

ІСТОРІЯ РОЗВИТКУ ФІЗІОЛОГІЇ СЕРЦЕВО-СУДИННОЇ СИСТЕМИ (ВІД ГАЛЕНА ДО СУЧАСНОСТІ)**Тетяна САВЧУК, Софія БОШТАН, Альона МАРУЩАК.**ВДНЗ України «Буковинський державний медичний університет», Чернівці (Україна)
savchuk519@ukr.net; sboshtan@gmail.com**HISTORY OF THE DEVELOPMENT OF THE PHYSIOLOGY OF THE CARDIOVASCULAR SYSTEM (FROM HALEN TO NOWADAYS)****Tetiana SAVCHUK, Sofia BOSHTAN, Aliona MARUSHAK**Higher State Educational Establishment of Ukraine
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Савчук Тетяна, Боштан Софія, Марущак Алена. Історія розвитку фізіології серцево-судинної системи (від Галена до сучасності). Введення. Історія вивчення серцево-судинної системи це шлях, який тривав більше тисячі років. Знання учених змінилися від примітивних представлень про будову серця і судин до високотехнологічних методів діагностики і лікування. **Ціль дослідження.** Знайомство учених з основними етапами історичного розвитку фізіології серцево-судинної системи. **Основна частина.** Історія кардіології, налічує не одну тисячу років. Іздревле робота серця і судин була загадкою і учені, по крупицям століттями збираючи всі нові дані про роботу серцево-судинної системи, змогли прийти від примітивних представлень про роботу серця і судин до широкого розуміння питань складної нервової і гуморальної регуляції, що стало толчком для розвитку серцево-судинної системи. Прорив у вивченні фізіології серцево-судинної системи був здійснений В. Гарвеєм, який шляхом експериментів на тваринах і на собі встановив наявність двох кіл кровообігу. Сучасні дослідження в області серцево-судинної системи продовжують розвиватися в декількох напрямках. **Висновок.** Історія вивчення серцево-судинної системи продовжується, сьогодні. Лікарі і учені вдосконалюють методи лікування, діагностики і хірургічної тактики і саме сьогодні вони створюють історію.

Ключові слова. серцево-судинна система, Гален, У. Гарвей, Мальпігі, історія кардіології

Introduction. Since ancient people have been trying to know their bodies, they are interested in the functions of various organs and the work of the heart. The history of studying the cardiovascular system is a long way that lasted more than a thousand years and analyzed this way, we can see how scientists' knowledge of the primitive notions about the structure and functioning of the heart and blood vessels has changed to the high-tech methods of diagnosis and treatment that allow for transplant operations the heart and intervene in hard-to-reach places of the cardiovascular system.

The aim of the study. To get acquainted with a wide range of medical workers with the main stages of historical development of physiologists of the cardiovascular system.

Historiography. For the first time, the scientific direction was initiated on the study of the history of the cardiovascular system of Yu. Fedorov, Y. Troyak, and E. Krylov¹. The research in this direction supported and followed the chronology of the accumulation of new information from U. Harvey to modern surgeons-transplantologists I. Kvetnoy². Accumulation of new knowledge about physiological functions, new methods of treatment and diagnosis of cardiovascular diseases are not interrupted.

errupted.

Main part. The heart literally supports life and provides a continuous circulation of blood. The very first anatomists were convinced that the heart was the most important organ, but did not know what exactly it was doing. The ancient Egyptians believed the heart was responsible for emotion. So in ancient Egyptian papyrus Ebers (XVII century BC) the following words are mentioned: "The beginning of the secrets of the doctor - the knowledge of the course of the heart, from which the vessels go to all members, because every doctor, every priest of the goddess Sohmet, every caster touching his head, neck, hands, palms, feet, everywhere applies to the heart: from him sent vessels to each member ... ". At the time of Aristotle, the heart attributed most of the functions associated with the brain. We often say that someone has a "broken heart" or that a person does something "not from a true heart", precisely because of this ancient conviction. The history of cardiology, which has more than one thousand years, has long been a mystery of grains for centuries gathering more and more information about the work of the cardiovascular system³.

