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ARE THE DANGERS OF THE MENOPAUSE NATURAL
OR ACQUIRED?—A PHYSIOLOGICAL STUDY.*

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In this country, the education of women is in its infancy.† The first *College* regularly organized for the education of women was Vassar College, which was incorporated in 1861, thirty-eight years ago. Mathew Vassar wrote: "It occurred to me that woman, having received from her Creator the same intellectual constitution as man, has the same right as man to intellectual culture and development. It is my hope to be the instrument in the hand of Providence of founding an institution which shall accomplish for young women what our colleges are accomplishing for young men."

The first medical college regularly organized for this special education of women, was the Woman's Medical College of Pennsylvania, incorporated in 1850, eleven years earlier. Thus it is seen that the need of the practical working education of woman was felt before that of her theoretical education. So the cart was placed before the horse; and the natural embarrassment caused by the awkwardness of the situation made itself sharply felt.

By the rapid multiplication of women's colleges, university extension, post-graduate courses, women's clubs, and travel, phenomenal changes have occurred in the education of the masses of women, and in the mind of the public concerning this change in the social status of women. Fifty years ago, all that woman knew of herself was what man told her, and the definition of a woman might have read thus:

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†Galbraith, Anna M., "The Women of Salerno." Trans. Al. Assoc. W. Med. Coll. Penn. 1898.

"A woman is a generative apparatus whose function is to perpetuate the species. She has a limited intellect contained in a frail body which is especially liable to be wrecked at the time of puberty and the danger is still greater at the menopause."

As a matter of fact, the average woman does look forward with the gravest apprehension to "the climacteric," as an awful abyss that must be gotten over or fallen into, on her onward journey through life.

Since it is a well-attested fact that dangers do attend the menopause, the question is one of vital importance to every woman—are these dangers natural or acquired?

In order to reach any satisfactory conclusion we must consider: (1) The etiology of menstruation; (2) the physical changes which occur at the time of the menopause, together with the resulting symptoms; (3) the pathological conditions which may arise; (4) measures which may be taken in order to prevent a physiological process from passing into a pathological condition.

The Etiology of Menstruation has been variously explained at different epochs. The chief theories have been, that of plethora, the ovulation, the tubal, and the nerve theory.

First, the Theory of Plethora.—From the time of Hippocrates to 1835, the theory prevailed, "that in the female body the formation of blood is sufficiently rich to provide every four weeks for an overflow of the same, the evacuation of which becomes a necessity. It was believed that this excess of blood depended upon an excess of formative power in the woman."

Second, the Ovulation Theory.—This was distinctly formulated about 1845. It construed the menstrual hæmorrhage as a subsidiary phenomenon, entirely dependent on the periodical dehiscence of ovules. The changes supposed to take place in the Graafian follicles at each menstrual period were believed to involve a peculiar expenditure of nerve-force, which was so much dead loss to the individual life of the woman. The growth of the Graafian vesicle and its contained ovum was supposed to cause an irritation of the nerves of the ovary, which was reflected to the entire nervous system. According to Pflüger the gradual accumulation of this irritation, finally determined by reflex transmission the afflux of blood to the uterus and ovaries, which constitutes the catamenial flow.

The ovulation theory of menstruation was refuted by the following facts: Ovulation may and does occur without menstruation. Women who have never menstruated may conceive. Conception may occur

during lactation without the menses having returned since the last parturition. Children at birth have many ovules contained within the ovaries. Ovulation may persist for a time after the menopause and even pregnancy has occurred, although very rarely, after this time. The menses may continue regular after the removal of the ovaries and Fallopian tubes. This is exceptional, and, as a rule, the periods only continue for two or three years at longest.

Third, the Tubal Theory.—Lawson Tait thought that thorough removal of the tubes was far more essential in determining the menopause, and that cases of periodically recurring hæmorrhage after oöphorectomy were to be explained by the fact that the tubes had not been sufficiently removed. As an anatomical and surgical fact, the tubes can never be wholly excised unless the upper part of the uterus is also amputated.

Fourth, the Nerve Theory of Menstruation.—This is based upon the following views:

1. That menstruation is a process directly controlled by a nerve-center situated in the lumbar region of the spinal cord.
2. That the menstrual impulses reach the uterus either through the pelvic splanchnics, or the ovarian plexus; probably both.
3. That menstruation is the result of nerve irritation, vascular congestion, and subsequent relief of these by hæmorrhagic discharges.
4. That hæmorrhage from the uterus is either the result of a local uterine condition, or of influences outside the uterus acting directly on the center.
5. That removal of the appendages arrests menstruation by preventing the propagation of uterine impulses to the centre

According to the researches of Körner, Röhrig, and others, the uterus is supplied by two sets of motor nerves. The first are derived from the abdominal splanchnics and pass through the abdominal and hypogastric sympathetic plexuses to the uterus. Stimulation of these fibres causes contraction of the circular muscular fibres of the uterus. The second set of fibres are the pelvic splanchnics which arise in the lumbar part of the cord, in the cells of the posterior column of Clark, and are also connected with the cells of the lateral horn of gray matter.—Gaskell. They run in the nerve-roots of the second and third sacral nerves and pass directly into the hypogastric plexus, from which they are distributed to the generative organs, the bladder and the rectum. They are chiefly vaso-dilator in function—*i. e.*, they transmit impulses which bring about vascular engorgement in the viscera supplied. It is probable, therefore, that they are concerned in bringing about the

determination of blood to the uterus and appendages, which is such a marked feature of the menstrual process.

