

Mária Gerová, M.D., DrSc. and Cardiovascular Physiology

(90th Anniversary)



This is a special issue of Physiological Research which is devoted to the prominent Slovak physiologist, Mária Gerová, on her jubilee. The professional life of Dr. Gerová is 60 years connected with the Institute of Normal and Pathological Physiology Slovak Academy of Sciences in Bratislava, where since 1956 she was involved in the development of physiological laboratories focused to the research of cardiovascular system. She has always been one of the leading personalities determining the thematic orientation of the Institute. She has been involved in the research and she still gets a great satisfaction when working on papers for publication. Her scientific work accumulated in great number of publications, focused especially on the regulation of cardiovascular system, which are known throughout the world, and many of them opened new frontiers in cardiovascular physiology.

Mária Gerová was born in 1926 in Žilina, Slovakia. She graduated from the Medical Faculty of Comenius University in Bratislava in 1950. She started to work as an Assistant Professor at the Department of Experimental Pathology. In 1951-1956 she has been working in the Institute of Cardiovascular Diseases (Ústav chorob obehu krvi) in Prague where her supervisor was Prof. Jan Brod and defended her CSc

thesis there. Then she returned to Bratislava and actively contributed to found new research laboratories within the framework of the Slovak Academy of Sciences. She became a member of the Department of Clinical Physiology at the Institute of Experimental Medicine which was renamed in 1965 as Department of Cardiovascular Physiology of the Institute of Normal and Pathological Physiology and she has remained in this department up to her retirement.

International symposium "*Circulation in Skeletal Muscle*" (edited by Olga Hudlická, Pergamon Press, 1968), held in Smolenice in 1965, created the base for friendship with many scientists from different countries. Scientific interest fortunately offered exceptional opportunities to Dr. Gerová to become acquainted with scientists of different European countries and USA. Thanks to excellent scientific results Dr. Gerová had the opportunity to meet the world leading physiologists, as J. A. Bevan, R. R. Sonnenschein, A. P. Somlyo, P. Johnson, E. M. Renkin or C. Hyman during her travelling through USA. From these times date her contacts and friendship also with leading physiologists in Europe, such as B. Folkow, G. Burnstock, B. Johansson, A. B. G. Kovach, and others. V. M. Khayutin, an extraordinarily learned man, was another scientist for

whom Dr. Gerová had a very high regard; he was one of the most outstanding contributors to science in the Russia in the second half of the 20th century. The research of Dr. Gerová was also positively influenced by other scientists such as M. Mulvany, R. F. Furchgott, O. Hudlická, A. Fronek, B. I. Tkachenko, E. Monos and others. After 1970 the travelling to foreign countries and many other activities started to be extremely difficult. The actual political changes affected the experimental research also in Slovak Academy of Sciences, and professional contacts were markedly attenuated.

Dr. Gerová has been an active member of many scientific societies, including The Association of American Medical Colleges, American Heart Association, American Physiological Society and Slovak Physiological Society. In 1986-1993 she was council member of International Union of Physiological Sciences. She is a member of the Learned Society of the Slovak Academy of Sciences. Over the years she has been an active contributor to the journal *Physiological Research* as an author, a reviewer and a member of its International Editorial Board. She has always spent her time productively, focused on reading scientific journals, working on her experiments, writing papers or seeing her experimental animals. In addition, owing to her extraordinary broad knowledge and scientific experience, she has inspired many other discoveries by other groups in the Department of Cardiovascular Physiology including the focus on the classic neurotransmitters in cardiovascular system. During her long and outstanding research career, Mária Gerová has published more than 500 scientific papers, she has written a monograph "*The Elasticity of Sinocarotid Region*" with Ján Gero and has prepared several chapters on cardiovascular topics. Her papers in the scientific journals have inspired many young readers to pursue a scientific career.

The main research interest of Dr. Gerová was cardiovascular physiology. Dr. Gerová collaborated with her husband Dr. Ján Gero until his death in 1991. Very fruitful scientific years she spent with Dr. S. Doležel (morphologist) and Dr. E. Barta (pathological physiologist). We are pleased that this issue of *Physiological Research*, in which she published more than 20 papers, may at least partially illustrate her work in the Institute of Normal and Pathological Physiology of Slovak Academy of Sciences, bearing a strong imprint of Dr. Gerová.

Mária Gerová and Ján Gero described fundamental factors involved in the stimulation of

baroreceptors: a) the biomechanical properties of the sinocarotid wall including dynamics of distensibility of this area due to smooth muscle activity of myogenic origin or induced by vasoactive drugs, and b) the role of the intravascular pulsating pressure. They found that changes of each individual parameter of pulsating pressure (mean pressure, pulse amplitude and frequency of pulsation) affect the response of baroreceptors with a subsequent reflex response of systemic blood pressure (Gerová and Gero 1965).

