

The Problem of Ageing

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THE process of ageing is casually, and rather accurately described by the layman as the "wearing out" of the "human engine". This "wearing out" and growing old is accepted as the inevitable last stage in the career of an individual living his full span of life. The gradual diminution of physical fitness, of the sensitiveness of the special senses, of the lust and zest for life, and of the alertness of attitude, heralds the coming of old age and insidiously converges on the mind as well. This problem of ageing has attracted the attention of thinkers at all ages and in all countries, but it is only recently that the problem is being investigated intensively and extensively on a long range programme. Medical men, physiologists, biochemists, chemists, pharmacologists, psychologists and physio-therapists are trying hard to find out what happens to the body with ageing, and how to check it.

One of the major problems that is being intensively investigated is that of physical fitness. It is physical fitness that first begins to diminish with ageing. Broadly speaking, a person with high physical fitness can do a task involving physical work more effectively and with less effort than a person with low physical fitness. His internal equilibria are nearer the resting state during exertion and return to rest-ink taste sooner, after exertion. The extent to which internal equilibria are disturbed during physical work is dependent on such a variety of factors as age, sex, training environment, and the health of the individual, besides the nature of the physical work itself. Human body is built not for resting conditions but for an activity level much higher than the basal metabolic rate. It is therefore essential to

know maximal activity level of a normal healthy human, the factors which influence this upper limit, and how they limit it.

The energy for muscular activity can be supplied either anaerobically or aerobically. The former has great limitations; it is utilised for short burst of intensive activity, and the tolerance of the muscular tissue to accumulation of anaerobic metabolites like lactic acid is decisive of its capacity. In aerobic work, which is utilised for prolonged heavy work respiration and circulation play a dominant role. The general impression is that the ability to meet the demands for oxygen decides the upper limit for prolonged, heavy physical work. And oxygen supply depends on the ability of the lungs for its intake, and of the circulation for its quick and adequate distribution. It is found, for example, that the average of the highest oxygen intakes during heavy muscular work like exercise on a tread-mill for 5 minutes is about 50 cc., per Kg. body weight per minute for youths upto 30 years of age. After that age there is a consistent and continuous decline in this capacity. It is reduced to 80% at 40 years of age and 70% or less at 60 years of age. These figures are, however, not definite, and the data of different investigators vary owing to different standards set by them for intensity and duration of work. Oxygen intake depends on lung volumes, and the maximal pulmonary ventilation also declines with age. Youths of 20-30 years of age can breathe an average maximum of 120 litres of air per minute. This capacity is reduced to about 80% at 40 years of age and to 60% or less at 60 years of age. There is a similar decline in the maximal pulse rate with advancing age. It is about 200 per minute dur-

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ing hard work for youths of 20-30 years of age, and is 170 or less for those above 50 years of age.

The reasons for diminished aerobic capacity of older people are not known. Elasticity of the arteries, costal cartilages and of lung tissues are diminished. In muscles, the number of muscle fibres diminishes and there is an increase in interstitial fibrous tissue. In most of the organs there is a slow accumulation of collagenous proteins and a gradual increase in polymerisation of the extracellular structural compounds. This increase in dense fibrous framework surrounding the cells will retard the diffusion of oxygen from blood to the cells and interfere with their metabolism. This change is considered by many scientists as the most important and causative of many of the observed metabolic disturbances, and as the essential feature of senescence.

Another important field of investigation is the imbalance of endocrine function in old age. The most striking of these is the change, or, rather decrease in sexual function with advancing age. It sets in earlier, at the age of 40-45 years in the female, and much later in the male. There is a disturbance in the secretion of the steroid hormones in the ovary, testis and the adrenal cortex. Histological changes of degenerative character in these glands are observed, there is a diminished secretion and a diminished anabolic influence on metabolism. Striking improvement in metabolism and sexual function can be obtained by administration of sex hormones. However, since there is a close association between steroid metabolism and cancer, the therapeutic use of these hormones is approached rather hesitantly by physicians. It is considered that many "adaptation diseases" of old age, such as tumors, arteriosclerosis and high blood pressure, nephrosis, gastric ulcers, cataract and other degenerative diseases are due to imbalance of adrenocortical

function in response to nonspecific stress. This hypothesis also threatens one with the possible dangerous consequences of hormone therapy in old age. Thyroid is another endocrine gland which shows degenerative changes in old age. There is diminution in its weight and the histological picture is one of a gland in childhood. Basal metabolic rate is reduced, and with it the general metabolism of all foods ingested. The islands of Langerhans in the pancreas, which secrete insulin may show degenerative changes resulting in disturbance of carbohydrate and fat metabolism leading to Diabetes mellitus. Degenerative changes are found in all the endocrine glands and there is disturbance of carbohydrate, fat, protein, salt and water metabolism.

