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LESSON 4.

THE SECRET OF PHYSICAL FITNESS.

What is "Physical Fitness"? Does it mean the physical development of the individual, his ability to lift huge weights or to run; does it mean preparedness for bodily activity; and, if so, what kind of activity; does it mean good health; does it mean freedom from fatigue? Unfortunately the term 'Physical Fitness' has not been consistently applied to any one of the above states. More frequently it is used to mean good health. If we should accept this, at once rises the question what is meant by 'Good Health'?

Here again is a certain degree of uncertainty. The attitude of the physician towards health seems to be to classify all people under two heads—the sick and the well. If actual disease is not present, the individual is classed as, well. But there are degrees of health, just as there are degrees of humidity and temperature. One person may have excellent health, another fair health, and still another poor health yet, none of these would be classified as sick from the view-point of the physician. One may be organically sound, in that, no defects could be found in any organ or tissue of the body: and yet he may not be a robust healthy individual. The healthy individual is able to combat adverse influences and react to the conditions of his external environment and his work, in such a manner that the physical processes of his body do not lose their nicety of adjustment, nor profoundly disturb or modify his internal circumstances.

SOURCES OF FITNESS:- That which enables a man to combat adverse influence and meet the requirements of his labour is partly inborn and partly acquired. The physical form and structure of the body are an equipment. To a large extent, heredity counts. But no one to-day doubts the statement that "Use makes the Organ". Heredity no doubt determines the possible course and limits of physical development, but the use of an organ is necessary for its full and proper development. Graded and frequent use of the organs and muscles are the instruments of physical development; by these the capacity for activity is enlarged and a nicety of adjustment obtained.

The mind is master of the bodily machine; it too acquires greater capacity and a better equilibrium and adjustment with graded and proper use. Just how far one should strive to develop the inherited capacities of his body is a question that cannot be entirely and satisfactorily answered. Most of us are interested in physical fitness,—health—, in so far as it helps us to avoid illness and postpone death. The ideal aim is to be sufficiently fit to accomplish each day's work, with a minimum of fatigue and to remain active to a ripe old age. This may mean that some individuals must train for heavy physical labour and others for light sedentary work. In either case life must be so ordered that the body maintains a normal physical status. If it is not so regulated the body becomes unhealthy. A low degree of health or fitness is not enough, as it leaves no margin of safety against adversity which so frequently descends upon mankind.

Regarding criteria of physical fitness, one must remember that there are needs for several efficiencies. The first criterion is that the chemical processes of the body should proceed in a rapid, orderly and economical manner. This means that digestion should not be delayed, that the absorbed food should be quickly utilised to form blood and yield energy, that the oxygen supply should be adequate for the demands of periods of work, as well as of rest, and that the elimination of waste matter should be prompt and complete.

The second is that the structure, quality and power of the organs should be adequate to the body's needs. Voluntary and involuntary muscles should possess size, toughness, and contractile power, sufficient for both ordinary and extraordinary demands. The heart should be able to resist effectively,

high blood pressure and to circulate an adequate supply of blood. The Vasomotor response of the blood vessels should be good and the capillaries should be capacious.

The third is the accurate and sensitive response by the organs of special senses, such as ear, nose, eye, tongue, brain, etc.

Last of all is efficient working of the central nervous system.

From the above criteria of efficiency it would seem that the important value of physical training is not necessarily the development of large muscles, or the ability to perform athletic feats.

Physical training is important in the attainment of physical and mental well-being, in that, it furthers the proper activity of the tissue-cells and organs, and the elimination of waste products.

Every aid, such as good diet, rest and exercise which brings and keeps the body in this physical condition, may be legitimately employed. It is essential to realise that it is much easier to keep well than to regain health after it has been impaired.

It is now my business to tell you the 'What' and 'Why' of exercise as well as its, 'How' and 'How not'. I must therefore begin at the beginning itself—the Cell and the Protoplasm. I shall try to be sharp and crisp and at the same time will not skip over the important points.

EFFECTS OF REGULAR EXERCISES

The benefits of regular Physical Training cannot be over-estimated. Exercise is necessary for healthy existence. It is a physiological need of a primitive kind, which cannot safely be eliminated by civilization. There can be little doubt that exercise strengthens the organism, and, therefore, tends to prolong life. It is difficult to find men injured by a rational system of muscular exercise, but it is easy to find many who have failed in normal development and been ruined for want of it.

Physical training is the key to all beauty of form and face as well as to grace of motion. Experiments and comparative study, conducted by great scientists, between persons of sedentary habits and persons who regularly took some sort

of physical training, show striking differences in the growth, structure and function of the organs of the human body.

Here is the result of an experiment to show what great differences were seen in a group of youths who were kept on regular training for six months, in comparison with another group of youths who took no exercise worth the name.

Youths who took a regular training, all showed a better functioning of the heart, kidneys and liver. The nerve reflexes were much better; their glands functioned better; their anatomical structure showed clear-cut results.

| | EXERCISE GROUP | NOTHING SPECIAL |
|-------------------------|----------------|-----------------|
| Weight .. | 12 lbs. | 4 lbs. |
| Height .. | 1.0 inches. | 0.2 inches. |
| Breadth, Shoulders .. | 2.0 ,, | 0.2 ,, |
| Girth: Chest Normal .. | 4.0 ,, | 1.0 ,, |
| Girth: right Thigh .. | 1.5 ,, | 0.4 ,, |
| Girth: right Calf .. | 0.7 ,, | 0.2 ,, |
| Girth: right Biceps .. | 2.0 ,, | 0.2 ,, |
| Girth: right Forearm .. | 1.0 ,, | 0.1 ,, |
| Girth: Neck .. | 1.5 ,, | 0.4 ,, |
| Lung capacity .. | 45 Cu. inches. | 18 Cu. inches |

Systematic physical exercise increases the height, weight and vital capacity of adolescent boys.

