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Contributors

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ON THE RELATIONS OF PREGNANCY TO GENERAL PATHOLOGY.

BY ROBERT BARNES, M. D.,

Fellow and Examiner in Obstetrics of the Royal College of Physicians; Obstetric Physician to St. George's Hospital, etc., London, England.

WHEN your eminent President did me the honor to invite me to give an address to this Society, which comprises so many distinguished men, I could not help feeling more than the usual embarrassment. I knew I could rely with unbounded confidence upon the generous indulgence of a friendly audience. But that indulgence ought not to be abused. It was still incumbent upon me to choose a topic not unworthy of the occasion, and to weigh well whether my shoulders would bear the burden. Now this last point is my difficulty. Topics are easy to find, but it could not be easy so to treat any one in such a manner as to interest, much less to instruct, a body of men so deeply versed in all the topics which fall within the scope of my poor ability to discuss.

However, I reflected that after all the responsibility of my appearance here would rest upon your President; that what my shoulders could not bear would weigh very lightly upon him; and that what I might find to say would not fail to elicit from him, and from his fellows, an outcome of rich experience and original thought, that would more than compensate for my short-coming.

We have a saying in the old country, which is no doubt familiar to our children on this side of the Atlantic: "Any fool may ask questions, but it takes a wise man to answer them." Now I am going to ask a great many questions. A man travels in order to learn; and learn he will if he carry with him an inquiring mind.

When one has nothing to teach, when there is no problem one can expound, the best thing to do is to set forth the problems that exercise his thoughts as clearly as he can; to put his speculations in the interrogative form; by appealing to a never-failing passion in the human breast, the desire to unfold a mystery, to penetrate a secret, to set others at work to help in carrying out the injunction of Bacon, to "question Nature." If what I propound seems to want order, to exhibit evidence of a muddled intellect, I must beg you to remember that it was chiefly composed under the emotions of the wild heaving waves of the Atlantic, and its occasional fogs.

It often occurs to me that the remarkable changes wrought in the female economy under the influences of ovulation or menstruation, and pregnancy, have been insufficiently studied either separately, in the aggregate, or in their relations to general physiology and pathology. Yet what investigation can be more interesting, more abounding in luciferous facts? When pregnancy supervenes, how marvelous are the changes produced. Regarding pregnancy as an experiment performed upon the organism, careful observation will open up a vast field of phenomena capable of illustrating many problems, apparently the most remote.

In all ages, poets gifted with true insight into Nature have been struck with this transformation. One of the latest, Browning, has well described it in these lines:—

"The strange and passionate precipitance
Of maiden into motherhood
Which changes body and soul by Nature's law;
So when the she-dove breeds, strange yearnings come
For the unknown shelter by undreamed-of shores,
And there is born a blood-pulse in her heart
To fight if needs be, though with flap of wing,
For the wool-flock or the fur-tuft, though a hawk
Contest the prize.

It has been too much the practice to view these phenomena singly, to consider them in their isolated character, detaching each from its natural relations to the rest. It is not easy to state in natural order the phenomena induced by

pregnancy, or so to describe them, as to give an adequate comprehensive view of them in their togetherness and essential unity. We may, perhaps, succeed to some extent by beginning with an account of the conditions of the blood and nervous system. Some of these conditions are among those most easily observed; from them as physiological states, we may subsequently trace the transitions or degenerations into the domain of pathology. It is a remarkable fact, of which many proofs may readily be adduced, that diseases quite dissociated from pregnancy, diseases even occurring in the male sex, cannot be fully appreciated in their etiology, course, and treatment, without the study of analogous or similar conditions created or developed under the stimulus of pregnancy. I will now cite but one example. The diseases of which albuminuria is one expression, have been considered to depend upon organic change in the kidney, to which, out of just homage to an illustrious man, the name of "Bright's disease" is given. Now, if we were to limit our study of this disease, or group of diseases, to the cases observed in men or in women outside the influence of pregnancy, we should probably be confirmed in the conclusion that some organic change in the kidney was an essential condition of albuminuria. The causes that lead up to albuminuria, are commonly so slow and insidious in their action, so little noticed in their beginning, and often so complex, as to defy precise analysis or estimation. It may be truly said of many cases that we only see the middle and the end, the origin being lost in the darkness of mythical history. We cannot tell at what precise time, or under what exact influences, the man who is dying of lardaceous or granular disease of the kidney, began to suffer. We may indeed know, from extensive pathological experience, much about the agencies that will gradually induce these diseases, as the habitual abuse of alcohol, syphilis, and other things. But unless we extended our observation to albuminuria, as it occurs in pregnant women, we could hardly arrive at clear proof of the great fact that albuminuria with all its results, uremia, blood-effusions, convulsions, can occur with-

out any organic lesion of the kidney at all. The disease that is slowly, by imperceptible degrees, produced in man, may be almost suddenly induced under the definite conditions that justify a precise conclusion when an experiment *ad hoc* is performed. For what can more nearly resemble a scientific experiment than to take a healthy woman, to induce pregnancy, and then to observe and to record the effects of this change upon the economy? In the whole range of medicine there is nothing to compare, for wealth of information, with the opportunities thus presented to us by this natural experiment.

