



A dangerous occupation
Zhores Medvedev

Early life and education in Soviet Russia during the second world war and immediate post-war years, and the influence of Trofim Lysenko on Soviet science. This essay was published in the Mill Hill Essays 2010.

ISBN: 978-0-9546302-8-9

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The Master and Margarita

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In December of 1938 my family and I - my mother Yulia and my twin brother Roy - were evicted from our Moscow apartment following the arrest of my father Aleksander Medvedev, who was a professor at the military academy during the final stages of Stalin's "Great Terror" campaign of 1937-38. My father had been arrested in August as a supporter of Nikolai Bukharin, a communist leader who had opposed Stalin's plan of forced collectivisation in agriculture, and he was sentenced in December to eight years of hard labour. As the family of an 'enemy of the people' we therefore lost the right to live in our apartment, which belonged to the military academy. We moved to Rostov-on-Don to live with my aunt Nadia and my grandmother, who was very ill and partially paralyzed after a stroke five years earlier. Nadia was a single mother with a 5 year old daughter, so there were six of us living in a one-bedroom flat. My mother, who was a cellist, managed to find a job at the local theatre.

When the German army invaded the USSR on June 22, 1941, I was 15 years old. Three months later German troops occupied Taganrog, a port town only 100 km from Rostov. Two weeks before Rostov was taken by the Germans we fled, this time to Tbilisi, leaving all our possessions behind. In Tbilisi, the city where I had been born in 1925, I had an aunt and an uncle. Our Tbilisi aunt was a piano teacher and she lived with her husband and two daughters in a comfortable three-bedroom apartment. Our uncle Misha's family also lived in Tbilisi and my brother Roy moved to live with them. By the end of 1941 our family suffered further great losses. My grandmother died of heart failure at the age of 69 and my uncle Misha died in a typhoid epidemic; he was only 41.

Why ageing?

My interest in the problems of ageing and longevity developed in 1939 when I was still at school. The main influence on me was a book by an American biologist, Paul de Kruif, called *Microbe Hunters* - a brilliantly written collection of biographies and achievements of famous scientists. I was also attracted by the biography of Elie Metchnikoff, the great Russian scientist who discovered phagocytes and immunity. Metchnikoff's book *The Prolongation of Life: Optimistic Studies* was originally published in Russia in 1908 and was reprinted many times. His ideas about ageing as a treatable pathology were immensely inspiring. Metchnikoff coined the term 'gerontology' for the new science of ageing and longevity. Ageing research was very popular in the USSR at this time because the Census of 1939 declared the Caucasus as the world centre of longevity. This legend about Georgian and Abkhazian longevity survived until 1975.

During 1942 at school I continued my study of ageing and was a regular reader at the Tbilisi State Library. Another book which influenced my thinking at that time was a brilliant monograph: *The Problem of Ageing and Longevity*, by A. V. Nagorny, a Professor at Kharkov University. It was probably the best book on

ageing at that time and presented a comprehensive analysis of age-related changes, as well as a review of existing theories.

On 1st February 1943 I received call-up papers for military duty although I was only 17 years old and still at school. The Red Army was liberating the North Caucasus and approaching Rostov, and so the age for entering active military service was lowered by a year. After three months of intensive military training I became a private in the 169th infantry regiment at the Taman Front, the southernmost part of the Soviet-German emplacements. Novorossiysk, an important Soviet port on the Black Sea, was still in German hands and an offensive was planned to liberate it at the end of May. After intensive artillery and air bombardment of German positions, three Soviet armies (21 divisions) attacked the German "Blue Line" which was defended by 17 German divisions and two brigades. We quickly overran the German trenches and moved on. Twelve kilometres behind the first line of German defences was another line that was better prepared. As a result the Soviet troops were stopped and unable to take the city, still 40 km away. We hastily dug out individual trenches, which were really nothing more than holes in the ground, and stayed put. On the next day we repelled the German counterattack but with heavy losses for both sides. My own experience of active fighting continued for only one week longer. I was wounded in my right foot on June 1st; and our company was reduced to only 20 men. Before the attack against German positions there had been 150 men in the company. Novorossiysk was finally liberated in October.

