

# MY FIRST 20 years IN NEUROSCIENCE: I HAD THREE GREAT TEACHERS AND THREE TIMES I CRIED BITTERLY\*

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*"Dear Volodymyr A. Maisky, you are a well-known scientist in the field of neurophysiology and neuroanatomy as an experienced specialist in the field of biophysics of cell membranes and EM. You together with your teachers and colleagues obtained for the first time important data about ultrastructural organization of the propriospinal projections in spinal cord (together with me, Brain Res. (1972)), axonal transport of horse radish peroxidase and fluorescent substances in the brain (Acad. F.N. Serkov, Dokl. AN USSR (1984)), organization of hypothalamic and spinal serotonergic projections (Acad. V.N. Kazakov, Neuroscience (1993)), c-fos expression and NOS activity in the brain in the rat model of Parkinson's disease (Corr. Member V.F. Sagach, Parkinson. Relat. Disord. (2002)), differences in the*

*distribution of NO-generating neurons in the cardiovascular centers of the brain (Acad. A.A. Moibenko, Comp. Biochem. and Physiol. (2003)), proto-oncogene c-fos expression in the brain induced by muscle fatigue (Acad. V.M. Moroz, Fiziol. Zh. (2006)). In 1975-1976 (10 months) you worked at the Dept. of Anatomy of the Erasmus University in Rotterdam (the Netherlands) headed by the famous neuroanatomist in Europe Prof. H. Kuypers (using IBRO/UNESCO fellowship) and together with Professor you have found that straight pathways from hypothalamus to spinal cord exist in the brain. These new data in neuroscience have been published in International Journals (Neurosci. Lett., 1975; Brain Res., 1977). Your well-known investigations in neuroanatomy, EM and immunohistochemistry of the brain were also carried out in different scientific centers of Europe, in Italy (as a guest scientist, 1993), Hungary (Award of Hungarian Acad. of Sci., 1994), Turkey (using TUBITAK/NATO fellowship, 1995-1996), Sweden (as a guest scientist, 2001, 2002, 2003), and Germany (as a guest scientist, 2002, 2003). However, you constantly returned back to your Alma Mater, i.e., Bogomoletz Institute of Physiology where you have been working for about 50 years as postgraduate student, Senior or Chief Res. Ass., acting head of Laboratory or Department. You are Dr. Sci., author (co-author) of about 200 scientific articles (30 of them have been published in international journals) and one monograph (Kyiv, Naukova Dumka, 1983). Six candidate theses have been made under your guidance (E. Krahotkina, A. Semeniutin, V. Vlasenko, N. Doroshenko, Yu. Honchar and V. Datsenko). You successfully combine scientific and editorial activities as a member of Editorial Board of the international journal Neurophysiology (Plenum Press) and your social work as a head of the Trade Union Committee of the Institute. I wish you great success in implementing your scientific projects at the Dept. of Brain Physiology."*

\* 19.02.2008 Acad. Platon G. Kostyuk. Letter to Dr. Sc. V.A. Maisky celebrating his 75th birthday. Ed.

## **The search for the truth through a microelectrode tip (1960-1970)**

Within the first 10 years, we focused on the search for novel biophysical approaches in order to gain a clear insight into the functioning of individual nerve cells. We all, young associates from the Lab. of General Physiology of the Nervous System (GPNS) headed by P.G. Kostyuk, were filled with awe when we read scientific papers by A. Hodgkin, B. Katz, and J. Eccles. I was the second postgraduate student of young DSc. P.G. Kostyuk, and naturally I worked under his guidance. We still value in our hearts the recollection of this beautiful time, so nicely expressed by the words of this song:

How young we once were,  
How young we once were,  
How sincerely we loved,  
How firmly we believed in ourselves!\*