To appreciate the pathological phenomena that arise in connection with pregnancy, it is obviously necessary to take as complete a survey as possible of the ordinary phenomena that may be assumed to fall within the limits of physiological action. We shall see that the transition from physiology to pathology, and back again, is wonderfully rapid; that often the boundary can hardly be defined; that although the mind revolts against the dictum of Mauriceau, that pregnancy is a disease of nine month's duration, the dictum of Boerhaave, "*femina plurimis afficitur malis ex solâ graviditate oriundis*," is true. In drawing the picture of healthy pregnancy, we shall naturally attempt to bring out the more striking features, namely, the changes in the blood itself, in the dynamics of the circulation, and in the nervous system. These changes are amongst the first to rise into prominence; they probably lie at the root of most of the other phenomena that come into notice. To take the *blood* first, Hippocrates and Galen saw in the blood of the gravid woman such changes, such impoverishment, as to regard it as approaching to a pathological condition. Although there are many points for which we may still claim the assistance of the chemists, we have acquired much useful knowledge. *Ann* / ~~Lecame~~ on the one hand, and Becquerel and Rodier on the other, concur in representing that the blood of women contains a smaller proportion of red globules than does that of men, and that the proportion of water is greater. When pregnancy occurs a marked change is produced.

Andral and Gavarret have shown that the globules almost constantly diminish. This is confirmed by Becquerel and Rodier, who affirm that the loss begins almost with the pregnancy. The fibrin increases. Becquerel and Rodier observed a less proportion of albumen, as well as a diminution in the density of the blood, and a marked increase in the fatty phosphorized matter. Andral and Gavarret found that the globules returned after parturition.

It may be recorded incidentally, that Becquerel and Rodier found that, before the establishment of menstruation, the red globules are below the normal mean of 127 per mille; that with menstruation the proportion rises to 127 or 137; and that at the critical age it drops again. These facts have an interest in relation to the pathology of women outside the childbearing condition. Nasse observed that the blood of women drawn from the veins begins to coagulate in three minutes, whilst that of men begins in four minutes. This may be explained by the greater proportion of fibrin. We see many instances of the increased coagulability of the blood in the pregnant state, in the various forms of thrombosis and phlegmasia dolens that are observed in pregnancy and childbed. The state of the blood is intimately associated with the conditions of *respiration*. Andral and Gavarret found that women, before puberty, burn less carbon than young boys; that after the critical age the quantity of carbon burned increases during several years, then diminishes with the advance in years, as in men. In boys the epoch of puberty is also that of a considerable increase in the exhalation of carbonic acid; but in young girls this exhalation ceases to increase from the moment when the menstrual flux is established, and remains stationary until the "*âge de retour*," when menstruation is suppressed. Then the lung-function assumes greater activity, the quantity of carbonic acid exhaled is increased, as if to regain the level below which the menstrual flux had kept it; then after this increase of respiratory activity has been produced at the critical age, the exhalation of carbonic acid diminishes as age advances, just as in men. Thus there seems to exist a strict

solidarity between the uterus and the respiratory functions : the first is supplementary of the second. A notable proportion of the materials of the blood is expelled by the menstrual flux ; and this fact explains the small activity of the pulmonary function whilst the uterus is active.

Pregnancy, by suppressing the flow of blood, ought then to increase the exhalation of carbonic acid ; and Andral and Gavarret observed, that in four pregnant women the mean consumption of carbon hourly was no longer 6.4 grammes, as in the menstruated woman, but 8 grammes, which represents the quantity produced at the climacteric. In connection with this, I wish to take note of the increased capillary and venous stagnation in the skin during pregnancy. Here we may note, that the type of respiration characteristic of women is the costo-superior, that in which the movements are marked only towards the upper ribs, especially the first, which are carried upwards and forwards, the clavicles and upper part of the sternum sharing in this movement. It is not much affected by pregnancy.

In close association with the chemical constitution of the blood, but still in some degree independent, are the changes in the dynamic state of the circulation. Some of these mechanical states have been ably analyzed and described by Dr. de Cristoforis ; and the hypertrophy of the heart has been established by Larcher, Natalis, Guillot, and others. Two main facts are : 1. The *superior arterial hyperemia* ; 2. The *inferior venous hyperemia*. De Cristoforis insists much, perhaps too much, upon the influence of mechanical pressure exerted by the gravid uterus upon the principal arterial and venous trunks. There results an obstacle at the point of pressure, in consequence of which the arterial blood accumulates in the upper parts of the body, and can only pass with difficulty to the lower. That this mechanical pressure acts in increasing arterial tension during the later months of pregnancy, cannot be doubted. But certain facts point strongly to the conclusion, that arterial tension is primarily due to altered conditions of the blood, of which the most marked characteristic is the loss of red globules. Which is

the first or the genetic factor, the chemical changes in the blood, the dynamic changes in the circulation, or the hypertrophy of the heart? This is one of the questions I submit for your consideration. Whichever be the first, it is probable that the others quickly follow. And soon there follow other conditions more or less closely encroaching on the borders of pathology. Of these the most prominent are changes in the glandular system throughout the body. Some of the glands undergo remarkable development; all probably do more work, and in the attempt to keep pace with the increased work thrown upon them, some break down, and physiology passes into pathology. Before enumerating the states of the secreting and excreting glands, let me first call attention to the thyroid. This is generally larger in females than in males. J. F. Meckel, by a figure of speech, regards the thyroid as the repetition of the uterus in the neck, referring to the swelling which the thyroid presents during menstruation and pregnancy. The effect of pregnancy, or, in some cases, of marriage, upon the thyroid was noticed by the ancients. Thus Catullus in the "Epithalamium:" —

"Non illam nutrix oriente revisens
Hesterno poterit collum circumdare filo."

This change has been associated, probably with reason, with increased action of the heart. Graves's disease, a condition in which we find a similar combination of hypertrophy of the heart, enlargement of the thyroid, and exophthalmos in the non-pregnant, in men it may be, offers a striking parallel. And here we have one of those interesting examples of the production of phenomena under the influence of pregnancy which, simulating or repeating pathological states, throw a new light upon them.