'Man is to a considerable extent the architect of his own frame.' The entire Skeleton or individual bones are modified by the action of the muscles. The structure of the spinal column, the shape of the torso, legs and feet, are all governed by the habits of the individual. Hard work increases the density of the bones of the body.

A person in poor physical condition is easily exhausted by mental and physical exertion; he is irritable, likely to have morbid thoughts, petty ailments, and low morale; he may have a sallow complexion and dull eyes; and he frequently complains of constipation, head-ache, nervousness and insomnia. On the other hand, it is equally common to observe in a man of good physical condition, evidences of mental and bodily vigour such as alertness, cheerfulness, high morale, bright eyes, elastic step, healthy complexion, and capacity for arduous mental and physical work.

EFFECTS OF TRAINING ON THE MUSCULAR SYSTEM:— The muscular system as a whole improves, and the range and delicacy

of the adjustments of the circulatory and respiratory systems also increase.

There is every reason to believe that the number of fibres in a muscle is not increased by training. In every muscle there are latent or unused fibres, and fibres that are small for lack of use. These develop in response to the increased demand made upon them.

The gain in power is out of all proportion to the gain in size. Such an increase in power, therefore, suggests that training improves the quality of contraction in the muscle. Training teaches the best combination of muscles. We learn to do away with superfluous muscle contractions, thereby increasing precision and endurance. To build big muscles is not enough. Bulging muscles need not mean improved quality or power. Skill and ease of action come only from the establishment of proper co-ordination. Training either results in formation of new blood capillaries, or in the opening up of hitherto unused capillaries. These provide for a more advantageous circulation and, therefore, a better supply of fuel and oxygen as well as for the removal of waste matter.

If graded exercise be taken day after day, the load of work may be gradually increased, and finally, that which was formerly an exhausting load is comfortably carried.

The muscular capacity of a man is measured by the extent, to which he can call upon his body for increased effort. Work is done with ease only if the performer can maintain an approximate equilibrium between the oxygen required by his muscles and that which he absorbs.

The margin of response is measured by the increase in capacity for muscular work and the increase in respiratory exchange. In the average normal person this response is likely to be in the neighbourhood of six hundred per cent. This means that if a man at rest uses approximately 250 c.c. of oxygen per minute, he may during work increase this to 1,500 c.c. In a well-trained person this margin may be raised to between 1,200 to 1,800 per cent—that is, to 3,000 to 4,500 c.c. of oxygen.

PHYSICAL TRAINING ACTUALLY INCREASES THE OXYGEN RESERVE:-

Inability of the untrained individual to supply to the muscles an adequate amount of oxygen, results in a considerable discharge of lactic acid into the blood stream. As this

acid reaches the blood it is immediately neutralized by the sodium of the Sodium Carbonate. In serving as a buffer the bi-carbonate is destroyed. Since the bi-carbonate of the blood constitutes its alkaline reserve and determines in large part the ability to care for lactic acid, it follows that the less there is of this reserve the more limited is the power of performance. It has been well said that "The limit to the power of performance is determined in any subject when the lactic acid attains certain concentration in the blood". It is of interest, therefore, to find that physical training actually increases the alkaline reserve.

It is evident that one important feature in the superiority of the trained man, lies in his ability to maintain the internal environment of his body nearly constant, even during severe exertion. This we have found, he manages to do by supplying a more adequate amount of oxygen to his muscles, and by maintaining a larger alkaline reserve than does the untrained man.

RESPIRATORY CHANGES:- Training brings out well-defined changes in the respiratory mechanism and its functioning. The expansion of the chest is increased, the rate of breathing is slowed and its depth is augmented. In the sedentary individual a large portion of the lungs may be physiologically closed off, from the air inhaled, while with training, the entire lung volume easily becomes accessible, so that the blood may be exposed to oxygen over as much as 100 square metres of surface, instead of a fraction thereof.

In the inefficient untrained person, the diaphragm moves very little during breathing and the respiratory frequency is 18 to 20 breaths per minute. In well-trained persons it is not more than 8 to 10 breaths per minute. Lung capacity cannot always be judged by external measurement. The chest-measurements may be sometimes poor, but the pulmonary ventilation may be good. There are also instances, where an athlete may have a spreading chest and large vital capacity, and yet get out of breath quickly during physical exertion. This is due to the poor muscular co-ordination of the respiratory mechanism.

The time for development of the chest is in youth. Exercise produces an enlargement of the chest during the period of growth, but will not have much influence on the size there-

after. The untrained person may start taking deeper breaths, but still he cannot absorb as much oxygen, as a trained person could; who although he breathes less air, absorbs a greater proportion of oxygen from the air he breathes. This shows that the breathing becomes more economical as a result of physical training. The trained man ventilates his lungs both during rest and in exercise, more economically than does the untrained, and, so, the trained man naturally aerates a greater amount of blood in a given time. As a result of this, the heart is saved from over-strain. It becomes more efficient from regular training.

THE OUTPUT OF THE HEART DURING EXERTION BETWEEN THE TRAINED AND THE UNTRAINED:—The efficiency of the heart is nothing else than the volume of blood that it can pump in relation to the oxygen requirement of the body, i.e., the heart of the trained man pumps more blood per minute with fewer strokes than the heart of the untrained man.

Another advantage to the trained man is that his heart is stronger and will empty itself more completely at each beat than the weaker heart of the untrained man. A longer stroke per beat and a slow pulse rate enable the trained man to carry oxygen more adequately than does the untrained person.

THE HEART IN THE TRAINED:—Carefully graduated exercise improves the nutritive condition and develops the muscular power of the heart. The weight of the heart is directly related to the general development of the body's muscles. One of the elements in the functioning of a strong heart is a highly efficient coronary circulation (Blood circulation for the muscles of the heart). It is believed that in the heart as in the skeletal muscles, there is either a formation of new capillaries or the opening up of hitherto unused capillaries.

