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## Health of Healthy Humans: Historical Heritage of Academician N.M. Amosov on Achieving Good Health

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**Abstract:** Nikolai Amosov (1913-2002), famous cardiac surgeon, academician and cybernetics research engineer promoted and argued a healthy lifestyle for over 50 years, proving it by his own example. He has written dozens of books on how to achieve and maintain good health. He studied the effects of physical and nutritional exercise, overtraining, detraining of the various body organs and systems, focusing particularly on gas exchange system, more specifically, on the respiratory and cardiovascular systems. He defined a health as the ability of the body to perform regular physiological functions. Considering regular and abnormal body operation functions at the molecular, organismic and social levels, Amosov came to the conclusion that the main principle of reaching health, stimulation of the body recovery functions, as well as preservation and rehabilitation of performance capabilities, is an adequate physical activity and reasonable dietary restriction.

Key words: Nikolai Amosov • Rehabilitation through training • Physical activity • Cardiovascular system • Nutrition

## **INTRODUCTION**

Nikolai Amosov (1913-2002) was a Member of the International Association of Surgeons, the International Society for Cardiovascular Surgery and the International Society of Medical Cybernetics. He was author of over 400 scientific papers, 19 monographs, works on gerontology and the artificial intelligence issues. He was the first in the USSR, who began surgical treatment of cardiac anomaly and introduced methods of cardiopulmonary bypass. He was the first who implemented mitral valve replacement. He propagated and asserted a healthy living through personal lifestyle. He has written dozens of books addressed to the issues of achieving and preserving health. Consider some of them [1-15].

**Main Part:** The first Amosov's book, addressing health issues [1], was published in 1963. Author defines health as a performance of normal physiological programs and a disease - as unstable operation mode of body self-regulating system, resulting from external influences or faults in body functions. The body turns out of balance and returns back to the balance not randomly, but

according to a particular program. Disease program is a sequence of changes in regular programs under the influence of pathological stimulus. A long-term human evolution formed replacement programs, which are triggered by excessive interventions, such as hyperbiosis (high reserve), which is mobilizing forces for active protection or attack and hypobiosis (low reserve), which is reduction in life-sustaining activity, maintaining vitality at a minimum level. General body program consists of two parts: the progression of disorders and recovery. Progression of disorders or disease is number of disturbances that violate body programs and are a source of new disturbances in the organs and cells interaction chain. That is the way of surging up the stream of pathological changes. The recovery program includes compensation, accommodation and positive defense. Compensation provides a constancy of internal environment and uses reserves. Accommodation (adaptation) is activated when the reserves are exhausted and the cells are hypertrophied. Positive defense, i.e. reserve programs (for example: the cough reflex, the development of antibodies, etc.) is a transient state to disease. Interrelation between the progression and recovery of body disorders determines the course and

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pace of the disease. According to Amosov, the study of normal, though not just pathological body programs should be the primary objective of the medicine.

Work [2] is addressed to the body regulation theory, which is considered from the perspective of cybernetics. Medicine, as an artificial intervention in organism self-regulation, needs the theory of complex systems regulation in normal state and in diseases. Amosov calls the regulation theory the theory of medicine. Currently this theory is probabilistic, statistic, approximate and is formed from the perspective of diseases. Though, the main thing for a human and humanity are the health issues. Normal, healthy life programs include two body action programs: external and internal. Implementation of an external program is provided by the quality implementation of internal program, acting through the body structure. Considering the sequence of body structure levels, starting from the molecular to the organismic ones, Amosov distinguishes four groups of accommodation programs, consequently being triggered under increasing strains: 1. adaptation; 2. hypertrophy (amplification of restructuring-based functions); 3. triggering reserve programs due to the action of intensive stimuli; 4. formation of temporary connections. This is formation of complicated accommodation program depending on the rapidity and impact of the external stimuli. During the evolution, the regulatory systems in self-regulating organisms became more complex. The chemical nonspecific nervous system was generated first, followed by the endocrine (hormonal) system and further - the autonomic nervous system. Evolution of the movement organs (muscles) originated somatic regulatory system. Further specialization of cells caused the necessity of direct links and feedback, as well as their excitation and inhibition. This is a way of sympathetic and parasympathetic nervous systems emergence. Reticular formation, regulating all segments of the central nervous system, appeared to ensure the selection and amplification of a specific program of the organism while suppressed other programs. Regulatory systems provide a constancy of internal environment of the organism in different conditions. The range, flexibility and reliability of regulation are provided by body reserves. The impact of external stimuli triggers two reaction cycles: 1. uneconomical (overload mode due to spending reserves) is triggered by emotions; and 2. economical chemical cycle, in which energy reserves of the cells and the body are not put at risk. This is normal body operation corresponding to healthy state.

