, and these often display pigmentation at their orifices.

According to Gegenbaur (*Elem. Comp. Anat.*, p. 609), "The germ-glands are developed from the structures known as genital ridges. Sometimes more and sometimes less of this ridge is converted into the ovary or testis." These genital ridges are found in the abdominal cavity, the epithelial investment of which "retains its primitive character along a tract which corresponds to the rudiment of the primitive kidney longer than it does in other regions; and this epithelial layer may be distinguished as the germinal epithelium."

In the lowest forms, there are no generative canals. "Both sets of generative products are passed into the coelom, whence they reach the exterior by the abdominal pore.....In the Salmonidæ, the eggs are passed into the abdominal cavity, and are evacuated through the abdominal pore." Again (p. 53): "In their simplest condition, the products of the reproductive glands merely break away from the spot where they are formed, and pass into the digestive sac, or into the body-cavity, or even directly to the exterior. Gradually, however, ducts, which are often very complicated in character, are added on; it is probable that these ducts are not primitively connected with the germinal glands. Where these ducts can be seen to have any relation to other organs, these appear to be excretory organs, and have been altered so as to correspond to this function. It becomes a great question whether the excretory ducts of the reproductive matter are not in all cases excretory organs."

When, having passed beyond the primitive ductless stage, inquiry is made into the origin of the excretory ducts of the reproductive glands, we find that they are furnished by the primitive renal excretory apparatus (archinephron), the organs which eliminate the nitrogenous excreta from the body—organs distinctly derived from dermal glands (Gegenbaur, p. 46). The primary archinephric duct divides into two parts, so that there come to be two canals. "One commences at the anterior abdominal orifice of the primary duct, and has no further relations to the kidney. This is the Müllerian duct." (*Ibid.*, p. 604.) Müller's ducts become, in females, efferent, or oviducts, portions of which are ultimately differentiated into uteri. (The other archinephric duct becomes the efferent duct of the kidney, or ureter.)

And the late Mr. Balfour, in his admirable work on *Embryology*, shows how closely related the excretory and generative ducts are in the vertebrata.

The basis for the generative and urinary ducts is formed by the segmental duct, which is the duct of the pronephros. These, he says, "are the most primitive parts of the vertebrate excretory system." The meso-nephros, or Wolffian body, is formed of glandular canals, which open into the body-cavity of the embryo. The segmental duct becomes, in many forms, divided longitudinally into two parts: one with segmental tubes, forming the Wolffian or mesonephric duct, the other the Müllerian duct.

The intimate relations thus indicated primitively between the urinary and generative organs foreshadow a connection which persists even in the highest mammalia, a point remarked by Aristotle.

In the Amphibia, the Müllerian ducts form oviducts, opening separately into the cloaca. "It is generally increased in size at the breeding season; this results in its being thrown into a number

from the male. When impregnation has occurred, a close watch has been kept upon the females, in the hope of discovering the mode of transference of the embryo from the generative passages to the marsupium, but, hitherto, unsuccessfully. Mr. Bartlett tells me that something resembling blood and mucus has been seen to be conveyed by the female in her fore-paws from the cloaca to the marsupium, in which it was supposed the embryo might be entangled; and the keeper says that they sometimes find "hollow fleshy things" in the pens (foetal envelopes?); but I understand that no conclusive observations have yet been made. The issue of blood in question, small though it be, at what in these creatures is equivalent to the parturient act, suggests obvious analogies.

Above these grades, whose sexual systems and mode of reproduction are peculiar (*aplacentalia*), we come to a multitude of mammals of various kinds (*placentalia*) concerning some of which observation has taught us many interesting facts, though these are still too few to satisfy legitimate desire for information.

In all creatures there are periods of "heat" or sexual excitement, when both males and females are apt for procreation. These periods are marked by systemic excitement, and by local phenomena of a more or less conspicuous character. Among the mammalia, the times of heat display a seasonal periodicity; that is to say, they recur annually, biennially, quarterly, or at more frequent intervals, according as the conditions of existence or environments are favourable, or the reverse, and, apparently in some degree, according to the size of the creature, being, for example, rare in the elephant. Yet in every creature seasonal periodicity, at longer or shorter intervals, is observed, and, as Darwin and Laycock have shown, this periodicity always partakes of an hebdomadal character. It is always some greater or lesser multiple of a weekly period.