The *spleen* feels the influence of pregnancy like the other glands. It enlarges notably; sometimes remains hypertrophied permanently. One might indulge in speculations as to the genesis and immediate cause of ague. We know that it is due to a poison taken into the blood; and that one of its characteristic features is enlargement of the spleen.

Now it is a remarkable fact, of which I have seen several examples, that women who for several years had been held to be cured of ague have suffered a relapse when pregnancy overtook them ; and that not once only, but in successive pregnancies, no fit of ague occurred when they were not pregnant. Is this recurrence due to the suddenly induced enlargement of the spleen, to the blood-degradation attendant on pregnancy, to the exalted centric nerve-irritability, or to a combination of all three conditions, or to some other which has escaped attention ? At any rate, those who would fathom the pathology of ague must study the relation of the disease to pregnancy. I am disposed to think that the part played by the spleen is, if not altogether accidental, secondary and not essential. We witness the same tendency to recur in the case of chorea. Analyzing all the cases of chorea in pregnant women which I could collect, I was struck with the large proportion in which the subjects had had chorea during childhood, and had been supposed to be cured. But pregnancy supervening, back comes the chorea, and generally with much increased severity. Pregnancy, then, may be regarded as a test of the cure of chorea. If the convulsive movements return, it is reasonable to conclude that the nervous centres have undergone some lasting changes of structure or of nutrition, a condition remaining latent, giving no outward sign of its existence, until an adequate force is applied. This force is probably twofold : there is the exalted centric nerve-irritability of pregnancy, which, it may readily be conceived, will revive the structural defects left by the original disease ; and there is the blood-degradation which plays so important a part in all the pathological processes of pregnancy. These two factors may be enough to reproduce a dormant ague.

Although we may see more or less clearly that the thyroid enlarges under the mechanical impulse of increased heart-action, we can only guess vaguely at the final cause or physiological use of this enlargement. What is the object of it ?

But in reference to other glands, especially those having

excreting ducts, the reason for their enlargement seems clear. I will only touch upon the mammary glands, for the purpose of noticing one or two points indirectly associated with their great use, the nourishment of the infant. The first of these is that the development of the breast during pregnancy creates a distinct focus of vascular activity, a new area into which blood is attracted with greater profusion than into any other part, the uterus alone, the prime focus of developmental force, excepted. We see this mammary turgescence sometimes pass into acute inflammation and abscess, even during pregnancy. The effects of this vascular diversion upon the general circulation deserve investigation. The other point is that the breast is a principal test of that singular phenomenon, pigmentation, upon which I shall offer a few speculations presently.

The glands of the neck of the uterus undergo remarkable growth, a physiological hypertrophy. In some instances they acquire a capacity for secreting an enormous quantity of fluid. One form of the hydrorrhea gravidarum is due to this excessive action of the uterine glands. Sometimes this discharge is so profuse as to induce languor and debility, but it is probable that it may be only a natural evacuation, to relieve excessive local or general vascular fullness. Sphygmographic, and other observations of women affected with hydrorrhea of this form, would be interesting and instructive. I have known this hydrorrhea to persist for a month after delivery.

In juxtaposition with uterine hydrorrhea, it may be useful to place that excessive salivation which we sometimes see. This, of course, is connected with increased development of the *salivary glands*. The "raison d'être" of this profuse salivation is not obvious; it is one of the problems which I leave to your research. When moderate, it may be simply evidence of that general glandular activity induced by pregnancy, which, it may be conjectured, is a provision for the elimination of the excess of circulating fluid, and products of nutrition, that have to be eliminated. But here again, as in so many other instances, physiological

provision easily passes into morbid excess. I have known a woman walk into my consulting-room, holding a pint mug, her constant companion, which she assured me she filled several times a day. A curious fact is that these excessive secretions once set up, it seems difficult or impossible to arrest them. Perhaps it is not wise to try overmuch. The true principle of action seems to be to set up a derivative evacuation by hydragogue cathartics. There is not seldom a nervous element, of emotional character, concerned in the excessive salivary secretion. How far a similar condition may be concerned in uterine hydrorrhea, I can only conjecture. That the nervous element enters largely into the processes which mark the obstinate vomiting of pregnancy, we know. I cannot in this place discuss this subject. I have dwelt upon it, regarding it as essentially a convulsive disease, in my Lumleian Lectures at the London College of Physicians, on the Convulsive Diseases of Women. I will only remark here that, associated with it, there must necessarily be a marked increase of development of the *glands of the stomach*, which in certain cases throw off an enormous quantity of fluid; and which, probably, in the ordinary cases of what may be the physiological vomiting of early pregnancy, serve a useful regulating office upon the circulation, as does the nervous explosion upon the overcharged nervous centres.

The *sebaceous and sudoriparous glands* of the skin also undergo increased development and activity. This might be expected when we think upon the remarkable fullness and stasis of the capillary vessels in pregnancy.

That the liver and kidney have more work to do in pregnancy is undoubted. The enlargement of the liver has been noticed by several observers. It is referred to by Trousseau. If we look upon the liver as executing a twofold function,—1st, that of furnishing the digestive elements of bile; 2d, that of a blood-purifying or excrementitial organ,—and, adopting the propositions of Verger,¹ regard the hepatic artery as supplying the materials for the first func-

¹ *Recherches Anatom. et Microscop. sur le Foie des Mammifères*, 1838.

tion, and the portal vein as supplying the materials for the second function, we may form some idea of the increase of duty thrown upon the liver during pregnancy. Under ordinary circumstances Verger shows it to be probable that in five sixths of its bulk, the liver is an organ of hemostasis and respiration. This proportion, it may fairly be assumed, is greatly augmented during pregnancy. If we call to mind the astonishing work going on in the pelvis, the uterus growing at a marvelous rate, the embryo and placenta in vigorous and rapid development and active function; if we remember the consequent vast increase of blood-supply to the lower abdomen; and the increased difficulty opposed to the return of this blood by the veins, — then shall we be convinced that the portal system is charged far beyond ordinary measure with blood loaded with carbon and other excrementitious matters. Under this difficulty the healthy balance is easily overturned, the liver strikes work or performs it imperfectly. Jaundice with or without organic change of the organ appears. The condition offers a parallel with that in which the kidney is overstrained, and its excreta accumulate in the blood.

