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# On some controversial issues concerning the interrelation of cardiology and cardiac surgery

Pavel M. Bogopolsky[*], Dmitry A. Balalykin[**]

[*] Academic B.V. Petrovsky Russian Scientific Center of Surgery
2 Abrikosovsky Lane, Moscow 119991, Russia

[**] I.M. Sechenov First Moscow State Medical University, the Ministry of Health of the Russian Federation
8 Trubetskaya St., building 2, Moscow 119991, Russia

**Abstract.** The article is devoted to discussion of a number of controversial issues in the history of cardiology and cardiac surgery. The authors substantiate the view that cardiology is an older and extensive science, while cardiac surgery is a new and highly specialized discipline. It can be noted that the impetus for the emergence of cardiac surgery in the first quarter of the 20th century was provided by cardiology when it revealed the inability to conservatively treat some serious heart diseases, compared to the expected benefits from the use of surgical techniques based on manually fixing basic mechanical obstructions to cardiac functioning.

The origin and development of cardiology in Russia and abroad took place almost simultaneously, in contrast to cardiac surgery. While the birth of cardiac surgery in Europe and the United States can be attributed to the beginning of the 1910s, in the Soviet Union cardiac surgery originated in the late 1940s as part of the rapidly developing thoracic surgery, and was designated a special field of clinical medicine in the 1950s and 1960s, largely based on the achievements of cardiology. It is noted that by this point, domestic cardiology had already gone through foundation and formation periods, and had entered a period of development. It should be emphasized that the history of cardiology and cardiac surgery in Russia and the world should not be seen only in the context of scientific and technological progress and advances in medical science, but also taking into account a number of important socio-economic factors. The authors invite readers to exchange ideas that can contribute to a more complete picture of the development of cardiology and cardiac surgery as an independent field of clinical medicine.

**Keywords:** cardiology, cardiac surgery, history of origin and development, interaction, periodization

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**About the authors**

Pavel M. Bogopolsky – Doctor of Medical Sciences, Senior Researcher at the Department of the Scientific Programs and Staff Training, B.V. Petrovsky National Research Center of Surgery (Moscow). E-mail: bogopolsky_med@mail.ru

Dmitry A. Balalykin – Doctor of Medical Sciences, Doctor of Historical Sciences, Professor, Chairman at the Department of the History of Medicine, National History and Culturology, I.M. Sechenov First Moscow State Medical University (Moscow). E-mail: shok@nmt.msk.ru

In recent years, Russian historiography has seen a surge in research focusing on the historical development of various fields within the medical sciences. Part of this research has been devoted to establishing a historically accurate picture of the birth and growth of the individual clinical disciplines. The journal *History of Medicine* published two articles by V.I. Borodulin, S.P. Glyantsev, and A.V. Topolyanskiy dealing with current issues in cardiology and cardiac surgery [1, 2]. These articles, in our view, represent an important scholarly contribution for a number of reasons: they propose a periodization of the history of Soviet cardiology, outline the most significant achievements of the founders and leaders of Russian cardiology, identify the major movements and schools within the field, and discuss the relationship between cardiology and cardiac surgery. An additional factor contributing to the significance of these articles is the fact that Borodulin and Glyantsev are, of course, two of the most accomplished authorities on the history of Russian cardiology and the history of cardiac surgery, respectively. It is also worth noting that Borodulin has made important contributions to the development of a general theory of the history of medicine (for example, he proposed a more elegant, in our view, the definition of a "clinical school"). Nevertheless, we will argue that several of the propounded by Borodulin et al. regarding the relationship between cardiology and cardiac

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surgery are controversial and merit further discussion [1, 2]. One such controversial thesis involves the significance of cardiac surgery on the development of cardiology in the USSR [2]. This article will provide an analysis of these debated issues and offer an invitation to participate in a collaborative process aimed at clarifying the periodization of the history of these important clinical disciplines.

A number of issues in the articles by Borodulin et al. indicate a need to foster a more in-depth discussion about the history of cardiology and cardiac surgery in our country and abroad and a need to expand the discussion to cover a longer period of time – from the beginning of the 20th to the beginning of the 21st century. We argue that within the proposed context a reexamination of the issues can contribute to a more complete picture of the emergence and evolution of Russian and world cardiology and cardiac surgery as two independent branches of clinical medicine devoted to the study of a wide variety of cardiovascular diseases and the development of effective methods for diagnosing, treating, and preventing them.