In the lower animals in a wild or feral state, the aptitude for procreation is seasonal, recurring mostly at times when food and warmth are plentiful. Under normal circumstances, the earliest longing for sexual congress is promptly gratified; in the female, conception ensues, gestation proceeds on its appointed course, and until the genesial cycle has been completed by parturition, the "rut" or "heat," with its attendant desire for copulation, does not ordinarily recur. But, impregnation failing from any cause (*e.g.*, absence of the male at the appropriate season of sexual appetite), we may inquire, Do the symptoms of heat persist indefinitely? and, if not, What period elapses before they are again exhibited? Observation of wild animals, both in a state of nature and during captivity (when the latter does not interfere with reproduction), and, still better, of domesticated animals, shows that, after a definite period of quiescence, oestruation, or the "rut," invariably recurs at epochs which strictly conform to some multiple of weeks. In highly bred and well cared-for domesticated animals, oestruation would probably be renewed periodically until arrested by conception; for it is well known that domestication enormously enhances the capacity for reproduction, and renders that sustained which, under other conditions of environment, subsides until it is renewed by the seasonal awakening. It is probable that, in the wild state, in the absence of the male, the "heat" or stimulus to sexual desire would, after a few periodical manifestations, die away, grow cold, and subside; remaining in abeyance until the return of the season with which it is primitively allied. This long rhythmical periodicity may be termed "seasonal," since it appears to be primarily allied with or dependent upon seasonal changes, as has been abundantly demonstrated by Darwin, Herbert Spencer, Laycock, and others. This seasonal periodicity of "heat" accounts for a corresponding periodicity in delivery, for, as is well known, many wild females bring forth their young at mild and favourable seasons, as spring, and not at inclement or unfruitful times. This is generally so in our domesticated animals when art does not interfere with their natural instincts; and, in truth, this primitive seasonal condition of the exercise of the generative function underlies the process of reproduction, even in the highest creatures. A trace of this seasonal influence is certainly still conspicuous in the greater tendency manifested by the human female to conceive at certain annual epochs; and it seems probable that this seasonal influence underlies the genesial function in all creatures, and is a relic and trace of a primitive or primordial condition governing reproduction.

We shall see that not only does woman most frequently begin her menstrual life in the summer months, but she brings forth her offspring more frequently in the spring than in other seasons, just as the lower animals do. Many years ago, I concluded that every woman had a law peculiar to herself, which governed the times of her bringing forth (and conceiving); that, in truth, she was more

prone to bring forth at certain epochs than at others; and subsequent researches have not only abundantly confirmed this surmise, but established the accuracy of the forecast. The evidence is given in other lectures.

The influence of civilisation and domestication in expanding the reproductive powers is conspicuous. And yet the generative system, as Mr. Darwin has ably and conclusively shown, is highly sensitive to changes in the environment of the individual. Seemingly, the higher mental endowment of advanced human beings carries with it not only an augmented capacity for the reproduction of their own species, but also bestows a like advantage upon the creatures showing amenability to man's sway by flourishing under his dominion. Not alone does the human race increase, but man's flocks and herds multiply prodigiously. Would that proportional care were observed in the breeding and propagation of the human species, as, *e.g.*, is taken in that of animals of merely commercial value!

The influence of domestication upon the fertility of animals amenable thereto is most instructive. The total productiveness of most of them is enormously increased thereby. The continuous and regular supply of food, the artificial warmth, selection, care, and culture bestowed upon them, greatly enhance their productiveness. Puberty not only arrives earlier, but a sustained power of reproduction is acquired; more offspring can be bred, and these again breed earlier. The manifestations of "heat," therefore, instead of being confined to seasonal appearances, are much more frequently renewed, resembling, be it noted, those of women; and where celibacy is imposed upon the female, as it is for commercial purposes in the case of cows, for example, by segregation from the male, the periods of heat may be observed to recur with remarkable regularity—in cows, usually every three weeks. Domesticity, then, increases the fertility of domesticable creatures; while seclusion from the male, either for economic purposes or through captivity, permits the repeated exhibition in the female of the phenomena of the rut or heat, whatever they may be.