I kept firmly in my mind the truth: "I can see further only thanks to standing on the shoulders of giants" (Sir Isaac Newton, Letter to Robert Hook. *Ed.*). I am paraphrasing it as follows: "To be able to see further, it is rather necessary for us, postgraduate students, to stand on the shoulders of our great teacher!" In 1961, my chief and mentor came back from Australia (he had had a long duty trip to the University of Canberra, Dept. of Physiology) where Prof. J. Eccles opened him the secret doors to the mysteries of the nerve cell. It is obvious that 1962 was the period of triumph of my chief: he published scientific articles in co-authorship with J. Eccles and T. Araki, as well as the first paper in *Nature*. This was Kostyuk's glorious victory, and also a victory for our Lab. Then, the Lab was reorganized in the Dept. of GPNS. At that time, we all made only the first steps towards the disclosure of the truth of functioning of the nerve cell and its membrane. My University education is in radiophysics. I became a biophysist under the influence of my first chief. When I began postgraduate course, I had already possessed professional skills necessary for operating and maintenance of radar stations. I also was good in higher mathematics, since several years earlier I graduated from the Kyiv Polytechnic Institute. My skills were very useful for my studies carried out in the Dept. of GPNS. At that early 1960s, we were up against a difficult problem. Our boss set a task before us: as soon as possible (for one year), we had to create a complex of electronic equipment for biophysical studies of the ionic processes occurring at the surface membranes of the nerve cells using glass microelectrodes. We also had to develop a reliable method for intracellular stimulation of the studied neurons, acoustic control, and recording electrical responses of the neurons to applied stimulation. We had no idea of where we could acquire all necessary equipment for such a complex task and where we could find animals with giant

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\* Original text in Russian. Music by A.N. Pakhmutova, poetry by N.N. Dobronravov. *Ed.*

nerve cells. The Directorate of the Bogomoletz Institute of Physiology, and Military District in Kyiv gave us a hand. For our Dept., I managed to get four radar stations which were unregistered in military units. At that time, such help was a major contribution to the realization of our chief's projects. In 1961, B.Ya. Piatihorsky, V.D. Herasimov, and I invested part of our modest salaries in the purchase of additional electronic components to construct necessary special transformers. Using the following Ukrainian idiom (a novel Soviet watchword) popular at that time, I can say that indeed we all worked together under this comic, but not horrifying, slogan:

We don't need the Sun as the Party provides light!

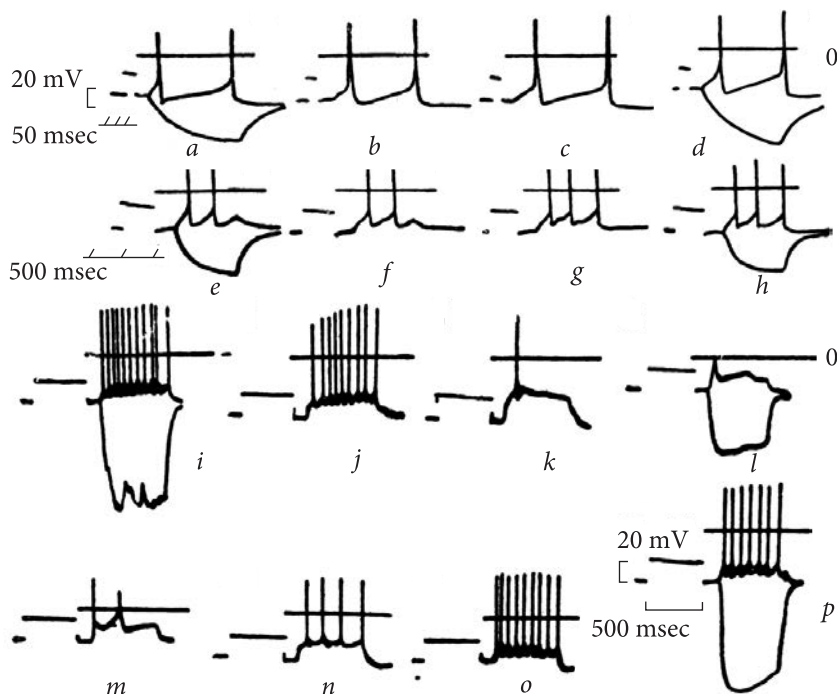
We don't need bread — rather hard job day-and-night!\*

A set of devices for electrophysiological investigations ("3V trend brand") was developed and made already in 1962 due to efforts of V. Piatyhorsky (Vilia, *alias* Benia), and two Volodymyrs, V. Herasymov and V. Maisky. Then we successfully used this 3V set in biophysical studies. Later on (in 1965), we described the 3V equipment in our paper published in *Fiziol. Zh.* (Kyiv). It seems impossible that the 3V set, after quite a number of modifications is still used by PhD V.D. Herasymov in his biophysical studies carried out in the Dept. of Physicochemical Biology of Cellular Membranes (PCBCM). Unfortunately, DSc. B.Ya. Piatihorskyi, one of the developers of this 3V set, passed away long ago. At the same time, our chief initiated in our Dept. electrophysiological studies on the cat spinal cord; these investigations were under his patronage. He always corrected our work schedule in accordance with the data reported in current scientific literature (published in German, French, or English) and their further careful analysis.