Health is provided by the body's own regulatory mechanisms. Therefore, the main focus should be directed to strengthen and build up the body reserves.

Work [3] proves the importance of modeling the functioning of particular organ systems, as well as an integral body.

Creating a science on disease and health mechanisms is the main topic of work [4]. Health is the result of training, while disease is detraining. With the weakening of external stimulus, body function is reduced, decreasing the request for the synthesis of new molecules. The protein mass, accumulated at a more powerful function, decays at the same rate. Disintegration of the protein overtakes its synthesis. This causes atrophy, function capability decreases, reserves become insufficient and the body organ is not able to cope with the additional workload. Thus, detraining determines the development of diseases. In training, which causes growing strength of the stimulus, backward processes take place. The functionality of cell or body grows. Mechanisms for structures training and detraining are multi-purpose. Health standard is the magnitude of life in normal environmental conditions and is determined by training level of structures. Health reserve is the variation limits of the external environment in which life still goes on. It is expressed in the "reserve capacity" that is gained through exercise, which is most effective when the strength of the stimulus approaches the boundary of the effort. For detrained structure, strong external stimulus turns it into the pathological mode, i.e. disease. For trained structure this is a normal hard operation. Normal (healthy) body operation needs energy and building materials; regular exercise, reduction of direct "poisoning" of cells by microbial and other poisons, as well as "slag" that is not removed due to circulatory failure and non-admission of direct damage to the DNA genes. The main cause of the human disease is "overeating, physical detraining, mental strain and the lack of tempering", rather than the external environment and society (p.59). There are two ways to recreate health disorders: with medication (artificial stimulation) and by mobilization of natural body defenses, increasing its total health capacity reserve and especially cardio-respiratory system.

To ensure the fitness and increase in reserve capacity, it is important to obey the following principles: a gradual approach, the principle of submaximal load, multiple repetition and training with the emphases on both the duration and the maximum load increase. Overtraining is dangerous, relaxation is important, because the cell's ability to exercise is not unlimited. The main things, when escalating the reserves, are bodily exercises for cardiovascular and respiratory systems (gas exchange system), as well as for the training functions of the muscles and joints. Normal load during the physiotherapy is not sufficient for increasing age-related problems. Load level should be controlled by the pulse rate. Equally important in building up the reserves is limiting the amount of food, ensuring at the same time the presence of microelement and vitamin content of natural components. Amosov concludes that lifestyle, ensuring achievement of health, is a mode of adequate physical activity and reasonable dietary restriction while maintaining and increasing the Level of Emotional Comfort.

In [5], author emphasizes that the health, in terms of the ability to fully live and work, is primarily a private matter of every human. Only one's own will is able to raise the level of his/her health.

Comprehensive work [6] presents the enhancement of brains capabilities, sense, subconscious and their selforganizing, activity and training abilities.