Now to sum up: one can easily see that the human body can be made physically and mentally more efficient if regular physical training is taken.

FATIGUE AND STALENESS

The term fatigue is a sort of miscellaneous file, into which are cast a number of conditions all having a common symptom "A diminished capacity to do work occurring as a result of work". Nothing is more familiar than the fact that muscles long and severely used, respond less and less readily to the demand we make on them. This flagging in muscular

response may be regarded as a diminished ability to react to stimuli, or, a condition in which the ability to repeat an activity is reduced.

In the ordinary performance of long continued work, either physical or mental, three stages are experienced. During the first stage our working power gradually increases and the performance is distinctly up-hill work. It is difficult to concentrate attention. We may even feel fatigued and disposed to give up; but if we keep on, we find the work getting easier—we have now "warmed up" and have got into "stride". This brings us to the second stage, during which our output of work remains nearly stationary at a high level. We feel we could continue for a long time, why! for an indefinite period. We soon realise that, after all, our power is limited, that the work is becoming harder, and that we have reached a third stage when power and output gradually decreases.

TYPES OF FATIGUE:— There are two types of fatigue, one arising entirely from within the central nervous system, and the other largely in the muscles themselves. IT IS QUITE GENERALLY RECOGNIZED THAT EXCESSIVE MENTAL WORK MAY CAUSE MENTAL WEARINESS, BUT THAT EXCESSIVE MENTAL WORK MAY CAUSE MUSCULAR WEARINESS, SEEMS TO BE A NEW THOUGHT TO MANY PEOPLE. But it is true.

The primary source of fatigue, mental and physical, must be activity which involves the expenditure of energy in the body; as there is no fatigue when, as in rest, all expenditure is excluded. The fact that fatigue can be delayed by the administration of sugar to men doing hard physical labour is sufficient evidence, that a reduction in the store of energy-producing substances, is a causative factor.

Oxygen is required for the chemical processes within an organ. There is no simpler way of hastening fatigue than to subject the individual to a diminished oxygen supply. An other cause of fatigue is that certain substances formed during work, depress the power of muscle contraction. Among these products are Lactic acid, Carbon-dioxide and Acid-phosphates. As fatigue progresses, the number of Nerve impulses passing from the sensory end organs decline more and more. The alkaline reserve is distinctly lowered, and the phosphates of the blood are increased.

Fatigue, as a scientist has very well put it, is the product of two factors: One is the work done; the other is the man's susceptibility to fatigue. Susceptibility varies from man to man and, in each person, from day to day. It is determined by four factors: the individual constitution, his habits of muscular use, the environment in which he works, and the nature of that work. A man's constitution can vary: it weakens with disease and strengthens with the adoption of good habits of living. RHYTHM IS A FUNDAMENTAL PROPERTY OF THE NERVOUS SYSTEM; therefore, exercises that have rhythmic movement, tempo in breathing and harmony of the motor nervous system are potent factors in preventing fatigue.

STALENESS:- Fatigue is only a depression of physiological activity,—mental or physical, or both,—resulting from continued hard work without adequate rest. A night's sleep brings recovery. When, however, it persists, after a reasonable amount of sleep, and continues day after day, it is accumulated fatigue or STALENESS; in other words it is CHRONIC FATIGUE.

Ordinary staleness is not brought on by a single bout of work. Staleness is usually the result of doing each day more work than can be recovered from a night's rest. This means that daily expenditure of the body is exceeding the income. If this continues over a considerable period of time bankruptcy is inevitable. The only attitude to fatigue is complete rest; without enough rest recuperation is not complete.

There is enough reason to believe that the fatigue which leads to staleness has its origin within at the central nervous system and that, as a rule, staleness is a neural limitation founded on chemical changes within the body.

Experience has shown that staleness may result from too much work, from too little physical exercise, from dissipation, from frequent and excessive emotion and from repeated loss of sleep. In staleness one is likely to notice first that he is beginning to feel generally tired. "The sleep does not refresh, there may be occasional head-aches. One does not get off to sleep quite as well as he did, the appetite is lost. There is digestive disorder. Constipation is common in such cases. The sleep may be troubled by dreams and nightmares of all kinds. One may find himself getting irritable, cannot enjoy company, and perhaps, desires to go off by himself. One may become conscious of his heartbeat day and night, and may feel short of breath even on slight exertion."

It is impossible to draw a clear-cut distinction between Neuresthenia (Nervous exhaustion) and staleness. Neuresthenia after all may be chronic staleness, especially in persons of nervous and asthenic type.

THE TRUTH ABOUT DILATATION OF THE HEART:- Great physiologists like Deutsch, Kauf, Warfield and Herxheimer have come to the conclusion that athletics and physical exercises bring about a change in the heart, chiefly, enlargement. Nevertheless they find the majority of athletes possess absolutely normal hearts. Herxheimer who has given much attention to the subject believes that in every athlete an increased cardiac load leads quickly to growth of skeletal muscle. The increase in size is due to a thickening (hypertrophy) of muscle, rather than to a dilatation of the heart. Years of physical training may result in a broadening in the transverse diameter of the heart.

Recent investigations emphasize the fact that the heart and the circulation can stand strain without harm, if the person trains gradually. In early adolescence, however, when the heart has not become accustomed to labour, or when the heart has been weakened by some previous infection, this organ will be susceptible to injury from heavy exercises. Overlooked chronic infections, such as those of tonsils and the teeth, and Rheumatism, may weaken the heart muscle and predispose it to strain during physical exercise.

The heart is known to be sensitive to oxygen want. The heart is capable of developing only a comparatively small oxygen debt. It cannot tolerate as much lactic acid as do skeletal muscles. The fatigue limit for the skeletal muscles is about 0.3 per cent. Hence, it is clear that while doing the exercise the inhaled air has to reach the alveolar spaces in the lung. If breathing is not adequate, there will be a heavy accumulation of lactic acid both in the muscles and in the blood; and while its subsequent removal (oxidative process) is not hastened, fatigue sets in early. And instead of muscular development and improved efficiency in the working of the internal organs, there will be only muscular degeneration, and physical and nervous exhaustion.