Biology, medicine or agronomy?

After treatment in three military hospitals my right foot had healed just enough for me to walk without crutches, using a cane, and so I boarded the train for Moscow. I arrived in Moscow at the beginning of January 1944 with an intention to enter Moscow University's Faculty of Biology. It was the middle of the academic year, but I had no choice.

The Dean of Biology at the University greeted me warmly. He was ready to designate me as a "candidate" at the beginning of the academic year in October. At that time there were very few male students. A temporary rule gave invalids and veterans of the war the right to enter universities without entrance examinations or competition. However, because the University did not have a hostel for students, it would have been necessary for me to rent a room. Finding accommodation in Moscow in 1944 was nearly impossible and extremely expensive; my small war invalid's pension was certainly not enough. There was also food rationing and because ration cards had to be linked to a permanent address, a place at a student hostel turned out to be a necessity. I was therefore unable to take up the University place.

My next destination was the Medical Institute. The Director of the Medical Institute was impressed with my knowledge of medical problems and was also ready to give me the status of "candidate". But again there was no accommodation for undergraduate students. All student hostels which were part of the Institute campus had become military hospitals.

There was still one possibility for education in biology – the K.A. Timiriazev Moscow Agricultural Academy. The programme of the academy included botany, zoology, organic chemistry and biochemistry, physics, plant physiology, genetics, and microbiology. Since plants and farm animals also age, I reasoned that I would be able to study ageing here just as well as at the university. The Timiriazev Academy, nearly 100 years old, occupied a very large plot of land in a suburb of Moscow and had 25 buildings, both old and new, as well as several blocks of student hostels, a park, ponds, experimental fields, a forest and several animal farms and museums. The dean of the main Faculty of Agronomy, Professor Nikolai Maisurian, welcomed me as a friend. Like me, he was also born in Tbilisi and realised how difficult it was to reach Moscow from there. He offered me candidate status, a temporary job at the experimental station and a bed in the student hostel (each room there was shared by four undergraduates). This offer solved all my problems. The academic year started on October 1st. There were two hundred undergraduates in the first year at the agronomic faculty who attended lectures, but only six of them were male. Four were war invalids, one was handicapped, and the sixth had tuberculosis. The other faculties were not much different. There were five faculties with horticulture the most popular.

Professor Petr Mikhailovich Zhukovsky

Different departments of the academy usually welcomed undergraduate students to remain at the laboratories and to receive some subject tuition or even to take part in some research projects. There was also a "Student Science Society". During the spring of 1945 this Society decided to organize a student science conference, a tradition that had been interrupted by the war. I did not have any research results to report yet but I did submit a handwritten paper anyway. It was a hypothesis concerning the question of how the plant vegetative growing point, which consists of an apical or primary meristem (the group of rapidly dividing embryonic cells), is transformed from the vegetative growing point into a flowering shoot under the influence of certain factors such as short or long days or cold weather (for winter crops). The problem of how the leaf-producing tissues change abruptly to flower-producing ones was the main puzzle not yet solved. The chairman of the conference who had to read papers or abstracts and select some for oral presentation was Professor Petr Zhukovsky, the famous botanist whose lectures for first year students were very popular. In 1943 he had been awarded the Stalin Prize in science. His textbook on botany was considered to be the best. Every week first year students not only had a lecture on botany, but also a practical seminar where we used to work with different plants, with herbariums, got experience using a microscope, worked in the greenhouse etc. Zhukovsky already knew me, since I was the only man in a group of 20 students at the practical seminars of different departments. After one of the botany seminars I was invited to the professor's office. Zhukovsky greeted me in a very friendly manner.