I believe that our boss, as one may say, was an inductive thinker. During the following years his image in the world science was grooving together with extensive career grows which strongly impacted on his first postgraduate students. He gave us scant personal attention. However, at that time, in spring and summer of 1962 and 1963, V.D. Herasymov, V.Ya. Piatyhorsky, and I, as well as other associates of our Dept. rather frequently were joyfully running bare-foot (while the morning dew was on the ground) around the modest cottage ("dacha" 33 km from Kyiv) of our teacher gathering in gardens, ponds and small lakes pulmonary mollusks *Helix pomatia*, *Limnea stagnalis*, and *Planorbis corneus*. We already knew that "giant neurons" (200  $\mu\text{m}$  in diameter) are localized in subpharyngeal ganglia in these "creations of God". We sacredly worshipped these animals. Once our convivial intercourse in the Dept. was unexpectedly interrupted by graduate student D.A. Vasylenko, who swallowed a whole big live *Helix pomatia* with no shell, followed by a small glass of vodka, and read us a short lecture about the utility of mucus and the protein hemocyanine of the *Helix* "blue blood" for the human stomach. It should be noted that, due to superficial localization of giant neurons in the ganglia of these mollusks, it was possible to rapidly change the ion

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\* Original text in Ukrainian.



**Fig. 1.** Changes in electrotonic potentials and APs of the same neuron of *Helix* (a-h) and *Planorbis* (i-p) in isotonic  $\text{CaCl}_2$  solution. Note APs and electrotonic potentials in Ringer's solution without  $\text{Na}^+$  (a) and after 1, 2, 3 min registration of the same characteristics (b-d), in isotonic solution of  $\text{CaCl}_2$ , correspondently; again in normal solution without  $\text{Na}^+$  after 1, 2, 3, and 4 min registration of the same characteristics (e-h), correspondently; the same changes in these characteristics in normal (i) and isotonic  $\text{CaCl}_2$  solution (j-l); again in normal solution (m-p) after 1, 2, 3, and 4 min, correspondently. Hyperpolarized and depolarized currents are  $1 \cdot 10^{-8}$  A and  $0.3 \cdot 10^{-8}$  A, correspondently (modified from Gerasimov et al., 1964, 1965)

composition of the medium around the neuron studied. In addition, since these neurons are huge, we could impale them with two microelectrodes, without any damage of the cell membrane. We also could polarize the membrane and record the electrical activity from the neuron during many hours.

Intriguing facts were revealed in the first electrophysiological investigations (Gerasimov et al., 1964, 1965): the action potentials (APs) produced by direct depolarization of the cell membrane in different species of mollusks showed specific dependence on the external ionic composition. In *Helix* neurons, the generation of AP was well maintained in sodium-free solutions with high calcium or barium content (Fig. 1, a-h). In such a case, the amplitude of the spike overshoot was linearly related to the logarithm of calcium concentration. It is interesting that the increase in the external calcium or barium ions decreased the conductance of the resting membrane ( $R_o$ ) also in linear relation to the logarithm of  $\text{Ca}^{2+}$  or  $\text{Ba}^{2+}$  concentration. It was found for the first time that addition of  $\text{Ba}^{2+}$  to the external solution

produced in the neurons well-developed prolonged (protracted) APs in all cases. On the contrary, the excitability of *Planorbis* and *Limnea* neurons was rapidly (during 3 min) and reversibly depressed in sodium-free solutions (Fig. 1, *i-p*).