First humans - hunters, herders, digging animals in their everyday lives, saw the heart, blood vessels, blood,

¹ Petrovskiy, B. V., red. *Bolshaya Medytsynskaia Entsiklopediya [Great Medical Encyclopedia]*, T. 2, Moskva, Sovetskaia entsiklopediya, 1984, P. 255-256 [in Russian].

² Kvetnoi Y. M. *От Гиппократов до Химутрена [From Hippocrates to Humutren]*, Moskva, Vuzovskaia knyha, 2001, S. 45 [in Russian].

³ Hrytsak E. N. *Populiarnaia ystoriya medytsyny [The popular history of medicine]*, Moskva, Veche, 2003, S. 35-38 [in Russian]. Hofstein A., Mamlok-Naaman R. The laboratory in science education: the state of the art, *Chemistry Education Research and Practice*, 2007, Vol. 8 (2), P. 105-107 [in English].

probably did not make up. Development of society, science the term "artery", the appearance of which we owe to the ancient Greek physician Erasistratus (300-250 BC), can serve as a striking example of this error, and by breaking the corpses of people, this scientist cut the vessels from thick walls and, without seeing blood there, and not knowing that the corpse all blood from the arteries passes into the veins, decided that they would spread through the body of the air. From here, the name is an artery (sirtria), an airborne channel. After 12 centuries (5th century BC), the inhabitant of the Greek island Kos Hippocrates first describes the structure of the heart as a muscular organ. Even then, he formed an idea of the ventricles of the heart and large vessels. The Roman physician Galen (II century AD) created a new, revolutionary for his time teaching that for a long time changed the idea of people about the work of the heart and blood vessels. Unfortunately, in the works of Galen there were many inaccuracies, and there were gross errors so, for example his description of the movement of blood in the body⁴.

The center of the circulatory system, Galen, considered not the heart, but the liver: the blood that is formed in the liver by the body, nourishes the body and completely absorbs it, without going back; in the liver the next batch of blood is formed for absorption by the body. This scheme was universally recognized up to the XVII century. When its erroneous proved Garvey thus, without knowing blood circulation, Galen imagined a peculiar system of blood supply to the body. Appointment of the left heart Galen believed the attraction of the lungs of pneumonia with the air, he considered the stretching - diastole, as the active movement of the heart, systole the same - as a passive decline of the heart, that is, they understood these processes are completely distorted. That is why Galen attributed the processes that occur in the body intangible forces that are inherent in man. Arabian physician Ibn al-Nafis in the XIII century expressed the idea of the existence of pulmonary circulation. He believed that the blood from the right ventricle enters the lungs, enriched there with air and then goes through the pulmonary vessels to the left ventricle. However, his ideas did not receive support from his contemporaries. After 300 years, the same discovery was repeated by the Spanish physician Miguel Servet (1509 or 1511-1553), but this time it was not perceived, and its author was burned as a heretic. The possibility of the preparation of corpses allowed Leonardo da Vinci in the Renaissance to make a serious breakthrough in the development of ideas about the work of the cardiovascular system and to create many anatomical illustrations, which clearly reflected the structures of the valves of the heart. Many mistakes Galen discovered and described Andreas Vesalius, who created the basic prerequisites for the further discovery of pulmonary circulation. Vesalius carefully describes the arteries and veins, the laws of the artery branching, the ways of the bypass blood flow. Even information on the features of the structure of the vascular wall was found in his work. Veins for Vesalius are blood vessels from which the blood moves from the liver to the periphery, and the arteries carry blood that is saturated with the vital spirit from the heart to the periphery. The heart for the vesicle remains the usual internal organ, not the center of the vascular system. The value of Veins is higher than arteries, but the description of the vein topography has inac-

curacies. It allows the connection of arteries of the brain with sinuses of a solid shell, for which the apparent variation of the veins is apparent. The works of Vesalius were a step for the next steps because only a complete theory of the distribution of vessels was possible.