Prolonged civilisation has done for women what domestication has done for the lower animals; it has augmented their power of reproduction, made them more prolific, and rendered more frequent the manifestations of that aptitude, hence the sustained repetitions of oestro-menstruation. Darwin (*Descent of Man*, p. 45), has remarked that savages appear to be less prolific than civilised people. Bischoff has truly said:—"If women menstruated only once or twice in a year, it would long since have been remarked that such was the only time when conception was possible; menstruation would long ago have been recognised as perfectly analogous to 'the heat' in animals, even though the most essential element of it, the maturation of ova, had not been discovered." He also says:—"The ova form, and become mature, and are extruded from the maternal organism, usually at fixed periods, having regularly recurring intervals." This is the period of "heat" in animals and "menstruation" in human females. The analogies existing between menstruation in women and oestruation in the lower animals, may be shown. In both, there is special aptitude for conception at or near these times, though women are more highly endowed, inasmuch as they may conceive at epochs somewhat remote from their "period." The lower females will rarely permit intercourse except at the periods of heat, which in ruminants, at any rate, are of brief duration; indeed, the males seldom attempt it during the intervals. This is unlike the practice of human beings. In both, it has been shown that germ-cells are then ready for impregnation; though here again woman enjoys the advantage implied above, in that ova may be produced at times other than those of the "heat," that, however, being admittedly the usual and ordinary epoch for their ripening and debiscence. Propinquity to the male, without access to him, is known to hasten ovulation in birds; and in the human female repeated sexual indulgence may stimulate the rupture, if no more, of Graafian follicles. One should not lose sight, however, of the superior evolution of the sexual system in the higher creatures, for this may not be without influence upon the process. It can hardly be maintained that sustained ovulation is the exclusive appanage of the higher mammals, but there can be little doubt that the organic superiority of the highest enables them to co-ordinate more readily the advantages their endowments and environments may chance to afford: their sexual superiority is correlated with their mental, as with their general organic superiority.

Bischoff says:—"In them (animals) the period of 'heat' either occurs so seldom, once or twice a year, or, when repeated more frequently, as in the cow, the sheep, the pig, etc., it is so interfered with by ordinary circumstances, such as our economical arrangements and the like, that the animals are either immediately impreg-

nated, or the recurrence of maturation of ova is obstructed and stopped by the secretion of milk. That analogy, otherwise so striking, with one of our commonest domestic animals, the cow, should have remained for the most part unnoticed, is no doubt to be attributed to some of the above circumstances."

To the question, should it be asked: Why do not the females of the lower animals menstruate with the persistent regularity with which the human female menstruates? the reply may be made that, under like advantages of food, warmth, and similar advantageous environments, they do so to a very large extent; but that, owing to their more constant exposure to conception, the catamenial function is liable to be suppressed by its natural successor, pregnancy. The regular periodical "horsing" of mares is often observed, especially when they are fairly well fed and not overworked; while cows, bitches, and other domesticated animals exhibit regularly renewed signs of sexual aptitude. If it be asked: Do these signs resemble the sanguineous catamenial discharges of women? the reply is unequivocally affirmative; it is supported by reflection, and is confirmed by observation.

My researches have led me to certain conclusions, one of which, fundamentally important, may here be thus tentatively formulated. The sanguineous character of the oestro-menstrual flux bears generally some relation to the degree of evolution of the sexual system in mammalia. Ordinarily it appears to be proportional with the development of the generative organs, and to be subordinate to their evolution; the chief evidence of evolution consisting in the lateral integration or fusion of the generative canals (Müller's ducts) accompanied by aggregation of the ovarian elements. But it should never be forgotten that intimately correlated therewith are other evolutionary facts, *e.g.*, the higher organisation of the nervous, vascular, and glandular systems, upon the special activity or development of which variation may depend.

Accordingly, in the highest mammals, man and the quadrumana, wherein the uterus is a compact organ,* (in the former, traces of the primitive duplicity being but feebly indicated) we find the catamenial flux to consist of almost pure blood. Even in the human species there are individual, often considerable, variations in the sanguineousness of the flux, in part obviously dependent upon the condition of the blood—some women having only a feebly stained, or even a colourless flow, constituting the "menstruatio alba" of old authors.

