

PART II.

CHIEFLY PHYSIOLOGICAL.

“ She girdeth her loins with strength.” — SOLOMON.

BEFORE describing the special forms of ill that exist among our American, certainly among our New-England girls and women, and that are often caused and fostered by our methods of education and social customs, it is important to refer in considerable detail to a few physiological matters. Physiology serves to disclose the cause, and explain the *modus operandi*, of these ills, and offers the only rational clew to their prevention and relief. The order in which the physiological data are presented that bear upon this discussion is not essential; their relation to the subject matter of it will be obvious as we proceed.

The sacred number, three, dominates the human frame. There is a trinity in our anatomy. Three systems, to which all the organs are directly or indirectly subsidiary, divide and control the body. First, there is the nutritive system, composed of stomach, intestines, liver, pancreas, glands, and vessels, by which food is elaborated, effete matter removed, the blood manufactured, and the whole organization nourished. This is the commissariat. Secondly, there is the nervous system, which co-ordinates all the organs and functions; which enables man to entertain relations with the world around him, and with his fellows; and through which intellectual power is manifested, and human thought and reason made possible. Thirdly, there is the reproductive system, by which the race is continued, and its grasp on the earth assured. The first two of these systems are alike in each sex. They are so alike, that they require a similar training in each, and yield in each a similar result. The machinery of them is the same. No scalpel has disclosed any difference between

a man's and a woman's liver. No microscope has revealed any structure, fibre, or cell, in the brain of man or woman, that is not common to both. No analysis or dynamometer has discovered or measured any chemical action or nerve-force that stamps either of these systems as male or female. From these anatomical and physiological data alone, the inference is legitimate, that intellectual power, the correlation and measure of cerebral structure and metamorphosis, is capable of equal development in both sexes. With regard to the reproductive system, the case is altogether different. Woman, in the interest of the race, is dowered with a set of organs peculiar to herself, whose complexity, delicacy, sympathies, and force are among the marvels of creation. If properly nurtured and cared for, they are a source of strength and power to her. If neglected and mismanaged, they retaliate upon their possessor with weakness and disease, as well of the mind as of the body. God was not in error, when, after Eve's creation, he looked upon his work, and pro-

nounced it good. Let Eve take a wise care of the temple God made for her, and Adam of the one made for him, and both will enter upon a career whose glory and beauty no seer has foretold or poet sung.

Ever since the time of Hippocrates, woman has been physiologically described as enjoying, and has always recognized herself as enjoying, or at least as possessing, a tri-partite life. The first period extends from birth to about the age of twelve or fifteen years; the second, from the end of the first period to about the age of forty-five; and the third, from the last boundary to the final passage into the unknown. The few years that are necessary for the voyage from the first to the second period, and those from the second to the third, are justly called critical ones. Mothers are, or should be, wisely anxious about the first passage for their daughters, and women are often unduly apprehensive about the second passage for themselves. All this is obvious and known; and yet, in our educational arrangements, little heed is paid to

the fact, that the first of these critical voyages is made during a girl's educational life, and extends over a very considerable portion of it.

This brief statement only hints at the vital physiological truths it contains: it does not disclose them. Let us look at some of them a moment. Remember, that we are now concerned only with the first of these passages, that from a girl's childhood to her maturity. In childhood, boys and girls are very nearly alike. If they are natural, they talk and romp, chase butterflies and climb fences, love and hate, with an innocent *abandon* that is ignorant of sex. Yet even then the difference is apparent to the observing. Inspired by the divine instinct of motherhood, the girl that can only creep to her mother's knees will caress a doll, that her tottling brother looks coldly upon. The infant Achilles breaks the thin disguise of his gown and sleeves by dropping the distaff, and grasping the sword. As maturity approaches, the sexes diverge. An unmistakable difference marks the form and

features of each, and reveals the demand for a special training. This divergence, however, is limited in its sweep and its duration. The difference exists for a definite purpose, and goes only to a definite extent. The curves of separation swell out as childhood recedes, like an ellipse, and, as old age draws on, approach, till they unite like an ellipse again. In old age, the second childhood, the difference of sex becomes of as little note as it was during the first. At that period, the picture of the

“Lean and slippered pantaloon,
With spectacles on nose, and pouch on side,

.
Sans teeth, sans eyes, sans taste, sans every thing,”

is faithful to either sex. Not as man or woman, but as a sexless being, does advanced age enter and pass the portals of what is called death.