What we have said of the liver we may with more certainty, because we have more exact knowledge, say of the kidney. This gland also is said to enlarge. I do not know that any positive observations establish this point. But that it does more work in the way of elimination, and that it is especially liable to fail under the effort, is proved in many ways. I need but allude to the altered quality of the urinary excretion during pregnancy. Independently of the different proportions of urea, uric acid, phosphates, and coloring matter observed, normal constituents which the kidney, working at high physiological pressure, discharges more or less easily, it has more direct relation to our theme to examine the abnormal elements which find their way into the urine, and which either prove that the kidney itself has been taxed beyond its power, or that some remote pathological action is going on. Like albumen, sugar in the urine is not infrequent in pregnancy. We have already glanced at the

light which the study of albuminuria in pregnancy throws upon these phenomena in the non-pregnant. The suddenness of its appearance during pregnancy, and the rapidity with which it disappears after labor, the kidney recovering perfect integrity, prove that structural change is no necessary factor. In pregnancy, we may almost see the disease manufactured ; we may watch the conditions of its progress ; its consequences ; and its cessation. I have studied the history of puerperal eclampsia with some care in the Lumleian Lectures already referred to. I therefore only glance at the subject here, in order to illustrate another order of facts, those connected with changes in the blood, secretion and excretion. I doubt if, in the whole range of medicine, there be anything more interesting than the history of an eclamptic fit in pregnancy. As an object of comparison let us take a frog, deal with it as Marshall Hall did ; inject under the skin a drop of a solution of strychnine, then apply peripheral irritation by touching the skin or shaking the table. If we analyze the phenomena we see three factors in the production of the tetanic convulsion that ensues, — 1st, there is the natural extreme centric irritability of the spinal cord ; 2d, there is the induced exaltation of this irritability by the added poison in the blood ; 3d, there is the eccentric irritation. And it is remarkable that the natural centric irritability of the frog is vastly intensified under the influence of ovulation. Now we have the equivalents of these three factors in our experiment upon woman, — 1st, there is the exalted tension of the nervous centres intensified by pregnancy ; 2d, there is the poison circulating in the blood, be it urea, or other excrementitious matter which the kidney ought to discharge, and which acts upon the nervous centres ; and 3d, there is the eccentric irritation supplied by uterine action, or by an overloaded stomach. There is produced a tetanoid state, analogous to that produced by strychnism in the frog. Sometimes we ourselves apply the eccentric irritation. Touching the vulva to pass the catheter, nay, shaking the bed, will cause a fit. And Dr. Townsend¹ re-

¹ *Dublin Quarterly Journal of Medicine*, 1871.

lates a case in which, on cutting the hair, every stroke of the scissors caused twitching of the muscles. The physiologist does not know much of the emotions of his friend the frog. The phenomena described occur when his brain has been removed. In the human female, emotion may produce the same effect as peripheral irritation. Emotion may, in fact, be regarded as a form of peripheral irritation. The passions, indeed, may in some cases be the immediate cause of those blood-changes which lead to functional and organic disease. Under their influence the blood may clot ; hence one chapter in the history of arterial thrombosis. Under their influence the singular disease called acute yellow atrophy of the liver may occur. There is some evidence to show that occasionally the shock of a fit of eclampsia will produce albuminuria, thus transposing the ordinary order of events. And since Claude Bernard's demonstration of the production of sugar in the liver by pricking the floor of the fourth ventricle, we have further proof of the influence of nervous force over the constitution of the blood and over the action of the secreting organs. How far the peculiar state or action of the nervous system is responsible for the presence of sugar in the urine of pregnant women, is another problem which I leave to your consideration. It does not appear to be of pathological significance. Carefully studied, the glycosuria of pregnant women should illustrate, and may one day be the means of solving the mystery of diabetes. In interesting illustration of Claude Bernard's discovery, are certain clinical facts observed by Dr. Dickinson.¹ He found that in seven cases of diabetes there was change in every part of the spinal cord and encephalon, attaining the greatest development in the medulla oblongata and pons varolii.

But disease, in the sense of organic lesion, we learn from the observation of glycosuria in pregnant women, is not a necessary factor. It appears to be connected with the function of lactation. Thus Dr. Sinéty² has shown by experiment and clinical observation, that glycosuria is produced

¹ *Medico-Chirurgical Transactions*, 1870.

² *Société de Biologie*, 1876.

when lactation is suppressed, and disappears when lactation is resumed. Pavy, working from the celebrated experiment of Claude Bernard, showed that lesion of the sympathetic nerve would also produce glycosuria. And, in further experiments designed to explain the mode in which these lesions acted, he came to the conclusion that it is through the consequent transmission of oxygenated blood through the liver. The subject is full of interest. And it is obvious that whatever the explanations deduced from laboratory experiments, those only can be accepted which will harmonize with the experiments presented to us in the course of pregnancy. The first questions that arise are : What is the state of the medulla oblongata, the floor of the fourth ventricle, and the sympathetic nerve? The second is, What is the state of the blood, as to oxygenation, that traverses the liver in pregnancy? That organic lesion of nerve structure is not necessary as a factor, is proved by the complete disappearance of the sugar, and by the integrity of the nerves, when the pregnancy is at an end. That modified nerve-function depending upon some temporary modification of nutrition is concerned, is highly probable; and we can hardly doubt that altered quality of the blood passing through the liver is an essential condition.

