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## The historical review of the research studies in Physiology conducted within Nicolae Testemitanu State University of Medicine and Pharmacy (1945-2020)

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### Abstract

**Background:** Undoubtedly, the research studies have played both a decisive and edifying role in the emergence and development of Physiology as a separate science. The research and particularly, the experimental studies, were the milestones for the development of physiology as a distinct science and discipline, used in both general and specific biological and medical education. Physiology is an important and permanent source of research and modeling methods of vital processes among the fundamental and preclinical medical and biological sciences, such as pathophysiology and pharmacology. This short essay does not claim to comprehensively describe the development of physiological research studies within Nicolae Testemitanu State University of Medicine and Pharmacy over 75 years since the university foundation. However, this present chronological presentation with elements of analysis provides historical and current data on the researchers and their research papers, while working as collaborators within the Department of Physiology at our university.

**Conclusions:** This historical review brings conclusive evidence upon the research work conducted by the academic staff and their study results, since the foundation of the Department of Physiology, which have greatly reflected the international research trends in the field of physiological sciences. Current physiological research studies, conducted at the Department of Physiology, are aimed at studying the physiological markers and predictors of different diseases, involving cardiovascular and respiratory systems by means of psychophysiology.

**Key words:** physiology, history, milestones, vital processes, conclusive evidence.

### Cite this article

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### Introduction

Undoubtedly, the research studies have played a decisive or even an edifying role in the emergence and development of Physiology as a separate science. The research and experimental studies, particularly, provided a background for the development of physiology as a distinct science and discipline, used in both general and specific biological and medical education. Among the fundamental and preclinical medical-biological sciences, such as pathophysiology, pharmacology, physiology has an important role, being a permanent source of research methods and modeling of vital processes. Physiology is also closely related to other premedical sciences, such as functional anatomy, histology, cytology, molecular biology, genetics, biochemistry, and morphopathology, since these domains use physiological research methods, as well as due to the widely applied morphological, histological, genetic, biochemical, molecular, biological and other approaches within the physiological research studies during the recent decades. Furthermore, over the last 50-70 years, the physiological research methods have been introduced into a variety of clinical and medical fields, ranging from psychiatry to traumatology, from neurology to surgery, from functional diagnosis to physiotherapy and medical rehabilitation, etc.

### The impact of international medical breakthroughs on the local research studies in physiology

Since the middle of the 20th century until today, the local science of physiology has passed through periods of onset and fruitful progresses. The physiology research studies during the Moldovan Soviet Socialist Republic (MSSR) period and later on, in the Republic of Moldova, were definitively influenced by the development of international physiological sciences. The 1950s and 1960s of the 20th century were characterized by a considerable research advance of electrophysiological methods, regarding the central and peripheral nervous system, which resulted in famous discoveries in physiology, as for example, of the reticular formation of the brainstem and the description of the upper parts of the central nervous system. Nevertheless, further development of local physiological research studies was also quite representative, due to the extensive and in-depth researches concerning stress and global adaptation, leading to important discoveries in neuroendocrinology and physiological cellular, subcellular and molecular processes. There have been significant study results of local researchers, which are more precisely described in this present review. Over 1970s and 1990s, physiology drew a special attention to scientific researches related to the cardiovascular system, worldwide. The

systemic and organ-specific physiological processes were described, as well as their disorders, which led to the occurrence and development of cardiovascular diseases, being the main cause of global mortality over the last 50 years. It should be mentioned, that important national and international research publications, as well as significant study results were also reported by the collaborators of the department of Physiology from the State University of Medicine and Pharmacy. Recently, the research methods used in physiology have been greatly expanded by physiologists from our university in the following clinical fields: neurology, resuscitation, medical rehabilitation, etc. In this respect, it should be noted that our academic staff has followed the current international trends in terms of various discoveries in the field of physiology, prophylaxis and non-drug treatment of functional and psycho-neurological disorders, as well as in the development of medical rehabilitation means of cardiovascular and neurological disorders.