Gaskell believes that active tissues are supplied by two sets of nerves, katabolic and anabolic. A katabolic nerve stimulates the destructive metabolism which is always going on in a tissue. It brings about a liberation of energy followed by exhaustion—*e. g.*, the motor-nerves of muscles, the accelerator nerve of the heart and the sympathetic nerve to the submaxillary gland. An anabolic nerve is the exact opposite to a katabolic in function. It subserves constructive metabolism, produces repair of tissue and building up—*e. g.*, the cardiac branch of the vagus and the chorda tympani.

Martin believes that in the intermenstrual period, the uterus is under the control of the anabolic nerves.

The uterus is believed to contain independent or parenchymatous nerve centres, which may be excited by suspension of respiration, anæmia, or rapid hæmorrhage—Körner, Spiegelberg. Automatic ganglia in the uterine mucosa connected with nerve filaments have been observed by Frankenhäuser. This observation is supported by Ries' experiments on bitches, which show that although all the nerves going to the uterus be divided, practically all the functions connected with conception, pregnancy, and parturition can take place, even with the uterus separated from its cerebro-spinal connections.

Active contractions of the uterus may be induced: (*a*) by direct stimulation of the hypogastric plexus—Frankenhäuser; (*b*) by stimulation of the pelvic splanchnics—Von Basch and Hoffmann; (*c*) by direct stimulation of the lumbar part of the spinal-cord—Spiegelberg.

The uterus may be made to contract reflexly: (*a*) by stimulating the central end of the sciatic nerve—Von Basch and Hoffman; (*b*) by stimulating the central end of the brachial plexus—Schlesinger; (*c*) by stimulating the nipple.

Uterine nerve-centre: the centre for parturition, according to Körner, lies at the first and second lumbar vertebræ; the afferent fibres come from the uterine plexus, to which also the motor fibres proceed. Goltz and Reusberg observed that a bitch became pregnant after its spinal cord was divided at the first lumbar vertebræ.

All the centres lying in the lower part of the spinal cord—*e. g.*, those for defæcation, micturition, erection, ejaculation, must, like the parturition centre, be regarded in the normal condition as subject to the control of higher reflex centres in the medulla. The experiments of Oser and Schlesinger confirm these observations. The cerebrum also, partly by the production of perceptions, partly as the organ of volition, can

excite or suppress the action of certain of these subordinate spinal centres.

The Menstrual Centre.—Reasoning from analogy, that the various pelvic functions are dominated by spinal centres, Mr. Christopher Martin argues for the existence of a menstrual centre situated in the lumbar enlargement of the chord. He pleads that as the parturition centre has been shown to exist in bitches, there is in all probability also a parturition centre in women, situated about the first and second lumbar vertebræ. If, writes Martin, the parturition centre be found there, the menstrual centre will not be far away. The centre is certainly not in the pelvis. There are ganglia in the substance of the uterus, ganglia in the nerve plexuses at the sides of the uterus between the layers of broad ligament, and on the cervix is situated a large ganglionic mass, developed in connection with the utero-vaginal plexus, called the *ganglion cervicale uteri*. If these ganglia have anything at all to do with menstruation they are certainly controlled by a higher centre.

James Oliver says: "It is, therefore, more than probable that the physiological changes recurring from time to time in the uterus are anticipated by and in reality the sequence of a molecular disturbance arising spontaneously in some centre located in the higher part of the cerebro-spinal tract, possibly somewhere in the medulla oblongata. All visceral activities are through habitation fulfilled in a somewhat automatic manner."

Dr. Arthur W. Johnstone of Cincinnati discovered the menstrual nerve, which he believes to stand in the same relation to the uterus as does the chorda tympani to the sublingual gland, or the sciatic nerve to the lower limb. "The closer you get to the uterine body with your excisions the more sure you are to stop menstruation; so also the more sure you are to extirpate the whole of the nerve plexus, embodied in the tube and broad ligament, thus completely isolating the endometrium from the trophic and vasomotor nerve, which control it as they do every other organ. This nerve comes up at such an acute angle with the body of the uterus from deep down in the broad ligament that one must get his ligature around the very origin of the tube if he expects always to secure it. It is probably a mixed nerve, being composed of cerebro-spinal and sympathetic nerves.

Napier says, there are several objections to this theory, the primary one is that the menstrual nerve has not been found by other competent observers.

Christopher Martin writes: "I doubt if this be as constant a struc-

ture as he would have us believe; it is probable that the ovarian structure contains some of the fibres governing menstruation."