I can but glance at the illustrations which the study of the diseases of pregnancy may throw upon that of diseases of the eye. Ophthalmologists boast with reason that there is no organ in the body that lends itself so freely to precise observation as the eye. Certainly the eye in pregnancy supplies many most interesting facts of the utmost value, in extending and controlling the conclusions derived from other sources of investigation. I may give one example. Amaurosis is generally connected with structural change, or degeneration of the retina. But there is a form of amaurosis not seldom associated with albuminuric eclampsia, which may end in complete recovery. I have seen such cases, and one has been recorded in the "*Archives de Tocologie*" (1876). On the other hand, the lesion thus arising is in some cases permanent. And in these cases we may see the

disease manufactured quickly, under conditions more simple, more precisely defined, therefore more instructive than under any other circumstances.

There is another system of glands, each minute, but in their aggregate hardly, perhaps, less extensive or doing less work than the liver. The whole surface of the skin may be regarded as a diffused gland. The sudoriparous and sebaceous glands in health throw off an enormous quantity of excreta. The alternative or compensatory action of the kidneys and skin is familiar to every one. Not only in throwing out water can the skin relieve the kidney, but it discharges urea, common salt, and other salts, and it throws off like the lungs a notable quantity of gases, especially carbonic acid, and sometimes ammonia. The odors also occasionally reveal the presence of animal matter; and there is no doubt that, like the liver and the kidney, the skin has a certain power of eliminating accidental poisons from the blood. Another function is that pointed out by Lavoisier. The skin by transpiration acts as a regulator of animal heat. In this function it is in intimate relation or solidarity with the *lung*, another enormous gland charged with excrementitious, as well as recrementitious duty. In health the four great emunctories, the liver, the lungs, the kidneys, and the skin, take their appropriate share in the work of excretion, and to a great extent have the power of helping and supplementing each other. But this power is limited. It does not appear that any one function can be suppressed, even to a considerable degree, without danger. Thus, to give one illustration: If the lungs are so far damaged that aëration is very imperfect, carbonic acid will accumulate in the blood in spite of the efforts of the skin, liver, and kidneys, to get rid of it. Thus there is not only danger to the life of the mother, but abortion is very likely to occur. If hypercarbonized blood do not exalt the centric irritability of the spinal cord, as I believe it does at a certain stage, it certainly does, as Marshall Hall and Brown-Séquard have shown, act as an exciter of muscular action, especially of the heart and uterus. And this is not an uncommon cause of abortion.

Abortion will almost always precede death from asphyxia ; and, whenever any marked excess of carbonic acid arises, abortion is extremely probable. This is one mode in which fevers produce abortion, although probably other poisons concur in the process. We may here pause for a moment to observe that failure in effective physiological power of either the lung, the liver, or the kidney, will induce the accumulation of a poison in the blood, — carbonic acid in the one case, biliary excrement in the second, urea or other urinary excrement in the third, all of which increase centric irritability and evoke abortion. We have no clear evidence that suppressed skin-function may entail a like result ; but it is probable that defective action of the skin may aggravate defective action of the other emunctories. If the due action of all these organs be so essential to the healthy course of pregnancy, it is not less essential to the safe course of childbed. In it lies the safeguard against most forms of autogenetic puerperal fever. In this lies the explanation why hard-working women, whose glandular system is highly developed, pull through under trials which crush the delicate, pampered daughters of Pluto.

The extraordinary activity of the lymphatic system in pregnancy is manifested in the rapid wasting of fat that so often attends this condition. And whenever appropriate aliment is denied this, active absorption of tissue is greatly increased. Thus in cases of obstinate vomiting, the wasting is so extreme that, as in a case recorded by Tyler Smith, the entire weight of the woman may be reduced to fifty-six pounds. Nor does absorption stop with the taking up of fat. So intense is the thirst, the craving for nutriment excited by exhaustion and empty state of the circulation, that the body, feeding on itself, absorbs the products of waste, and thus poisons itself. It is in this way that a new element of danger is added to the nerve-disorder. I believe that when things have come to this point of empoisonment a fatal result can hardly be avoided. Therefore, I am disposed to advise that the induction of labor should be resorted to as soon as evidence of rapid wasting and the earliest indications of irritative fever are clearly seen.

The *lymphatic system, with its vessels and glands*, is so important an element in the work of pregnancy and child-bed, and is so full of interesting pathological relations, that it would carry me far beyond my present scope to dwell upon it. I can but touch upon one or two points. During pregnancy the lymphatic vessels and glands are unusually active. The enormous structural work going on in the uterus involves a corresponding machinery for the removal of superfluous material. The material taken up by the lymphatics is sometimes contaminated by noxious or toxic matter. The glands called upon to exert their property of purifying, by filtration or other processes, enlarge. But it is after labor that the work of the lymphatics becomes most manifest. The blood-tide which for nine months has set so steadily towards the pelvis is suddenly turned; the uterus is rapidly reduced from two pounds or more to three ounces. Within ten days the entire body-weight has diminished by nearly one fifth.¹ A great share of all this work is done by the lymphatic system. To the lymphatics falls the duty of taking up and removing from the uterus, and other organs developed during pregnancy, the liquid into which the solid muscle and other tissues are melted down when their work is done. There is hardly a parallel in man, or in other circumstances than pregnancy, of work so great and so quickly done by the lymphatics. It is marvelous to see how smoothly the work is done when all goes well. But when the process of melting down is disturbed, especially when, what Virchow called by what is hardly a metaphor, the "physiological milk" becomes contaminated either by a disordered process of conversion, or by the admission of septic matter from the interior of the uterus, then the fluid in the lymphatics may coagulate, obstructing these vessels, and, a corresponding process taking place in the veins, the phenomena of phlegmasia dolens be produced. This condition supplies a remarkable proof of the use of the lymphatics, as well as an illustration of the history of thrombosis and phlegmasia dolens. Three factors seem to