Professor Petr Zhukovsky

Zhukovsky made some positive comments about my paper: "It is written with good scientific language. Let's test your theory together", he suggested, "we have a laboratory of plant embryology at our department. We'll give you a good microscope. You do need to learn a lot." The next day I came to the laboratory and found it was a large room with different microscopes and other equipment and the smell of toluene.

Two weeks later the war was over.

The Nikitsky Botanical garden

While continuing to study a number of subjects, I worked intensively at the plant embryology laboratory. I was also given a small space in the Department of Organic Chemistry for analytical procedures. At the end of 1945, a lot of new laboratory equipment was arriving from Germany as "war reparations", including modern Zeiss microscopes, Jena laboratory glass and many chemicals. Professor Zhukovsky was fascinated by a 1939 German study of unicellular algae, *Chlorella*, which showed that the male and female cells contained different compositions of carotenoid pigments. It was suggested that these pigments, or products of their metabolism, might play a role in the sexual differentiation of plant cells. It was known that there were several hundred different carotenoids, but their role in plant tissues was not well established. Zhukovsky asked me to collect all available literature on the problem in English, since he did not know

the language although he was fluent in French and German. I made nearly one hundred translations for him from material I found in the main state library and he wrote a review entitled "The role of light and carotenoids in the development of asexual and sexual generations of plants" (in Russian) which was soon published in an academic journal under both our names. It was my first scientific publication.

At the beginning of 1948 Zhukovsky arranged a six month research assignment for me at the laboratory of plant biochemistry of the Nikitsky Botanical Garden, near Yalta in Crimea, to study the composition of carotenoid pigments in the male and female organs of different plants. It had been founded by Tsar Alexander I as an "Imperial" botanical garden in 1812. Thanks to the subtropical climate and extensive space, nearly 10 square kilometers, by 1947 more than 50,000 species and varieties were collected in this garden, including different sorts of olive trees, grapes, fig trees, palms and decorative trees, such as the Lebanon cedar and Ginkgo biloba. When I arrived, at the beginning of April 1948, the head of Biochemistry was Professor Vasily Nilov, a good friend of Zhukovsky. I was given a small room at the laboratory and a single room in a guest house for research visitors. A modest salary was also provided in addition to my student stipend and invalid pension.



Zhores Medvedev

Since 1946 the Nikitsky Botanical Garden's biochemistry laboratory was focused on the quest for plant extracts with antibiotic activity. Extracts and evaporation products from different plant tissues were tested for their antibacterial effects. My work was different but extremely absorbing. I was collecting samples of male and female parts of different plants and analysing their carotenoid diversity. There is a great variety of sex types among plants: hermaphrodite (selfpollinating), bisexual and heterosexual, with male and female plants growing separately. To identify individual carotenoids I used paper and column

chromatography, at that time a new and exciting analytical technology. Nearly every week I would prepare a detailed report of results which I mailed to Professor Zhukovsky in Moscow. I also greatly enjoyed all the opportunities offered by the Black Sea coast, with the beach only a ten minute walk from my house. This idyllic life, however, was suddenly interrupted on August 1st, the day when *Pravda*, *Izvestia* and other central newspapers (distributed throughout the country by air) published a lengthy report by Academician Trofim Lysenko entitled "On the Situation in Biological Science". It had been presented at a special session of the Lenin Academy of Agricultural Sciences on 31st July 1948. Lysenko was at the time the president of this academy.