In [7] author discusses the crucial importance of cardiac capacity reserve to the health, as well as features and methods of heart training at different ages. Despite significant progress of clinical medicine, the number of cardiovascular diseases is not reduced significantly. The main problem concludes in detraining of people. Training regulates the relationship between fatigue and recovery processes. Moderate fatigue stimulates regenerative processes in the working bodies; one should strive for this condition. It is important that the load would not exceed the capacity of the organism (overtraining), when full recovery would be impossible. When detrained, even minor physical exertion does not stimulate regenerative processes. Physical exercise increases the efficiency of the circulatory organs, metabolism and reduces energy consumption required for maintenance of body tissues. Decrease in heart rate is a sign of the body's transition to a more advanced level of regulation. Training involves the activity of the whole body; it is possible to train memory, thinking, digestive system, etc. The impact of exercise increases the vitality of the body, postpones aging and prolongs life.

In [8] Amosov deepens his viewpoint on exercise as a heal-all for health and longevity. To prevent disease, it is important to train functions, broadening their adaptation limits. Emerging dysfunctions are consequences of insufficient training of the proper function in the preceding period of time and its insufficient accommodation (adaptation). That is why any disease is characterized to a greater extent by quantitative impairments (status of blood, urine, etc.) rather than qualitative. Increase in adaptive capacity improves health. Defense mechanisms, which are another important recovery component, evolve more slowly than constantly running normal body mechanisms. That is why it is important to accustom further exactly the defense mechanisms.

Work [9] provides information on the impact of physical activity on the heart and other organs, considering the issues of physical exertion physiology, prevention and rehabilitation of cardiovascular and other diseases by means of training programs. These include load tests, particularly tests, evaluating the functional status of the cardiovascular and respiratory systems that make it possible to evaluate human organism in terms of its readiness for physical activities and availability for carrying out household and professional responsibilities. Author identified the most rational training conditions, being the key to health and longevity. The following various loading modes are compared: 1. constantly acting loads of average level; 2. short-term intensive loads, alternating with periods of rest; and 3. constantly acting loads of high intensity. It is found that the 3<sup>rd</sup> type of load is extremely exhaustive. In the 2<sup>nd</sup> case the load becomes more exhaustive. Maximum healing effect has the load of 1<sup>st</sup> type with 60-75% of maximum aerobic capacity of the organism. Heavy loads pose a danger of overstressing the organism without increasing the training effect. Maximum training effect and quality recreation gives the 4<sup>th</sup> type of loads: intense exercise during 3-5 minutes, covering a large number of muscle groups and 3-5 minutes breaks for a light load that is more favorable than complete rest. For untrained people, the increase in heart rate over 30 beats per minute comparing to the rest rate is quite dangerous. Gradual increase of loads and strict medical supervision are of crucial importance.

In [10] author investigates the reserve capabilities of heart, as well as its training methods at different ages. Authors propose some simple methods for assessing heart condition at regenerative activities, providing stimulation of regenerative processes. They have obtained data showing that "pre-dosed use of so-called "contraindicative" exercises is most effective for health improvement" (p. 23). Complex specific exercise provides body with intensive training effect. The higher exercise complexity, the stronger the effect. Ordered physical exercises and suitable diet should be included in the human's pace of living to achieve better health.

Book [11] deals with the issues related to prevention and treatment of various diseases. Empirical observations "groped" leading dysfunctions in a number of diseases; though in severe stages, when "many functions are disturbed... our "blind" treatment is often ineffective" (p.5). Dysfunctions occur primarily because of detraining that is generated by hypodynamia - the main civilization's disease. Way to overcome physical inactivity consists in using prevention and rehabilitation programs of physical training. Important is the search of available self-control methods to determine the level of physical condition that correlates with the general health standard as an indicator determining performance efficiency and resistance to diseases. "Application of graduated exercise combined with dietary restrictions can give a good effect when preventing and treating the most chronic diseases. It has a direct relationship with the key problems of 20th century medicine" (p. 192).