In certain of the higher monkeys, in consonance with the law of evolution already propounded, the catamenial flux is perfectly sanguineous, and recurs with regularity every three or four weeks. In cows it is also decidedly, though probably less intensely, sanguineous, and recurs with strict regularity every three weeks. Of the accuracy of this observation, as it applies to highly bred cattle, I am assured by a most competent and able observer, Mr. Simpson of Wray Park, Reigate, at whose model farm is a large herd of beautiful Alderney or Jersey cattle of his own breeding; and Mr. Simpson has not only for upwards of fifteen years been a breeder on a large scale (having a herd varying between 70 and 100 animals), but he brings cultivated powers of observation to bear upon the phenomena presented, having in his earlier years studied medicine.

More or less sanguineous (sanguineo-mucous) catamenial fluxes have also been observed to recur periodically in mares, asses, ewes, sows, bitches, cats, and so on. Wild animals kept in captivity often sustain injury in their capacity for reproduction, but not always; and when they do manifest sexual aptitude, it has been observed to obey the law of periodicity (hebdomadad) already adduced. I am indebted to Mr. Bartlett, the able superintendent of the Zoological Gardens, for valuable information on this point. For instance, the hippopotamus, which has borne three young ones in the Gardens, exhibits monthly sexual excitement; the vulvar orifice swelling and weeping. Whether blood escapes is not certainly known, as the creatures frequent the water much at these times, copulation taking place in the water. Elephants, both male and female, become much excited during the breeding season; while some animals, at other times wild, become tame and quiet.

Observation shows that generally the discharge becomes less and less sanguineous as we go lower in the scale of organisation, so that, in the lowest creatures, we see only a mucous exudation, perhaps but slightly, if at all, tinged with blood. In all presenting a vulvar aperture, there is swelling with turgescence of the genital orifice; but the exhalation of blood appears to be mostly, if not entirely, in relation with and subordination to the evolution of the

sexual organs, so that, in the lowest forms, it may be represented merely by an odorous mucous flux. Probably undiscovered exceptions to this law exist. It is believed that their discovery would not invalidate the general truth of the law propounded; they would merely illustrate what is well known in biological inquiries, that variations and divergencies for adaptive purposes, are not uncommon in correlation with certain conditions of environment—nutritional, climatic or other. Pouchet recognised some such relation as is indicated above, but he seems to have thought that it also bore relation to the size of mammals; and he regarded a copious intestiniform uterus, with its extensive mucous membrane, as accommodating a larger volume of blood than the thicker small uterus of woman and the Simiæ was capable of doing. He says:—"The quantity of blood emitted by the animal is absolutely related to the structure of its uterus, but the afflux of the fluid towards the genital organ is always proportionate to the size of mammals. The species in which the genital apparatus approaches more that of woman, and which, as in monkeys, have a small and coriaceous uterus, are manifestly regular, and show an abundant external flow of blood. We have seen that the assertions of Buffon, Cuvier, Burdach, G. Sainte-Hilaire, Rengger, Ehrenberg, Raciborski, and Isidore Sainte-Hilaire, leave no doubt in this respect;" and again, "Thus, then, menstruation in the sow is a demonstrated fact. As in human species, there is an emission of blood; but if this is not abundant, it is because this fluid is found in great part poured out in the immense extent of the internal generative apparatus."

The generalisation I have independently worked out, and now venture to propound, differs from Pouchet's, in that I regard the relation of the catamenial function, in respect of its sanguineousness, to the generative organs as being, in the main, one of subordination to the extent of their evolution, not merely to the accidents of shape of the uterus or size of the creature. Aberrations in, exceptions to, or divergencies from the law, may in time be discovered, or may declare themselves in the course of inquiry; and the explanation of exceptions, apparent or real, may be found in, or be ascribable to, such causes as difference in the plasticity or adaptability of animals to their environment; in the tendency of some species to organic degradation, or to other factors as yet unknown; but with the allowances scientific caution would prescribe, it is believed that the general accuracy of the evolutionary law, now provisionally advanced, will become established as observations are extended. Seeing the extreme difficulty of instituting adequate personal inquiry into the phenomena as they are presented in all animals, by one individual, it is to be hoped that all who enjoy exceptional opportunities for observation, will be so good as to make and record them, so that, in process of time, an accurate record of facts may be garnered.

