14. Experimental Life Prolongation*

The mean life span of the Romans was 22 years. By the end of the last century, i.e. in approximately two thousand years, the human life span increased by 20–30 years. In the last 70–80 years, it grew by another 20–30 years in the developed countries. In other words, the rate of human life prolongation increased almost 30-fold in one century. In the Soviet Union, the mean life span almost doubled in comparison with the level which existed before the Great October Revolution. Such a sharp growth of the life span became the basis of many optimistic predictions, which were often made by quite competent scientific organizations. At the end of the 1960’s, for instance, the U.S. scientific corporation Rand predicted that the life span will increase by another 50 years by the year 2020, while Smith Kline & French Laboratories predicted such a growth by the 1990’s. Experts of both corporations were of the same opinion that the main mechanisms of aging will be revealed and control over them will be established with the subsequent sharp growth of the life span by the middle of the next century (Bender et al., 1970). However, the presently high growth of the life span is obviously connected not with a change in the aging rate and not with the shifts in the life span of a species, but with both a sharp decrease in infant mortality and the elimination of some infectious diseases. In recent years, the life span growth rate dropped sharply in the highly developed countries. According to demographers, this rate will drop even more in the future. The human life span will grow only by 8–10 years even when malignant tumours and cardiovascular diseases can be treated successfully.

Two tasks, one tactical and one strategic, must be tackled in order to increase the life span (Frolkis, 1979b). The tactical task is to increase the life span right up to the highest limit allowed by a species, while the strategic task is to increase the life span of a species itself. Until now, the life span was increased by successfully solving tactical problems. In the future, it can be increased mainly by successfully solving more complicated strategic problems.

Therefore, most gerontologists are not very optimistic about the further growth of the life span. There are grounds for such pessimism, especially if researches involving life prolongation will be continued at the same pace. To assess this situation, it is enough to read Shock’s well-known gerontological bibliography, which includes the main researches into aging, beginning with ancient civilizations. This bibliography, which is naturally not quite complete, now includes more than 100,000 researches, of which less than 1 per cent

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involves the solution of the main problem of gerontology: life prolongation. Many researchers believe that life can be prolonged only after the mechanisms of aging are completely revealed and control is established over them. Although there is some logic in this, it should be taken into account that much is known about aging. Firstly, several definite mechanisms of aging and the key links which limit the organism’s life have already been revealed. The tactical as well as the strategic task of gerontology can be successfully tackled by influencing these links. Secondly, the general biological concept of the essence of aging and the processes which determine the life span has greatly changed. According to the adaptive regulatory theory (Frolkis, 1970), vitauct processes, which serve the purpose of increasing the organism’s viability and life, had originated together with the aging processes during evolution. Hence, the means which influence the aging processes as well as those which activate opposite tendencies in the organism can be used to increase the life span. Thirdly, there are many examples in the history of natural science and especially biology and medicine which show that very difficult problems were solved long before the necessary mechanisms were understood. Fourthly, the ways of increasing the life span must be studied experimentally in order to reveal the mechanisms of aging. Only the model experiments in prolonging the life span can be an adequate criterion of the truth of certain hypotheses of aging.

Criteria of the Life Span

The main criteria of the life span are the values of the mean and maximum lifetime. In spite of the seeming simplicity of these criteria, they are still interpreted in different ways. In experimental gerontology, for instance, the average life span implies the mean arithmetic life span of all the animals of the selected group, while in demographic investigations, it implies the mean future life span. In some investigations, the life span is studied not from the moment of birth, but from a later period of ontogeny, and the mean life span is determined. The age at which the observations began is automatically added without taking account of the mortality at the previous stages, and this naturally produces exaggerated results. The criteria of the maximum life span are even more diverse. Some authors take the life span of the longest living specimen of a selected group as the maximum life span, while others propose that the mean life span of 1, 5 or 10 per cent of the longest living specimens of the population under consideration should be taken as the maximum life span.

Besides the mean and maximum life spans, wide use is made of such indices as the time of 50 per cent of mortality that corresponds to the moment of death of one-half of the specimens which are under observation. The times of 20, 40, 70 and 80 per cent of mortality are also often used.

An important fact is that the experiments involving the study of the life span take a very long time (except those when short-living species are concerned). Therefore, it is very difficult to take account of all the factors which can influence the ultimate result. No wonder the repeated determinations of the life span of biological subjects differ greatly from one another even when they are carried out by the same researchers under the same conditions. These differences