In the article "Stages in the foundation and subsequent development of Russian cardiology. Part 1", Borodulin, Glyantsev, and Topolyanskiy claim the following: "Cardiology as a branch of clinical medicine separate from internal medicine and dealing with the morphofunctional peculiarities and pathologies of the cardiovascular system was born at the turn of the 20th century" [1, p. 40]. It is true that the classification of cardiology as an independent branch of clinical medicine is generally accepted to have arisen at the beginning of the 20th century. In historiography this process is usually associated with the advent of specialized methods of researching the cardiovascular system, leading to a significant expansion in the conceptualization of the corresponding nosological norms [3, p. 380]. The English doctor James Mackenzie (1853–1925) is usually considered the founder of clinical cardiology. In 1902, he published his first work on cardiac arrhythmias and an extensive study of cardiac diseases; in 1908, he published a work on angina pectoris [3, p. 380].

Furthermore, Borodulin et al. note that, "the foundation and development of cardiology as an independent multifaceted academic field, a clinical discipline and medical specialization, continued throughout the pre-Soviet period (the beginning of the 20th century), the Soviet period, and the post-Soviet period" [1, p. 41]. This is a fairly long stretch of time in Russian and Soviet history and it includes the "pre-Soviet" period from about 1901 to 1917. The "post-Soviet" period, of course, begins in 1991 with the fall of the USSR, although the authors do not carry their investigation beyond the 1980s. They note, "according to our research, the earliest appearance in Russian-language medical literature of the term 'cardiology', in the sense we are considering, dates back to 1921... Therefore, it seems appropriate to use the term 'cardiology' when speaking of the formation of this discipline beginning in the 1920s" [1, p. 41]. However, the appearance and spread of a new term do tell us anything about what a thing actually is or how it originated. Unlike Rudolf Carnap and his followers, we are not inclined to exaggerate the significance of terminology and semantics in the history of the applied sciences. For example, as we will show, the basic elements of modern endovascular cardiac surgery were in place by the 1910s, but the term "endovascular surgery" was not used until the end of the 20th century.

By and large, Borodulin's articles make it impossible to determine why and how cardiology arose as an independent specialization. The authors write different and contradictory information in different parts of the work. They say that cardiology arose "at the turn of the 20th century", but then go on to make the following claim: "In the initial stage (the first half of the 20th century), the field of cardiology developed as a part of internal medicine... In the second half of the 20th century, cardiology began to crystallize as an independent clinical and academic discipline (this being the second stage lasting form the 1950s to the middle of the 1970s)... In the third stage (from the second half of the 1970s on), cardiology entered the ranks of practical medicine as an independent medical specialty" [1, p. 41]. Later, they take a completely different approach: "This suggests that cardiology's process of separation began in the 1930s as a division of clinical internal medicine in the USSR" [1, p. 43, 44]. And finally, "Thus, the first stage in the foundation

of Russian cardiology took place in the first half of the 20th century as part of clinical internal medicine" [1, p. 44]. It remains unclear, then, when exactly cardiology began to be distinguished as a separate practical specialization: did the process start in 1901, the 1920s, the 1930s, or the 1950s? Moreover, in the second part of their work, the authors claim, "Cardiology as a new field of medical knowledge in the USSR was born in the 1920s and 1930s. However, its separation from clinical internal medicine as an independent scientific, academic and medical specialization, took place only in the second half of the 20th century" [2, p. 352].

As for the history of cardiac surgery, the authors rightly claim that during the period from 1900 to 1930, "surgical treatment (at first on heart defects and major blood vessels) was still in its experimental stages" [1, p. 44]. We agree with this claim but add that the various surgical experiments conducted during this period were conducted not only on animals but on people. However, the following position is more difficult to reconcile with the available historical data: "The second stage [in the history of cardiology] took place in the 1940s and the beginning of the 1950s..." [1, p. 44]. It is apparent that the authors associate the beginning of the second period of the history of *cardiology* with the first *cardiac surgeries* of A.N. Bakulev, Y.N. Meshalkin, and with A.V. Gulyaev's treatment of congenital and rheumatic heart disease from 1948–1952 (i.e. the birth of clinical cardiac surgery in our country). We argue that this association is, for the most part, artificial. In fact, the first operations on extracardiac structures (for example, a ligation of a *patent ductus arteriosus*) and the first closed mitral commissurotomy performed in the USSR at that time were unsystematic, occasional and did not change the views of many cardiologists or impact the course of their research. Moreover, we would like to point out that there were clear and evident reasons for suspicion on the part of the medical community when it came to experiments in the field of clinical cardiac surgery. The following claim made by Borodulin et al. seems even more controversial: "The beginning of this stage [in the history of cardiology in the USSR] is recorded in published abstracts, first by surgeons and then by surgeons and physicians working together on these problems" [1, p. 44]. However, the fact is that the first published abstract by surgeons A.N. Bakulev and Y.N. Meshalkin, whom the authors cite, dates back to 1955 (and deals only with surgery) [4], and the first joint work by surgeon A.A. Busalov and physician A.M. Damir [5] dates back to 1962. Exactly when did the second historical period of cardiology, marked by a broad consensus between cardiac surgeons and cardiologists with regards to a new surgical practice, begin – in the 1950s or the 1960s?