Later on, my chief offered me a more complex problem, namely, to use mathematical apparatus from the "cable theory" (mathematical modelling of spreading electrotonic potentials (EPs) along giant axons of squid, Hodgkin — Rushton, 1946) in order to predict the biophysical characteristics of individual muscle fibers (*m. sartorius*) of frog *in vitro* experiments on the effects of the changes in the external solution composition. Within the framework of this theory, the following partial differential equation was suggested:

$$-\lambda^2 \frac{\partial^2 V}{\partial x^2} + \tau \frac{\partial V}{\partial t} + V = 0,$$

where  $\lambda$  is the first coefficient of attenuation of the EP (V) amplitude along the cable expressed in terms of specific resistance of the axoplasm (sarcoplasm) ( $R_i$ ) and resistance of the membrane per unit surface ( $R_m$ ). The second attenuation coefficient  $\tau$ , or the time constant, is related to the membrane capacity ( $C_m$ ) per unit surface. At earliest possible date, I developed a special electronic device and original protocol for recording EPs along the excitable fiber membrane. The device included a complex radio-frequency set for uncoupling of the biological object from the stimulator. The membranes of individual muscle fibers were polarized by weak hyperpolarizing current pulses ( $2 \cdot 10^{-8}$  A) passed through one microelectrode, while the other electrode was used for recording EPs along this fiber at different distances (100–2000  $\mu\text{m}$ ) from the polarizing electrode. Throughout 1962, I carried out these complex experiments. For the majority of the studied frog muscle fibers, the following mean biophysical parameters were obtained in the normal Ringer solution:  $R_m = 3960 \pm 480 \Omega \times \text{cm}^2$ ,  $R_i = 87 \pm 10.3 \Omega \times \text{cm}$ , and  $C_m = 8 \pm 3.2 \mu\text{F}/\text{cm}^2$ . These parameters decreased with increase in the concentration of  $\text{K}^+$  in the external solution. The data that I obtained in these experiments were described in the paper published in the Moscow scientific journal (Maisky, 1963). It should be noted that they attracted lively interest from biophysicists.

In those memorable times (namely of the 1960s), our research activities sometimes alternated with informal gatherings with music. We knew that piano concerts in philharmonics of Kyiv and Moscow are another strong passion or the second dominant after science for our teacher. We knew that he himself wonderfully plays the piano and also loves to listen to great pianists like S. Richter or A. Rubinstein who could make the piano sing. Each of us was just "a copy cat" and we also loved to listen to great pianists and singers. I remember how our trade union organization bought a piano "Ukraine" for the Institute, and we put it in the director's office. The next day all of us, connoisseurs of art, were invited to listen to music. Platon Grygorovych emotionally played for us a part of Chopin's Piano

Concerto No.1 in E minor. We listened to the music with bated breath. It was so beautiful! We remarked that our maestro put his own feeling into sounds and told us a pleasant and lively story. Indeed, a Kostyuk's master class was an example of the brilliant emotionally-semantic inversion.

Many years have passed invisibly. *Tempus fugit* (time flies. *Ed.*). Those decades seem to have flown by as the inexorable fate willed; time changes all of us and all around us. However, our glorious past, the 1960s, will always remain in our memory. That period of time our cohort including Platon Kostyuk, Lida Savoskina, Zoia Sorokina-Marina, Halyna Skibo, Lysia Vihreva, Nellia Pohorela, B. Piatihorskyi, V. Herasymov, N. Preobrazhenskyi, A. Piliavskyi, nonpareil D. Vasylenko, and I enthusiastically worked together at the Dept. of GPNS.

However, I also had some conflicts with my boss. I recollect the end of the cold winter of 1965. Before, my five original manuscripts (in co-authorship with my teacher P.G. Kostyuk) were submitted to the Moscow scientific journals. It was snowing. I saw snow-covered streets and snow-covered Bogomoletz Park from the first floor of my room. I was sitting at my desk making some notes. Just as my boss came in, he started out by attacking me and out of a clear sky. He told me about the transfer of my assistance N. Babets to another research team in order to perform technical service of the new French-made setup "Racia" enabling scientists to successfully run electrophysiological studies on the cat spinal cord. I had an objection. I was not a diplomat. I was 32 years old and my supervisor was older, 41 years old. "It is my order!" he said. And he spoke to me as if we had established a new contact, namely manager-subordinate relationship but not before teacher — student one. He told me that he is the chief, and I am just a collaborator of the Dept. It was rather painful for me to hear such words. I was silent. I crumpled a sheet of paper covered with my writing and began to cry... "I am only a graduate student" was in my mind and in all my body... The following day I wrote a letter of voluntary resignation addressed to the Director of the Institute Acad. A.F. Makarchenko. I was the first and last "victim" of such circumstances. Many years elapsed. My boss became an excellent diplomat; his students never heard rude remarks from him. He merely said: "I am surprised". My vivid recollections are the homage which I pay to my first great teacher Platon Kostyuk.