The next interest of Dr. Gerová was neural regulation of consecutive segments of vascular tree in confrontation with the distribution of terminals in vessel wall. She investigated functional and structural changes of cardiovascular system under normal and pathological conditions. Functional studies were aimed on investigations of vasoactive properties of isolated conduit and resistance arteries with a specific focus on humoral regulation and perivascular nerve activity.

In a close cooperation with her coworkers (J. Gero, S. Doležel and others) she had thoroughly described the origins, distribution and local effects of autonomic vegetative neurons. The adrenergic nerve terminals have been found in most conduit arteries to be remote from effector smooth muscle cells. Dr. Gerová suggested that the transmitter to activate remote cells must to diffuse through the vessel wall; it was shown that the stimulation of perivascular nerves led to diffusion of transmitter from adventitio-medial border to muscle layers (Gerová *et al.* 1967). Our later results obtained with an isotope frozen-section technique supported these earlier findings on the general function of the sympathetic nervous system (Török and Bevan 1971).

Dr. Gerová published the chapter on autonomic innervation of coronary vasculature in the international monograph "*The Coronary Artery*" where she summarized results focused on the sympathetic regulation of the arteries and veins and on local mechanisms regulating blood flow (Gerová 1982). She showed that conduit coronary arteries have an exceptional position in the cardiovascular system. She also described two contrasting processes operating in the coronary wall during sympathetic stimulation: one constricting – operating from the adventitia, and the other relaxing – operating from the endothelium (Gerová *et al.* 1983). She obtained the first data of radial and longitudinal deformation of two main conduit coronary arteries, in relation to the left and right ventricle volume. She also contributed to elucidation of neurogenic and myogenic

control of consecutive segments of coronary artery tree. The maximal sympathetic constriction of conduit coronary artery represents only 4 % stimulating stellate ganglion. The high coronary blood flow induces a myogenic relaxation of coronary artery and may counterbalance the sympathetic constriction of the conduit coronary artery (Gerová *et al.* 1981). Owing to this priority and outstanding discovery, Dr. Gerová became a worldwide respected physiologist.

Together with Dr. Doležel she revealed that the myocardium is supplied by axons of the cardiac plexus and by the perivascular nerves; the vascular wall, on the other hand, is supplied by the perivascular nerves only. These morphological differences in innervation suggest that two different types of neurons exist in the sympathetic ganglia: a) neurons innervating the vessels (coronarmotor neurons), and b) neurons innervating the myocardium (cardiomotor neurons) (Doležel *et al.* 1984, 1990). The monoaminergic terminals innervating the myocardium are markedly thinner than the fibres innervating arteries.

Dr. Gerová obtained basic biomechanical data (diameter, length) of both main coronary arteries during dynamic changes of the left and right heart ventricle (Gerová *et al.* 1992) and contributed to elucidation of early metabolic changes in coronary artery during heart pressure-overload (Gerová *et al.* 1994, 1995). The deformation and/or rate of deformation of cells in the coronary wall may trigger an increase in protein synthesis (Gerová *et al.* 1996).

Dr. Gerová belongs to the first investigators who performed direct *in vivo* measurements of nitric oxide in cardiovascular system using Malinski's porphyrinic sensor in anesthetized dogs (Gerová *et al.* 1998). She described the role of sympathetic nervous system in experimental hypertension induced by nitric oxide deficiency. In anesthetized NO-deficient rats with NO-compromised hypertension the response to acetylcholine was not attenuated but it was even enhanced, as compared to control normotensive rats

(Gerová 2000). In both normotensive and hypertensive rats the acetylcholine-induced relaxation is acting through the muscarinic receptors since atropin totally abolished the acetylcholine-induced vascular relaxation.

She also contributed to the elucidation of cardiovascular control in ontogenesis (Török and Gerová 1996). It has been shown that during ontogenesis the number of endothelial-smooth muscle cell contacts in intimal layer of coronary artery is high in young animals (puppies) and it decreases in adulthood (Kristek and Gerová 1997).

Dr. Gerová belongs to the great contributors to our knowledge on the physiology of neurogenic control in vascular system. On the other hand, she declares the necessity to study living organism in its complexity (including cardiovascular regulations) which undergo profound changes in the course of its ontogenesis. She is zealous propagator of original scientific results obtained in the Institute of Normal and Pathological Physiology.

Mária Gerová is an extremely helpful and belongs to friendly women always willing to do her best for others. She is an honest and decent woman. She is well up in history, literature and fine arts. She belongs to the scientists who are primarily focused on specific and particular professional issues. She is a selfless person and devoted friend everybody would like to have.