During the first of these critical periods, when the divergence of the sexes becomes obvious to the most careless observer, the complicated apparatus peculiar to the female enters upon a condition of functional activity.

“The ovaries, which constitute,” says Dr. Dalton, “the ‘essential parts’* of this apparatus, and certain accessory organs, are now rapidly developed.” Previously they were inactive. During infancy and childhood all of them existed, or rather all the germs of them existed; but they were incapable of function. At this period they take on a process of rapid growth and development. Coincident with this process, indicating it, and essential to it, are the periodical phenomena which characterize woman’s physique till she attains the third division of her tripartite life. The growth of this peculiar and marvellous apparatus, in the perfect development of which humanity has so large an interest, occurs during the few years of a girl’s educational life. No such extraordinary task, calling for such rapid expenditure of force, building up such a delicate and extensive mechanism within the organism, — a house within a house, an engine within an engine, — is imposed upon the male

* Human Physiology, p. 546.

physique at the same epoch.* The organization of the male grows steadily, gradually, and equally, from birth to maturity. The importance of having our methods of female education recognize this peculiar demand for growth, and of so adjusting themselves to it, as to allow a sufficient opportunity for the healthy development of the ovaries and their accessory organs, and for the establishment of their periodical functions, cannot be overestimated. Moreover, unless the work is accomplished at that period, unless the reproductive mechanism is built and put in good working order at that time, it is never perfectly accomplished afterwards. "It is not enough," says Dr. Charles

* As might be expected, the mortality of girls is greater at this period than that of boys, an additional reason for imposing less labor on the former at that time. According to the authority of MM. Quetelet and Smits, the mortality of the two sexes is equal in childhood, or that of the male is greatest; but that of the female rises between the ages of fourteen and sixteen to 1.28 to one male death. For the next four years, it falls again to 1.05 females to one male death. — *Sur la Reproduction et la Mortalité de l'Homme*. 8vo. Bruxelles.

West, the accomplished London physician, and lecturer on diseases of women, "it is not enough to take precautions till menstruation has for the first time occurred: the period for its return should, even in the healthiest girl, be watched for, and all previous precautions should be once more repeated; and this should be done again and again, until at length the *habit* of regular, healthy menstruation is established. If this be not accomplished during the first few years of womanhood, it will, in all probability, never be attained." * There have been instances, and I have seen such, of females in whom the special mechanism we are speaking of remained germinal,—undeveloped. It seemed to have been aborted. They graduated from school or college excellent scholars, but with undeveloped ovaries. Later they married, and were sterile. †

* Lectures on Diseases of Women. Am. ed., p. 48.

† "Much less uncommon than the absence of either ovary is the persistence of both through the whole or greater part of life in the condition which they present in infancy and early childhood, with scarcely a trace of graafian vesicles in

The system never does two things well at the same time. The muscles and the brain cannot *functionate* in their best way at the same moment. One cannot meditate a poem and drive a saw simultaneously, without dividing his force. He may poetize fairly, and saw poorly ; or he may saw fairly, and poetize poorly ; or he may both saw and poetize indifferently. Brain-work and stomach-work interfere with each other if attempted together. The digestion of a dinner calls force to the stomach, and temporarily slows the brain. The experiment of trying to digest a hearty supper, and to sleep during the process, has sometimes cost the careless experimenter his life. The physiological principle of doing only one thing at a time, if you would do it well, holds as truly of the growth of the organization as it does of the performance of

their tissue. This want of development of the ovaries is generally, though not invariably, associated with want of development of the uterus and other sexual organs ; and I need not say that women in whom it exists are sterile." — *Lectures on the Diseases of Women, by Charles West, M.D Am. ed., p. 37.*

