

NASA TECHNICAL MEMORANDUM

NASA TM-77202

LIFE IN MOTION, IN MOTION!

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Translation of "V dvizhen'ye zhizn', v dvizhen'ye!",  
Zdorov'ye (Moscow), No. 5(317). 1980, pp. 7-8.



(NASA-TM-77202) LIFE IN MOTION, IN MOTION!  
(National Aeronautics and Space  
Administration) 7 p HC A02/MF A01 CSCI 06C

N83-24136

Unclas  
G3/51 11620

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
WASHINGTON, D.C. 20546 MARCH 1983

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STANDARD TITLE PAGE

1. Report No. NASA TM-77202		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle LIFE IN MOTION, IN MOTION!				5. Report Date March 1983	
				6. Performing Organization Code	
7. Author(s) Ye.A. Kovalenko				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address Leo Kanner Associates Redwood City, California 94063				11. Contract or Grant No. NASw-3541	
				13. Type of Report and Period Covered Translation	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration, Washington, D.C. 20546				14. Sponsoring Agency Code	
15. Supplementary Notes Translation of "V dvizhen'ye zhizn', v dvizhen'ye!", Zdorov'ye (Moscow), No. 5(317), 1980, pp. 7-8.					
16. Abstract A 120 day limited mobility experiment with young male rats and its results, including retarded growth and degenerative changes in the cardiac muscle, are described. A 120 day strict bedrest experiment with 10 human volunteers and its results are described and discussed. Early subjective complaints, subsequent adaptation and eventual progressive changes in excitability and reactivity, reduction in functional capability of the cerebral cortex, and disturbances in water-salt, protein and fat metabolism, including development of precursors of atherosclerosis, as well as poor results of the orthostatic test after 4 months, are presented. These results are explained as applied to sedentary workers and recommendations are given for such persons to exercise in the morning, at work and in the evening in order to prevent hypokinesia and its physical, mental and physiological effects					
17. Key Words (Selected by Author(s))				18. Distribution Statement This copyrighted Soviet work is reproduced and sold by NTIS under license from VAAP, the Soviet copyright agency. No further copying is permitted without permission from VAAP.	
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages	22.

## LIFE IN MOTION, IN MOTION!

Ye.A. Kovalenko

In our century of the atom and space, electronics and chemistry, /7\* mechanization and automation, "intelligent machines" which ease labor in industry and in life, the fate of man is less and less physical effort. His role is gradually being reduced to control and monitoring of the action of his mechanical assistants. After transferring the major part of the physical work to them, modern man began to experience a tremendous deficit of motion. He was not forced to expect the results: the motor deficit gave rise to hypokinesia or hypodynamia, a state caused by a reduction in the amount and force of muscle contractions, which threatens human health.

Hypokinesia, which has become a mass phenomenon, is called the disease of the century. Extensive, convincing experimental and clinical material is evidence of the destructive effect which it has on practically all organs and systems of the body. I tell of only two experiments.

Young rats were divided into two groups. The animals of the first group were placed in narrow cages which sharply limit movement for 120 days. The rats of the control group moved freely. It turned out that the gas and energy metabolism of the rats, the motor activity of which was restricted (hypokinetic), changed and they began to lag behind the control group animals in weight and growth. In 100 days, the active rats increased in weight an average of 150 and the hypokinetic rats only 7 grams. /8

In a series of additional tests of the animals, they were completely immobilized, and they then began to deteriorate catastrophically. The reason? Serious disruption of metabolism in the mus-

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\*Numbers in the margin indicate pagination in the foreign text.

cles, as a result of which the plastic processes slowed down and the weight of the muscles decreased. But the heart also is a muscle! Hence the absence of motion did not pass without trace for it. In the cardiac muscle of the immobilized rats, the investigators found degenerative changes: individual sections of muscle tissue degenerated into connective tissue, which never again becomes working muscle tissue.

This experiment indicates how negatively the lack of sufficient motor activity affects performance, mental activity and health of man. Ten volunteers lay in a strictly horizontal position for 120 days. They were only permitted to turn from side to side and from the back to the stomach. Eating, physiological functions and hygienic procedures were all performed in the horizontal position. A strict account was kept of foodstuffs and water consumed and wastes.

It would have seemed that they had to lie down and rest. Yet the volunteers began to complain on the second or third day of headache, pain in various parts of the body and difficulty in falling asleep. By the end of the first week, pain and unpleasant sensations decreased, the test subjects began to be quieter, and they adapted to hypokinesia. Moreover, it continued to have its effect on the body. In weeks 4 and 5, the specialists recorded deviations in activity of the nervous system, primarily of its vegetative sections, changes in behavior of the volunteers appeared, and the sleep function was disrupted. These phenomena increased all the time and, by the end of the second month, clear vegetative-vascular disfunction and neuropsychiatric asthenization (collapse) were noted.