### Contributions of local researchers

The Department of Physiology was founded in 1945, at that time Moldova was one of the republics of the USSR, by Professor A. Zubkov, Emeritus in Science, Habilitated Doctor in Medicine. Professor A. Zubkov started his scientific research activity under the guidance of Professor M. Saternicov, who was a disciple of the outstanding physiologist – Ivan Sechenov. His scientific contributions included multilateral research studies like those related to pancreatic secretion and the importance of reticular formation for nervous activity.

The university Professor Anatolii Zubkov (fig. 1) had a major role in founding and developing scientific research studies in the field of physiology at the Chisinau State Institute of Medicine. Due to his extensive knowledge and scientific interest, the university Professor A. Zubkov organized and conducted physiological research studies at the Department of Physiology of the State Institute of Medicine in Chisinau in 1945, 1951-1967. Another major contribution of this outstanding physiologist was the foundation of the first physiology laboratory (in 1957) within the MSSR branch of the USSR Academy of Sciences. The physiological researchers of those times contributed substantially to the development of universal physiological science, by providing new experimental and theoretical data in neurophysiology, neuroendocrinology, experimental cardiology, physiology of farm animals in the agricultural sector, etc. [1].

It is worth mentioning the research results of the disciples and collaborators of the university Professor A. Zubkov during the 60s - 70s of the 20th century. O. Dobromaslova (habilitated doctor in medicine and university professor) studied the changes of the afferent impulses in the nerve trunks due to different actions on the energetic metabolism of the peripheral receptors. Other researches included studies on the occurrence of spontaneous and evoked afferent impulses due to excitation of the cutaneous receptors and of the small intestine. The changes in the function of receptors, resulting from excitation of the reticular formation within the brainstem were also described. O. Sherstneva (habilitated doctor in medicine and university professor) studied the afferent impulses generated in peripheral receptors under inflammatory conditions. She also proved the

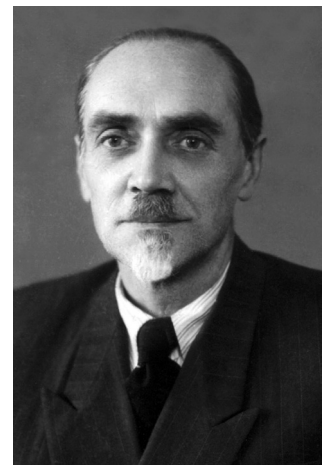
dependence between the spontaneous afferent impulses and the impulses evoked by the inflammatory stages. The author studied the influence of desimpathization of the animal limbs on the evolution of the inflammatory processes, as well as the occurrence of the afferent impulses in the muscles. The study highlighted that in these conditions, the inflammatory process is reduced or even inhibited; moreover, the afferent impulses in the nerves of desimpathizes limbs also decreased.

Professor A. Zubkov also guided a number of physiological research studies closely related to the practical medicine requirements. In this context, the university lecturers A. Babin and T. Sorocean, who conducted relevant researches, should also be mentioned. These scientific works analyzed the electrophysiological changes in the central nervous system functioning, while developing a traumatic and blood transfusion shock [1, 2].

Professor A. Zubkov also conducted and personally participated within a series of important scientific researches as to the role of reticular formation of the brainstem in regulating various body functions, within the Moldovan SSR branch of the USSR Academy of Sciences. Thus, the fundamental work of T. Furdui (habilitated doctor in Biology, university professor, academician of ASM) on corticoreticular-thyroid interaction, namely, on “Regulation of thyroid gland functions and the mechanism of neurogenic thyrotoxicosis”, published in 1967 was of great importance, as well. This research was the first successful attempt to design an experimental model of neurogenic thyrotoxicosis due to chronic stress, thus arousing great interest to the studies on physiology and pathology of the thyroid gland.

Being more concerned with the theoretical issues of physiology, Professor A. Zubkov paid more attention to the applied aspects of physiology, such as the work physiology. In this regard, the research paper of G. Rudi (habilitated doctor in medicine and university professor) referred to the work physiology of the agricultural workers of the viticulture sector. The study findings were implemented in practical recommendations on reducing fatigue and providing proper work management [3].