any of its special functions. If excessive labor, either mental or physical, is imposed upon children, male or female, their development will be in some way checked. If the schoolmaster overworks the brains of his pupils, he diverts force to the brain that is needed elsewhere. He spends in the study of geography and arithmetic, of Latin, Greek and chemistry, in the brain-work of the school room, force that should have been spent in the manufacture of blood, muscle, and nerve, that is, in growth. The results are monstrous brains and puny bodies; abnormally active cerebration, and abnormally weak digestion; flowing thought and constipated bowels; lofty aspirations and neuralgic sensations;

“A youth of study an old age of *nerves*.”

Nature has reserved the catamenial week for the process of ovulation, and for the development and perfectation of the reproductive system. Previously to the age of eighteen or twenty, opportunity must be periodically allowed for the accomplishment of this task.

Both muscular and brain labor must be remitted enough to yield sufficient force for the work. If the reproductive machinery is not manufactured then, it will not be later. If it is imperfectly made then, it can only be patched up, not made perfect, afterwards. To be well made, it must be carefully managed. Force must be allowed to flow thither in an ample stream, and not diverted to the brain by the school, or to the arms by the factory, or to the feet by dancing. "Every physician," says a recent writer, "can point to students whose splendid cerebral development has been paid for by emaciated limbs, enfeebled digestion, and disordered lungs. Every biography of the intellectual great records the dangers they have encountered, often those to which they have succumbed, in overstepping the ordinary bounds of human capacity; and while beckoning onward to the glories of their almost preternatural achievements, register, by way of warning, the fearful penalty of disease, suffering, and bodily infirmity, which Nature exacts as the price for this par-

tial and inharmonious grandeur. It cannot be otherwise. The brain cannot take more than its share without injury to other organs. It cannot *do* more than its share without depriving other organs of that exercise and nourishment which are essential to their health and vigor. It is in the power of the individual to throw, as it were, the whole vigor of the constitution into any one part, and, by giving to this part exclusive or excessive attention, to develop it at the expense, and to the neglect, of the others." *

In the system of lichens, Nylander reckons all organs of equal value.† No one of them can be neglected without evil to the whole organization. From lichens to men and women there is no exception to the law, that, if one member suffers, all the members suffer. What is true of the neglect of a single organ, is true in a geometrical ratio of the neglect of a system of organs. If the nutritive system is wrong, the evil of poor nourishment and

* *Enigmas of Life*, pp. 165-8.

† Tackerman's *Genera Lichenum*. Introduction, p. v

bad assimilation infects the whole economy. Brain and thought are enfeebled, because the stomach and liver are in error. If the nervous system is abnormally developed, every organ feels the *twist* in the nerves. The balance and co-ordination of movement and function are destroyed, and the ill percolates into an unhappy posterity. If the reproductive system is aborted, there may be no future generations to pay the penalty of the abortion, but what is left of the organism suffers sadly. When this sort of arrest of development occurs in a man, it takes the element of masculineness out of him, and replaces it with adipose effeminacy. When it occurs in a woman, it not only substitutes in her case a wiry and perhaps thin bearded masculineness for distinctive feminine traits and power, making her an epicene, but it entails a variety of prolonged weaknesses, that dwarf her rightful power in almost every direction. The persistent neglect and ignoring by women, and especially by girls, ignorantly more than wilfully, of that part of

their organization which they hold in trust for the future of the race, has been fearfully punished here in America, where, of all the world, they are least trammelled and should be the best, by all sorts of female troubles. "Nature," says Lord Bacon, "is often hidden, sometimes overcome, seldom extinguished." In the education of our girls, the attempt to hide or overcome nature by training them as boys has almost extinguished them as girls. Let the fact be accepted, that there is nothing to be ashamed of in a woman's organization, and let her whole education and life be guided by the divine requirements of her system.