Having made an exhaustive study of the uterine mucous membrane, Johnstone has come to the conclusion that it ought to be regarded as an adenoid or glandular tissue of like structure as the thyroid, spleen, tonsil, and lymph tissue in the walls of the intestine and lymphatic glands. He holds that in the ordinary acceptation of the term the endometrium is not a mucous membrane, but adenoid tissue, and that menstruation is for it what the lymph-stream is to lymph-gland or the blood-current to the spleen. Johnstone says (*Brit. Gynec. Jour.*, Vol. 2, p. 296, June, 1886): "Having satisfied myself that the corpuscles of the healthy endometrium are never found bifurcating, but that the developmental gradation is always present, I was convinced that the tissue belonged to that class of organs whose function it is to replace organic waste, and it ought to be classed with the spleen and thymus gland, instead of the vagina and bladder. Menstruation is a periodic wasting away of those corpuscles that are too old to make a placenta." He has further found, that as compared with the uteri of very many of the lower animals the human uterus is very scantily supplied with lymphatics, and the only way to rid the uterus of the over-ripe and consequently useless tissue is to wash it out through the vagina by a blood-stream. The tough walls of the human uterus and the increased blood-pressure caused by the erect position cause the difference between menstruation in the human female and rut in the lower animals. He endorses the statements of Engelmann that the mucous membrane is not destroyed and consequently does not need regeneration between each flow. Bland Sutton also holds the view that only the surface epithelium is shed during menstruation.

E. Tenison Collins says: "That uterine hæmorrhage, menstrual or metrorrhagic, is invariably caused by intra-uterine irritation acting reflexly through a nerve-centre. Physiologically we have proof of the existence of such a centre, and nerve filaments have been traced into the uterine mucous membrane. Foreign bodies are expelled from the uterus partly by expulsive contractions, partly by blood flux. In tubal disease hæmorrhage is common, but the tubes are embryologically part of the uterus. In all these diseases the chief afferent nerve conveying the impulses to the centre is probably Johnstone's nerve. Apart from the local causes of hæmorrhage the centre may, like all others, be affected by the quantity of its blood-supply, drugs acting on it, also, cardiac, hepatic, or renal disease.

He believes that the uterine mucosa undergoes progressive con-

struction for the reception and retention of the ovum. Failing this, having reached the highest stage of development, it degenerates and becomes a foreign body, and so acts as a stimulus generating afferent impulses to the utero-ovarian centre."

Christopher Martin says: "In the inter-menstrual periods, the organ is under the control of anabolic nerves, engaged in a constructive metabolism, preparing a decidua, building a nest for the expected egg. But should impregnation not occur within a definite period, the katabolic nerves exert their influence and menstruation occurs. The actively growing cells of the endometrium undergo a rapid, destructive metabolism, the fabric of the half-formed decidua tumbles to pieces, the turgid capillaries burst and pour out the menstrual flow, which sweeps away the useless débris." The irritant sets up reflex uterine contractions, and so the blood, according to Dr. Champnay, is squeezed out of the distended capillaries and washes away the degenerated cells.

Napier believes that the cause of the peripheral irritation is the increased size of the utricular glands, which press directly on the fine nerve-filaments and ganglia in the uterine tissue, also indirectly by filling up the stroma and pressing on the vascular radicles: possibly also by the influence of some special glandular secretion.

He says that the time necessary for the growth of the glands to such a size and probably with such functional activity that they will act as peripheral irritant factors, corresponds to the time during which the uterus is functionally at rest so far as menstruation is concerned. As the result of afferent nerve impulses, awakened or increased muscular action of the involuntary uterine fibres occurs; this also aids in determining the congestion which results in the breaking down of vessels.

Professor Stephenson has shown that menstrual life is associated with a well-marked wave of vital energy, which manifests itself in a monthly fluctuation of the temperature of the body, of the daily amount of the excretion of urea and carbonic acid and of the rate and tension of the pulse. The wave attains its maximum during the week preceding menstruation and slowly falls to its minimum, which is reached the week after menstruation. This wave indicates a periodic variation in the bodily metabolism, and is probably directly influenced by the rhythmical activity of the menstrual centre. This observation would seem to be nullified by the fact that the phenomena referred to were found by him to occur in men as well as women, and that the lower animals also seemed to show the same periodic variations. He writes:

—"it is, therefore, evident that the phenomena belong not to the function of menstruation, but to a general law of vital energy."

Johnstone (A. W.) observes, that "the close of the nineteenth century will see the emancipation of the uterus from the thralldom of the ovary. For generations it has been taught that the ovary was the centre around which the woman revolved and that the uterus was a mere appendage to it. Now, however, we know that they are independent organs, each having a separate nerve control which centres back in the sympathetic plexus and the spinal cord. The greatest discovery which the century has seen is that of Stephenson's law. Without it, to-day the physiology of the productive organs would be in an inextricable tangle; it marks the same era for gynæcology that Harvey's discovery of the circulation of the blood did for general surgery."

Menstruation may, then, be defined as the periodical discharge of blood from the uterus, accompanied by the shedding of the epithelium of the body and fundus, as well as that of the utricular glands near their orifices. The sanguineous discharge is due partly to the oozing of blood from the surfaces denuded of epithelium and partly to active congestion. The discharge from the uterus is largely augmented by mucous secreted in increased quantity at this period from the enlarged utricular glands. The tubes take some part in the process of menstruation; their mucous membrane is swollen, the epithelium is shed in places and they are filled with a thin, bloody fluid containing blood-corpuscles and cast-off epithelial cells. The menstrual wave continues from puberty to the menopause. It is a nervous phenomena.

Ovulation is a progressive non-periodic process. It begins before birth and continues till the ovarian tissue is atrophied or worn out.

