

ПЕТР КУЗЬМИЧ АНОХИН – МОЙ УЧИТЕЛЬ

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В работе приведены биографические и исторические факты, отражающие научную среду, в которой жили и работали автор и его учитель П.К. Анохин. Анализируются дискуссии вокруг положений и идей теории функциональных систем. Живым языком передана атмосфера научного творчества, которая в текстах научных статей обычно не присутствует. Приводятся малоизвестные и неопубликованные ранее факты и фотографии из архива автора, представляющие как исторический, так и научный интерес, и не утратившие своего значения до настоящего времени.

Ключевые слова: теория функциональных систем; физиология; нейрохимические механизмы нейронов; физика; системный подход; рефлексорная теория; системная деятельность организма.

PYOTR KUZMICH ANOKHIN – MY TEACHER

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The article presents biographical and historical facts reflecting the scientific environment in which the author and his teacher P.K. Anokhin lived and worked. Discussions around the positions and ideas of the theory of functional systems are analyzed. The living language conveys the atmosphere of scientific creativity, which is usually not present in the texts of scientific articles. The little-known and unpublished facts and photos from the author's archive, which are of both historical and scientific interest, and have not lost their importance to date, are given.

Keywords: theory of functional systems; physiology; neurochemical mechanisms of neurons; physics; systemic approach; reflex theory; systemic activity of an organism.

This year marked 45 years since organization of P.K. Anokhin Research Institute of Normal Physiology. My life and my destiny appeared to be tightly linked with the name of a prominent Russian scientist, laureate of the Lenin Prize, academician Pyotr Kuzmich Anokhin. And this is I want to tell about in this article.

I was lucky to be a student and to listen to remarkable lectures of P.K. Anokhin. After

finishing I.M. Sechenov First Moscow Medical University (the First MMI) I became a postgraduate student of P.K. Anokhin, and after that for many years I worked at the department of normal physiology of the University headed by P.K. Anokhin. That was one of the best periods in my scientific-pedagogical work. Many vivid reminiscences of the work under guidance of P.K. Anokhin remained in



my memory. It is impossible to describe all of them in this article. I will settle upon several very important for me events that, thanks to P.K. Anokhin, determined my destiny and scientific and pedagogical activity.

When being a second year student, I came to the department of normal physiology and joined the students' scientific circle. I was carried away by that atmosphere and by the spirit of creative interest and activity prevailing at the department and in scientific laboratories. P.K. Anokhin was surrounded by his colleagues and pupils, well-known scientists and brilliant teachers: V.A. Shidlovsky, N.I. Shumilina, E.L. Golubeva, K.V. Shuleikina, V.N. Shelekhov, I.V. Orlov, K.V. Sudakov and others. Lectures of P.K. Anokhin and of his colleagues were fascinating, they were penetrated by the scientific passion of studying the brain, purposive behavior, functions of a living organism. P.K. Anokhin introduced a systemic approach into physiology and in general into the science that was translated into his theory of the functional system. Being a pupil and a co-worker of I.P. Pavlov, P.K. Anokhin expanded the reflex theory, described the systemic activity of an organism aimed to a useful adaptive final result, that was described in his monograph «Biology and Neurophysiology of Conditioned Reflex» [1]. The founder of cybernetics N. Wiener confessed that the theory of functional systems was 12 years ahead of its development.

My student scientific life started with an experimental work at the department of normal physiology. To do that work, I came to the department in the evenings after classes 1-2 times a week. P.K. Anokhin usually liked to stay at the department until late. One may say that at that time experimental work of the assistants and postgraduate students continued day and night. I got acquainted with P.K. Anokhin in one of such evenings when he, by his habit, went round the scientific laboratories. I was sitting at a table and assembling an experimental setup. P.K. Anokhin

quietly came in, stood beside me, asked me something and also quietly left the laboratory. This happened several times during the academic year. I was not sure if P.K. Anokhin recognized me after those short meetings when we occasionally met in the vestibule moreover that there were many students at the department who succeeded in scientific work. But one day, at the end of the academic year, when I came across P.K. Anokhin, he told me to come to his office. When I came, he said: «I want to offer you a job of a senior lab assistant». That flattering remark was absolutely unexpected for me. I found myself at a loss and said: «Petr Kuzmich, I am studying at the institute, what will I have to do?» «What you did before», was the answer. I thanked Petr Kuzmich for his attention and care but said that I had a dream to enter the physics faculty of M.V. Lomonosov Moscow State University for to obtain, along with medical education, one more physico-mathematical education.