## **Ukrainian endocrinology of socialist realism**

At the beginning of 1965, by the decree of the Ministry of Public Health of the Ukr. USSR, Acad. V.P. Komissarenko founded a new research institution in Kyiv, the Institute of Endocrinology and Metabolism, and occupied the position of its first director. From February 10, I occupied the position of his scientist. Over the

early years, the Institute was located in a beautiful two-storied mansion just at the corner of Shevchenko's Boulevard and Pushkinskaya Street. Here, there was rather a big patio. I took on a job (my first job) to re-equip field service, arrange the work shop and storehouses. The scientific staff of the Institute, administrative staff, and support personnel mushroomed up. My second chief was 58 years old. Over a long period of time, he worked under the guidance of Acad. O.O. Bogomoletz. Until the end of 1964, Acad. V.P. Komissarenko was the head of the Department at the Bogomoletz Institute of Physiology of the Acad. Sci. of the Ukr. SSR. He also was well-trained in the Laboratory headed by Prof. H. Selye (the founder of the theory of stress and general adaptation syndrome, GAS) at the Institute of Experimental Medicine, Montreal (Canada). Thus, Prof. O.O. Bogomoletz and Prof. H. Selye were indeed his great teachers. There was an ambitious task in front of our energetic, full of bush fire, and talented leader and associates of his Institute: to lay the first stone of fundamental endocrinology as a science in Ukraine. It was impossible for us to stand against his energy and charm, and all of us worked wholeheartedly. In the first year, Acad. Komissarenko offered a job at his Institute for many young and talented scientists from Kharkiv and Odesa (PhD Reznikov A.G. and others). In our environment, in that hard period of formation of the Institute, a unique aura of high respect and mutual support was formed. I was a Senior Res. Ass. in the Laboratory of Physiology and again began my career from scratch. As before, I began to actively seek for biochemical equipment, amplifiers, oscillographs, and stimulators. I remember that we received a great number of items of equipment retired from the Institute of Cybernetics in the mid-1965. We also bought biochemical reagents. Our experimental infrastructure and machine shops took on life. I started assembling a set of electrophysiological equipment for recording neuronal activity in mollusks. I should emphasize that our director was a very respected within the circle of communist party functionary, government officials, and even writers in Kyiv and Moscow. Once (it was in the autumn of 1965), my second great boss, the master of science and life, told me that Japanese exhibition of high-resolution electronic microscopes (JEOL) should be opened in Moscow and that he wants to go to Moscow with me. I agreed with my boss with ineffable joy. I should note that I had already published my first paper entitled "Submicroscopic Structure Giant Neurons of the Mollusk *Planorbis corneus*". I remember interesting events in Moscow. We are in Japanese exhibition; we are burning with curiosity: Here, booklets, badges, and even 3-D postcards with winking Japanese women are distributed... But there are only four high-resolution microscopes for all 16 republics of the former USSR. Guests and visitors of the exhibition were talking about partitioning the spoils system by the rules of the well-known character Popandopulo: "...this is my...(Moscow), and this is... also mine!" Of course, I lost all hope that Ukraine could receive an electronic microscope, but Vasiliy Pavlovich smiled mysteriously and repeated:

"Choose the best!" (i.e., JEM-100). Later on, it came to my knowledge that Vasiliy Pavlovich had a personal encounter with N.B. Podgornyi (the first Secretary of the Central Committee of the Communist Party of Ukraine up to 1963 and the Chairman of the Presidium of the Supreme Soviet of the USSR from 1965) who already gave a special order specifically to send one electronic microscope JEM-100 to Ukraine. This JEM-100 was the first high-class electronic microscope in Ukraine which was actively used in the research at Komissarenko's Institute (in winter of 1966), and I together with DSc K.P. Zak began electron microscopic examination of blood cells in dogs. The first experimental paper was published already in 1967 (Zak, Maisky et al., 1967).