In [12] Amosov shares personal experiences on maintenance of health and performance capability even at an advanced age, as well as describes how to overcome manifestations of old age. He regrets: "Medicine recovers some people, ... detrains others and makes them powerless against diseases" (p.12). To reduce the biological age, author practices "restrictions and loads mode", consisting of the following: 1. food - a diet with restriction of animal fats and sugar; 2. training and tempering - training and strengthening regulators of "stress-induced system"; and 3. mentality control and willpower.

In [13] Amosov narrates that at the age of 38 he has developed and began to practice a special complex of one thousand exercises a day to strengthen the health. Since the age of 79, Amosov, having congenital heart disease and withstanding several cardio surgeries, when feeling his old age, started an experiment on overcoming decline of life. This is impossible without good heredity, imperturbation (stresses significantly reduce the life), good morals and personal standards of hard work. People differ in their ability to strain [14]. With the increase of years, a human is functioning at a lesser extent. This causes detraining of his functional structures and genetically programmed aging accelerates. It will slow down significantly if a human will force himself to exercise.

In [15], when responding to the questions what health is and how to achieve it and maintain, Amosov destroys some concepts, established in medicine: "The less food the body gets, the more perfect is its metabolism" (p. 34). "Do not count calories and grams. Different ways of life stipulate different metabolism. It is impossible ... to develop an appropriate diet ..., the only tool one needs to follow, is scales" (p. 75). The most difficult problem for one's health is "struggling with own appetite" and detraining". When considering the issues of training, detraining, tempering and testing functional statuses, Amosov notes that the heart is the most vulnerable organ in physical training; thus, when increasing the load capacity, one needs to focus on heart condition (cardiac output).

Final Part: Health is the performance of the normal physiological programs of the body and the ability to fully live and work. There are two ways to achieve health: artificial, that is medicamental initiation; and natural, i.e. mobilizing the body defenses and increasing its reserve capacity. In severe stages of the disease, when many functions are disturbed, medication is often ineffective, because such violations result from insufficient training of functions - the inability to adapt to pathological effects [16, 17, 18, 19, 20, 21, 22, 23, 24]. Recovery of the body from pathology is facilitated by its increased adaptive capabilities, which are achieved by regular physical activity up to moderate fatigue that has to be reached for the stimulation of regenerative processes. One needs to train gastrointestinal tract as well. According to Amosov, the less food the body gets, the more perfect is its metabolism.

Different ways of life stipulate different metabolism and there is no unique diet - it is important just to monitor one's own weight. Thus, an adequate physical activity and reasonable dietary restriction mode is important to recover from diseases, prevent them and achieve a good health.

## CONCLUSIONS

According to Amosov, to achieve and maintain health, one needs to fulfill the following requirements: temperance in eating and restriction of animal fats and sugar; regular adequate exercise and tempering; high morality and personal standards of hard work. All this suggests the training as a universal heal to achieve health and longevity.

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## REFERENCES

 Amosov, N.M., 1963. Cybernetics and medicine (extended transcript of a lecture delivered at the "Knowledge" Central All-Union Society), Moscow, Knowledge, pp: 48.