The August coup

In the entire history of the USSR this was an unprecedented occurrence. Never before had a scientific report, even by scientists at the highest level, been published simultaneously and in its entirety in government and Party papers, which amounted approximately to sixty million copies. Normally only Reports of Central Committee Secretaries at Communist Party Congresses or Plenums would receive this treatment. This meant therefore that the Lysenko Report was made on behalf of the Central Committee and had been approved by Stalin and the Politburo, which were the main policy-making and governing bodies in the USSR. Yet the main content of Lysenko's work was primitive pseudoscience that returned biology and all related sciences to the past, going back 150 years to Lamarckian ideas according to which acquired characteristics can be inherited. At the centre of Lysenko's Report was a declaration that theories of heredity, based on discoveries by Mendel, Morgan and the ideas of Weismann, were reactionary, idealistic and bourgeois. The chromosomal theory of inheritance and the existence of genes and germ lines were all rejected. All explanations of the significance of meiosis and mitosis were dismissed as irrelevant, and those who continued to believe in these theories were now to be regarded as reactionaries, idealists, and carriers of a bourgeois influence in Soviet science. Only those who accepted, without qualification, the concept of heredity developed by Lysenko would be considered to be materialists and representatives of progressive science.

In the next few days the newspapers published shortened versions of the debates on the Lysenko report. Most speakers had risen in support while some were even more radical, treating Morganists-Mendelists- Weismannists as "enemies of the people" serving the interests of imperialists. Zhukovsky took part in the debates, presenting the strongest criticism of Lysenko's theories and supporting the chromosomal theory of inheritance. He attempted to explain the meaning of the constancy of chromosome numbers in different species, meiosis, and the connection between chromosomal alterations and mutations. However, on the final day of the debates, after Lysenko's acknowledgment of the fact that his report had been considered and approved by the Central Committee of the Communist Party, Zhukovsky took the floor again and stated that he now understood his errors, rejected Morganism and would work according to Michurin's biological principles. Ivan Michurin was a Russian self-educated fruit plant selectionist who considered that vegetative hybridization or grafts were the way to change plants. Zhukovsky was a member of the Communist Party and

had little choice but to follow party discipline. Two other prominent scientists repented their errors as well.

It was clear that the August session of the Lenin Academy had transformed Lysenko into a kind of dictator in biological and agricultural sciences. Mass repressions against supporters of traditional genetics inevitably would follow. It was also possible that the campaign against geneticists was a cover-up for a more general repressive political campaign upon which Stalin's dictatorship was based. Unexpectedly my professor, Petr Mikhailovich Zhukovsky arrived at the Nikitsky Botanical Garden, badly in need of a rest and the chance to talk to friends. The Nikitsky Garden was under his supervision. He embraced me and tears were in his eyes. He told me "I made a Brest Treaty with Lysenko, a shameful treaty... But I did this for my students." He was referring to the Treaty of Brest-Litovsk, which Lenin signed with Germany in March 1918. It was annulled a few months later.

The new situation made it extremely problematic for me to stay at the academy and to do research for my Ph.D. The new rector of the academy, V.N. Stoletov, personally took charge of changing the research topics of graduate student projects in many departments.



Vavilov-Lysenko-Stalin
Courtesy of Roberto Bobrow

Vavilov repeatedly criticised the non-concepts of Trofim Lysenko. As a result, Vavilov was arrested on August 6, 1940 and died of malnutrition in a prison in 1943

The transformed Academy

When I returned to Moscow at the end of September 1948, the Timiriachev Academy was already a different place. The Rector of the Academy, the prominent agrarian economist Professor Vasily Nemchinov had been dismissed, and the new rector Vsevolod Stoletov was a trusted assistant of Lysenko. Key biological departments were completely reorganised. The famous plant geneticist, Professor Anton Zhebrak and nearly all lecturers in the Department of Genetics and Selection had been fired. Lysenko himself took the chair. Professor Aleksandr Paramonov, Head of Zoology and a world-famous expert on farm animal parasites and the author of two textbooks was also dismissed. He was replaced by Nikolai Nuzhdin, a Lysenko supporter who was not even a zoologist. Deans of two faculties were also replaced. Both Zhukovsky and Maisurian, who had repented their "errors", retained their positions. For undergraduate students the main problem now was the textbooks. Previous textbooks on botany, zoology, genetics, plant and animal breeding, plant physiology and other subjects were withdrawn. But new textbooks were non-existent. Biological faculties of universities suffered even more serious reorganizations. There were not enough Lysenko cadres for all the key positions therefore one of the true Lysenkoists was given several posts. Isai Present, who was a Marxist philosopher and Lysenko's closest colleague since 1930, became the dean of biological faculties of Moscow and Leningrad universities simultaneously. He would spend one week in Moscow and the next in Leningrad.