Furthermore, O. Sherstneva (fig. 2), one of Professor A. Zubkov's disciples, habilitated doctor in medicine, university professor, and head of the Physiology Department of the Chisinau State Institute of Medicine, took over and developed further studies in the field of physiology during the years 1967–1988. This period was characterized by the development of experimental neurophysiological research studies on “Central-peripheral relationships under the action of various stress factors upon the body”. The contemporary electrophysiological methods used in those times (spontaneous and evoked biopotential recordings of the central and peripheral structures of the nervous system), provided important scientific results on



**Fig. 1. Anatolii Zubkov, MD, PhD, Emeritus Professor**



**Fig. 2. Olga Sherstneva, MD, PhD, Professor**

the regulatory importance of the central and peripheral interaction of the nervous system in different experimental models: the action of myorelaxants and their combinations was studied by university assistant V. Cuzor; experiments on hypothermia were made by university lecturer I. Chiaburu; the role of radiotoxins in the afferent activity was investigated by Associate Professor A. Saulea; the afferent impulse in allotransplantation – by univer-

sity lecturer N. Demishcan [4].

During the second half of aforementioned period, a group of young researchers was formed within the scientific and academic staff of the Department of Physiology, aimed to diversify and adjust the scientific research studies to the global requirements and tendencies for the development of physiological sciences. A technical-material and experimental basis was developed, used for advanced scientific research, in terms of experimental cardiology on models of adaptation to hypobaric hypoxia and containment stress, as well as on hyperbaric oxygen therapy. The study findings were successfully implemented within two doctoral theses by V. Vovc and N. Bolocan and one habilitation thesis in medicine by A. Saulea. These research studies exhibited actuality and scientific significance of the new field of research, a fact proved by the development of fruitful cooperation of the aforementioned collaborators with the leading laboratories in the field of physiology within the former USSR.

In 1988, A. Saulea (fig. 3) habilitated doctor in medical sciences, university professor, corresponding member of the Romanian Academy of Medical Sciences, and Emeritus, was appointed the head of the Department of Physiology. The scientific investigations of the department were oriented towards the study of the impact of stressful mechanisms on the cardiovascular system. The original concept, described by the university professor A. Saulea (1989), regarding the role of the trypsin-antitrypsin system in the pathogenesis of stress lesion of cardiomyocytes was a conclusive evidence, found in the research papers of the following collaborators: V. Rotari (MD, 1993) and T. Tazlavan (MD, 1993). The Associate Professor O. Arnaut presented this concept in terms of clinical and physiological application within his PhD thesis. A scientific research laboratory in the field of psychophysiology was founded within the Department of Physiology, which allowed studies to be conducted on the impact of stressors on human psychophysiological parameters, as well as the development of a psychophysiological assessment on vegetative deficiency and its related disorders. The 1980s – 1990s were characterized by a multilateral development of physiological research, showing a more applicative value. The collaborators of the department conducted investigations in the field of sports medicine, medical rehabilitation and gerontology.

Therefore, the department started joint projects with the relevant departments from the entire republic, from Romania, Ukraine, and the Russian Federation. The scientific findings were presented at various republican and international events. There was set up much successful scientific activities with the University of Physical Education and Sports (Chisinau), the Technical University of Moldova, the Universities of Medicine and Pharmacy from Iasi, Cluj-Napoca and Bucharest (Romania), as well as with Rene Decartes University (Paris).

In 1990, Professor A. Saulea jointly with Professor F. Meerson (Moscow) published a monograph on “Post-stress disorders of myocardial functioning”, reporting new conclusive data on the harmful effect of excessive stress factors on the myocardium functioning. Two other monographs of Professor A. Saulea, “Balneophysiotherapy” and “Gerontology” were published in 1993 and 2009, respectively.

In 1994, the Department organized a symposium on sports medicine under the auspices of the International Olympic Committee of Medical Commission. In 1990-1994, the department staff participated in the organization of the Republican Center for Medical and Social Rehabilitation and conducted scientific researches in the field of gerontology and geriatrics. The department also organized an international scientific conference and four symposia on current physiology-related issues and on medical and gerontological recovery. Furthermore, the academic staff attended international congresses and conferences with original scientific reports, thus following the European and world standards of research in the field of physiology and its related fields [4, 5].