Many other physiological changes in old age have also been observed. There is a reduction in cerebral blood flow, reduction in the speed of transmission of nerve impulse, reduction in food intake attended with possible protein, vitamin and mineral deficiency, loss of calcium in bones, negative nitrogen balance and reduced protein content of tissues, and above all, an altered mental outlook.

Apart from the academic interest, studies on ageing have been made with two important views: (1) suitable employment for the aged (2) retardation of onset of the distressing degenerative changes, alleviation of such distress, and possibly increasing of the span of life. The first of these, namely the employment of the aged is of special interest to the industrialist and the social worker. No industrial work involves continuous work of 100% capacity. Generally a worker works on an optimum of 50% of his capacity for physical work and this optimum should not be exceeded if injury, illness or untimely death should be avoided. In order to put the right man for the right job it is necessary to know the demands made upon the individual by the work and his capacity and training. With these data in hand it is pos-

sible to employ even the aged and disabled in certain types of jobs, and thus increase the man-power of the nation and also avoid the economic distress caused to the individual by early retirement from service. The problem in work rationalisation is to determine the maximum rate of work that can be carried on day in and day out and still retain vigour to an advanced age.

The second, namely, the therapeutic aspect of senescence has also received considerable attention. It has been observed that many of the ailments of the aged, even amongst persons of upper economic strata, arise from undernutrition and abstention from physical work. The body is not built for resting conditions even in old age. Physical work that does not cause fatigue or exhaustion is essential at all ages, and its absence will hasten the degenerative changes of old age. Similarly, though an aged person has a lower metabolic rate his needs of essential proteins, vitamins and minerals are not considerably reduced. Vitamin and mineral therapy is the commonest physician's prescription for the aged. Many do suffer from a sluggish liver, but this can be improved. It is in the field of hormone therapy that spectacular results have been achieved. Insulin for Diabetes, Cortisone and *ACTH* for rheumatoid arthritis are now indispensable remedies. In spite of the hazards of carcinogenesis the steroid hormones are gaining a strong foothold in treatment of the embarrassing symptoms of menopause and senescence. Therapy with a combination of male and female hormones are being used for tiding over the syndrome of menopause, for breast cancer, enlarged prostate and minor ailments like neurasthenia and loss of weight. These hormones are also being boldly prescribed to help the aged to continue to enjoy the pleasures of marital life, to enjoy a sense of well being and to curb down such depressing and frustrating thoughts as only the aged experience. It is no more a shame to ask the doctor

for an injection of sex hormones; it is becoming the fashion. Besides these, the latest drugs of great benefit to the aged are hypotensive drugs like the alkaloids of *Rawolfia serpentina*, many synthetic tranquillizers, alkaloids of *Belladonna* and *Ergot* for imbalance of the autonomic nervous system, cholinergic drugs for certain degenerative nervous and muscular diseases like *myasthenia gravis*, curare for Parkinson's disease, sulphamides and antibiotics for terminal infectious diseases like pneumonia which generally claims a high mortality in the aged, and *Radium* and antimetabolites for cancer. None of these can claim to prevent old age or enhance the span of life. The chemists and pharmacologists are helpless to discover newer remedies in the absence of information on the cause of senescence.

It appears, however, that this problem, had its full share of attention and even solution in ancient Hindu medicine. Vitalizers and virilifics made from rare herbs and minerals administered with caution are claimed to bring youth to the aged and life to the dying. It is said that great sages took these elixirs and were able to live for thousands of years in perfect health and youth. The modern scientist can only look upon these claims with scepticism. If their claims are true then there is no reason why such a miracle could not be repeated by modern Ayurvedic pundits. Many of the herbs mentioned are identified. Chebulic and emblic myrobalans, white yam, bael tree, white teak, castor oil plant, a variety of grasses and pulses, sandalwood, liquorice, spices, brahmi plant, hog's weed and metals like gold, copper, iron and lead are but a few of the hundreds of drugs mentioned. There is, however, no reason to discredit these drugs either, for, the *Rawolfia* plant has lived up to its reputation, and there might be others waiting to be discovered. The charm of research lies in searching for truth and this jungle of herbs seems to offer both charm and profit.