At that time, I also intensely studied electrical activity of giant neurons, located in the buccal ganglia of mollusks. These giant neurons of *Planorbis corneus* exhibited intense electrical activity periodically (every 3 s) followed by deep (up to 30 mV) and prolonged (nearly 2 s) inhibitory hyperpolarization. These parameters sharply changed with the addition of different neurotransmitters (or other biologically active substances used in very high dilutions) to superfusing solutions. I remember that once Vasyl Pavlovych invited high-profile officials of the Ministry of Public Health, writers, and journalists in order to demonstrate at the Institute the electrical activity of these giant nerve cells of *Planorbis* using the microelectrode technique for recording of action potentials combined with video and sound control. When the guests saw alternate impulse discharges of a separate neuron on the oscillograph screen and heard how that neuron "speaks", they were truly amazed. A well-known Ukrainian writer Natan Rybak even exclaimed: "This is a real Ukrainian endocrinological science of socialistic realism!" After inspection of other Labs and JEM-100, all guests (as well as associates of the Institute) went to the monument to the leader of world proletariat (V.I. Lenin) to give him "thanks for the miracles of socialistic science" in Ukraine. The monument was constantly visible from the windows of the first store of our Institute. Our valuable time passed in such a way, in painstaking labour and vain efforts. My second boss (Acad. V.P. Komissarenko) decided for expansion of investigations. Then, an excellent German EM (Carl Zeiss Jena) and some optical microscopes were additionally purchased for Labs. Somewhat later my first chief P.G. Kostyuk (from 1966, Corr. Member of AN USSR and director of the Bogomoletz Institute of Physiology) was invited to Komissarenko's Institute. Of course, he met me and asked me about my results obtained using EM and my electrophysiological investigations. Then he simply said that a long time had elapsed from our "fight". Summer, not winter, was outside and I could come back to the Dept. of GPNS. I decided to return "home" to the Bogomoletz Institute of Physiology. More than 40 years have elapsed, but I remember now only my deep emotions, tears in my eyes and the last words of my dear second teacher: "Volodia, I do not object your returning "home", to your *Alma Mater*".



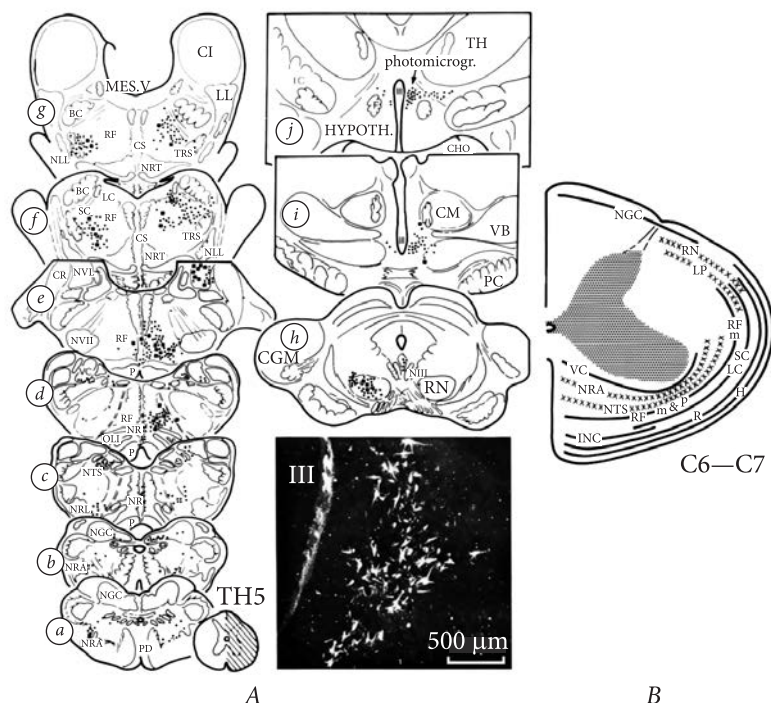
## **Revolution in neuroanatomy of the 1970s and my third great mentor**