The Menopause.—The average duration of the menstrual function is from 30-32 years. Raciborski estimated the duration of menstrual life at about 31 years and 9 months. According to him, the mean age of puberty at Paris was 14 years and 7 months; therefore, the average age of the menopause was 46½ years. Tilt gives the average age of cessation of menstruation in 1082 cases as 45 years and 9 months. The average age is between 45 and 50 years. It has been shown by Krieger, Kisch, and others, that the earlier the menses appear, the later they cease, and *vice versa*. However, when the first period is unusually early or late, the menopause comes very early—also that the sexual function is usually abolished earlier in the laboring class, who are compelled to work hard and who have many cares, than in the well-to-do and rich.

Race does unquestionably influence the duration, but given a sound, healthy race, which is not too much enervated with civilization, and

the menstrual process will, equally with the total physical vigor and vitality, be increased. At the present day there is an increased sexual vitality, which shows itself in the fact that the duration of menstrual life has been increased three or four years during the past generation. The inference can be fairly deduced that vigorous vitality causes prolongation of the menstrual process and the actual age. Robinson believes that a prolonged menstrual life depends on a largely developed solar and hypogastric plexus, which indicate a large blood-supply as well.

By the menopause is understood the whole period from the beginning irregularities in the time of appearance of the menstrual flow until its actual cessation. The average duration of the menopause is two and a half to three years.

The menopause is a physiological and conservative process. It occurs at a time of life when all the tissues are most stable and the nutrition of the body at its best. Other physiological changes which occur at the same time are decrease in size of the spleen and lymphatic glands; Peyer's patches smooth down and lose their peculiar structure; the intestinal villi shrink and become less vascular; the muscular coats of the intestine atrophy and lessened peristalsis ensues. These are not the degenerations of age, but the blood-supplying, blood-making, and blood-elaborating organs of the body have completed the growth of the organism, done their work, and are striking a balance with the needs of the economy.

The object of each metamorphic, or developmental, epoch is a critical readjustment of the organism, in order to insure the greatest possible amount of health for each subsequent period of life. In the vast majority of cases this object is quietly effected, but sometimes the constitution only rallies after having been severely shaken for a varying period.

General Phenomena of the Menopause.—Börner states that while many women pass this period without noting any change in their former condition, and are conscious of the occurrence of the change of life only by reason of the absence of the menstrual flow, others suffer for years with a host of troubles.

One of the most essential changes is that of the woman's psychical condition. From slight vagaries, loss of interest in the daily affairs of life, to melancholia and insanity.

"Two factors are generally taken into account; first, the sudden cessation of the menses; second, the reflexions of the patient caused by her condition, meditations on the loss of youth and sexual power, and

anxiety in view of the dangers of the climacteric. It cannot be denied that there is some truth in the supposed sad thoughts about the beginning of old age and the depression caused by them can scarcely be considered abnormal."*

Napier believes it is extremely rare for the cessation to occur without some physical discomfort or some disturbance of the nervous system, but adds that "some women, however, cease menstruating with very slight inconvenience." As a rule, the woman misses one, two, or more periods, then a menstruation of almost normal quantity and duration, and this is again repeated at gradually longer intervals and with a diminished flow, until actual cessation occurs.

The periods cease owing to the degeneration and disappearance of the glandular tissues of the uterus, and secondarily to similar changes in the ovaries and other glands. This is followed by an involution or atrophy of all the structures of the genitalia.

An increase in the size of the uterus, from increase in the amount of blood, is frequently noticed at the beginning of the menopause; later it becomes smaller in all its dimensions. The wall becomes thinner, the os internum smaller, and is often even obliterated. The cervix becomes shorter and thinner, sometimes hard, sometimes flabby as a membrane. But the distinguishing feature of the menopastic uterus is atrophy of the endometrium. The large bundles of tissues are lacking, the whole membrane is thinned and wasted, the fibrillated structure is disappearing, the corpuscles are few and the utricular glands are lessened in size and number.

In consequence of the removal of these features of peripheral irritation, the nerve-centres cease to receive afferent stimulation and after a given period, longer or shorter, and attended with more or less functional disturbance, cease to functionate.

The changes in the uterus and Fallopian tubes are earlier than those in the ovaries, so that ovulation, though lessened in activity, may persist for a considerable time after menstruation has ceased. Ovarian atrophy has been referred to senile rather than menopastic changes.

Atrophy of the ovaries occurs very gradually. Puech found in one case that the ovaries were of normal size three years after the establishment of the menopause. Kiwisch describes the structural change in this gland as consisting on the one hand of an increase of the connective-tissue stroma from the periphery towards the centre, the gradual hypertrophy of which results in the destruction of the epithelial elements and on the other hand the Graafian vesicles themselves undergo

* Börner.

retrograde change. In consequence of these microscopical changes, which take place very slowly, the entire organ becomes harder and smaller.

Napier believes that the ovaries secrete certain specialized substances which aid in determining menstruation; and that in a less degree the utricular glands and the glands of the Fallopian tubes share in this action. He considers that this is probably secondary to the chain of peripheral irritation from the uterine glands, and the resulting afferent-nerve impulses and efferent-nerve currents; but that this secretion is not the less an essential feature of the menstrual process.

In support of this view he calls attention to the pigmentation of the skin which occurs during pregnancy and chlorosis, showing that the absence of the catamenia results in the retention in the blood of some substance which would normally be excreted at this time.

Other atrophic changes of the genitalia are, shriveling of the vulva, with prolapse of the vagina or uterus from relaxation of the ligaments and loss of the natural support afforded by the changed perinæal body.