The purpose of physical training is to strengthen and guard from strain, the most precious organ....THE HEART. The more the number of breaths per minute, the more shallow

the breathing becomes, hence, the gaseous exchange in the alveolar space of the lungs becomes poor and the return of the oxygenated blood to the heart becomes less and less subsequently while at the same time due to muscular effort and exercise, more venous blood is brought continuously to the heart to be pumped into the lungs for purification, with but little return, it will only result in congestion of the lungs, and in an unbalanced irrhythmical working of the heart.

This sort of thing cannot go on for long. To safeguard the organs from getting beyond recovery, fatigue or exhaustion very soon sets in and you will have to give up exercises.

THE BODY MUST AT ALL TIMES HAVE ACCESS TO AN ABUNDANT SUPPLY OF OXYGEN, AND MORE SO WHILE YOU ARE AT EXERCISE.

YOUR BREATHING MUST ALWAYS BE DEEP AND ITS FREQUENCY LESS.

CHEMICAL COMPOSITION OF THE MUSCLE.

Healthy Muscle during a State of rest is:-

| | | | | | | |
|-----------------|----|----|----|----|----|--------------|
| Water | .. | .. | .. | .. | .. | 75 per cent. |
| Protein | .. | .. | .. | .. | .. | 18 " |
| Fat and Gelatin | | .. | .. | .. | .. | 3 to 5 " |
| Inorganic Salts | | .. | .. | .. | .. | 2 " |

This composition varies in proportion to the work done by the muscle. Muscle during rest is constantly taking up oxygen from the blood through the lymph and giving off carbonic-acid. This action of gaseous interchange is much increased when a muscle is at work. This leads to an increase of heat, chemical change, etc.

THE PHYSICAL AND CHEMICAL CHANGES OCCURRING IN A MUSCLE AT WORK

PHYSICAL CHANGE:- When a muscle is vigorously flexed, it becomes shorter and at the same time thicker. What the muscle loses in length it gains in girth. When the muscle is much worked its arteries and veins swell up with a surcharge of blood.

CHEMICAL CHANGE:- When a muscle is worked, heat is evolved and the temperature in the muscle rises, and this leads to more energetic chemical changes in the muscle. Fat and Carbohydrate in the muscle are the sources of this muscular energy and this chemical change. There exists in the muscle an unstable substance named "Lactic-acid-Precursor" (Lacticidogen). It is a compound of Glycogen with some other substance not as

yet analysed. The first chemical change which occurs during exercise is a breakdown of this compound and the consequent liberation of 'Sarco-lactic-acid'. When the supply of oxygen is adequate (through proper breathing during exercise) oxidation of this lactic-acid leads to formation of Carbonic-acid and water ($C_3H_6 + 3 O_2 = 3 CO_2 + 3 H_2O$).

If the supply of oxygen is slackened through inadequate breathing or suppression of breath while exercising, this 'Sarco-lactic-acid', a harmful product, is allowed to remain unchanged.

During severe exercise the formation of this Sarco-lactic-acid is increased. The system, then demands plenty of oxygen supplied by the increase of lung-activity, i.e., breathing. Then the carbonic-acid formed by the oxygenation of Sarco-lactic-acid is dissolved and carried away by the vigorously circulating blood to the lungs, where it is breathed out as Carbon-dioxide formed through the diffusion of oxygen we breathe in into the lungs. The water formed through the already mentioned chemical change finds its way out through the pores of the skin as sweat, carrying with it numerous waste products such as Keratin, Sodium salts and Volatile fatty acids.

THE NECESSITY FOR NORMAL BREATHING EVEN DURING VIGOROUS EXERCISE

YOU HAVE NOW COME TO UNDERSTAND THE NECESSITY FOR MAINTAINING PROPER BREATHING AND THE SUPPLY OF PLENTY OF FRESH AIR THROUGHOUT YOUR EXERCISES. All this talk to you is to impress upon you the importance of NORMAL BREATHING and the dangers of suppressed or withheld breathing. This loads the muscles heavily with Carbon-dioxide, and fatigue sets in very early as a result. I FEEL IT MY DUTY ONCE AGAIN TO REMIND YOU THAT ON NO ACCOUNT YOU SHOULD HOLD YOUR BREATH DURING YOUR EXERCISES; NOR CHECK NOR MOP OFF THE PERSPIRATION ISSUING THROUGH THE PORES OF THE SKIN. Sweat finds its way out through the innumerable pores of the skin. These pores dilate while exuding the sweat. If the sweat is mopped off, the pores are left open for the cold air to make them contract and thus check the outcoming sweat which if retained in the system reacts as a poison. Dry yourself with a towel or take a tepid-bath after the perspiration has completely ceased. There is also one other important point to be considered in this connection. Exercise produces heat in the exercised

muscle; and as a result more water is drawn to the muscle through the blood to maintain the equilibrium of temperature. During strenuous and prolonged exercises the blood becomes thick (viscous) and hence requires an adequate supply of water to maintain its original and normal limpidity, liquidity and temperature.

The fact that a severe thirst ensues from exercise proves the above statement; and if this demand is not readily and copiously complied with, the body becomes prone to diseases allied to excessive heat and dryness in the system; piles and constipation being its usual lot. This is one of the chief reasons why a large number of Athletes and Physical Culturists suffer from chronic constipation. I have incessantly been hearing of people who took to Physical Culture seriously to get rid of their constipation only to find to their dismay that their malady was only aggravated.

THE DANGEROUS URIC-ACID:- The failure to compensate for the loss of liquid from the system through exercise, burdens the system with another poisonous product: **THE URIC-ACID** and this is how it comes about. The human body is a big colony of the cells and life is a series of cycles of the birth, life and death and renewal of these cells. Exercise is only the means for the destruction of the weak cells, to be rebuilt by rest and replenishment of food, each time stronger and more numerous than before.