At the beginning of 1970s, methods based on cell biology and chemistry, aimed as "pathway tracing" via anterograde and retrograde axonal transport of horse radish peroxidase (HRP) and techniques for immunohistochemical localization of neurotransmitters in the brain were implemented. Acad. P.G. Kostyuk remained abreast of scientific developments. His very interesting papers were published in international journals; a paper describing ultrastructural organization of propriospinal projections in cat was published in co-authorship with me in *Brain Res.* (1972). At that time, my mentor had become internationally renowned and occupied the position of Vice-President of IBRO/UNESCO (1974-1979). With the help of my supervisor, I received Invitation to work for the period of 10 months (using IBRO/UNESCO fellowship (1975-1976) in the Dept. of Anatomy of the Erasmus University in Rotterdam (the Netherlands) headed by the famous European scientist Prof. H. Kuypers. Thus, Prof. H. Kuypers (1925-1989) became my third great teacher. Indeed, all of us who had the privilege to contact with him or work with him are fully aware of the really important scientific contributions that he made during his lifetime. At the beginning of our experiments on cats and rats, we found that microinjections of HRP into the spinal gray matter resulted in retrograde labeling of only a very limited number of brain stem neurons. About a year before, Prof. K. Kristensson from Sweden found that effective retrograde transport of HRP in transected axons really exists. Thus, as the first step I studied temporal relationships between transport of HRP (Sigma, USA; Boehringer, Germany) and induction of chromatolysis. Prof. H. Kuypers, DSc. J. Siegel (from USA), me, and two young scientists from the Dept. of Anatomy (C. Catsman-Berrevoets and I. Molenaar) worked together. In this Dept., there was also a "secret" scientific Lab. where Prof. H. Kuypers during 1975-1976 began developing a new retrograde labeling technique employing fluorescent substances (Primuline, Fast Blue, Evans Blue, and others) for double labeling of neurons in rat through divergent axon collaterals. Only in 1977, the new technique was published by Prof. H. Kuypers and young scientist Marina Bentivoglio (from Italy, using IBRO/UNESCO fellowship). However, at the beginning of 1975 our group included Prof. H. Kuypers, two technicians, and me. We made subsequent spinal injections of HRP into the gray and white matter of rat's or cat's spinal cord and in such a way damaged as many axons as possible.

The method, as we found, was very effective even for large animals (cats). Too many, about twenty cats (two animals per month) were used for investigation of retrograde axonal transport of HRP from spinal cord (C2, C8/TH1, TH5, L2, and L4 segments, respectively). The most important part of experimental work (contralateral or bilateral spinal lesions at C2, C8/TH1, which in the respective cases spared small portions of different funiculi, unilaterally) was done only

by Prof. H. Kuypers himself and his two very skilled assistants using a special binocular microscope and a vacuum pump. I analyzed experimental material (sections of cat's brain and spinal cord) and prepared illustrations. I must note that cats were extraordinary spinal animals. After operation, all cats needed special conditions for rehabilitation. Only a week later, spinal HRP injections were made below the lesions in both animal groups (30  $\mu$ l of 30 % HRP was deposited in the case). We found that after HRP injections, the enzyme was transported retrogradely to brain stem neurons in the bulbar medial reticular formation, the vestibular complex, and the red nucleus. We obtained intriguing facts in our investigations: we recorded the labeled neurons in the *locus coeruleus* and *subcoeruleus*, as well as in the paraventricular hypothalamic nucleus (Kuypers a. Maisky, 1975). The existence of straight pathways from hypothalamus to the spinal cord (as can be seen in Fig. 2, A) had not been demonstrated earlier. The next step of our study was to determine the corresponding spinal *funiculi* where descending fibers (from various brain stem cell groups) are located. Indeed, in our pioneer studies, we revealed that the fibers from the hypothalamus, which descend throughout the spinal cord, are located mainly in the lateral *funiculus*, ipsilaterally (Fig. 2, B).

My stay in that beautiful country was going to the end. As often as I came in the evening to the downtown at the bus station Rotterdam–Istanbul and sadly looked after the laborers from Turkey: there, to the east, is also my country, my Ukraine. I kept firmly in my mind (as a prayer) Kostyuk's hard directions he gave me in the bar of Moscow hotel of the Acad. Sci. of USSR: "You must obtain good results and publish a paper in an international journal as soon as possible!" He went to Switzerland at the same time as I went to the Netherlands. I remembered that he was on probation in Australia during five months and shortly after published (in co-authorship) five scientific papers in 1962. But I had a problem in the Netherlands: Prof. H. Kuypers even did not guess that he was a person of considerable talent. Each scientific problem he touched always turned into pioneering discoveries in neuroscience. Additionally, he was the father of six children. He lived in a beautiful realm together with his horses, car, certainly, with his beloved wife and dear science. Surely, he did not know our "specific" idiom (in Russian) extensively used in our real life in the former USSR, such as "*рвать подметки на ходу*!" ("be a fast climber", or "not to waste any time!"). Really, at the end of the first part of my academic mission (in late spring of 1975), I prepared all primary materials for our scientific paper to be published. It was necessary to write at least a short communication and submit it to an international journal. However, Professor "dragged" preparation of our manuscript. His teaching duties and extensive international cooperation strongly distracted his efforts from the main subject - the manuscript. In this situation, I was running out of time absolutely. Academic circles "boiled" like a samovar; this was like a three-ring circus: "The winner is the scientist who first publishes the novel data!" Nearly two weeks before my return