Uterine catarrh occurs almost invariably and only ceases in advanced years. Displacements of all kinds are frequent, but on account of the now greatly diminished weight of the uterus, these are insignificant.

The vagina is at first almost always hyperæmic. This disappears as the vessels successively atrophy, but it takes place much sooner in some spots than others, hence the characteristic appearance of dark-red spots a pale ground. The vagina gradually becomes narrower and shorter. The mucous membrane loses its rugæ and presents a pale, grayish, blanched hue.

The researches of Byron Robinson,* made by the dissection of a number of old women, show that after the menopause not only is there an atrophy of the genital organs, but the hypogastric plexus also shrinks away. "It becomes smaller and firmer, and no doubt some strands disappear. On this fact must be based the pathological symptoms accompanying the cessation of the menstrual function. In dissecting infants which have lain in alcohol for some six weeks, the opposite condition of the hypogastric plexus may be observed, for in the young child the hypogastric plexus is disproportionately large and can be very plainly dissected out."

The importance of the genital organs is shown by the vast nerve-supply sent to them, and also because the hypogastric originates in great central sources; the solar and renal plexus and the lateral chain

* Amer. Med. Ass., 23, 345-351, Chicago, 1894.

of the sympathetic. When this great nerve-tract becomes atrophied so that it can no longer transmit the higher physiological orders, all parts of the sympathetic system must be unbalanced, until a new line, the next line of least resistance, is established. And Robinson believes that this is the explanation of the many pathological manifestations of every viscus at the menopause, that is: "The irritation which arises by trying to pass more nervous impulses over plexuses than normal gives origin to what is unfortunately known as functional disease. It is just as organic as any disease, only we are unable to detect it."

Chemical changes in the blood and tissues are constant vital phenomena; increased oxidation causes increased activity of the circulation, increase of temperature, increase of urea and carbonic acid in the economy from the retrograde changes, and finally during menstrual life the flow of blood from the uterus carried off the effete materials from the highly charged system.

The elimination of albumenoids, as shown by the altered condition of the blood after menstruation, is greater than can be accounted for by the blood discharged. When the menopause is attained suddenly the retention of such albumenoid substances must act toxically. Hence the resulting clinical fact that sudden cessation of the menses is in the majority of cases, attended with pronounced symptoms of discomfort, and it is in these cases that untoward results are most likely.

James Oliver believes that the catamenial flow eliminates from the body substances whose presence in the blood would exert a deleterious influence on the animal economy.

The Prominent Symptoms of the Menopause.—Christopher Martin holds that the symptoms of the change of life are produced largely by a condition of instability and increased excitability of certain other cerebro-spinal centres directly brought about by failure of the menstrual centre, and adds: "It is probable that the ovaries, like the liver and thyroid gland, modify the blood circulating through them, and add to the blood some peculiar product of their metabolism. It may be that some of the climacteric symptoms are due to the loss of this substance from the system."*

Arthur Johnstone's theory of the symptoms of the menopause is, the endometrium atrophies and becomes old cicatricial tissue, and like all other adenoid structures it sinks into quiet decay. The nervous system begins to readjust itself, but no longer having free outlet through the soft, lymphoid tissues of the uterus, the wave-pressure meets with resistance and a choppy sea results. Vertigoes, bilious attacks, etc.,

* *Brit. Gynec. Jour.*, vol. 9, 271, 1893.

are nothing more than reflex waves. The weakest organ of the individual is the one that generally suffers. And that the kidneys, which all along have borne the brunt of life, should now show positive signs of Bright's disease is natural.

The etiology and pathology of the menopause lie in the sympathetic or ganglionic nervous system. And it is by breaking up of the harmony of previous processes that nervous disturbances are produced.

After the cessation of the flow, over eight per cent. of women suffer from "flashes," which is caused by the irritation of the heart and vasomotor centres. The blood-vessels of the head and neck seem to be most affected, yet the skin of the whole body shares in the disturbance. The nerve-impulse, which should be emitted along the hypogastric plexus, is abnormally forced along other plexuses, and the vasomotor centre becomes irritated, resulting in the dilatation and contraction of the peripheral vessels. All molecular action generates heat, and it may be that much of the heat experienced may be due to the rapid dilatation of the vast number of vessels and the rapid flow of fresh blood in them. Besides the vasomotor and heat-centre being disturbed, the sweat-centre is irritated. The flushes and flashes are followed by various degrees of sweating, which varies from a slight moisture to great drops.

Nervous irritability is a prominent symptom in eight per cent. of women at the time of the menopause. Most of the pain arises around the stomach, that is, the solar plexus. Digestive disturbances are very common at this time.

The effects on the individual viscera can readily be understood by noting how the irritation can pass up the hypogastric plexus to the solar plexus, and, being reorganized, be transmitted to the digestive tract. When the irritation reaches the digestive canal by way of the gastric, superior and inferior mesenteric plexuses it first affects Auerbach's ganglionic plexus of nerves, which lies between the muscular layers of the gut wall. This simply disturbs peristalsis and may produce some colic. But as irritation passes on to Meissner's plexus it disorders secretion, which is controlled by this centre. Irritation of Meissner's ganglia may produce excessive secretion, diarrhoea, or, deficient secretion, constipation; or disproportionate secretion, fermentation. Disturbances of the liver are caused by the irritation passing from the solar plexus to the liver, inducing excessive, deficient, or disproportionate secretions of bile, glycogen, or urea.