All this period in the history of medicine until the XVII century characterized by domination over the minds of scientists and doctors of the undeniable authority of Galen, Hippocrates, Aristotle thus, after Galen, for many centuries, the existence of two independent systems - the arterial, starting from the heart, and the venous, which depart from the liver, was asserted. These systems, according to the scientist, are never connected. A huge jump in the development of physiological knowledge was the activities of the University of Padua William Garvey (1578-1657), an English doctor who studied blood circulation. Garvey first experimentally proved the existence of blood circulation. The first experience of a young physician has put on himself. He tied his own hand and began to wait. It took only a few minutes, and the hand began to swell, lived swollen and became asleep, the skin began to darken. Harvey guessed that the bandage was holding back the blood. But what? There were no answers yet. He decided to conduct experiments on the dog. Liking a piece of a cake street dog in the house, he deftly threw a lace on his paw, swept over it and pulled it off. The paw began to swell below the tied place. Garnet another paw, tightened with a dull loop. A few minutes later Harvey called again the dog made a deep cut on the paw, the vein below the dressing was cut and from it dripped thick dark blood. At the second leg, the doctor made the incision just above the bandage, and from it a single drop of blood did not flow out. In these experiments, Garvey proved that blood in the veins is moving in one direction. Subsequently, Garvey compiled a blood flow chart based on sections of 40 different animal species. He came to the conclusion that the heart is a muscle sac that acts as a pump that pumps blood into blood vessels. The valves allow the flow of blood in only one direction. The impulses of the heart - is a consistent reduction of the muscles of its departments, that is, the external signs of the "pump". In the book by W. Harvey, "Anatomical Study on the Movement of the Heart and Blood in Animals," along with anatomical description, an experiment was widely used. Harvey uses the vivisection method, conducts numerous experiments on both animals and on himself, and concludes that "... the blood from the arterial vein passes from the right ventricle into the lungs, from where it flows through the venous artery to the left atrium, and finally to the left ventricle. "And there is an extremely important conclusion that" animals have blood in a circular and constant movement. "Of course Garvey at that time could not see the capillaries he suggested the existence of hypothetical "pores of the body"⁵.

A little later, in 1661, an Italian physician and biologist M. Malpighi (1628-1694) described the blood capillaries and placing them between the arteries and veins, thereby closing the Garvey's circles of blood circulation. So Garvey owns the merit of the creation and experimental justification of the first scientific physiological theory of the movement of blood in the body of animals and humans in a circle, circulation of blood, that is, the opening of the blood circulation system. That is why the year of publication of the famous book by V. Garvey is considered the birth year of a

⁴ Shoifet M. S. *100 velykykh vrachei [100 great doctors]*, Moskva, Veche, 2011, S. 19. (in Russian).

⁵ Istoriya razvytyia ucheniya o krovoobrashchenyy. 30.11.2015 [Electronic resource], Access mode: https://knowledge.allbest.ru/biology/3c0b65625b2bd68a4d43a89421206c37_0.html.

new science - physiology. This date is also the beginning of a new one experimental stage in the development of the doctrine of blood circulation. Experimental physiology required methods for measuring and quantifying the work of the cardiovascular system. And such methods began to emerge and improve. After about 100 years, the English priest Stephen Hales has invented a method that allows measuring blood pressure, that is, the force with which the heart pumps blood. Using a sophisticated device made of copper tubes and goose trachea, he discovered that in the mare, at the cross-section of the artery, the blood beats a fountain height up to eight feet⁶.