We would like to stress the fact that the birth of clinical cardiac surgery antedates the development of experimental cardiac surgery, whose primary exponents in the USSR are rightly considered to be I.P. Dmitriev, N.N. Terebinsky, and V.P. Demikhov. One theory found in the literature links the birth of cardiac surgery to the first attempts to suture heart wounds, a trend which began towards the end of the 19th century. In fact, in analyzing the achievements of German surgeon Ludwig Rehn, the first to successfully carry out such an operation in 1896, historians often cite the failed prediction of eminent Austrian surgeon Theodor Billroth. In 1893, he wrote, "A surgeon who tries to suture a heart wound deserves to lose the esteem of his colleagues" [6–8].

We consider this approach to be methodologically unsound, as the first external operations on heart wounds were, in fact, preconditions for the birth of cardiac surgery in the modern sense. Taking this approach, if we were to examine the practice of diagnosing, treating, and preventing heart diseases from a slightly broader perspective, it would not be difficult to discern the conditions for the birth of cardiology in the writings of the great physicians of the past. For example, it is well-known that Aristotle proposed a reliable topographical and anatomical description of the heart which could have arrived at only by direct observation of the heart in the ribcage [9]. Also, one of the authors of this article has brought to light a text that was previously unknown in the Russian-language literature: a fragment from Hippocrates' treatise *De carnibus* (*On flesh*) [9, p. 59–60], a text that is thought to be a part of the Hippocratic Corpus, although it was never included in the Russian-language edition of the Corpus edited by V.P. Kaprov [10]. *De Carnibus* also

contains the same kind of clear observations of the anatomical structure of the heart and major blood vessels. Also, Herophilos made extremely useful observations of the arterial pulse and was the first to link this phenomenon with the flow of blood through the arteries [11]. Galen's treatise *On the doctrines of Hippocrates and Plato* contains a number of anatomical descriptions of the heart and even mentions an attempted surgical treatment for transsternal fistula of the pericardial sac [12]. Do these examples (and others) mean that we can date the study of cardiac anatomy to the times of Aristotle and Galen and consider Galen a founder of thoracic surgery? Of course not. However, this answer requires a methodological explanation. In our view, passing observations, chance surgical findings and emergency operations (even if successful) cannot be thought of as constituting the birth of a clinical discipline. It is necessary to take into account all of the conditions which motivate scientists to act in an experimental or practical clinical context: their world views, research agendas, theoretical justifications, etc. The authors of this article have, in their works, focused on reconstructing the history of esophageal and stomach surgery. The advent of this specialization is usually associated with V.A. Basov's 1842 experimental work on the justification for gastrostomy operations. Basov had a conscious research plan aimed at solving the problem of surgical access to the stomach with an eye to making progress on the multiplicity of clinical problems arising from it. Thus, we do not consider it appropriate to identify the birth of esophageal and stomach surgery with a few passing attempts at surgical intervention on the esophagus and stomach that took place before Basov's work.

Strictly speaking, although an operation to suture heart wounds can be classified as emergency general surgery, it is not cardiac surgery in the full sense of the term in the same way that, for example, the first surgical treatment of an open fracture of the bones of the calvaria is not neurosurgery. Of course, the enormous significance (including psychological) of the first successful suturing of a heart wound cannot be overstated. R. Nissenand R.H.L. Wilson (1960) echo this sentiment when they cite Sherman's popular expression, "The heart is only two or three centimeters away, but the field of surgery needed 2400 years to surmount this distance" [8, p. 79]. N.I. Napalkov, the author of the first dissertation in Russia on the experimental study of heart and blood vessel suturing (1900), wrote: "The development of a means to stop the bleeding of a heart wound was the seed from which the field of heart surgery grew" [12, p. 45]. Some scholars think that the necessary preconditions for heart surgery arose even earlier – starting in 1810 when pericardiocentesis and pericardiotomy operations began to be performed [14].