P.K. Anokhin did not turn a deaf ear to my request and wrote a letter to Vice-President of the Academy of Sciences of the USSR, academician A.I. Berg, who in his turn addressed the Minister of Higher and secondary education and asked him to give me a chance to enter the department of evening studies of the physics faculty of M.V. Lomonosov MSU. The Minister agreed and on an exceptional basis sent a letter to M.V. Lomonosov MSU (Figure 1). Then I passed the entrance exams on the same basis as everyone else, and, fortunately, entered the university and began to study at two higher educational institutions: at the medical at daytime, and at the physical faculty in the evening. I should say, it was very difficult to study because there often happened to be two simultaneous non-coordinated with each other examination sessions: for example, today I had an exam on obstetrics, and tomorrow my exam was on higher mathematics. In this way the first fateful period in my life started that was determined by P.K. Anokhin.

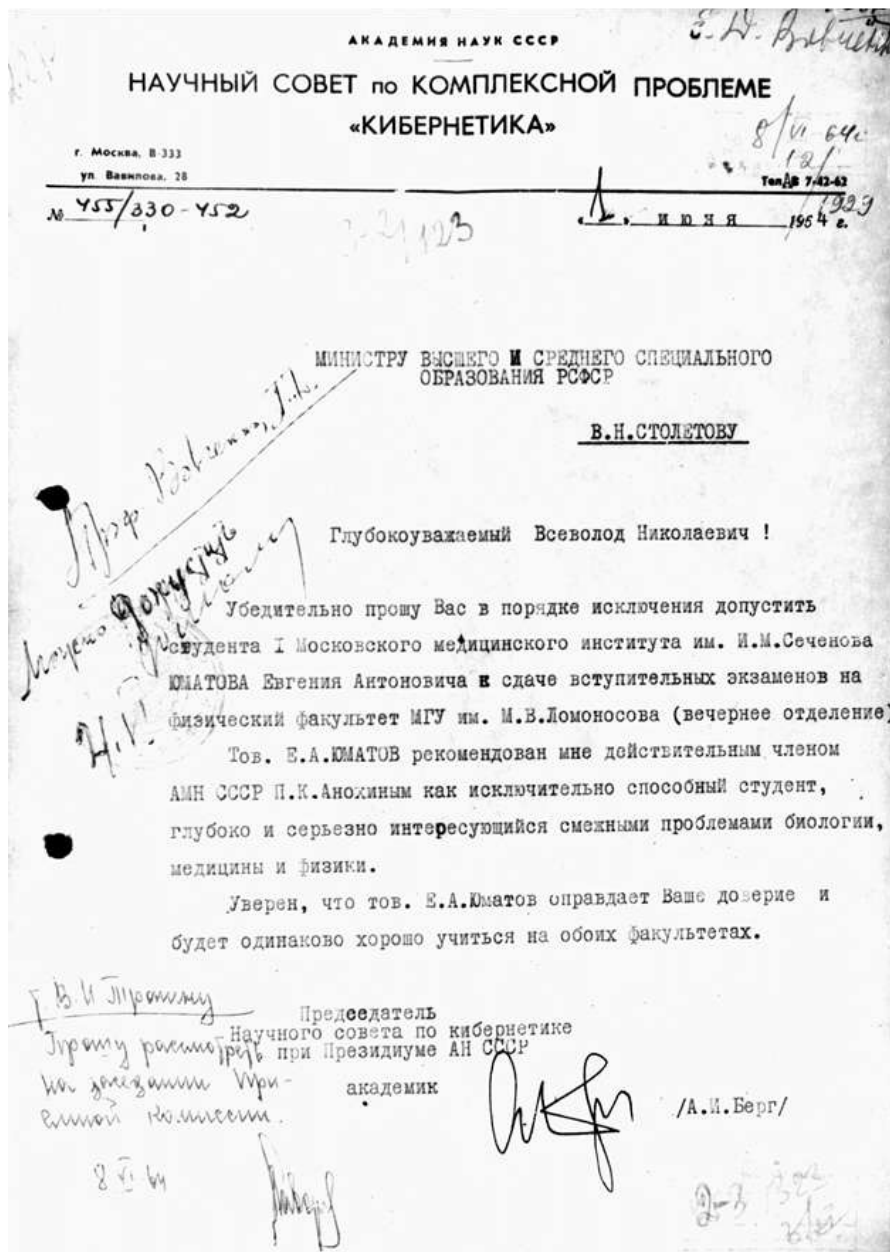


Fig. 1. Recommendation letter for admission to M.V. Lomonov MSU

The second most important period of my life associated with P.K. Anokhin, began after graduation from I.M. Sechenov First MMI. When giving his recommendation for my admission to the M.V. Lomonosov MSU, P.K. Anokhin said: «After finishing the medical institute, come to my doctoral courses». Thus I became a postgraduate student of P.K. Anokhin and V.A. Shidlovsky in medical biophysics at the department of normal physiology of First MMI. During my postgraduate studies I had regular meetings with

P.K. Anokhin. We met at his lectures, at the meetings of the department, at weekly scientific conferences of the department which were of great significance for formation and perfection of scientific logical thinking.

According to my observations, P.K. Anokhin was a highly creative, enthusiastic sort. In his room some ‘paper chaos’ was always present that was clear only to him. Books, journals, documents were everywhere – on the tables, armchairs, a sofa. P.K. Anokhin could cast aside unnecessary, minor things

and concentrate on the important matter. P.K. Anokhin usually came to his office in the second half of the day. In the reception room his colleagues were already waiting for him. It often happened that P.K. Anokhin, having already planned something important for himself, cancelled these meetings. It was not always easy for colleagues to have a personal meeting with him. A person usually knocked at the door and asked for permission to come in for a conversation, but Petr Kuzmich absorbed in his work, often asked him to come later. I noticed that if after greeting him at the door a person immediately started a conversation concerning some idea, scientific article or scientific fact, Pyotr Kuzmich instantly responded and invited the person to his room: «Yes, come in, let's talk».