The blood, which is our life, is a complex fluid. It contains the materials out of which the tissues are made, and also the *débris* which results from the destruction of the same tissues,—the worn-out cells of brain and muscle,—the cast-off clothes of emotion, thought, and power. It is a common carrier, conveying unceasingly to every gland and tissue, to every nerve and organ, the fibrin

and albumen which repair their constant waste, thus supplying their daily bread; and as unceasingly conveying away from every gland and tissue, from every nerve and organ, the oxidized refuse, which are both the result and measure of their work. Like the water flowing through the canals of Venice, that carries health and wealth to the portals of every house, and filth and disease from every doorway, the blood flowing through the canals of the organization carries nutriment to all the tissues, and refuse from them. Its current sweeps nourishment in, and waste out. The former, it yields to the body for assimilation; the latter, it deposits with the organs of elimination for rejection. In order to have good blood, then, two things are essential: first, a regular and sufficient supply of nutriment, and, secondly, an equally regular and sufficient removal of waste. Insufficient nourishment starves the blood; insufficient elimination poisons it. A wise housekeeper will look as carefully after the condition of his drains as after the quantity of his food.

The principal organs of elimination, common to both sexes, are the bowels, kidneys, lungs, and skin. A neglect of their functions is punished in each alike. To woman is intrusted the exclusive management of another process of elimination, viz., the catamenial function. This, using the blood for its channel of operation, performs, like the blood, double duty. It is necessary to ovulation, and to the integrity of every part of the reproductive apparatus; it also serves as a means of elimination for the blood itself. A careless management of this function, at any period of life during its existence, is apt to be followed by consequences that may be serious; but a neglect of it during the epoch of development, that is, from the age of fourteen to eighteen or twenty, not only produces great evil at the time of the neglect, but leaves a large legacy of evil to the future. The system is then peculiarly susceptible; and disturbances of the delicate mechanism we are considering, induced during the catamenial weeks of that critical age by constrained positions, muscular effort, brain

work, and all forms of mental and physical excitement, germinate a host of ills. Sometimes these causes, which pervade more or less the methods of instruction in our public and private schools, which our social customs ignore, and to which operatives of all sorts pay little heed, produce an excessive performance of the catamenial function ; and this is equivalent to a periodical hemorrhage. Sometimes they produce an insufficient performance of it ; and this, by closing an avenue of elimination, poisons the blood, and depraves the organization. The host of ills thus induced are known to physicians and to the sufferers as amenorrhœa, menorrhagia, dysmenorrhœa, hysteria, anemia, chorea, and the like. Some of these fasten themselves on their victim for a lifetime, and some are shaken off. Now and then they lead to an abortion of the function, and consequent sterility. Fortunate is the girls' school or college that does not furnish abundant examples of these sad cases. The more completely any such school or college succeeds, while adopting every detail and

method of a boy's school, in ignoring and neglecting the physiological conditions of sexual development, the larger will be the number of these pathological cases among its graduates. Clinical illustrations of these statements will be given in another place.

The mysterious process which physiologists call metamorphosis of tissue, or interstitial change, deserves attention in connection with our subject. It interests both sexes alike. Unless it goes on normally, neither boys, girls, men, nor women, can have bodies or brains worth talking about. It is a process, without which not a step can be taken, or muscle moved, or food digested, or nutriment assimilated, or any function, physical or mental, performed. By its aid, growth and development are carried on. Youth, maturity, and old age result from changes in its character. It is alike the support and the guide of health, convalescence, and disease. It is the means by which, in the human system, force is developed, and growth and decay rendered possible. The process, in itself, is one of the

simplest. It is merely the replacing of one microscopic cell by another; and yet upon this simple process hang the issues of life and death, of thought and power.