Borodulin et al. claim: "Since the end of the 1940s, the emergence of heart (cardiac) surgery from thoracic surgery has had an important influence on the development of cardiology..." [2, p. 356]. Earlier we noted that in the USSR cardiac surgery only arose towards the end of the 1940s and start of the 1950s, and within the booming field of thoracic surgery. But by the 1960s cardiac surgery had become an independent academic discipline capable of dealing with the kinds of complex issues that cardiology was not equipped to deal with. To better understand the factors leading to the origin of cardiac surgery in the USSR it is important to remember a few subjective factors not directly related to the history of diagnosis and treatment methods. In the second half of the 1940s, a group of prominent and ambitious surgeons arose who had extensive experience operating on chest cavity organs – experience obtained in wartime military hospitals. They wanted to master previously unused reconstructive operations to repair heart damage caused by congenital and acquired diseases (A.N. Bakulev, A.A. Bishnevsky, B.V. Petrovsky, P.A. Kupriayov, B.A. Korolev). As models for these procedures, Soviet surgeons looked to foreign (especially American) scientists who had begun working on the surgical treatment of heart diseases several years earlier. It is thought that the surgical treatment of congenital heart conditions was first begun in 1938 by American surgeon R. Gross, although a major breakthrough in cardiac surgery occurred in 1953 when J. Gibbon developed artificial blood circulation [14, 15]. Of course, opinions are divided on this issue. For example, S.R. Zalaquett (2000) argues that the birth of cardiovascular surgery occurred in Philadelphia on 10 June 1948 when Charles

Bailey successfully operated on a patient with mitral stenosis and the operation was repeated six days later in Boston by Dwight Harken [16].

We would also like to note that S.R. Zalaquett [16], like many other authors, refers to cardiac surgery as "cardiovascular surgery". We call attention to this terminology because a correct understanding of the foundations and development of cardiac surgery (heart surgery or, as it was traditionally called in English "surgery of the heart") is complicated by the very fact that it can be described as surgery of the heart and blood vessels, or within a broader chronological and epistemological context. Thus, some scholars trace the origin of cardiovascular surgery to the development of vascular suturing [17]. It is also worth noting that these works appeared at the end of the 19th and beginning of the 20th century and were initially aimed at surgical treatment of diseases and injuries of the peripheral blood vessels and their dangerous consequences, including thrombosis and post-traumatic arteriovenous aneurysms. Their authors, most notably Nobel laureate A. Carrel, were in no way attempting to treat diseases of the heart and major blood vessels.

In our view, an approach to determining the point of origin of one or another scientific discipline should be based on epistemological criteria. It must deal not only with a scientific problem on its own but must consider the conscious, purposeful, systematic program of study undertaken by particular researchers to make progress on a problem. In this way, the origins of a discipline can be dated with some precision. We will now highlight several such factors which allow for a more accurate determination of the time of birth of Russian (and in general, world) cardiac surgery. Even at the beginning of the 20th century, the study of surgical treatment options for patients with serious heart diseases was one of the most urgent problems. During an autopsy in 1902, American doctor L. Brunton observed a severely stenotic aortic valve and came to the conclusion that the patient might have been more effectively treated if it were possible to somehow widen the atrioventricular opening [18, p. 11]. In the first years of the 20th century, a number of European and American scientists (Scheppelmann, Rosenbach, Klebs, Rihl, Biondi, Muller, Tollemer, Cushing, Bernheim, Carrel, Tuffier) began to develop methods to conduct "closed" surgical interventions on the inner structures of the heart by using specialized instruments, e.g. the valvotomy and cordotomy. Such procedures were done on animals and they accessed the atrioventricular valves through the carotid artery or jugular vein and by puncturing the ventricular or arterial walls. This avoided damage to the valves and heart strings [18–20]. Soon the closed valvotomy was being used in clinical practice. In 1913, French surgeon E. Doyen employed a tenotomy to enter the right ventricle by cutting its wall in order to repair a fused pulmonary valve. The patient, however, soon died of an untreated infundibular stenosis [21]. In 1925, the American surgeon E. Cutler used a valvotomy via the upper right ventricle to perform several commissurotomies. One of his patients survived the operation and went on to live for four and a half years, but the others died. That year, German surgeon B. Pribram successfully completed the same operation; however, his patient died six months later of endocarditis [18–20]. According to N.N Terebinsky (1940), before 1930 only nine such operations treating mitral stenosis were known to have taken place throughout the world. Although these closed operations had the advantage of reducing significant trauma to the walls of the heart, they also risked accidental damage to other intracardiac structures [19].

