

## Lectures on Elementary Physiology in relation to Medical Nursing.

By BEDFORD FENWICK, M.D.

*Physician to The Hospital for Women, Soko Square.*

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VERY important processes which are continually going on are those which are known as Waste and Renewal. The substances forming each cell in the human body are constantly breaking down into simpler compounds of which, as we have already seen, the simplest and final are water and carbonic acid. Each cell, therefore, in the body is constantly wasting away, if there is not continually added to it more of the complex substances of which it is formed. This process of waste which is in progress in every part of the body is in health imperceptible, partly because of the minuteness of the cells, partly because by a process of renewal the waste tissue is being constantly repaired. If, however, the nutrition of any part is interfered with so that the necessary renewal is not effected, then the evidence of wasting becomes evident. In a starving man for example, all the fat cells of the body become burnt up so as to maintain the bodily heat; and not being renewed, we find the shrunken frame—the thinness of starvation becomes apparent. So, again, in disease when the patient is unable to take food, or when the processes of digestion are so interfered with that the cells are not renewed as they should be, the body wastes. As a general rule, therefore, it is an excellent sign of health in adults that the body weight should be just maintained at an even level because it is then evident that the waste and the renewal of the tissues are exactly balanced. In children, of course, the weight should tend to increase as the body grows, and if a child becomes markedly less in weight while not growing rapidly, it is almost invariably a sign of grave mischief. In adult life, it is more usual for the weight to increase if the body is in health, because activity diminishes, energy is lessened, and there is, therefore, a decreased amount of the wear and tear of the tissues, while at the same time the appetite may remain good and the digestive functions perfect, so that there is an excess of renewal over the waste of tissue.

The greatest attention is therefore paid to the body weight by medical men, because, especially in those diseases which tend to impair nutrition, the loss in weight is an infallible index to the downward progress of the disease. In consumption, it is especially necessary that the patient should be accurately weighed, because

one chief effect of the lung mischief is evidenced by the diminished digestive powers, and this is the reason why it is so important to diet a consumptive patient, and especially to give him foods containing an excess of fat so as to replace and renew the fat cells which are specially burnt up in the progress of the lung disease. For the same reason, in patients suffering from nerve diseases, in whom the prominent symptom is rapid and extreme wasting—due probably to the want of nerve power on the part of the digestive organs, but frequently described under the name of hysteria—the most successful treatment consists of complete rest in bed, so as to diminish “waste” to the lowest possible degree, and the frequent administration of large quantities of milk and nourishing food, so as to increase the renewal of the body tissues as rapidly and completely as possible.

It is well to remember that plants are like animals in that they consist also of living cells, that both animals and plants are constantly building up living matter and complex substances from simpler substances and so are “storing up” energy; that they are constantly taking up oxygen, undergoing oxidation of those complex substances, and thus breaking down the complex substances into simpler substances again, and so are giving out or expending energy; and that they form new plants or animals like unto themselves. Plants therefore require oxygen for their life, as we have seen that animals do, but their oxidation is much more slow, and moreover there is this great difference, that whereas an animal for the greater part of its life may by its active movements and work expend as much or even more energy than it stores up, a plant builds up during its more passive existence a much greater amount of tissue—that is to say, of “energy”—than it expends. A tree for example goes on growing and increasing in size throughout its life, and thousands of years after its death it may furnish a large amount of heat and light from the coal into which it has been transformed. On the other hand, so soon as an animal reaches maturity, that is to say after about a third of its natural life, it probably begins to lose as much as, or even more energy than, it creates.

There are two chief methods in which energy is used up, that is to say, in which the tissues of an animal are wasted, Work and Heat. In the mere movements of the body necessary to raise a weight, a certain amount of force is employed which corresponds to a definite amount of energy expended. When for example a steam engine draws a heavy train after it, the engineer can calculate to a pound the precise force obtained by the expenditure of a

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