¹ Gassner, *Monatsschrift für Geburtskunde*, 1862.

concur in producing coagulation in the veins and lymphatics: (1.) Some degree of arrest in the movement of the blood. To this the vessels in the pelvis and lower extremities are peculiarly prone after labor, and to some degree during pregnancy, from pressure and recumbency. (2.) A peculiar constitution of the blood, of which a marked feature is excess of fibrin; this nearly constantly exists in pregnancy, and soon after labor; the lymph being in a similar condition. (3.) The introduction of some foreign material which, acting chemically, has the property of causing the precipitation of the fibrin. These are the conditions, the two last being the most essential, which we see after labor. There is the comparative stagnation of the local circulation, in producing which the altered dynamic relation, the sudden diversion of the blood-stream from the pelvis has some influence; there is the hyperinosis of the blood; there is the poison, the septic matter, either absorbed directly from the foul matters found in the cavity of the uterus, or the product of defective conversion of the now superfluous tissues. These are just the conditions of the numerous experiments of Henry Lee and others who injected septic matter into the blood. The history, then, of phlegmasia dolens in child-bed, where the disease is manufactured in a healthy woman with almost all the precision of a laboratory experiment, cannot fail to throw valuable light upon thrombosis in general, and especially upon those cases of phlegmasia dolens which occur in connection with typhoid and other fevers, with phthisis, and with cancer. Indeed phlegmasia dolens occasionally occurs in the course of cancer, apparently started by the absorption of foul decomposing matter from the ulcerating surface. In these cases there is often obstruction of the vessels in the broad ligaments, and even beyond by the matting of the environing cellular tissue. For some time the lymphatic glands, although irritated, enlarged, and perhaps diseased, by the entry of septic matter into their substance, resist the invasion into the main vessels. But at last this resistance is overcome and clotting takes place, alike in the lymphatics and veins. Now, I have in

several cases seen the phlegmasia dolens subside when the foul surface was removed by amputation or by cautery.

Another condition that lends fresh impetus to the already active work of absorption after labor, is the sudden diminution of arterial tension, and the attendant freedom of the capillary and venous circulation. Here I might call to mind that there is hardly any other physiological or pathological state in which the phenomena of arterial tension can be studied with so much precision or instruction, as in pregnancy. In scarlatina, as Dr. Mahomed has shown, the sphygmograph enables us to watch the conditions leading up to kidney-distress, and a modified application of the guaiacum test gives notice of the presence of minute quantities of blood-matter in the urine, thus indicating the pre-albuminuric stage. Thus warned, the danger may be averted by hydrogogue purgatives, which, by drawing off a portion of the circulating mass, lessens the tension and the strain upon the kidneys. In like manner we may act in pregnancy. Whenever there is edema, or sign of undue vascular tension, the sphygmograph and the guaiacum test should be steadily used.

I have adverted to this arterial tension of pregnancy for the purpose of turning attention for a moment to the hemorrhages of pregnancy. I pass by the special hemorrhages from the interior of the uterus, which are recognized as proceeding from detachment of the ovum, although even these fall within the general law that determines hemorrhages from other parts. This law, or underlying cause, is the excessive arterial tension. Under great pressure the vessels give way. If the regulating part of the machinery, that is, the excreting glands chiefly, such as the lungs, skin, kidneys, liver, and the glands of the intestinal canal, fail to throw off a sufficient amount of the circulating mass to give relief, some portion will break its accustomed bounds, and there will be extravasation. This may occur at almost any point. So long as it takes place from a mucous membrane having a natural external outlet, we not only have visible intimation of what is going on, but the vital organs are exempt from

those injuries which attend the internal extravasations into tissue, known under the general name of apoplexies. And in many cases we can use topical styptics. Regarded in this light, we recognize the justice of an old popular belief, that sanguine evacuations are often critical or beneficial. The hemorrhages of pregnancy are the evidence of high vascular tension. Hemorrhage is the next resource of nature, when the ordinary regulating or safety-valve machinery is at fault. Sometimes the hemorrhages are excessive, and threaten life by the mere loss of blood. This is the case sometimes in uterine hemorrhages during pregnancy; but it should not be forgotten that these hemorrhages are commonly doing important physiological work; and that even abortion, or premature labor, may be only an incidental event in a salutary process, necessary to avert more serious danger.

Although blood is most prone to escape from the uterus, the natural evacuant, the seat of greatest accumulation, if not of tension, it may escape from any part of the mucous tracts. Thus we have hemorrhages from the lungs, the stomach, the intestines, the bladder. It is of extreme importance to recognize the true nature of these hemorrhages, because they always give rise to the fear of organic disease. And here the special pathologist, who neglects the study of pregnant women, is often in danger of falling into serious error.

What is the practical indication in the management of these natural, but irregular hemorrhages? Is it not obvious that we must take the hint given by nature to relieve vascular tension? How is this done? Could we by the sphygmograph, or other means, tell beforehand that vascular tension was rising to too high a point; had we some contrivance, or means of observation, analogous to the pressure-gauge of a steam-engine, whereby we could read off the state of the circulating-machine, should we not anticipate bursting by taking off the pressure, that is, by drawing a little blood? or, where this is not considered advisable, should we not drain vessels by promoting watery excretion from the skin, the kidneys, and especially from the bowels?