In 1925, Russian scientist I.P. Dmitriev published a major article on this problem, writing: "The prospect of performing operations inside the heart is extremely attractive and promising both from a theoretical and practical point of view and has only recently become a possibility" [18, p. 3]. Experimenting with animals, Dmitriev was able to insert his finger into the right atrium via the right auricle and use it to control an instrument (a knife or probe) in the left auricle in order to perforate an atrial septal defect in the foramen ovalearea [18]. In Germany, a similar kind of operation for mitral stenosis was developed in an experiment by E. Schepelmann, who also connected the auricles and stitched an artery segment between them [18, 19]. Additionally, in the first quarter of the 20th century, there were a number of known cases where the heart cavities were

opened to remove bullets and shell splinters (Beaussenat, 1916; Fort и Decoulx, 1918; I.I. Grekov, 1929) [19].

During this time several less invasive procedures were developed and made their way into clinical practice. For example, in 1914 the French surgeon Truffier was able to press his finger into the wall of the aorta in order to widen a stenotic aortic valve in a 14-year-old patient. In 1925, the English surgeon H. Souttar successfully carried out a closed mitral commissurotomy by inserting his finger into an incision in the left atrial appendage [8, 18, 21].

Towards the end of the 1920s the famous Russian surgeon Professor N.N. Terebinsky became the first person in the world to propose the ambitious research project of "studying a method for artificial blood circulation to try operating on a temporarily stopped heart"[1] [19, p. 44]. From 1929 to 1937, Terebinsky carried out a major, rigorous, and completely original experimental research program, which attempted to model the defects and stenoses of the atrioventricular valves for their subsequent repair. This work is believed to have served as a foundation for many open surgeries to repair a range of congenital and acquired heart defects [23].

Thus, although cardiology emerged in Russia at practically the same time as in the rest of the world, the situation for cardiac surgery was quite different. While the first period of clinical cardiac surgery in Europe and the United States began in the 1910s, in the USSR it did not begin until the end of the 1940s. It should be noted that by this time cardiology had already passed through its formative period and was beginning its developmental stage.

It is important to stress that the lengthy historical process of conception, formation, and development of cardiology should be considered not only in the context of global scientific and technical progress and global medical science but also in the context of a range of important social and economic factors. At any rate, when studying the development of cardiology in the USSR, which occurred under the conditions of a planned socialist economy, it is important to consider the following factors: the activity of the Central Committee of the Communist Party and the Government of the USSR, the successes (and failures) of the social reform policies, the actions of the Ministries of Health of the USSR, the RSFSR, and the Soviet Academy of Medical Sciences, reforms of the higher and post-graduate medical education system of the 1960s, the state of medical and pharmaceutical production throughout the period, as well as conflicts between Russian medical leaders, the leading medical societies, and members of the state, party, and medical bureaucracies.

Obviously, in the Soviet Union the development of cardiology and cardiac surgery were influenced by scientific and organizational measures taken at the national level, including the construction of enormous 1000-bed hospitals with specialized cardiology departments, the creation of specialized scientific research institutes and departments, the publication of academic journals for specialists, etc. These internal driving forces, along with external developmental conditions, made the fight against cardiovascular diseases a government concern [3, p. 381].

In Russian medical history research, there has been a tendency to ignore socioeconomic factors impacting and often determining the course of development in clinical disciplines. We make this claim not to reproach the previous generation of our colleagues but rather to encourage further development of interdisciplinary research and to include scholars dealing with the organization of health care. Otherwise, the history of clinical medicine might start to look like nothing more than the evolution of ideas and techniques. However, this conception is fundamentally flawed, since with significant budget allocations, the construction of new medical institutions became an important part of major health care institutions and the medical sciences.

It is quite possible to draw connections between cardiac surgery and the development of cardiology, but this association is not a direct one and cardiac surgery should not be thought of as one of the main contributors to the development of cardiology in the USSR. It is only in the second half of the 20th century that any serious pattern of interaction between cardiology and cardiac surgery arose. Also, when examining this issue one should not assume that the developmental

[1]This idea came to N.N.Terebinsky after conducting a series of experiments on the artificial blood circulation together with S.S. Brukhonenko in 1926–1927.

process of Russian cardiology (and cardiac surgery) was always constant, as there were also periods of stagnation in which it lagged behind the rest of the world.