Tilt holds the view that the too strong reaction of the sexual organs on the central ganglia is their principal cause of disease. Puberty, menstruation, pregnancy, lactation, or the menopause almost always

entail some derangement of the ganglionic system which is sometimes sufficiently severe to lead to insanity and suicide. Debility underlies all ganglionic affections, in the same way as nervous irritability underlies all cerebral diseases. Sometimes there is an overpowering sense of exhaustion pervading the whole system.

Forms of climacteric insanity are delirium, mania, hypochondriasis, melancholia, irresponsible impulses, and the perversion of moral instincts.

"If the reproduction apparatus does not act on the brain by the instrumentality of the circulating organs of the blood, it must do so by means of the nerves. The genital apparatus is richly endowed with ganglionic nerves, and I have shown how frequently evident signs of disturbance in the ganglionic centres coincided or alternated with headaches, nervousness, hysteria, and epilepsy. What wonder, then, if the same powerful influence of the sexual organs, through the instrumentality of the ganglionic nervous system, should at times produce a permanent derangement of the mental and moral faculties. I am thus led to look on the ganglionic nervous centre as a course of vital power producing reflex morbid phenomena, in accordance with variable cerebral predisposition." (Tilt.)

Another very frequent symptom of the menopause is *tachycardia*. It may be caused by the condition of the blood, whether it be impoverished—*anæmia*—too rich in red globules or fibrin; by reflex irritation of the pneumogastric or sympathetic nerves; by over-exertion; or by alcoholism.

Clement believes that the tachycardia of the menopause is due to general debility; the woman resists fatigue less easily and she experiences a general malaise. To the palpitations are rapidly added syncope, distress, and shortness of breath. The sleep is troubled with *præcordial* distress.

Baldwin says that women in whom the menopause occurs early are more liable to tachycardia than those who menstruate until later in life. And that it occurs with especial frequency when the menopause has been prematurely induced by surgical operation or by disease.

Kisch concludes that tachycardia is due to the hyperplasia of the stroma of the sexual organs, and says that this increase in connective-tissue fibres acts in some unknown way upon the terminal fibres of the sympathetic.

Baldwin suggests that it is equally probable that tachycardia may be due to the formation of scar-tissue at the seat of a cervical laceration, especially as it has sometimes been promptly and permanently

cured by removing the cicatricial tissue and suturing the wound.

Nothnagel, who has studied this subject with great care, stated that whatever the cause may be it acts in some cases by stimulating the sympathetic and in others by producing a transitory paralysis of the inhibitory fibres of the pneumogastric.

Perhaps the most alarming symptom of the menopause is hæmorrhage. It may be due to general or local causes. Among the general causes are cardiac, pulmonary, splenic, and renal diseases. Local causes of hæmorrhage are: endometritis, chronic pelvic inflammations, faulty uterine positions, erosions and ulcerations of the os, glandular polypi, fibroid tumors, and cancer. All competent observers agree that cancer in women is much commoner from forty to fifty years than at any other age.

Hæmorrhages occupy the foremost place among the pathological phenomena of the genital tract during the menopause. Scanzoni thinks that in many instances they are due to the senile rigidity and friability of the uterine vessels, which are not in a condition to offer sufficient resistance to the blood-pressure which is brought to bear on their walls. According to Kisch, the hæmorrhages of the menopause are due to softening and relaxation of the uterine tissue. Additional causes are found in the circulatory disturbances in the pelvic organs, and obstruction of the vena cava inferior, whereby the outflow of blood from the pelvic vessels is hindered and a chronic stasis in the uterine walls is produced. The same author in another place quotes from Peter Frank, who attributes it to early and profuse menstruation, frequent and difficult labors, frequent abortions, and excess in drinking.

In many cases the hæmorrhages seem to be the expression of vasomotor disturbances, such as those in other regions which frequently characterize the menopause. The third and last variety include those cases which may be referred to some disease of the pelvic organs themselves.

Anatomical changes may lead up to pathological conditions. A chief feature characteristic of uterine disease is malnutrition from atrophy. A sudden curtailing of the blood-supply from the degeneration of the genital-nerve apparatus and consequent impaired vitality of tissue from defective nourishment. Ulcerative surfaces, local death and purulent secretions arise from low granular-cell formations. The anatomical changes in the glands and substance of the uterus also favor the irritation or the development of malignant and benign neoplasms—*e. g.*, cancers, fibromyomata, etc.

A most annoying and obstinate symptom is pruritus.

Glycosuria of the menopause is likely to attract attention first through an obstinate form of pruritus vulvæ. Eckhard contends that the phenomena of glycosuria are irritative rather than paralytic, be that as it may, hyperæmia of the liver is the result by which sugar is thrown into the system and eliminated by the kidneys. Pary has advanced a chemical theory to explain the action of hyperæmia in producing glycosuria. He considers that in healthy digestion the carbohydrates—starches and sugars—are converted, not into glucose, but into maltose, which is absorbed and assimilated and converted into glycogen. For the proper production of maltose and its assimilation, a good, venous blood, producing a maltose-forming ferment is necessary. When hyperæmia of the chylo poëtic viscera exists the blood reaches the liver too little deoxygenated and a glucose-forming ferment is produced. The glucose not being assimilable, passes off into the circulation and is excreted by the kidneys. It is quite possible that this is due to the altered circulatory conditions of the menopause.