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Ph.D. degree by surprise

I decided to extend my undergraduate term, moving from the general agronomic faculty to the more specialised smaller faculty of agro-chemistry and soil science. Because I now had to study several new disciplines (analytical chemistry, physical chemistry, soil chemistry, herbicides) I needed two years before graduation, rather than one as before. I calculated that the two years would give me enough time, not only to complete my diploma work, but also to accumulate enough experimental results for a Ph.D. thesis and to prepare for oral examinations. The Soviet Union's manner of awarding scientific degrees was inherited from the old Russian tradition. It required an open public defence in front of the "Scientific council" either of the faculty or the research institute. All the professors of the faculty or heads of laboratories of the institute, between 10 and 20 men and women, were members of such councils. Two official opponents, usually professors, were given the task of evaluation. Anyone else could also attend and scrutinise the work. In some rare controversial cases the debates could extend to the following day. A decision was then made by secret ballot of the council.

The political situation in the USSR in 1949 was going from bad to worse. The Berlin crisis which started in July 1948 along with the conflict between the USSR and Yugoslavia made the international situation very unstable. This tension

provided an excuse for a campaign against "agents of imperialism" in the Soviet Union, during which several thousand party and state officials in Leningrad and Moscow became victims and hundreds were sentenced to death. A second terror campaign was anti-semitic. Prominent figures of the Jewish Anti-Fascist Committee were arrested and the Jewish theatre in Moscow was closed. The death penalty, which had been abolished in 1947 in commemoration of the 30th anniversary of the October Revolution, was reintroduced. Now it was not only the courts that could impose death sentences, but also "Special Committees" formed by the Ministry of State Security (MGB) which were given the power to condemn people without trial, on the basis of "investigation".

During the spring and summer of 1949 I worked in a small botanical garden at the Timiriachev Academy. My main project was research into the nature of the sexual determination of hemp (*Cannabis sativa*) which has separate male and female plants in variable proportions. With sensitive tests based on isoelectric point measurements I was able to discover the fact that the pollen of hemp is nearly equally divided into two groups. I suggested that half were male and the other half female. Results of this study were soon published in the scientific journal *Doklady Akademii Nauk*. The previous year's results of my carotenoid research were also published. From October 1949 I spent long hours in the library reading and writing until very late.

I was known in the academy as a young researcher, but it was also clear that Zhores Medvedev, now a chairman of the Student Research Society, was not a supporter of "Michurin science". I decided to submit my work not to the Science Council of the Faculty, but to the Institute of Plant Physiology of the Academy of Sciences of the USSR. The Director of this Institute, Professor and Academician Nikolai Maksimov, was a good friend of Zhukovsky and it was he who was submitting our papers for publication in *Doklady Akademii Nauk*. There were 13 voting members of the science council at this Institute and only one of them was known as a follower of Lysenko. At our faculty the ratio was not as favourable.

By March 1950 my thesis manuscript was ready: 260 pages of typewritten text. Its title "*The Physiological Nature of the Formation of Sexual Differentiation in Plants*" made it possible to discuss different theories in an objective way. I brought a copy of my thesis to Professor Zhukovsky who was my official supervisor. He was surprised but pleased and relieved. It was his achievement as well.

In March 1950 I finally graduated from the Timiriachev Academy with the qualification of "agronomist" specializing in agro-chemistry and soil science. The date of my Ph.D. defence was December 1st 1950. The secret ballot decision to award the degree was unanimous. Now I was free to apply for a position as a research scientist and to select a new research problem. I decided to start some experiments on protein synthesis and the nature of senescence in plants. The Nikitsky Botanical Garden biochemistry laboratory was the first place where I started.



Zhores Medvedev