It would lead us too far to notice, with any approach to fullness, the many points of analogy which menstruation presents to pregnancy in the phenomena we have passed under rapid review. Menstruation might be called a mimic pregnancy. Similar nervous and blood phenomena are produced, and similar morbid manifestations occur. Hemoptysis, hematemesis, hematuria, conditions that excite so much alarm, are not uncommonly evacuations to relieve tension, when the due determination to the uterus is disturbed; they are supplementary to menstruation. And before we hastily conclude, in a given case of profuse menorrhagia, that the condition is morbid, we should observe the general state of the circulation, and consider whether the loss is really of pathological import.

Dominating all blood-distribution and all secretions is nerve-power. It is nerve-force that directs the tide of blood in especial torrent to the pregnant uterus. This is highly probable, although it has been contended by Graves and others that there is an independent capillary development in the organ that attracts the blood. We know that blood may be instantaneously driven or attracted to the uterus in volume so great, that it will burst forth in floods under mere reflex or emotional disturbance of the nervous equilibrium. We are therefore warranted in the inference that the equable, healthy poise of the nervous centres presides over the normal, steady distribution of blood necessary to orderly development.

The peculiar state and action of the nervous and circulating systems and the blood is most remarkably manifested in that singular phenomenon, *pigmentation*. Concerning this, little precise knowledge has been gained. But I cannot help thinking that a thorough investigation of the conditions, under which it is produced, will amply repay the trouble, and be very likely to lead to the solution of other physiological and pathological problems.

It may be useful to notice some extreme examples. Laycock quotes the following: *General melasma from terror; anemia; discoloration permanent*. "A woman was condemned

to death by a Parisian mob. The 'lantern' was let down before her at the moment she was menstruating; menstruation immediately ceased. Her execution was deferred, and a few days after her skin became as black as that of a moderately black negro. The tint was deeper on the neck and shoulders than on the face; on the face and chest the tint was the same; it was less deep on the abdomen and legs. The joints of the fingers were blacker than other parts; the soles, palms, and folds of the skin in the inguinal region paler. She became languishing (anemic). She died in 1819, aged seventy-five, more than thirty-five years after the shock, the skin remaining dark until death."

The melasma of the face and abdomen which occurs during pregnancy. — Here the pigment deposit is determined, probably, according to the same law which leads to pigmentation of the mammary areola, and to the excitation of the functions of the surrounding glands. Although so common in pregnancy, it occurs also in ovarian disease. In a case of multilocular dropsy of the ovary of some years' standing, in a woman at thirty-eight, there was well marked melasma of the face and abdomen. It will sometimes occur in cases apparently of functional disorder of the reproductive organs. This form may be characterized by a very intense blackness of the face and abdomen. Le Cat refers to a case in which the left leg became black during each pregnancy. The mammæ of the Samoyed women are black; and Dr. Latham, who notices the fact, thinks it may be due to a peculiar mode of sexual excitation. "Nupta virgine, pro primitiis mammæ a marito sugebantur. Multi de nigritudine mammarum apud Samoyedies scripsere historici. Olim credidi aut gravidas aut fusciores visas fuisse. Quid si hæc mammarum stupratio causa nigritudinis fuerit?"

Neurose blepharal melasma. — Amongst the sexual forms, the most common is discoloration of the eyelids. There are *two forms*: one in which there is simply a pigmentary deposit in the epidermic scales, like the ordinary swarthy skin; and another, in which there is a deposit of free pigment on the skin, so that it can be wiped off. This latter is the true *stearrhea nigricans*.

Discoloration of the eyelids, so common during menstruation, is not necessarily due to deposit of pigment. In some it is due to a sort of venous lividity. This lividity differs, however, so much, that I am inclined to think in some cases there is pigment in the blood, although not deposited in the epidermic cells; for, after menstruation has ceased, the color seems to pass away. In others, it has only become less deep, or yellower.

Permanent or chronic blepharal melasma is seen in women with chlorosis or melancholia.

Mr. Yonge, of Plymouth,¹ relates the following: A girl, aged sixteen years, had never menstruated, but was healthy although thin; had a few "hot pimples" on her cheeks, which bleeding and a purge or two cured. She continued very well until a month or two after, when her face suddenly turned black, like that of a negro. The terror the change excited, and the curiosity, exorcisms, and prayers of which she was the subject, under the belief that she was bewitched, rendered her very hysterical. If washed off, the black matter reappeared from two to five or six times in the twenty-four hours. There was a little warm flushing of the skin when it appeared, but no pain. It felt unctuous to the touch, had no taste, and colored the cloth used to wipe it off. (This might be fictitious. The microscope might reveal the nature of artificial pigment.) But E. Wilson relates a case of Dr. Macintyre.²

Stearrhea cerulea, amenorrhea, hematemesis, anemia, splenic disease? Woman thirty-three; had not menstruated for fourteen years. There was an indigo-blue pigment, contained for the most part in epidermic cells. The urine was tested for cyanuria without success.

Büchner relates a case of blue discoloration in a pregnant woman. Laycock says this pathological production of pigments may be looked at from three points of view: (1) as the result of imperfect oxidation of carbon, so that it is not eliminated as carbonic acid, lactic acid, hemaphein, etc.;

¹ *Phil. Trans.*, 1709.

² Lewan's case, *Med. Chir. Trans.*, vol. xxviii.