**Fig. 2.** Cells of origin of descending brain stem pathways to the spinal cord in cat: *A*, distribution of retrogradely labeled neurons (dots and squares) at various brain stem levels (*a-j*) after unilateral (right) injection of HRP at TH5. Note labeled neurons in the *locus coeruleus* (LC) and the nucleus *subcoeruleus* (SC) at levels *f* and *g*, and in the paraventricular nucleus of hypothalamus (H) at levels *i*, *j* ipsilaterally, as well as in the lateral pontine tegmentum (LT), adjoining the rubrospinal tract (TRS) contralaterally. Dark-field micrograph shows the labeled neurons in periventricular (III) area (level *j*) in the hypothalamus; *B*, funicular trajectories of descending brain stem pathways in C6-C7 segments. Abbreviations: CM, center medium; F, fornix; INC, interstitial nucleus of Cajal; NGC, nuclei gracilis and cuneatus; NRA, nucleus retroambiguus; NTS, nucleus of the tractus solitarius; P, pyramidal tract; R, raphe nuclei; RFm, medullary medial reticular formation; RFp, pontine medial reticular formation; RN, red nucleus; TH, thalamus (modified from Kuypers and Maisky, 1975; 1977)

to Kyiv. I again insisted on the necessity to get through with our manuscript. I realized that my dear maestro did not comprehend my uneasiness. "You discovered for the first time the direct pathway from the hypothalamus to the spinal cord along its whole length!" I exclaimed... and then my voice suddenly trembled, and my tears dropped on Israel strawberries covered with sour cream and sugar. This worked well. Teacher put his hand on my shoulder, and then he merely said: "I understand!" Later on, it came to my knowledge that, after our talk, Prof. H. Kuypers intensely worked during four days in his room with our manuscript. On the 5th day, Professor left by Euro-Express, together with our manuscript, for Germany to Prof. M. Zimmermann (II Physiological Institute in Heidelberg),

who was the Editor of a new international journal *Neuroscience Letters*, the first issue of which was supposed to be published within a month. Platon Kostyuk and I were pleased, since this paper was published in the first number of the Journal and even on its first pages (Kuypers a. Maitsky, 1975). Yes, indeed, it was my victory achieved through enormous efforts. Later on, a known research group of morphologists (Cowan's laboratory, USA) published their own data about direct pathways from the hypothalamus to autonomic centers of the rat spinal cord (Saper et al, 1976). It was also shown that direct projections from hypothalamus to spinal cord arise in paraventricular nucleus and ends in the intermediolateral column and marginal zone of the dorsal horn (Swanson, 1999). To emphasize the contribution of Prof. Kuypers to Neuroscience, I must note that only Pavlov's term *conditioned reflex* (1903), Bykov's postulates about transfer between hemispheres in Pavlov's Lab., and our intriguing facts about straight pathways from the hypothalamus to the spinal cord in cats (Kuypers a. Maitsky, 1975; 1977) were discussed and cited in the last issue (50, No. 5/6, 1999) of the millennium *Brain Res. Bull.*, which was devoted to the achievements in neuroscience of the 20th Century (see Swanson, 1999).

P.S. We have Shakespeare at our tongue's end:

"I hold the world as the world, Goratiano,  
Is a stage where everyone must play a part."

*William Shakespeare.  
The Merchant of Venice*

The reality in Neuroscience (here severe competition reigns) means to sing certain parts of "science services" (by analogy with "church services"), since we are wholly committed to the service of Science. My first 20 years in Neuroscience have come to an end. I have had three great "mentors" and three times I cried bitterly. I am going home in order "to sing my own song" tomorrow! However, next day... a new *stage* and new singers will appear (see Kostyuk, Kryshchal, Pidoplichko, 1975; 1978; Veselovsky a. Fedulova, 1983; Kostyuk, Lukianets, Doroshenko, 1992).

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