Later, scientists calculated that with the same method, human blood would rise by about 5 feet. Fortunately, other, harmless methods for determining blood pressure were invented later. One hundred years later, a French physician and physicist Jean Poiseil (1799-1869) used U-shaped tubes to measure blood pressure and also filled it with mercury, thus creating a mercury gauge. Since then and until now blood pressure is determined only in millimeters of mercury column. An Italian criminal scientist, Cesare Lombroso, was one of the first to argue that measuring blood pressure can be useful in the study of mental processes. In particular, Lobroso believed that if a suspected offender, whom the police questioned, to measure blood pressure, then it would be possible to determine whether the man was telling the truth. In practical medicine, it is now widely known that stress and tension intensify the cardiovascular function. With the help of portable measuring instruments, it was discovered that in many stressful situations, heart rhythm (PC) and heart rate (BP) increase in real life. The use of such portable devices was often of little decisive importance for the diagnosis of heart disease in cases where it was not detected in a calm condition in a doctor's office. Gunn and the staff report, for example, about one patient who had an accelerated heart rhythm (more precisely, paroxysmal tachycardia of the athlete) only during a bridge game when his partner was a partner. Several years later, this patient died of a heart attack during such a party in a bridge. A little later (1846), the famous German physiologist Karl Ludwig, for the first time in the world, recorded the blood pressure in the animal's artery. For this purpose, he placed on the surface of mercury fluctuating in one of the manometer's knees, float, connected with the lever of the myograph, and also invented and built the world's first kymograph on which the blood pressure was recorded. In addition, in the laboratory and on the proposal of K. Ludwig's Russian pharmacist I.M. Dougel (1830-1916) created another device, which allowed measuring the speed of blood flow in the blood of their animal vessels, the so-called Ludwig bloody clock. There are methods that help us to measure and record the work of the cardiovascular system in a bloodless, non-invasive way. Thus, the German physicist A. Fik (1870) proposed a relatively blood-free way to determine the minute volume of blood in animals and humans, which subsequently became widespread in a clinic and an experiment. The first plethysmograph by A. Moss (1874) allowed the recording of the volume pulse in humans, and with the help of the sphygmomanometer Riva-Rocchi (1896) began to measure blood

pressure. It was developed in 1905 by the Russian physician N.S. Korotkov auspicious method and still remains the only bloodless method of determination of blood pressure in humans throughout the world. The Netherlands physician and physiologist V. Einthoven (1860-1927), who was rightly considered to be the founder of electrocardiography in 1903, designed a device for recording electrical processes in the heart and for the first time recorded an electrocardiogram of a person and gave a description of her teeth. He used electrocardiography for diagnostic purposes for the first time in parallel with the emergence of new methods, the study of manifestations of the cardiovascular system, quantitative assessment of its parameters, the study of the relationship between them⁷.

Already mentioned J. Poiseil (1841) formulates a law that binds the pressure and velocity of the fluid in the tube with its diameter and fluid properties, and which formed the basis of a new section of physiology - haemodynamic implants. E. Marie and J. Schoow (1861-1863) with the help of catheters inserted into the atrium and the ventricles of the heart of the horse recorded the variations of pressure in the cells of the heart during its reductions, having initiated the study of cardiodynamics. Many scientists, including W. Gis, R. Remak, P. Stannius and many others, devoted themselves to the study of automation of the heart. Thanks to their efforts, to some extent, the veil over the nature of this mysterious phenomenon was raised to a certain extent⁸.

From 40-60 years of the XIX century. Investigations of innervation and regulation of the cardiovascular system are underway. In 1843, Professor of the University of Kyiv A.P. Walter published works in which he described the expansion of the blood vessels of the fungus of the floating membrane after cutting the sympathetic fibers of the sciatic nerve. That is A.P. Walter, much earlier than the famous French physiologist and pathologist K. Bernard (1813-1878), with his famous trial on the rabbit's ear, put in 1852, established vasoconstrictive effects of sympathetic nerves. And K. Bernard, in addition, managed to show that parasympathetic nerves are able to expand the blood vessels of the salivary gland. Almost simultaneously with these works, scientists began to study the innervation of the heart: the inhibitory effect of the vagus nerve on the heart was discovered (Ed. Weber, 1845) and the stimulating effect of the sympathetic nerves (I. Tsyohn, 1867), although now it the discoveries are attributed to Professor of Moscow University O. M. Orlovsky, who made him even in 1856 significant contribution to the study of innervation and regulation of the heart was made by Alexander Petrovich Walter I.P. Pavlov, V. Gaskel, (1817-1889) E. Starling and many other scholars⁹.