While one is at exercise or at work the destruction of these cells increases a hundredfold and these dead cells are all carried away by the fast circulating blood-stream; and as this blood-stream passes through the Liver and the Kidneys, it allows the dead cells to be broken up by these two organs into many chemical constituents, chief among them being **URIC-ACID**, a highly injurious substance.

Uric-acid must pass out of the system with the urine. When there is a scantiness of water in the system uric-acid remains in the blood-stream and is gradually deposited in the joints of the limbs, which is invariably the beginning of **RHEUMATISM** and its allied complications.

DRINK PLENTY OF WATER; Uric-acid dissolves in water usually in the ratio 1:8. Hence one should drink plenty of water, the 'ELIXIR' of life. A normal man should drink from three to four pints of water every day. A Physical Culturist

should drink more. It will not only assuage any extra heat or temperature in the system, but will also filter the blood and replenish the system with plenty of liquid.

Almost all Naturopaths of the West advise against the drinking of water with a meal. But while CHARAKA, the most ancient and eminent Hindu Physician, writes in his 'Samhita' "DRINKING WATER WITH MEAL IS NECTAR." Charaka being a native had well studied the climatic conditions of his land before he wrote that.

DOES DRINKING WATER WITH MEAL RETARD DIGESTION?

I think there is no harm if there be a slightly extra amount of liquid in the diet. In fact it helps the digestion in being able to readily combine with the enzymes and secretions of the alimentary tract and also in being able to move freely on its journey towards the rectum. I have mentioned to you before that the blood becomes viscous through prolonged exercise, thus losing much of its liquidity. The various digestive enzymes and secretions being liquid in state depend entirely upon the blood for their water. And there is very little chance for a copious secretion of the various digestive juices when the blood itself is thick and viscous.

I have met with a number of people who having read somewhere, or been advised by somebody that they should not drink water with their meal, religiously follow this advice only because they have been told that water dilutes digestive juices and so retards digestion. It is wrong not to allay the thirst that naturally comes after exercise or drinking water with a meal. It is a call of the blood that should be answered.

I will cite another example to prove my statement and to prove too that this extra water ingested along with the food does not slow down digestion. You must have very often experienced after drinking a large quantity of water that you freely pass urine almost within half or three-quarters of an hour. You know very well that the water you drank went into the stomach; the fact that the food first of all goes into the stomach and requires from six to eight hours for digestion and absorption and nearly twice that time for the undigested effete matter to be thrown out of the rectum gives ample support to my statement that the extra water is readily absorbed from any part of the alimentary tract and does in no way retard digestion. If, on the other hand, your food lacks

sufficient liquid, (1) it requires more muscular effort to swallow the food; (2) it takes more time and spells more effort for the gastric enzyme to pierce through the bolus of your swallowed food; (3) it takes the mucous-membrane for more secretion and lastly what little extra liquid is left, is readily absorbed by the ever-thirsty Colon and the faecal matter becomes very dry and hence hard to be thrown out, resulting in fissures, fistula, piles and haemorrhage.

THE USE AND ABUSE OF OUR STOMACH. Every man from his birth to his death, is built, replenished and maintained by the activities of his stomach; and his temperament and moods largely depend upon the quality of his digestion. A well-built machine works efficiently; so does a well-built body too. Health, Strength, Youth and Vitality, each of them depends above all upon good digestion.

The gravest of popular errors concerning the stomach is that its efficiency is to be judged by the abuse that it can stand. The stomach that can digest an abnormal quantity of food, or digests foods that are obstinate to digest, is often termed a 'Strong-Stomach'; but this sort of stomach invites continuous abuse from its possessor and if not checked by intelligent restraint, will, in the long run, have a sad story to tell.

WHY DYSPEPTICS INCREASE DAILY? This is not mainly due to the abuse of the stomach, but sometimes may also be due to the lack of its use. In these days of labour-saving mechanical devices, Physical-power, or Man-power is least wanted. The muscles of the body have been almost put out of use. People living in big cities are not required even to walk; let alone other physical exertions. They have been taught and made to think that there is no necessity to walk when they can get easy, cheap and quick conveyance; no need to climb stairs when there are lifts handy; no need for visits and calls when the telephone is handy. Days on end are spent in chairs, cushioned settees and sofas. Gradually the strong supple muscles of the body wither away giving place to fat and goose-flesh; failing appetite is probed with tonics and carminatives; sleep is courted with drugs and narcotics; above all, MONEY can bring in a doctor friend who is always ready with his bagful of digestive stimulants, carminatives, tonics, bromides and strong hypnotics and injections.

We cannot get rid of our muscles in spite of this machine-age; at least for this reason some sort of physical activity ought to be maintained. No amount of mental activity can create as good an appetite as can be induced by good labour or physical exercise; and upon good appetite alone depends one's health.

A great physician once said "YOU ARE AS OLD AS YOUR STOMACH". As the body's need for food decreases, there happens a corresponding decrease in the secretion of the Gastric enzyme. This happens in sickness too. Then, the physician very often—why! most often—attempts to titillate the action of the stomach with carminatives and prepared pepsins. This might help digestion for the time, but, seriously, does it in any way improve the condition of the stomach?.....I mean, its muscular tone and secretion?

Peptonised and pre-digested foods are a double delusion. In the first place, little actual pre-digestion is possible by artificial means. In the second, pre-digested foods, in so far as they live up to their claims, are mere crutches to aid crippled digestion. They defeat the end sought, since they do not create a want for Natural digestive powers; muscular action and secretion. Except in cases due to accidents or acute illness such pre-digested foods should never be used. All artificial means to stimulate or aid digestion should be avoided.