Borodulin et al. characterize a number of Russian surgeons as "pioneers in the development and implementation of surgical methods for diagnosis and treatment in cardiology" [2, p. 356]. But the term "surgical methods for diagnosis" is, in our view, not entirely clear. This is particularly true given the fact that "invasive methods for diagnosis" is already a widely used term. After all, when cardiology uses surgical methods of treatment (i.e. operations) it is no longer cardiology but cardiac surgery. Of course, cardiac surgery is, in essence, invasive and cardiology is noninvasive, but that does not mean that invasive methods of diagnosis were in all cases introduced into cardiology by cardiac surgery. For example, it is well known that in 1929 surgeon V. Forssmann proposed right heart catheterization. However, this invasive diagnostic method was actually perfected by the physician and the physiologist, A.F. Cournand and D.W. Richards respectively. All three scientists were awarded the Nobel Prize for this achievement in 1956.

The general methodology of the history and philosophy of science includes detailed consideration of the scientist's world view [24, 25]. With this in mind, it is important to remember that surgeons often approach treatment from a mechanical point of view and always with the expectation of manual intervention. Meanwhile, cardiology physicians are traditionally committed to a pathogenetic approach and noninvasive (mainly medical) treatment options. This difference in approach is not a discordant one and provides an opportunity for the two disciplines to engage in productive synergy and mutual enrichment, as cardiac surgery is in a position to achieve quick results in areas where cardiology has more limited ability (for example, when dealing with congenital heart conditions or complications of acquired heart diseases).

On the one hand, advances in medical technology, the maturation of surgical methods, and the perfection of anesthetics and postoperative intensive care have made surgical interventions a viable and effective option to treat diseases that were previously considered untreatable. On the other hand, the progress made in the surgical arena has served as an important stimulus for progress in areas dealing with the etiology, pathogenesis, diagnosis, treatment, and prevention of a variety of heart diseases.

At the same time, one must understand that cardiologists were not very enthusiastic about a number of surgical procedures frequently performed in the 1950s and 1960s. Given the dubious pathogenetic grounds for such procedures and the lack of clear methods for evaluating their results, the skepticism on behalf of the cardiologists of the 50s and 60s concerning surgical treatments for heart diseases is understandable. It is only after a long history of trial and error, culminating in the 1970s and 80s, that cardiac surgery achieved a sufficiently extensive body of valuable experience. But cardiology, by maintaining its ties to other scientific disciplines, including cardiac surgery, maintains its individual approach to research and treatment to this day. It is perhaps for this very reason that in the last quarter of the 20th century (in our country, at least) a particular professional conflict has developed – a kind of conflict of interest in which cardiologists have demonstrated an excessive reluctance to refer their patients to cardiac surgeons, even when they are in grave condition.

From this, we can conclude that cardiology is an older and more extensive science and that cardiac surgery is a newer and more highly specialized discipline. One could say that cardiology, in particular, sparked the formation of cardiac surgery in the first quarter of the 20th century when doctors became increasingly aware of noninvasive treatment options for serious heart conditions as compared to the perceived benefits of purely surgical options for correcting physiological impediments to normal heart functioning.

If cardiology split off into an independent branch of medicine starting at the turn of the 20th century, then cardiac surgery, a child of thoracic surgery, came into its own as an independent branch of clinical medicine in the 1940s and 50s largely based on the achievements of cardiology. In Russia, the development of these two fields took paths different from those in western countries. Moreover, we have not here considered the principle differences between "Russian

cardiology" or "Russian cardiac surgery" and their analogs in the rest of the world.

Finally, the period spanning the end of the 20th century and the beginning of the 21st century could possibly be the most important stage in the development of cardiology and cardiac surgery. Significant historical research on this period has yet to be done, but it is always useful to connect history with modernity in order to illustrate the relevance of a particular issue to current practice.

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**About the authors**

Pavel Mayorovich Bogopolsky – Doctor of Medical Sciences, Senior Researcher at the Department of the Scientific Programs and Staff Training, B.V. Petrovsky National Research Center of Surgery, Moscow (Russia).

Dmitry Alekseevich Balalykin – Doctor of Medical Sciences, Doctor of Historical Sciences, Professor, Chairman at the Department of the History of Medicine, National History and Culturology, I.M. Sechenov First Moscow State Medical University, Moscow (Russia).