In particular, I.P. Pavlov, studying the innervations of the heart, described the branch of the sympathetic nerve, whose irritation only caused an exaggerated effect on the heart. This phenomenon was explained by the trophic influence of the scientist and this he discovered a new direction in physiology about the trophic function of the nervous system, which was successfully developed by his students L.A. Orbel and O.D. Speransky. At the heart, a discovery was made, which led to revolution in all physiology. O. Levy (1921) showed that the inhibition of the isolated heart of a

⁶ Istoriya razvityia ucheniya o krovoobrashcheniy. 30.11.2015 [Electronic resource], Access mode: https://knowledge.allbest.ru/biology/3c0b65625b2bd68a4d43a89421206c37_0.html [in Russian].

⁷ Verkhratskyi S. A. *Istoriia medytsyny [History of medicine]*, Kyiv, Zdorovia, 2011, S. 149 [in Ukrainian].

⁸ Ibidem., P. 67.

⁹ Kvetnoi Y. M. *Ot Hippokrata do Khiumtrena [From Hippocrates to Humutren]*, Moskva, Vuzovskaia knyha, 2001, S. 123 [in Russian].

frog during irritation of the vagus nerve is carried out with the participation of a substance-acetylcholine, which is isolated by the endings of this nerve. This fact gave an impetus to the creation of a mediator theory of the transmission of nerve signals in a living organism - a theory that is now universally accepted. In parallel with the investigation of innervation of the cardiovascular system, it began to study its reflex regulation. One of the first, probably, was the reflex, described by F. Golz in 1863: irritation of mechanoreceptors of the abdominal organs of the frog caused the inhibition of her heart. The Russian scientist Ivan Tsion in the laboratory of K. Ludwig observed a decrease in blood pressure in the rabbit by irritation of the depressor nerve, which departed from the receptors of the arch of the aorta - the reflex of Tsion-Ludwig, or the reflex from the arch of the aorta (1866). A similar reflex was obtained by irritation of the carotid sinus receptors (G.Gering, 1923) and the pulmonary artery and vessels of the small circle (V.V. Parin, 1941). It turned out that the heart is also a powerful reflexogenic zone: the Bainbridge (1914) reflex of the mechanoreceptors of the atrium and reflex of Bezold-Yarish (1939) from the chemoreceptors of the heart were described. In the laboratory of the already mentioned K. Ludwig, there was not one outstanding discovery. In particular, F.V. Ovsyannikov, working in this laboratory, established the localization of the vessel's motor center in the medulla oblongata (1871).

Generally, as a laboratory in Vienna, and subsequently the whole Institute of Physiology in Leipzig due to the high authority of their leader K. Ludwig - the inventor, researcher, organizer and teacher became physiologic Mecca. Scientists from all over the world came here to listen to the lectures of an outstanding scientist, to work in his laboratories, to learn unique techniques, to make remarkable discoveries and, first of all, in the field of physiology of blood circulation. Only from Russia in the laboratories of K. Ludwig there were more than 50 scientists, among whom, besides the already named I. Dogel, I. Tsiona, and F. Ovsyannikov, there were such well-known physiologists as V.A. Bets, V.L. Danylevsky, I.P. Pavlov, I.M. Sechenov, S.I. Chiriev and others. It was found that in regulating the cardiovascular system, in addition to the medulla oblongata with its vascular center, higher levels of the central nervous system participate. Thus, J. Karplus and A. Craidel (1910) and V. Hess (1936) first drew attention to the important role of the hypothalamus as a sympathetic center in the regulation of blood circulation. The effect of measles is also revealed. hemispheres on blood pressure and heart work (B.L. Danilevsky, 1874: V.M. Bekhterev and M.A. Mislavsky, 1886). As evidence of presence in the cerebral cortex of the circulatory system, man's conditioned reflexes were produced in a person (I.S. Tsitovich, 1918)¹⁰.