With ample material furnishing reliable data, further conclusions may become warrantable, and correlations be discovered that are now unsuspected. For example, the flux may be found to bear some relation to the evolutionary or hæmoglobin value of the red cells. Probably diet influences it also; and, possibly, it may bear some relation to the number of ova, for in the multiparous carnivora the manifestations of heat, including the flux, are more sustained than in the uniparous ruminant.

In illustration of my position, the following passage and woodcuts, borrowed from Gegenbaur, may be usefully quoted.* (Fig. 352.)

"Two completely separated uteri open into a vagina in many Rodentia (*Lepus*, *Sciurus*, *Hydrochoerus*, etc.), and in *Orycteropus* (Fig. 352, A). In other Rodentia, the two uteri are only united for

Fig. 352.

a short distance into a common opening into the vagina (*e.g.* *Cavia*, *Cœlogenys*, *Mus*). This leads to the arrangements seen in the uterus of the Insectivora, Carnivora, Cetacea, and Ungulata, where a single uterus is continued into two separate cornua (B), which are continued into the oviducts. When the common portion of the uterus is elongated, the cornua are shortened; this is the case in the Chiroptera and Prosimiæ; in the Simiæ, as in Man, there is a single

* Gegenbaur says (*Elem. Comp. Anat.*, p. 616): "In the Simiæ, as in Man, there is a single uterus, which receives an oviduct on each side."

* I have to thank Messrs. Macmillan and Mr. Ray Lankester for permission to use these illustrations.

uterus (C), which receives an oviduct on either side. The cornua of the uterus, and the common uterus itself, vary very greatly in length; so, too, does the vagina, the mucous membrane of which may be variously modified. In many Rodents (*Lagostomus*), a certain portion retains its original double nature. Its opening into the urogenital sinus is sometimes distinguished by a temporary fold of mucous membrane, which is known as the hymen. This has been observed in the *Ruminantia*, *Carnivora*, etc.; but it is in the *Simiæ* only that it has the same relations as in man. The primitive Müllerian duct, which only served for the passage of the generative products, is, therefore, differentiated into three parts, owing to the great physiological changes that happen to it; and of these parts the first, or Fallopian tube, alone retains its primitive relations.

"The ovaries, which are generally small, vary greatly according to the relation that obtains between the follicles and the stroma of the ovary. In a large number of mammals they are racemose in form. They seldom retain their primitive position, and generally travel towards the pelvic basin, or, with their oviducts, are completely enclosed in it. They are always in close relation to the oviduct, or, rather, to its infundibular cœlomic mouth, for a process of the margin of the ostium extends to the ovary. The mesenteric folds (*ligamenta uteri lata*), which support the ovaries and oviducts, not unfrequently unite with the pouch that encloses the ovary to form the mouth of the oviduct (as in the *carnivora*)."

ABSTRACT OF AN ADDRESS

ON

THE INFLUENCE OF THE SYSTEM OF FREE AND PROVIDENT DISPENSARIES AND HOSPITALS UPON THE GENERAL PRACTITIONER OF MEDICINE.

Delivered at the Harveian Society.

By W. HICKMAN, M.B., President of the Society.

AFTER a few introductory remarks respecting the value of the Society to its members, Dr. Hickman discussed the position and prospects of the general practitioner of medicine—the advantages and difficulties, the aids and hindrances, which attended his career. His difficulties often began at his first case, which might be one that he perhaps had not watched in hospital—measles or scarlatina, for example. The school work of anatomy, physiology, botany, etc., might be done anywhere, but should be tested by thorough and practical examination. Hospital and practical work, and actual medical study, could then be entered upon without distraction. The four years now allotted to the student were far too short, and might be supplemented by a year's actual practice under supervision, as an assistant, or dispensary medical officer, before he could obtain the full licence to practise. This would advantageously take the place of the old apprenticeship system, in which, probably, as much was acquired that it was necessary to unlearn as to retain. The education of the student being at the present day under the control of hospital physicians, surgeons, and specialists, its tendency was to produce hospital men and specialists, rather than good general practitioners. Escaped from his text-books and examinations, the practitioner had various means of increasing and extending his knowledge of the ever-advancing science and practice of medicine, amongst the chief of which was the literature of his subject, in which assuredly was no lack of material. But as "in the making of books there was no end," and the mass of medical literature yearly poured forth was far more than any one man could digest, it became necessary to make a selection; and those books would best repay perusal which were written from, not for, practice. But, if reading made a full man, and practice a ready man, pathology made an exact man. The practitioner should consequently take every opportunity that offered itself of making *post mortem* examinations. Necropsies should be the rule, instead of the exception, for more was to be gained therefrom in private than in hospital practice, as the examination might throw light on the history and symptoms of a lifetime. Many cases, too, occurred in private, of which very few were seen in hospital practice, and these presented a vast field for pathological research. Further, if cremation was to be adopted, mortisection must in every case precede it, in order that the cause of death might be established; whilst a general adoption of necropsy in every case of death would