IS IT ADVISABLE TO VARY YOUR COURSES AT A MEAL? Most of us are slaves to our tongues. Our tongue craves for variety and succulent dainties, having been pandered to from our childhood days. But the stomach cannot withstand such outrage for long. The tongue and the stomach are always at logger-heads. If people will only learn to control their tongue, in talk and taste, their days would certainly be happier and healthier.

What makes us feel uneasy, sick, irritable and fidgety is the heterogeneous mixture of our foods. Let us at a big dinner mix all the varieties of the dishes into one heap; and look at it for a moment or two and then speak out honestly if our stomachs can tolerate that messey mass of liquid and solid, sweet and sour, pungent and salty, mealy and fibrous, half-boiled and full-boiled, raw and cooked, soaked and dried, baked and steamed, fried and toasted! Let me tell you what

perhaps you have not even once in your life thought of. Some foods require twice or thrice as much time as others to undergo complete digestion. Among the courses of our daily foods there may be one or two courses which require only an hour or so for digestion in the stomach before passing further to be completely assimilated; and again, some foods may remain 2 or 3 hours in the stomach to undergo the same. There might also be foodstuffs upon which the gastric enzyme has little or no action at all. Thus the work of digestive organs becomes very heavy and complicated. There might also be excessive drainage of the digestive enzymes and secretions, and owing to the prolonged digestion, the blood might have to centre itself in the digestive organs quite a long time, depriving their due to the brain-centres and nerves. Thus the gourmand becomes lazy and lethargic. Gradually his mental powers too begin to wane and nerves become debilitated.

I have always thought that there should not be more than three, or at the most, four courses at one meal, and care should always be taken in selecting only such foods as are digested in almost the same amount of time. There should be Proteins, Carbo-hydrates, Fats and Mineral Salts; all combined in a healthy, easily assimilable and required proportion. Do not overlook the vitamins either. The food should be easily accessible for the gastric enzyme and other secretions of the digestive tract.

HOW TO WASH THE STOMACH:—Blood is rightly termed the "STREAM OF LIFE" and the blood-building process begins first in the stomach. Indiscriminate feeding in quantity or quality or any other interference with digestion materially affects one's whole system; hence, the importance of maintaining the stomach in a sound condition of health can never be over-estimated. Our unwholesome foods, our false and imagined appetites often times give chance to very unpleasant symptoms in the stomach. A coated tongue and a fetid breath are signs of dietetic abuse.

I am suggesting a method of cleaning the stomach in such cases. Nature has endowed the baby with this power to which I refer. But as the baby grows and as it develops the ability to express its hunger and satisfaction, this power is taken away. This power, which we all possessed as babies but were deprived of later, is termed 'EMESIS'. The little baby 'throws up' the excess when over-fed; Nature

invests the baby with this power of making it vomit the excess food.

It is sad fact that most of us though wise in very many ways, are not wise enough in matters regarding diet. Usually the stomach is much abused. Such continuous abuse brings on gastric disorder, such as, Catarrh, Gastritis, Acidity, Flatulence, Ulcers and so on. I am prescribing an excellent remedy for all such disorders. In modern medical circles it is called a 'Stomach-wash'. In HATA-YOGA it is called 'KUNJARY-KRIYA' and it can root out 'Kapha' (Phlegm and Mucus).

HOW TO TAKE STOMACH-WASH:—This wash has to be taken preferably in the morning when the stomach is empty. Drink some two pints of warm water. A table-spoonful of Sodium-bicarbonate, commonly known as Cooking-Soda, may be dissolved in it;—lie on your back and give a vigorous shake to the stomach for a minute or two with the palms placed against the upper part of the abdomen (more to the left side of your abdomen). You should be able to hear the gurgling of the water inside the stomach as you vigorously shake its contents. Rise to a sitting posture and introduce your index and middle fingers well into the throat. Tickle and irritate until you vomit all the water. Cold water may also be used for normal stomachs as in such cases it acts as a stimulant. People suffering from gastric ulcers, mucous irritation, gas and acidity should use warm water. In cases of 'acidity' cooking-soda mixed with the warm water will reduce the acidity of the stomach. Impaired stomachs need two to three washes a week while normal stomachs need only one a week or a fortnight.

People suffering from 'Ptosis' (fallen condition of the stomach owing to lack of muscular tone and strength) should, after the wash, lie on an inclined plank (head on a lower level than the lower portion of the body) and massage their abdomen from below upwards and never vice-versa. Those who are suffering from acute and chronic disorder of the stomach should take a daily warm alkalised stomach-wash and live on bland diet till their digestion improves. 'HATA-YOGA' speaks very highly of the virtues of this stomach-wash 'Kunjary-Kriya'. It is said to destroy 'Kapha' mucus sticking on to the walls of the stomach preventing the Gastric-enzyme from being secreted; it kindles up 'AGNI' (power of digestion and assimilation).

Various skin diseases, asthma and allied bronchial troubles, torpidity of the liver, costiveness of the intestines and chronic constipation, can be successfully combated by this 'Kunjary-Kriya'. Dyspepsia can be rooted out by the regular practice of this 'Kriya' if combined with light abdominal exercises. In short, 'Hata-Yoga' says, it restores health and bestows a long life upon its votary.

This stomach-wash is also taken with the aid of a stomach-tube or a stomach-pump, which can be procured at any good chemist's. Any doctor may be requested to teach how to manipulate it. DO NOT FORGET THAT WHAT YOU EAT TO-DAY WILL BE WAKING TO-MORROW, TALKING TO-MORROW, YOUR TO-MORROW'S TEMPER AND MOOD DEPEND MORE THAN YOU THINK UPON THE FOOD YOU EAT TO-DAY. Therefore it is of the utmost importance that your stomach and diet receive all your CARE, SYMPATHY and UNDERSTANDING.