Dr. Gerová is still active in retirement and enjoy her freedom to follow own schedule with regard to scientific work and own hobbies. All collaborators sincerely wish her all the best and steady health, so that she can continue her incredible scientific pursuit and spread the inspiration for many more years. In addition, we wish her endurance and boundless optimism in order to bear our presence around her with a smile for a long time.

Ad multos annos!

Jozef Török, Olga Pecháňová

References

- DOLEŽEL S, GEROVÁ M, HARTMANNOVÁ B, DOSTÁL M, JANEČKOVÁ H, VAŠKŮ J: Cardiac adrenergic innervation after instrumentation of the coronary artery in dog. *Am J Physiol* **246**: H459-H465, 1984.
- DOLEŽEL S, GEROVÁ M, HARTMANNOVÁ B, VAŠKŮ J: Development of the adrenergic innervation in the myocardium and coronary arteries of the dog. *Acta Anat (Basel)* **139**: 191-200, 1990.
- GERO J, GEROVÁ M: Significance of the individual parameters of pulsating pressure in stimulation of baroreceptors. In: *Baroreceptors and Hypertension*. KEZDI P (ed), Pergamon Press, New York, 1967, pp 17-30.

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- GEROVÁ M: Autonomic innervation of the coronary vasculature. In: *The Coronary Artery*. KALSNER S (ed.), Croom Helm, London, 1982, pp 189-215.
- GEROVÁ M: Acetylcholine and bradykinin induce paradoxically amplified hypotensive response in hypertensive NO-deficient rats. *Physiol Res* **48**: 249-257, 1999.
- GEROVÁ M: Nitric oxide-compromised hypertension: facts and enigmas. *Physiol Res* **49**: 27-35, 2000.
- GEROVÁ M, GERO J: Effector mechanisms induced by baroreceptor stimulation. In: *Baroreceptors and Hypertension*. KEZDI P (ed.), Pergamon Press, Oxford, 1965, pp 225-233.
- GEROVÁ M, GERO J: Mechanism of sympathetic regulation of arterial smooth muscle. *Experientia* **2**: 639-642, 1967.
- GEROVÁ M, BARTA E, GERO J: Sympathetic control of major coronary artery diameter in the dog. *Circ Res* **44**: 459-467, 1979.
- GEROVÁ M, GERO J, BARTA E, DOLEŽEL S, SMIEŠKO V, LEVICKÝ V: Neurogenic and myogenic control of conduit coronary: a possible interference. *Basic Res Cardiol* **76**: 503-507, 1981.
- GEROVÁ M, SMIEŠKO V, GERO J, BARTA E: Dilatation of conduit artery induced by high blood flow. *Physiol Bohemoslov* **32**: 55-63, 1983.
- GEROVÁ M, BARTA E, STOLÁRIK M, GERO J: Heterogeneity in geometrical alterations of two main branches of left coronary artery induced by increase in left and right ventricle volume. *Am J Physiol* **262**: H1049-H1054, 1992.
- GEROVÁ M, PECHÁŇOVÁ O, STOE V, KITTOVÁ M, BERNÁTOVÁ I: Protein metabolism in coronary wall affected by cardiac load. *Cell Mol Biol Res* **40**: 123-128, 1994.
- GEROVÁ M, PECHÁŇOVÁ O, STOE V, KITTOVÁ M, BERNÁTOVÁ I, JURÁNI M, DOLEŽEL S: Biomechanical signals in the coronary artery triggering the metabolic processes during cardiac overload. *Mol Cell Biochem* **147**: 69-73, 1995.
- GEROVÁ M, PECHÁŇOVÁ O, STOE V, KITTOVÁ M, BERNÁTOVÁ I, BARTA E: Early changes in protein synthesis in epicardial coronary artery of pressure-overloaded heart. *Am J Physiol* **270**: H685-H691, 1996.
- GEROVÁ M, MESÁROŠ Š, KITTOVÁ M, KRISTEK F, MALINSKI T: The level of NO in femoral artery and vein estimated in animal experiment: Basal values after stimulation and inhibition of NO synthase. *Cardiology* **7**: 18-22, 1998.
- KRISTEK F, GEROVÁ M: Endothelial-muscle cell contacts in the coronary artery of the dog during the development. *Acta Anat (Basel)* **158**: 166-171, 1997.
- TÖRÖK J, BEVAN JA: Entry of ³H-norepinephrine into the arterial wall. *J Pharmacol Exp Ther* **177**: 612-620, 1971.
- TÖRÖK J, GEROVÁ M: Vascular responses after long-term inhibition of nitric oxide synthesis in newborn dogs. *Physiol Res* **45**: 323-328, 1996.
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