In our time, the circulatory system continues to be at the center of the attention of scientists from many laboratories in the world. Researchers continue to accumulate new facts, refine previously established parameters, test, revise some controversial or questionable provisions. In particular, since F.V. Ovsyannikova, although not at fault, was led to believe that the vessel's motor center is located at the bottom of the IV ventricle. The majority of the facts received by a whole army of researchers testified in favor of this idea, and it was firmly included in textbooks and scientific monographs. However, in 1963 R. Michel, and later G. Leshche

and M. Shlyafke (1967) found on the opposite side of the oblongata brain - on the very surface of its ventral part of the accumulation of neurons, named in honor of these scientists in the first letters of their names by the zones M, L and S. further study of these sites made it possible to assume that they are part of the vasomotor center, and since the 80s many scientists have been formed and the idea that the vascular center is located precisely in the ventrolateral segment of the medulla oblongata, not on the bottom of IV ventricle. Another discovery made by R. Furcgot and M. Zavadsky in 1980 significantly changed the perception of specialists about the nature of vascular tone and the pathogenesis of some cardiovascular diseases. These are physiologically active substances (nitric oxide, endothelium and some others) produced by the endothelial cells of the blood vessels and capable of maintaining the tone of the vessels, regardless of the nervous system¹¹.

Second half of XX century thanks to the outstanding successes of physics and, in particular, the electronic industry is marked by the creation and implementation of a large number of modern precise and highly sensitive methods of studying the cardiovascular system in scientific studies of physiologists and clinical practice. Widely used electrometers, meters and registers of cardiac output, blood flow velocity in main vessels and microwells, equipment that allows not only to fix but also to hear and even see the human heart during its reduction phonological, echoshardiography, positron emission tomography, NMR-equipment working with nuclear magnetic resonance, etc.)¹².

Current research in the field of cardiovascular system continues to evolve in several directions. This is, firstly, the study of regional and organ blood circulation, the characteristics of blood supply to various organs and tissues, its connection with the function and its regulation (B.I. Tkachenko, V.M. Khayutin); cardiodynamics, its regulation in norm, at aging and pathology (V.V. Frolkis, O.O. Moybenko). Secondly, the application of electrophysiological and biochemical methods allowed to investigate the behavior of central and peripheral neurons in cardiovascular reactions, participation and mechanisms of muscle and endothelial cells of the heart and blood vessels in these reactions (V.F. Saghat, V.P. Lebedev, O. Medvedev). Thirdly, studies on the molecular level of the interaction of specific agonists and antagonists with membrane receptors of the nervous, muscular and endothelial cells of the cardiovascular system (M.F. Shuba, S. Monkada, N. Sperelakis,). These problems are particularly important in connection with the need for medicine in effective and directed remedies for the treatment of cardiovascular diseases. It is necessary to name one more direction of development of physiology of blood circulation - it is modeling of cardiovascular system. Here you can distinguish two main directions. This is first of all, the creation of an adequate model of the blood circulation system and the study of quantitative aspects of physiological and biophysical laws the regularities of the functioning of the cardiovascular system (M.M. Amosov, F. Grodins). Secondly, the development and creation of simple models for use in clinics of cardiac surgery (O. Lischuk, M. Kumada), as well as complex computer simulation models for the study of human hemodynamics reserves in order to ensure its survival under extreme conditions (R.D. Grigoryan, R. Croston).

¹⁰ Sorokyna T. S. *Ystoriya medytsyny [History of medicine]*, 4-e yzd., Moskva, Akademyia, 2008, S. 238 [in Russian].