Our personal communication with P.K. Anokhin and discussions in his office reached the highest level when I was completing my Candidate's dissertation, before its defense. My dissertation was about multiparametrical regulation. As it was shown by experiments, a functional system, where several interrelated parameters are simultaneously regulated, does not maintain the constancy of each parameter. This system has an internal contradiction: the better it maintains the constancy of one of the controlled parameters, the higher is deviation from the norm of other parameters. The multiparametrical system maintains the integral result that consists of certain deviations from the norm of each controlled parameter [2,3]. In the first stage of our discussion P.K. Anokhin objected: «I always prove that the functional system maintains the controlled parameters constant, and you write that it is not so». I was arguing: «This is true about a system having one controlled parameter. In the given case the system is multiparametrical, its final result consists of several controlled parameters».

Can you imagine an argument of an academician with a postgraduate student, and the end of this argument? But I had nowhere to retreat, there were experimental facts behind

me, and I could not write anything different. In result of the fruitful democratic discussion P.K. Anokhin agreed with my arguments and conclusions and signed the manuscript of the extended abstract of the dissertation which I keep as an evidence of true and objective attitude of a real Scientist to science. At the defense of the dissertation P.K. Anokhin highly appreciated my work. Discovered by us principle of multiparametrical regulation in functional systems with many controlled parameters and in the intersystem interrelations is now universally recognized [2,3].

It also happened that P.K. Anokhin kept articles and extended abstracts of dissertations of the workers of the institute for a long time without signing. I think it was so because they did not arouse his interest and he postponed their reading until later time. I was lucky, P.K. Anokhin rapidly signed my works, in 1-2 days. Numerous personal meetings with P.K. Anokhin remain unforgettable and very important events for me (Figure 2).