Carpenter, in his physiology, reports the discovery, which we owe to German investigation, "that the whole structure originates in a single cell; that this cell gives birth to others, analogous to itself, and these again to many future generations; and that all the varied tissues of the animal body are developed from cells."* A more recent writer adds, "In the higher animals and plants, we are presented with structures which may be regarded as essentially aggregates of cells; and there is now a physiological division of labor, some of the cells being concerned with the nutriment of the organism, whilst others are set apart, and dedicated to the function of reproduction. Every cell in such an aggregate leads a life, which, in a certain limited sense, may be said to be independent; and each discharges its own function in the

* Carpenter's Human Physiology, p. 455.

general economy. Each cell has a period of development, growth, and active life, and each ultimately perishes; the life of the organism not only not depending upon the life of its elemental factors, but actually being kept up by their constant destruction and as constant renewal."* Growth, health, and disease are cellular manifestations. With every act of life, the movement of a finger, the pulsation of a heart, the uttering of a word, the coining of a thought, the thrill of an emotion, there is the destruction of a certain number of cells. Their destruction evolves or sets free the force that we recognize as movement, speech, thought, and emotion. The number of cells destroyed depends upon the intensity and duration of the effort that correlates their destruction. When a blacksmith wields a hammer for an hour, he uses up the number of cells necessary to yield that amount of muscular force. When a girl studies Latin for an hour, she uses up the number of brain-cells necessary

* Nicholson, Study of Biology, p. 79.

to yield that amount of intellectual force. As fast as one cell is destroyed, another is generated. The death of one is followed instantly by the birth of its successor. This continual process of cellular death and birth, the income and outgo of cells, that follow each other like the waves of the sea, each different yet each the same, is metamorphosis of tissue. This is life. It corresponds very nearly to Bichat's definition that, "life is organization in action." The finer sense of Shakspeare dictated a truer definition than the science of the French physiologist, —

"What's yet in this
That bears the name of life? Yet in this life
Lie hid more thousand deaths."

Measure for Measure, Act iii. Scene 1.

No physical or psychical act is possible without this change. It is a process of continual waste and repair. Subject to its inevitable power, the organization is continually wasting away and continually being repaired.

The old notion that our bodies are changed

every seven years, science has long since exploded. "The matter," said Mr. John Goodsir, "of the organized frame to its minutest parts is in a continual flux." Our bodies are never the same for any two successive days. The feet that Mary shall dance with next Christmas Eve will not be the same feet that bore her triumphantly through the previous Christmas holidays. The brain that she learns German with to-day does not contain a cell in its convolutions that was spent in studying French one year ago. Whether her present feet can dance better or worse than those of a year ago, and whether her present brain can *do* more or less German and French than the one of the year before, depends upon how she has used her feet and brain during the intervening time, that is, upon the metamorphosis of her tissue.

From birth to adult age, the cells of muscle, organ, and brain that are spent in the activities of life, such as digesting, growing, studying, playing, working, and the like, are

replaced by others of better quality and larger number. At least, such is the case where metamorphosis is permitted to go on normally. The result is growth and development. This growing period or formative epoch extends from birth to the age of twenty or twenty-five years. Its duration is shorter for a girl than for a boy. She ripens quicker than he. In the four years from fourteen to eighteen, she accomplishes an amount of physiological cell change and growth which Nature does not require of a boy in less than twice that number of years. It is obvious, that to secure the best kind of growth during this period, and the best development at the end of it, the waste of tissue produced by study, work, and fashion must not be so great that repair will only equal it. It is equally obvious that a girl upon whom Nature, for a limited period and for a definite purpose, imposes so great a physiological task, will not have as much power left for the tasks of the school, as the boy of whom Nature requires less at the

corresponding epoch. A margin must be allowed for growth. The repair must be greater and better than the waste.

During middle age, life's active period, there is an equilibrium between the body's waste and repair: one equals the other. The machine, when properly managed, then holds its own. A French physiologist fixes the close of this period for the ideal man of the future at eighty, when, he says, old age begins. Few have such inherited power, and live with such physiological wisdom, as to keep their machine in good repair, — in good working-order, — to that late period. From the age of twenty-five or thirty, however, to that of sixty or sixty-five, this equilibrium occurs. Repair then equals waste; reconstruction equals destruction. The female organization, like the male, is now developed: its tissues are consolidated; its functions are established. With decent care, it can perform an immense amount of physical and mental labor. It is now capable of its best work. But, in order to do its best, it must

obey the law of periodicity; just as the male organization, to do its best, must obey the law of sustained effort.