From the second to the middle of the fourth month, progressive changes in excitability and reactivity, a reduction in the functional capabilities of the cerebral cortex (rapid fatigue, distortion of responses and rapid onset of somnolence) were observed.

Disturbances of the water-salt, protein and fat metabolism also were found in the volunteers. The cholesterol and lipid content of

the blood increased, i.e., the actual prerequisites for the development of atherosclerosis appeared.

The so called orthostatic test proved to be very difficult for them. It only consists of immediately standing from the prone position. This test was conducted at the end of the fourth month, and it turned out that the orthostatic stability of the test subjects deteriorated so much that brief loss of consciousness of four of them was observed in the attempt to stand.

It is completely understandable that the locomotor system suffered from the inaction. But why are the negative consequences of hypokinesia not limited to weakening of the muscles and ligaments which, it would seem, alone are concerned with movement, and why do they extend to nearly all the remaining body functions? One of the main reasons is the lack of nerve impulses which, in any movement, rush from the working muscles and joints to the brain and stimulate its activity. There is no stimulation, and the performance of the brain is sharply decreased. Since the activity of all organs is controlled and directed by the highest center, the brain, with reduction or the lack of monitoring their distinct smooth performance is upset.

"But actually the conditions of the 10 volunteers are practically not found in life," the reader may object, "hence all these 'horrors' do not threaten us."

No they are a threat! Actually, even the most inveterate lazybones moves more than the test participants. But the fact is that the incomplete restriction of required motor activity ultimately leads to almost the same result as in the experiment. The physical and mental performance of a man deteriorate, sluggishness develops, he begins to suffer from insomnia, lack of appetite . . . In a word, the body weakens and a background is created which predisposes to the development of disease. It is not accidentally that specialists call hypokinesia a risk factor and consider it one of the causes of such severe diseases of the cardiovascular system and metabolism as hypotension,

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atherosclerosis, ischemic heart disease, polyarthritis, spondylitis deformans and others.

Today, even in the hospital, physicians reduce the duration of bedrest by introducing early motor activity and therapeutic physical culture in many diseases, even in myocardial infarction. As clinical experience shows, the establishment of a reasonable motor schedule with the functional condition of the body of the patient taken into account accelerates recovery and protects the patient from the unfavorable aftereffects of hypokinesia. This is all the more important that it is practically impossible to control hypokinesia by means of pharmacological agents. There is no medicine for it in a single phar-

macy, although it is very simple, motion.

Specialists consider that modern man (especially those who work seated) must set aside approximately 10 hours a week for physical exercises to make up for the shortage of muscle loading and compensate the motor deficit.

The day should be started with gymnastics. So much proof is in favor of it that it should be thought that there is no need to do this again. I wish only to state that it is simple to make up a gymnastic set oneself, guided by those exercises which are proposed by Central Television, radio and special popular publications.

Be sure to arrange physical culture breaks once or twice during the work day. When you work behind a desk or kuhlmann and you feel that you are tired, your back aches, it has become more difficult to concentrate and hence time itself does not exist, do not smoke a cigarette or drink a cup of coffee! Do a few simple exercises after ventilating the room. It is better to do such exercises one and a half to two hours before the dinner break or before the end of work. Do not regret 5-7 minutes for exercises. They help fight fatigue and restore efficiency.

The fatigue accumulated during the day can be removed in the evening by exercises. In distinction from the morning warmup, it is called relaxing. Do some slow, easy exercises for 10-15 minutes at least one and a half to two hours before bedtime. If possible, after relaxing walk in the fresh air and shower before going to bed.

These exercises should be regular. Try not to miss a single day without a special reason for it. In addition, ski, swim, join a health group, and if there is a garden plot work in it. In a word, try to find gaps in the solid wall of everyday affairs and utilize any possibility of moving.

For example, you stand ten minutes at the bus stop waiting for a

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bus. Don't get tired. Two or three stops can and even must be traveled on foot. Unfortunately, many do not take walking seriously but, among other things, this is an excellent means of conditioning the cardiovascular, respiratory and nervous systems. Walking like other types of physical activity improves metabolism and prevents obesity. It is accessible to everyone, it does not required special training and it knows no season.

As desired, that minimum physical load which cannot be avoided is easily entered in the daily routine of any person. It is only necessary to reduce the television viewing time or the time sitting on the couch and involve exercises and sports breaks, working gymnastics and walking, active recreation after work and on days off in the control of hypokinesia. It is only necessary once and for all to understand that, without regular conditioning, without physical activity, health is unthinkable. Life in motion, in motion!