¹¹ Ibidem., P. 145

¹² Ibidem., P. 59

Conclusion. The history of physiology of the cardiovascular system has long lasted from its inception, when the concept of the cardiovascular system was rather limited. For centuries on grains, using the methods of observation, chronic and acute experiment already in the XIX century the cardiology emerged as an independent branch of medicine, and physiology of the cardiovascular system at that time had a lot of scientific achievements. Science does not stand still as a result of the emergence of new methods of treatment and diagnosis. Surgery of the cardiovascular system is one of the most powerful directions that is constantly evolving and where there are many problems that need to be solved by collaborative work of scientists, clinicians, surgeons. The history of the cardiovascular system continues, it is today that doctors and scientists improve the methods of treatment, diagnosis and surgical tactics that make history.

Савчук Тетяна, Боштан Софія, Марушак Альона. Історія розвитку фізіології серцево-судинної системи (від Галена до сучасності). Вступ. Історія вивчення серцево-судинної системи це шлях, який тривав понад тисячу років. Знання науковців змінилися від примітивних уявлень про будову і роботу серця і судин до високотехнологічних методів діагностики і лікування.

Мета дослідження. Ознайомити широке коло науковців з основними етапами історичного розвитку фізіології серцево-судинної системи.

Основна частина Історії кардіології, налічує не одну тисячу років. Спрадавна робота серця і судин була загадкою і науковці по крупних століттях збираючи все нові відомості про роботу серцево-судинної системи, змогли прийти від примітивних уявлень про роботу серця і судин до широкого розуміння питань про складну нервовому і гуморальну регуляцію, що стало поштовхом для розвитку хірургії серцево-судинної системи.

Прорив у вивченні фізіології серцево-судинної системи був здійснений У. Гарвеєм, який шляхом експериментів на тваринах і на собі встановив наявність двох кіл кровообігу, а згодом Мальпігі була відкрита система капілярів. Стефен Хейлс винайшов метод, що дозволяв вимірювати артеріальний тиск, а через сто років французький лікар і фізик Жан Пуазейль створив ртутний манометр. В 1846 р. знаменитий німецький фізіолог Карл Людвіг вперше у світі записав тиск крові в артерії тварини. Німецький фізик А. Фік в 1870 запропонував безкровний спосіб визначення хвилиного об'єму крові у тварин і людини. Розроблений у 1905 р. російським лікарем Н.С. Коротковим аускультативний метод і понині залишається в усьому світі єдиним безкровним методом визначення артеріального тиску в людей.

Нідерландський лікар і фізіолог В. Ейнтховен (1860-1927), у 1903 р. вперше записав електрокардіограму людини та дав опис її зубців. Починаючи з 40-60 років XIX ст. розгортаються дослідження іннервації та регуляції серцево-судинної системи.

Сучасні дослідження в галузі серцево-судинної системи продовжують розвиватись у кількох напрямках. Це, по-перше, вивчення регіонарного та органного кровообігу, особливостей кровопостачання різних органів і тканин, його зв'язку з функцією та його регуляції (Б.І. Ткаченко, В.М. Хаютін);

кардіодинаміка, її регуляція в нормі, при старінні та патології (В.В. Фролькіс, О.О. Мойбенко). По-друге, застосування електрофізіологічних та біохімічних методів дозволило досліджувати поведінку центральних та периферичних нейронів при здійсненні серцево-судинних реакцій, участь і механізми роботи м'язових та ендотеліальних клітин серця і кровоносних судин у цих реакціях (В.Ф. Сагач, В.П. Лебедев, О.С. Медведєв). По-третє, дослідження на молекулярному рівні взаємодії специфічних агоністів та антагоністів з мембранними рецепторами нервових, м'язових та ендотеліальних клітин серцево-судинної системи (М.Ф. Шуба, Дж. Арндт, С. Монкада, Н. Сперелакіс.). Ці проблеми набувають особливо важливого значення в зв'язку з потребою медицини у ефективних і направлено діючих засобах для лікування серцево-судинних захворювань.

Висновок. Історія вивчення серцево-судинної системи продовжується, сьогодні. Лікарі та вчені вдосконалюють методи лікування, діагностики та хірургічної тактики і саме сьогодні вони створюють історію.

Ключові слова. серцево-судинна система, Гален, У. Гарвей, Мальпігі, історія кардіології

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