P.K. Anokhin often came up with revolutionary ideas and scientific concepts that were ahead of the time: theory of systemogenesis [4], a concept of intraneuronal information processing published in the article «Systemic Analysis of Integrative Activity of Neuron» where the main ideas about intraneuronal molecular processes were formulated [5]. Of interest was the discussion on this problem between academicians P.K. Anokhin and P.G. Kostyuk that was held in the physiological lecture hall of the First MMI and became for me a vivid example of far-sightedness and firmness of P.K. Anokhin in holding his principal scientific positions. P.K. Anokhin emphasized the limitedness of the existing synaptic theory of electrical processing of information on the neuronal membrane, and mustered arguments that proved existence of intracellular neurochemical mechanisms of the integrative activity of neuron. P.G. Kostyuk supported the synaptic theory of electrical processing of the information on the neuronal membrane and categorically



Fig. 2. P.K. Anokhin and E.Yu. Yumatov

denied the probability of existence of intracellular neurochemical mechanisms of integrative activity of neurons.

Modern achievements of neurophysiology and molecular biology showed who was right. It would seem that young scientists propose revolutionary progressive ideas, and older scientists usually keep to conservative views. In that discussion everything was vice versa. A sound scholar P.K. Anokhin introduced advanced concept and a new trend into neurophysiology, and a younger scientist P.G. Kostyuk left a different memory of himself. Paradoxically, several years later, academician P.G. Kostyuk began to successfully study intracellular neurochemical mechanisms of neurons [6] which he had denied in discussion with P.K. Anokhin, but he never mentioned P.K. Anokhin's priority.

The truth of the scientific position of P.K. Anokhin was confirmed in the works of his grandson – K.V. Anokhin who with the co-workers within several years actively studied molecular intracellular mechanisms of the integrative activity of a neuron associated with cognitive functions and memory [7].

In the 70s of the 20th century of great interest for the scientific community were open discussions of the known representatives of different scientific schools. I well remember one such discussion with participation of

P.K. Anokhin and a corresponding member of the Academy of Sciences of the USSR E.A. Asratyan. Unfortunately, today such open direct scientific discussions are for some reason no longer practiced in lectures and plenary reports of famous scientists.

The outstanding scientific contribution of P.K. Anokhin cannot be overestimated. He opened a new page in development of science which found the widest reflection in physiology, medicine, in sports, in labor, etc. At that time a galaxy of well-known scientists emerged from P.K. Anokhin's school: K.V. Sudakov, V.B. Shvyrkov, K.V. Shuleikina, B.G. Zilov, V.V. Rayevsky, S.N. Khayutin, E.A. Umrjukhin, V.V. Sherstnyev, B.V. Zhuravlyev, V.I. Badikov, Yu.I. Aleksandrov, that made a significant contribution to physiology.

The theory of functional systems of P.K. Anokhin became for me the fundamental basis for research and scientific developments in different directions of physiology and medicine. Resting on the theory of functional systems, systemic mechanisms of resistance to the emotional stress were discovered [8]; a new trend – information medicine was proposed, unique microprocessor-based electronic devices ('Health guardians') were designed and patented to protect life and health of people in everyday life, 'Dynamic theory of emotions' was formulated [11], conceptual ideas

of the origin of the mental activity of the brain were proposed [13-15].

The name of P.K. Anokhin is given to Research Institute of Normal Physiology which continues developing the creative heritage of P.K. Anokhin on the modern level. For many years P.K. Anokhin Research Institute of Normal Physiology was headed by his pupil, academician of RAS K.V. Sudakov who successively developed the theory of functional systems [16,17]. At present the Institute is headed by a corresponding member of the Academy of Sciences S.K. Sudakov who preserves scientific traditions of P.K. Anokhin's school and develops systemic concepts of reinforcement mechanisms [18]. In P.K. Anokhin's school the next scientific generation of young scientists appeared among which there are a corresponding member of the Academy of Sciences S.S. Pertsov, Grand PhD in Medical sciences A.E. Umryukhin who continue studying the systemic

mechanisms of the emotional stress [1,20].

Conclusion

Progress and development of science not only depends on scientific ideas of scientists, technical equipment and organization of research work, but, what is very important, on formation of scientific schools, creative teams, open and free scientific discussions, correct and objective attitude of the scientific community to scientists and their achievements. Unfortunately, in recent years the balance between all these aspects of the scientific activity is deranged which inevitably influenced the productivity of scientific research.

The fundamental factor of development of science is revival of creative scientific group without which the scientific progress is impossible. It is reasonable to expand free scientific discussions, an example of which was creative atmosphere in the school of academician P.K. Anokhin.

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