- Amosov, N.M., 1964. Regulation of vital functions and cybernetics, Kiev, Naukova Dumka, pp: 115.
- Amosov, N.M., 1968. Modeling of complex systems, Kiev, Naukova Dumka, pp: 88.
- 4. Amosov, N.M., 1978. Thinking about health, Moscow, Molodaya Gvardia, pp: 191.
- Amosov, N.M., 1981. Thinking about health. 3<sup>rd</sup> edition, revised and enlarged, Kemerovo, Kemerovo Publishing House, pp: 176.
- 6. Amosov, N.M., 1979. Algorithms of mind, Kiev, Naukova Dumka, pp: 224.
- Amosov, N.M. and I.V. Muravov, 1982. Heart and bodily exercises, Moscow, Knowledge, pp: 64.
- Amosov, N.M., 1983. Human Nature, Kiev, Naukova Dumka, pp: 224.
- 9. Amosov, N.M. and Y.A. Bendet, 1984. Physical activity and heart, Kiev, Health, pp: 240.
- 10. Amosov, N.M. and I.V. Muravov, 1985. Heart and physical exercises, Moscow, Knowledge, pp: 64.
- Amosov, N.M. and Y.A. Bendet, 1989. Physical activity and heart. 3<sup>rd</sup> edition, revised and enlarged, Kiev, Health, pp: 214.
- 12. Amosov, N.M., 1996. Overcoming the age. Moscow, Be healthy, pp: 190.
- Visiting Dmitry Gordon: Nikolai Amosov, 2000. [Electronic resource], www.video.yandex.ru/search?filmId=H7mN-58wUXI&where=all&text=%D0%BF%D0% BE%D1%81%D0%BB%D0%B5%D0%B4%D0%BD %D0%B5%D0%B5%20%D0%B8%D0%BD%D1%8 2%D0%B5%D1%80%D0%B2%D1%8C%D1%8E%2 0%D0%B0%D0%BC%D0%BE%D1%81%D0%BE% D0%B2%D0%B0 (access date 25.09.2013).
- 14. Amosov, N.M., 2013. In the Borsyuk's TV talk show "SOLILOQUIES", 2001. "Soliloquies of N. Amosov". D a t e v i e w 2 2 . 0 9 . 2 0 1 3 . www.youtube.com/watch?v=tYytWDPQRAY.
- 15. Amosov, N.M., 2003. Algorithm of Health, Moscow, AST, pp: 224.
- 16. Murton, A.J. and P.L. Greenhaff, 2013. Resistance exercise and the mechanisms of muscle mass regulation in humans: Acute effects on muscle protein turnover and the gaps in our understanding of chronic resistance exercise training adaptation. The International Journal of Biochemistry & Cell Biology, 45(10): 2209-2214.

- 17. Murphy, M.H. and E.M. Murtagh, 2013. Physical Activity: Beneficial Effects. Encyclopedia of Human Nutrition (Third Edition), pp: 33-38.
- Smith, B.K. and E. Kirk, 2013. Resistance Training and Physical Exercise in Human Health. Nutrition and Enhanced Sports Performance, pp: 55-64.
- Roberts, E., F.K. Li and K. Sykes, 2006. Validity of the 6-minute walk test for assessing heart rate recovery after an exercise-based cardiac rehabilitation programme. Physiotherapy, 92(2): 116-121.
- Beniamini, Y., J.J. Rubenstein, L.D. Zaichkowsky and M.C. Crim, 1997. Effects of High-Intensity Strength Training on Quality-of-Life Parameters in Cardiac Rehabilitation Patients. The American Journal of Cardiology, 80(7): 841-846.
- 21. May, A.M., E. Van Weert, I. Korstjens, J.E. Hoekstra-Weebers, C.P. Van Der Schans, M.L. Zonderland, I. Mesters, B. Van Den Borne and W.J. Ros, 2010. Monitoring Training Progress During Exercise Training in Cancer Survivors: A Submaximal Exercise Test as an Alternative for a Maximal Exercise Test? Archives of Physical Medicine and Rehabilitation, 91(3): 351-357.
- Adams, B.J., J.G. Carr, A. Ozonoff, M.S. Lauer and G.J. Balady, 2008. Effect of Exercise Training in Supervised Cardiac Rehabilitation Programs on Prognostic Variables From the Exercise Tolerance Test. The American Journal of Cardiology, 101(10): 1403-1407.
- Carlson, J.J., J.A. Johnson, B.A. Franklin and R.L. Vander Laan, 2000. Program participation, exercise adherence, cardiovascular outcomes and program cost of traditional versus modified cardiac rehabilitation. The American Journal of Cardiology, 86(1): 17-23.
- Garza, K.B., C.V. Harris and M.S. Bolding, 2013. Examination of value of the future and health beliefs to explain dietary and physical activity behaviors. Research in Social and Administrative Pharmacy, 9(6): 851-862.