I am prescribing for you a stomach tonic extracted from vegetables. It not only furnishes your system with a copious supply of liquid but also supplies important nourishing elements. It can be safely used as a drink throughout the day instead of water. This tonic is made from vegetables of various kinds. Any sort of edible greens may be used in its preparation. Onions, Cabbages, Tomatoes and all kinds of English and Indian vegetables and greens may be used. Some three or four of them would make a good mixture. First, they should be minced fine. To one pound of this minced mixture add three quarts of water and simmer it over a slow fire, down to a quart. Filter this liquid. The boiled vegetables placed on a clean linen, its juice may be squeezed into the liquid. A pinch of salt and a few drops of lemon juice may be added while being used; but it is better taken without them. This may be drunk in cases of lowered digestive powers, during sickness, after sickness and during fasts too.

THE IMPORTANCE OF INTERNAL CLEANLINESS:—When the process of curing diseases and building up of the body has become as scientifically accurate as modern mechanics, it is about time we learnt that all parts of the human mechanism ought first to be corrected starting with the alimentary canal. There are perhaps a few exceptions to this rule; but very nearly all complaints have their origin in the complicated digestive tract. In short, a clean alimentary canal makes for cleanliness throughout the body.

Do not be under the impression that you are clean only because the outer surface of your body has been scrubbed and scraped. The cleanliness of the inner surface of all various ducts within the body, ranging in size from the thinnest capillaries, to the stomach and the colon, is undoubtedly a hundred-fold more important.

If you would clean the alimentary canal in its entirety with almost the same ease that you wash face, here is a way.

CLEANING THE ALIMENTARY CANAL:—This cleaning process is so direct in its effects and the results are so certain that failure in its use is practically impossible unless there exists some chronic organic disorder. This method entails also the drinking of hot water during the exercises and should be done on an empty stomach, the most suitable time being the morning soon after you are awake. Keep some two pints of hot water near; first drink a glass or two as hot as you can. You can add a tea-spoonful of pure honey to every glass-ful of water to rid the hot water of its insipid taste and also as a cleaning agent. Finely powdered cumin seeds (jeera) act as a carminative (stomach-stimulant). A few people prefer to add a few drops of lemon juice to remove the insipid taste of hot water. After having drunk the water, begin taking your exercises vigorously, particularly for your abdomen, hips, waist, spine and back. Drink another glass of water after eight or ten minutes of vigorous exercise and continue exercising in the same way till you well-perspire. (Few constitutions do not perspire at all, or weather-conditions might be too cold to effect a visible perspiration. In such cases exercises should be carried on to a fair point of tiredness.) This method has been tried and found very efficacious in cases of dyspepsia, chronic constipation and acute indigestion. It is also helpful in all vascular disorders, lumbago, rheumatism, kidney-disorders and diseases due to the clogged condition of the colon.

I think I have spoken enough regarding diet and digestion both in your second and in this lesson. You will, I dare say, agree with me when I consider them to be the basis upon which you build your health and physique. You will not be benefited by merely reading these lessons. (A large part of my experience, I have placed before you.) It is yours if you go through it over and over, and make it all your very own.

EXERCISES FOR THE ENTIRE TORSO

EX. 16. For the PECTORALS (Chest muscles). Study Fig. 16 closely. Stand upright--interlace your fingers pressing the palms firmly against each other in front of your chest. Your elbows are to be kept close to your sides. Now, push your arms straight in front of you as indicated by the lines and arrow mark. After the arms are completely straightened, retrace to starting position still maintaining the pressure of palms against each other. Maintain your chest high and forward, your back slightly backward. Let your shoulders also be kept back, and take every care to keep them there even when the palms are thrust forward. The pressure of the palms is specially against the heel of the palms, and if correctly done this pressure brings the pectorals to a state of intense rigidity. Exhale as you push forward and inhale very deeply as you retrace back. This completes one movement. Perform 8 movements and gradually increase the number to 12.

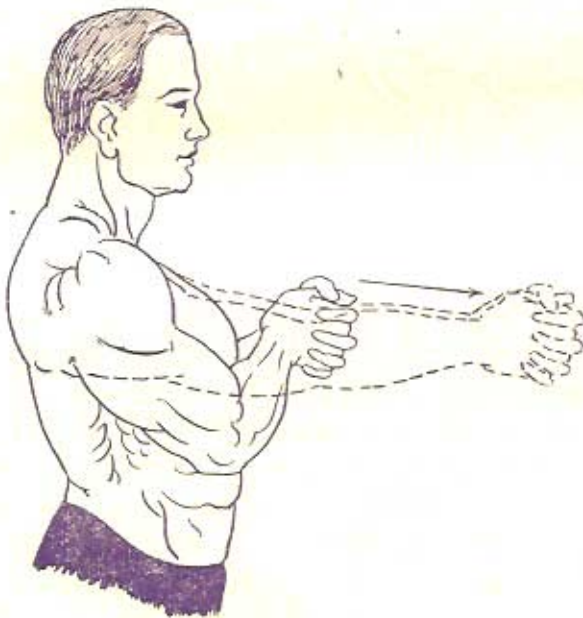


Fig. 16.



Fig. 17.

EX. 17. Study Fig. 17. This exercise is also done as the above, except that instead of pushing your arms straight in front of you, you now push it straight down until the arms

are just in front of your thighs and retrace to starting position. You may slightly bend forward while pushing the arms downwards so that you might bring the pectorals to a thoroughly flexed condition. Exhale as you push down and inhale deeply as you retrace back to starting position. All other details are as in the previous exercise.

EX. 18. For Obliques (muscles on either side of the waist). Study Fig. 18. Stand with legs wide apart as shown in the illustration. Hook fingers and place them upon the head, arms slightly pulling apart. Now get all the muscles of your left side to a state of intense rigidity--especially the oblique muscles on the left. If this control is done properly, the left heel is automatically drawn up owing to the contraction of the left oblique muscle. Bend well on your left thus flexing the obliques further till your left elbow meets the left knee as indicated by the dotted lines figure.