The last pathological condition which we will mention is kidney disease.

Le Gendre believes that the menopause exerts a deleterious effect on the kidneys: whether this be a congestion followed by a diminution in the quantity of the urine, or a sort of auto-intoxication due to the retention of a poison in the system that has been prevented from leaving by the ordinary path. And that this is especially so in women of a neuro-arthritis diathesis.

Armstrong says that in almost all cases at the time of the menopause the amount of urine passed is below normal, that the specific gravity is increased, and that the urine contains urates and almost always uric acid in excess. Further, that the functions of digestion and assimilation and the various metabolic changes are so largely under the control of the nerve-centres that nothing seems more likely than that so great a disturbance of that system as takes place at the menopause should cause secondary derangement of these most important functions. That being so, the blood becomes loaded with waste-products and the usual symptoms follow, gout, etc.

Having considered the etiology of menstruation; the physical changes which occur at the time of the menopause, together with the resulting symptoms; and certain pathological conditions which may arise; there remains only to consider what measures may be taken in order to prevent a physiological process from passing into a pathological condition. Or, in other words, *are the dangers of the menopause natural or acquired?*

Tilt has reached the conclusion that "The best way to avoid the dangers of this critical time is to meet its approach with a healthy constitution. A marked want of strength prevents the regular succession of the vital phenomena, by which all critical periods are carried on. And as the change of life is marked by debility, when this is grafted on constitutional weakness, loss of power will be of long duration. All complaints remain chronic because there is not stamina enough to carry them through their stages."

Dusourd, whose practice lay in an agricultural district in the south of France, as well as Tilt, believes that peasant women suffer little at this period. Their health is generally good when the menopause comes on and they are little liable to nervous disorders. The poor of large towns suffer much at this epoch. The necessity of working hard, the anxieties of poverty, and their unhygienic surroundings. But by a fortunate compensation, the necessity for working hard prevents or cures the nervous affections which so often assail the rich at this period.

Tilt's cases showed that women who suffered much at the menopause had previously suffered at puberty and at the menstrual periods. And among thirty-nine cases where there was no suffering at the menopause, there was the same immunity from suffering at puberty and at the menstrual epochs.

In forty-four cases of my own, all women past the menopause, the age of the first menstruation was as follows:

- One at 10 years.
- One at 11 years.
- Three at 12 years.
- Eight at 13 years.
- Thirteen at 14 years.
- Eight at 15 years.
- Five at 16 years.
- Three at 17 years.
- One at 18 years.
- One at 21 years.

Making the average age of the first menstruation 14 years and 4 months.

In a list of forty-nine cases, the age of the actual cessation of the menstrual flow was:

- Three at 40 years.
- One at 41 years.
- One at 42 years.

Two at 44 years.
Five at 45 years.
Three at 46 years.
Two at 47 years.
Five at 48 years.
Four at 49 years.
Six at 50 years.
Five at 51 years.
Four at 52 years.
Six at 53 years.
Two at 55 years.

Making the average age of the actual cessation of menstruation at 48 years $5\frac{2}{3}$ months. Subtracting from this the average age of the first menstruation, 14 years and 4 months, we have as the mean age of menstrual life, 34 years $1\frac{2}{3}$ months. That is, the average duration of the menstrual function was from two to four years longer than that usually given.

A further investigation in order to ascertain any possible relation between the age of marriage and the number of pregnancies to the sufferings of the menopause elicited the following statistics. In a list of 39 cases the age of marriage was:

One at 16 years.
One at 17 years.
Two at 18 years.
One at 19 years.
Two at 20 years.
Three at 21 years.
Seven at 22 years.
One at 23 years.
Three at 24 years.
Four at 26 years.
One at 27 years.
Three at 28 years.
Two at 30 years.
One at 31 years.
Two at 32 years.
One at 35 years.
One at 38 years.
One at 42 years.
One at 46 years.

One at 47 years.

Making the average of marriage 25 years and 10 months.

In a list of forty-eight married women, of the four who were married after thirty-eight years all were sterile; of the remainder:

Six each gave birth to 1 child.

Eleven each gave birth to 2 children.

Eight each gave birth to 3 children.

Five each gave birth to 4 children.

Seven each gave birth to 5 children.

Four each gave birth to 6 children.

One gave birth to 7 children.

One gave birth to 9 children.

One gave birth to 10 children.

Giving an average of slightly above three children each.

The number of miscarriages in the same list of forty-eight women was as follows:

Twenty-nine had no miscarriages.

Fifteen had each one miscarriage.

One had two miscarriages.

One had three miscarriages.

One had four miscarriages.

One had seven miscarriages.

That is, 40 per cent. of all these patients had one or more miscarriages.

In a list of forty-two cases, nine had habitually suffered from severe dysmenorrhœa, eleven had slight dysmenorrhœa, and twenty-two never had felt the slightest inconvenience.

In a list of fifty-two cases, all of whom had passed the menopause, five were perfectly healthy and had never suffered the slightest inconvenience. Of these one was single and only one had had one miscarriage. Ten had suffered at the time of the menopause from slight malaise, but not sufficiently to call in a medical attendant. Thirty-seven were more or less seriously ill; thirty of these needed local as well as constitutional treatment, and seven constitutional treatment only.