**Fig. 3. Aurel Saulea, MD, PhD, Emeritus Professor**

During 1990-2000, the department staff carried out a series of scientific research, predominantly focused on the physiology of adaptive medicine. In 1993, the Associate Professor V. Vovc (later on, habilitated doctor in medicine and university professor) defended the Habilitation thesis on the cardio-protective effect of organism adaptation to hypobaric hypoxia and stress. At the same time, adaptive physiological reserves of the elderly were studied in order to develop and implement geriatric rehabilitation methods. Studies in the field of physiological gerontology resulted in a successful presentation of two PhD theses in medical sciences: G. Vasilache (2001) and L. Munteanu (2001). There was conducted a series of experimental studies on the physiological mechanisms of vascular smooth muscle contractility (V. Ojog); on the reactions of blood components to the action of physical factors, like helium plasma, and millimeter waves (S. Lozovanu, MD, 2006); the diagnostic value of physiological tremor recording and analysis (B. Dragan, MD, 2006) [6].

Research studies in the field of physiology were also carried out in the years 1999–2010, by the Department of Biophy-





**Fig. 4. Victor Vovc, MD, PhD, Emeritus Professor**

sics, Informatics and Human Physiology, which have been continued since 2010 till present, within the current Department of Physiology and Biophysics, run by the head of the Department, university professor and Habilitated Doctor in Medicine – Victor Vovc (fig. 4). There was made a number of researches on changes in the respiratory patterns of different experimental models and certain neurological disorders; ventilatory and cardiac effects of voluntary

hyperventilation in healthy subjects and in patients suffering from panic disorders (T. Besleaga, PhD, 2011); cardiovascular interactions in respiratory pattern changes (A. Ganenco). A scientific collaboration with the Laboratory of Respiratory Physiology of Joseph Fourier University (Grenoble, France) is currently being developed. The scientific activities between the French scientists and those from the Department of Neurology of our university, guided by the university professor Ion Moldovanu, resulted in joint scientific papers, aimed at analyzing the parameters of the respiration patterns as a new type of assessment for functional diagnosis, which is applied for psychoneurovegetative disorders, Parkinson's disease, etc. Currently, applied physiological research studies are being conducted on "The importance of oscillatory physiological processes in regulating the cardiovascular and respiratory system functioning" (V. Tonu, PhD student); "Objective criteria of mechanisms inducing functional heart rate disorders" (L. Sidorenko, PhD student); "The morning headaches in patients with breathing-related sleep disorders" (a clinical and psycho-physiological study) (A. Lupushor, PhD student). The department is also working on two Habilitation theses, conducted by the Associate Professor S. Lozovanu, regarding an extensive and in-depth research on the psychophysiology of respiration; whereas the university lecturer O. Arnăut studies the possibility of mathematical modeling in vital organ disorders due to polytraumas, by developing the assessment criteria based on the study of physiological indices. Since 2013, when the Somnology Center was founded, the scientific department showed great interests in the field of physiology and disorders of sleep and wakefulness. The relevant studies are being carried out by the university professor V. Vovc and A. Lupushor, the university assistant and PhD student [7].

## Conclusions

This short essay does not claim to comprehensively describe the development of physiological research studies within *Nicolae Testemitanu* State University of Medicine and Pharmacy over 75 years since the university foundation. This present chronological presentation with elements of analysis provides historical and current data on the researchers and their research papers, while working as collaborators within the Department of Physiology at our university.

This present paper has provided conclusive evidence that since its foundation, the Department of Physiology has conducted a variety of research studies, whereas the study results have largely reflected the international trends in the field of physiological sciences. The past and contemporary researchers achieved valuable research results in the field of electrophysiology of the central and peripheral nervous system, cardiovascular system physiology, stress and adaptation physiology, work physiology, psychophysiology, modeling of physiological processes and predicting the transition of physiological processes into pathological ones.

Current physiological research studies, conducted at the Department of Physiology, are aimed at studying the physiological markers and predictors for different diseases, involving cardiovascular and respiratory systems by means of psychophysiology. These research features correspond to the up-to-date trends of research development that refer to physiological sciences.

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