When old age begins, whether, normally, at seventy or eighty, or, prematurely, at fifty or thirty, repair does not equal waste, and degeneration of tissue results. More cells are destroyed by wear and tear than are made up from nutriment. The friction of the machine rubs the stuff of life away faster than it can be replaced. The muscles stiffen, the hair turns white, the joints crack, the arteries ossify, the nerve-centres harden or soften: all sorts of degeneration creep on till death appears, — *Mors janua vitæ*. There the curves unite, and men and women are alike again.

Sleep, whose inventor received the benediction of Sancho Panza, and whose power Dryden apostrophized, —

“Of all the powers the best:

Oh! peace of mind, repairer of decay,

Whose balm renews the limbs to labor of the day,” —

is a most important physiological factor.

Our schools are as apt in frightening it away as our churches are in inviting it. Sleep is the opportunity for repair. During its hours of quiet rest, when muscular and nervous effort are stilled, millions of microscopic cells are busy in the penetralia of the organism, like coral insects in the depths of the sea, repairing the waste which the day's study and work have caused. Dr. B. W. Richardson of London, one of the most ingenious and accomplished physiologists of the present day, describes the labor of sleep in the following language: "During this period of natural sleep, the most important changes of nutrition are in progress: the body is renovating, and, if young, is actually growing. If the body be properly covered, the animal heat is being conserved, and laid up for expenditure during the waking hours that are to follow; the respiration is reduced, the inspirations being lessened in the proportion of six to seven, as compared with the number made when the body is awake; the action of the heart is reduced; the voluntary

muscles, relieved of all fatigue, and with the extensors more relaxed than the flexors, are undergoing repair of structure, and recruiting their excitability; and the voluntary nervous system, dead for the time to the external vibration, or, as the older men called it, 'stimulus' from without, is also undergoing rest and repair, so that, when it comes again into work, it may receive better the impressions it may have to gather up, and influence more effectively the muscles it may be called upon to animate, direct, control."*

An American observer and physiologist, Dr. William A. Hammond, confirms the views of his English colleague. He tells us that "the state of general repose which accompanies sleep is of especial value to the organism, in allowing the nutrition of the nervous tissue to go on at a greater rate than its destructive metamorphosis." In another place he adds, "For the brain, there is no rest except during sleep." And, again, he says, "The more active the mind, the

* Popular Science Monthly, August, 1872, p. 411.

greater the necessity for sleep ; just as with a steamer, the greater the number of revolutions its engine makes, the more imperative is the demand for fuel."* These statements justify and explain the instinctive demand for sleep. They also show why it is that infants require more sleep than children, and children than middle-age folk, and middle-age folk than old people. Infants must have sleep for repair and rapid growth ; children, for repair and moderate growth ; middle-age folk, for repair without growth ; and old people, only for the minimum of repair. Girls, between the ages of fourteen and eighteen, must have sleep, not only for repair and growth, like boys, but for the additional task of constructing, or, more properly speaking, of developing and perfecting then, a reproductive system, — the engine within an engine. The bearing of this physiological fact upon education is obvious. Work of the school is work of the brain. Work of the brain eats the brain away. Sleep is the chance

* Sleep and its Derangements, pp. 9, 10, 13.

and laboratory of repair. If a child's brain-work and sleep are normally proportioned to each other, each night will more than make good each day's loss. Clear heads will greet each welcome morn. But if the reverse occurs, the night will not repair the day; and aching heads will signalize the advance of neuralgia, tubercle, and disease. So Nature punishés disobedience.

It is apparent, from these physiological considerations, that, in order to give girls a fair chance in education, four conditions at least must be observed: first, a sufficient supply of appropriate nutriment; secondly, a normal management of the catamenial functions, including the building of the reproductive apparatus; thirdly, mental and physical work so apportioned, that repair shall exceed waste, and a margin be left for general and sexual development; and fourthly, sufficient sleep. Evidence of the results brought about by a disregard of these conditions will next be given.