The prominent symptoms of the climacteric in a list of fifty-two cases were as follows

Marked debility.....	24
Intense nervousness.....	31
Neurasthenia	9
Melancholia	10
Headache	14

Neuralgia	6
Hysteria	7
Irritable heart.....	11
Tachycardia	8
Insomnia	19
Indigestion	32
Constipation	28
Diarrhœa	3
Leucorrhœa	38
Rheumatism	21
Gout	1
Bright's disease.....	12
Hæmorrhage	6
Alcoholism	2
Corpulency	2

As a result of the study of these cases, the most striking feature was the relation of miscarriages to the sufferings and ill health at the time of the menopause. Of the nineteen women who had miscarriages only one did not suffer in some way at the time of the menopause. Four suffered only slightly and fourteen suffered extremely not only during the menopause, but in the post-climacteric period as well. And secondly that the prominent symptoms of the menopause are pre-eminently reflex or the functional diseases of the nervous system.

Tilt believes that single women suffer less than other women at the time of the menopause. He writes further, "As at puberty, from the ignorance in which it is still thought right to leave young women, so at the change of life, women often suffer from ignorance of what may occur, or from exaggerated notions of the perils that await them. It would be well if they were made to understand that if in tolerable health, provided they will conform to judicious rules, they have only blessings to expect from the change of life. Most unfortunately, the individual not cognizant of the invisible changes going on in the economy, does not adapt the mode of life to the new conditions of the organism, and the weakened and lessened amount of the digestive fluids are unable to master the large quantities of food. The absorbents refuse to take more than is needed to repair the tissues. The atrophying muscles of the digestive tube unable to hurry on the mixed products of indigestion, fermentation, and micro-organisms inciting fermentations and elaborating toxic alkaloids, poison and disorder the functions of life. Man's outdoor life enables him to escape many of these evils.

Woman's enervating mode of life, the continued introspection,

coupled with the peculiar changes in the nutrition of the body at this time, render the nervous system peculiarly impressionable and liable to the manifold forms of diseases. While "the woman is told that she must be patient and calm and time the tomb-builder will alleviate all her sufferings." This critical period may be dangerous to those who are always ailing, for habitual sufferers at the menstrual periods and for those affected with uterine diseases. If, on the first indication of the change of life, women who are in fair health carefully followed a regimen and pursued a line of life in harmony with the physiological processes on which this change depends, disease would be prevented. But as the change concerns a natural function, it is left to Nature; no additional precautions are taken, and advice is only sought when the mischief is done.

It is not wise to marry during this period. On the first appearances of the irregularities of the menopause, the amount of food and stimulants to which women have been accustomed should be curtailed rather than augmented. The system requires supporting by medicine and regimen rather than stimulating by spirits. Baths, mental, and moral hygiene, and occupation.

From the foregoing physiological study we have seen that according to the plethoric theory which prevailed until 1835, and to the nerve theory, which is based on the latest anatomical and physiological researches, that menstruation is a physiological process to get rid of effete material, and is, therefore, an excretion.

At the end of perhaps thirty years, by a conservative process of Nature, the child-bearing period ceases and the organism is readjusted to the end that the woman's vitality may all be conserved for her own individual life.

Each metamorphic or developmental period of life, dentition, puberty, and the menopause, throw a special strain on the nervous system, and the recent studies of the sympathetic system at the time of the menopause show that very extensive anatomical changes occur at this time. That being the case, the woman must lead such a life as will insure her having on hand a large reserve force, necessary to meet those heavy demands. Tilt's observations show that women who have experienced no suffering at puberty or at the menstrual periods do not suffer at the menopause. It is, therefore, evident that the time to begin this preparation is in childhood.*

That single women suffer less than married women would suggest the occurrence of lesions as the results of pregnancies many of which

* Anna M. Galbraith, "Hygiene and Physical Culture for Women."

lesions could have been prevented or cured by the timely aid of the physician.

That the most frequent and serious disturbances are those of the nervous system, and that from their mode of life and habits of introspection the rich suffer more from these ailments than the poor, must cause serious consideration of the physiological necessity for a definite occupation for the daughters as well as for the sons of the rich.

The frequency with which Bright's disease is found at the time of the menopause is dependent not so much on the local physiological changes which are taking place as on the time of life. Loomis says, it was not until life-insurance examinations became so common that the frequency with which kidney disease existed in persons who believed themselves well, was even imagined. And as the result of his observations in these cases and of a large number of autopsies conducted at the Bellevue, he stated that it is his belief that 90 per cent. of men and women over forty years of age suffer from some form of Bright's disease. That being the case, it would seem that after this period of life at least as much attention should be directed to the kidneys as to the teeth, and a semi-annual examination of the urine should be made.

The recently acquired knowledge of the therapeutic action of the thyroid and other gland extract favors the belief of a special gland secretion, which would suggest that gland extracts given in certain morbid conditions would aid in restoring what is lacking in the system, until the economy has become accustomed to effect the necessary metabolism independently. Fosberg advises for vasomotor disturbances, flushings, etc., 5 gr. palatinoids of ovarian gland.

That if gynæcologists should watch women as carefully through the menopause as obstetricians now watch women through pregnancy that even to that class of women liable to suffer, much of the sufferings and many of the dangers would be averted and the woman would be prepared to enjoy a healthy and useful post-climacteric period of life.

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