bring to light many instances of neglect and foul play which now passed unsuspected, or, better still, would tend to prevent them, by the wholesome fear of detection which the system itself would engender.

A more frequent resort to mortisection also would deprive vivisection of much of its *raison d'être*, a result which none would desire more than the members of the medical profession. One of the chief obstacles to the adoption of mortisection was the prejudice of the public, which must be educated until its prejudices disappeared. The public must be taught by every means to understand the usefulness and necessity of *post mortem* examinations, which should be made legal and compulsory in all public and charitable institutions; and they might be made to see how it would tend to their immediate advantage, in making practitioners more careful and more accurate in their diagnoses.

If the necropsies were made by independent men—men who made pathology their study and business—the public would have some test of the knowledge and capabilities of their advisers, by the corroboration or disproof of their opinions afforded by the *post mortem* examination. Much good might be done to combat the popular prejudice by men in the higher walks of the profession more often asking for *post mortem* examinations, and insisting on their utility and importance; much, also, by the public advocacy of them by such societies as the lately formed association for the promotion of medical research. Young practitioners, as a rule, asked for and obtained necropsies, but, after awhile, from a variety of reasons, their energy became blunted. This would not be the case if, at each hospital, there were pathological officers, who should be allowed and expected to make *post mortem* examinations for any practitioner in their neighbourhood, who, as he liked, might or might not be present, but who should receive an official report of the necropsy. A second copy of the report should also be kept amongst the records of the hospital, and a third might be given if asked for, to the nearest relative of the deceased.

The next requisite for the general practitioner was practice, or patients, through attendance upon whom he gradually enlarged his experience; for even the man who had filled important hospital offices, upon commencing home practice of any kind, found many factors to be taken into account which he had disregarded in the wards, where they formed part of the usual routine of the hospital, and were almost independent of and unknown to him. This experience he could best obtain in an assistantship, which should be compulsory on all men before the conferring of the diploma. As things at present stood, dispensary appointments and qualified assistantships were scarce, and men anxious for work were easily satisfied with small emoluments, or even none, as the poorest class would at least furnish instructive cases. Patients were to be seen everywhere, flocking in overwhelming numbers in and out of hospitals, dispensaries and homes of all kinds, so that in London, every year, one million of the inhabitants (about every fourth person) received gratuitous medical advice. This, to the would-be practitioner, was a great hindrance as regarded his early attainment of experience, and was to his great injury in respect of present livelihood, or prospects of future competency. Stimulated by the necessity of subsistence and laudable desire for work, such an one was possibly led into paths of doubtful professional propriety. Here might possibly be found some excuse for the advice gratis system, the self-supporting dispensary, the special hospital, and the various fresh and extended forms of this hydra-headed monster, gratuitous medical attendance, which were springing up every day. It was acknowledged by all authorities, lay and medical, to be a great and growing evil, injurious both to the public and the profession, which must be faced and fought.

Energetic reformers had, of late years, taken the matter in hand, and a consensus of opinion seemed to have been arrived at, that the only cure was the establishment of provident dispensaries in sufficient numbers in every district. These had accordingly been vastly multiplied during the last few years, societies and companies having even been formed for their introduction and development. And with what results? Were there now fewer general or special hospitals? Did fewer patients now than formerly obtain gratuitous advice and attendance? The advocates of provident dispensaries wrote regretfully of the general difficulty of making them self-supporting, the aid of charity being almost constantly necessary to keep them going, though they told of the success of some few. And what was this success? Sir Charles Trevelyan (than whom there was no better friend or well wisher to the profession or to the artisan) held up before us the example of Northampton, Derby, and Manchester. "At Northampton," he said, "the members of the prew-