Fig. 18

Relax and come back to starting position. Repeat on the right side as well, the same way. One thing you have particularly to observe in this exercise is, to exhale completely while

bending to the sides and inhale deeply while recovering to upright position. This is an excellent exercise to slim and strengthen the waist and hips and at the same time strengthen the stomach, pancreas, spleen and liver. It also makes the spine supple and strong. Repeat the numbers as in the previous exercises. Perform each movement correctly, slowly and deeply concentrating on getting the oblique muscles to an intense state of rigidity.

EXERCISE FOR THE ABDOMEN:- EX. 19. Study Fig. 10. (Lesson 3.) (Paschimottanasan). The performance of this exercise is no more than a modification of the Paschimottanasan. After you reach the toes with your fingers and after taking your forehead to touch the knee (or after you have touched it), retrace to starting position inhaling deeply. Now, get up again (exhaling deeply) to sitting position (keeping the head always well between the shoulders) and reach for the toes again (tensing the abdominal muscles strongly). Hold on in that position for a couple of seconds and then go back again to starting position. Your entire concentration in the exercise should lie in the intense flexion of your abdominal muscles and the depression of the diaphragm. Keep the head always in between the shoulders. The knees should be rigid and straight throughout the exercise. Perform 8 movements and gradually increase the number to 12 movements.

EX.20. Study. Fig. 18. Now widen your legs apart (some 24 to 30 inches) instead of keeping them together as in the previous exercise. The movement is as follows: Raise yourself, and with Your head well in between the shoulders, bend more on your left side exhaling well and reach the left toe with both the hands. Take the forehead as close to the left knee as possible and if possible rest your forehead on the left knee. While performing this movement you should VERY VERY TENSELY flex all the muscles of your left side and particularly the left abdomen. This will inflict a keen intra-abdominal pressure on the stomach, spleen, pancreas, etc. After having touched the left toe, hold on for a second or two and retrace to starting position inhaling deeply and releasing the pressure that was put on the left side. Start again and repeat the same thing again on the right side. Always keep the head well between the shoulders. This exercise will wake the liver up. Repeat left and right alternately, deeply concentrating on an intense flexion of the muscles of the

abdomen on the particular side you bend. This is an excellent exercise to slim down hips and waist and tone up the impaired digestion. Repetition of movement is as in the previous exercise, maximum number being 10 on either side.

EX. 21. Study Fig. 19. Observe closely the rigidity of the knee, the thigh and calf muscles--the abdomen drawn in and the rectus-abdominis muscle in a state of intense rigidity the position of the head (very important) and the palms placed flat on the ground. (It might not be possible for just a beginner to secure all these positions correctly, nevertheless, bear in mind that no effort should be spared to ensure the exact positions within a few days, or, utmost, a couple of weeks of practice.)



Fig. 19.



Fig. 20.

Stand, with heels together--both arms stretched straight above head, palms open--bend forward exhaling deeply, and simultaneously getting the abdominal muscles into a state of INTENSE-RIGIDITY. All through this exercise the head should be held well between the shoulders and the chin pressing against the chest. Place your palms immediately in front of

your toes. Maintain the knees rigid and straight throughout, and hold the finished position for a couple of seconds. Retrace to starting position inhaling deeply and releasing the abdominal pressure. After having straightened yourself again bend as far backwards as possible arching your spine before you begin bending forward for the next movement. Start with 8 such full movements and gradually work up to 12. Put all your concentration upon the intense flexion of the abdomen, the rigidity of knees and the in-between shoulder position of the head. Number of movements as in the previous exercise.

EX. 22. Study Fig. 20 closely. In this exercise you stand with your legs wide apart (some 24 to 28 inches). The rest of the movement is exactly as in Exercise 20. You must put forth all your effort, energy and concentration in getting all the muscles on the side of your abdomen, taut, as you bend down on the particular side and reach for the toes. I need not tell you that on THIS (getting all the muscles into a state of intense rigidity) lies the entire benefit of this exercise. Repetitions and maximum number of movements are the same as in Exercise 20.

Here is the end of your Fourth Lesson. I hope you have not failed to notice how each lesson has grown in importance and value. It entirely lies with you to make the best use of all this knowledge. HARD.....HARD WORK is the only way to realise your aim. I expect you to be as honest in your duties as I am in mine.

Now arrange your programme as follows:—

FIRST DAY—The three Neck exercises of Lesson I. 'Stool Dips' and 'Baitaks'. (First perform a stretch of Leg Baitaks in correct style and inhaling very deeply at each straightening of the legs, 40 to 50 in number. Take a couple of minutes rest till the heart has come to its normality. Oxygenate yourself fully during these two minutes leisure. Perform 3 stretches of 'Stool-Dips' any number between 12 and 20, according to your capacity, taking not more than 2 or 3 minutes rest between each stretch, during which, you must keep on breathing deeply to oxygenate yourself fully. Once again perform Leg Baitaks in same numbers as before. Rest and oxygenate 3 minutes. Perform 3 more stretches of 'Stool-Dips' keeping up to the same numbers, as in the previous stretches,

and the same period of rest and oxygenation, as before. For those who find it impossible to keep to the numbers in stool-dips, they are allowed to deduct only three repetitions in each of these three stretches. But it is better if they could manage to do all the numbers. Once again perform the leg 'Baitaks', followed by two more stretches of 'Stool-Dips'. Those who can keep up to the original number in stool dips, must do so. For those that cannot, the minimum reduction allowed is 5 numbers, in each of these last two stretches. The time limit for this day's exercise including the rest periods must not exceed 50 minutes to an hour.)

SECOND DAY—Ex. 7 and 8 of Lesson 2. Bhujangasan, Dhanurasan and Ex. 14 of Lesson 3. Include all the exercises of this Lesson (4). Time limit for this second day's exercise is 40 to 45 minutes.

THIRD DAY—First Day's programme.

FOURTH DAY—Second Day's Programme, and so on. Take complete rest on Sundays.