(2) as the result of imperfect elimination of carbon proper, when that is the normal excretion, as in the hair and epidermic scales ; (3) as the result of excess in the production of carbon from highly carbonaceous foods. In all there is a close analogy between the carbonaceous excreta as morbid pigments, and the nitrogenous excreta as morbid pigments, and the nitrogenous excreta as morbid deposits of urates, etc. As to the first, it is obvious that all modifications in the blood corpuscles which impair their functions as oxygen carriers, will tend to imperfect oxidation of the carbon waste. In this way we can understand how carbon may be substituted for carbonic acid and lactic acid in cases of leukemia, leucocytosis, the anemia of chlorosis, Bright's disease, and all cachectic states in which the blood corpuscles are defective in oxygenating power. So pigment deposits occur in certain states of the lungs in which the oxygenation of the blood is impaired, and there is at the same time no vicarious elimination of carbon as hemaphein or purpurin by the kidneys.

The examples cited prove beyond dispute that, in many cases at least, the nervous system is closely concerned in pigmentation. Lister says, "the cerebro-spinal axis is chiefly concerned in regulating the function of the pigment cells." This influence may be general, that is, affecting the whole system ; but it is extremely interesting to notice that the pigmentation is often partial, limited to certain areas more or less sharply defined. This limitation cannot be explained by supposing that there is any peculiarity of structure in the tissues, which are the seat of pigmentation, or by any special quality of the blood distributed to the colored areas. For example, how can we explain the singular case figured by Dr. Godson in the last volume of the "London Obstetrical Transactions." A girl, aged eighteen, came under Dr. Southey, at Bartholomew's Hospital, for chorea. She was seven months pregnant. My conjecture that she had had chorea before pregnancy proved correct. This girl exhibited a characteristic dark pigmentation of the areolæ of both breasts, leaving an area of about one third perfectly free

from discoloration. This free area was almost exactly symmetrical in the two sides ; it was sharply limited. Now, it is inconceivable that any difference in the quality of the blood going to the part could exist ; it appears only possible to conclude that this partial pigmentation was determined by nerve-distribution. If so, the determining condition of pigment deposit must, in some cases at least, be a peculiar condition of the nerves at their ultimate peripheral distribution. On the other hand, the pigment matter is probably existent in the blood, not produced altogether by changes after reaching the spot where the change of color is observed.

Since the discovery of the relation between disease of the supra-renal capsules and the bronze discoloration of the skin, by Addison, it seems reasonable to infer that these bodies are concerned in pigmentation. Thus, Brown-Séquard observed, (1) That when the capsules in man are so altered that they cannot functionate, or that their function is notably diminished, a pigment is deposited in the skin, and often also in the peritoneum and elsewhere ; (2) that in all the cases of inflammation of the supra-renal capsule in rabbits (pigmentary disease), there is more pigment in the blood ; (3) that the blood of animals, cats, dogs, rabbits, deprived of their capsules, also contains a larger quantity of pigment.

Is it not more than probable that in pregnancy the supra-renal capsules, like other organs and tissues, undergo a special modification ; that this modification also is transitory, called forth by the transient influence of pregnancy, and in harmony with the changes observed in other organs ? It is rather exaggerated function than pathology. Still it is desirable to make the capsules the subject of careful observation in women dying in pregnancy and child-bed.

Dr. Wilks observed ¹ that in Addison's disease the pigmentation was more marked at the nipples, the navel, and the scrotum. It is curious to remark how rapidly, and

¹ *Guy's Hospital Reports*, 1859.

sometimes how completely, the dark pigmentation arising during pregnancy disappears after delivery.

In speculating upon this subject, we cannot fail to be struck with certain features or conditions in the blood common to all the states under which pigmentation is produced. Thus, in all, probably, the red globules are diminished in number. Has the lesser proportion of iron attendant anything to do with the formation of pigment? In some diseases, blood degradation manifestly produces abnormal pigmentation. The observations of Planer, Vogel, Frerichs, and others, have shown that in intermittent fever the blood often undergoes a disintegration in the spleen, and that the hematin from the broken up corpuscles circulates in the system until it becomes impacted in the capillaries of the various organs of the body.

Might we not modify pigmentation by certain agents, such as bromide, or iodide of potassium?

There are facts which render it highly probable that, although the elements of pigment must be brought to the skin by the blood-vessels, some local influences must come into play in the skin to determine the deposit or production there of the pigment matter. Thus, nitrate of silver and lead are certainly carried to every part of the body in the blood; but it is specially in the skin and gums that the resulting color is developed. So in pregnancy, the blood brought to the areolæ of the breasts, and to the skin of the belly, contains the same things as the blood carries to other parts. Yet, it has not been noticed that the internal organs are the seat of this pigmentation. What is the peripheral or surface condition? In pregnancy there is, as we have seen, a remarkable capillary stagnation or retardation, a hæmostasis, or engorgement of the superficial veins. But this is as much, or even more marked in the legs, and yet pigmentation is much less marked, or even altogether wanting in this part.

I think the proposition may fairly be hazarded that all the blood changes, all the modifications of secretion and nutrition, all the nervous phenomena to which reference has been

made, are inseparably associated by one common bond, whereby they are intimately correlated. If this be granted, we may reasonably hope that if we can but get firm hold of one link of the chain, we shall have in hand the clue to the whole mystery ; that the explanation of many physiological and pathological processes which at present are imperfectly understood, may be discovered. So fixed is the law of unity and interdependence in nature, that to seize one point well is to grasp the whole, just as in the famous reconstruction of the extinct animal from a single bone, by the illustrious Cuvier.

In concluding, permit me to plead a word in extenuation of the fragmentary, or sketchy character of this paper. I have placed before you some of the difficulties that crowd upon me, in the hope that I may, through your help, find a solution. I have observed that the Americans are an eminently interrogative nation. It is the attribute of strong minds to compel others to their own likeness. I have caught this impulse, and accordingly ask questions. If I do not receive satisfactory answers before I leave your country, where to state a difficulty is commonly enough to evoke the determination to overcome it, I shall come again in the full hope of satisfaction, and — to ask some more questions.









